

# **DESIGN DEVELOPMENT**

NOT INTENDED FOR CONSTRUCTION

10/24/24

# **PROJECT MANUAL**

Divisions 02-33

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# Benteh Nuutah Valley Native Primary Care Center Expansion



**nb**bj

WASILLA, AK

VOLUME 2 of 2

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#### SECTION 02 4100 DEMOLITION

## PART 1 GENERAL

# 1.01 SECTION INCLUDES

- A. Selective demolition of built site elements.
- B. Selective demolition of building elements for alteration purposes.
- C. **<< Abandonment in place;** <u>Abandonment and removal;</u> or \_\_\_\_\_>> of existing utilities and utility structures.

# 1.02 RELATED REQUIREMENTS

- A. Section 00 3100 Available Project Information:
- B. Section **<u>01 1000 Summary</u>**: Limitations on Contractor's use of site and premises.
- C. Section <u>01 1000 Summary</u>: Sequencing and staging requirements.
- D. Section <u>01 1000 Summary</u>: Description of items to be removed by Owner.
- E. Section <u>01 1000 Summary</u>: Description of items to be salvaged or removed for re-use by Contractor.
- F. Section 01 4010 Clean Construction Procedures: Owner's clean construction requirements
- G. Section 01 4010.01 Infection Control Risk Assessment Construction Permit: Owner's requirements
- H. Section <u>01 5000 Temporary Facilities and Controls</u>: Site fences, security, protective barriers, and waste removal.
- I. Section <u>01 6000 Product Requirements</u>: Handling and storage of items removed for salvage and relocation.
- J. Section <u>01 7000 Execution and Closeout Requirements</u>: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.
- K. Section <u>31 1000 Site Clearing</u>: Vegetation and existing debris removal.
- L. Section <u>31 2323 Fill</u>: Fill material for filling holes, pits, and excavations generated as a result of removal operations.

## 1.03 REFERENCE STANDARDS

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

# 1.04 SUBMITTALS

- A. See Section <u>01 3000 Administrative Requirements</u>, for submittal procedures.
- B. Site Plan: Showing:
  - 1. Vegetation to be protected.
  - 2. Areas for temporary construction and field offices.
  - 3. Areas for temporary and permanent placement of removed materials.
- C. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.
  - 1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences.
  - 2. Include a summary of safety procedures.
- D. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

# PART 2 PRODUCTS << <u>-- NOT USED;</u> OR NONE - N/A>> PART 3 EXECUTION

#### 3.01 SCOPE

- A. See drawings
- B. Demolition for access: Contractor is responsible for all necessary demolition in order to execute the entire scope of work. Demolition drawings are for orientation and may not contain all aspects of demolition. Contractor is responsible for inferring demolition requirements based on all aspects of the scope of work. Contractor shall include demolition to access hidden conditions for purposes of upgrades of normal building activity. Contractor is responsible for building back to orginal or designed condition.
- C. Remove other items indicated, for << <u>salvage</u>; <u>relocation</u>; <u>recycling</u>; and \_\_\_\_>>.
- D. Fill excavations, open pits, and holes in ground areas generated as result of removals, using specified fill; compact fill << as required so that required rough grade elevations do not subside within one year after completion; <u>as specified in Section 31 2200</u>; or \_\_\_\_\_\_>.

## 3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

- A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
  - 1. Obtain required permits.
  - 2. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
  - 3. Provide, erect, and maintain temporary barriers and security devices.
  - 4. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
  - 5. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
  - 6. Do not close or obstruct roadways or sidewalks without permit.
  - 7. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
  - 8. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.
- B. Do not begin removal until receipt of notification to proceed from Owner.
- C. Protect existing structures and other elements that are not to be removed.
  - 1. Provide bracing and shoring.
  - 2. Prevent movement or settlement of adjacent structures.
  - 3. Stop work immediately if adjacent structures appear to be in danger.
- D. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury.
- E. Hazardous Materials: Comply with 29 CFR 1926 and state and local regulations.

## 3.03 EXISTING UTILITIES

- A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.
- B. Protect existing utilities to remain from damage.
- C. Do not disrupt public utilities without permit from authority having jurisdiction.
- D. Do not close, shut off, or disrupt existing life safety systems that are in use without << <u>at least 7</u> <u>days;</u> <u>; or None N/A>> prior written notification to Owner.</u>

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- E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without << at least 3 days; at least 7 days; or None N/A>> prior << written; or None N/A>> notification to Owner.
- F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.
- G. << <u>Remove</u>; Unused underground piping may be abandoned in place, provided it is completely drained and capped; remove; or \_\_\_\_\_\_>> exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

# 3.04 SELECTIVE DEMOLITION FOR ALTERATIONS

- A. Drawings showing existing construction and utilities are based on << <u>casual field observation</u> <u>and existing record documents only</u>; casual field observation only; existing record documents only; or \_\_\_\_\_>>.
  - 1. Verify that construction and utility arrangements are as indicated.
  - 2. Report discrepancies to Architect before disturbing existing installation.
  - 3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.
- B. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
- C. Remove existing work as indicated and as required to accomplish new work.
  - 1. Remove items indicated on drawings.
- D. Services (Including but not limited to << <u>HVAC</u>; <u>Plumbing</u>; <u>Fire Protection</u>; <u>Electrical</u>; <u>Telecommunications</u>; and \_\_\_\_>>): Remove existing systems and equipment as indicated.
  - 1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.
  - 2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
  - 3. Verify that abandoned services serve only abandoned facilities before removal.
  - 4. Remove abandoned pipe, ducts, conduits, and equipment<< <u>, including those above</u> <u>accessible ceilings;</u> ; or None - N/A>>; remove back to source of supply where possible, otherwise cap stub and tag with identification.
- E. Protect existing work to remain.
  - 1. Prevent movement of structure; provide shoring and bracing if necessary.
  - 2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
  - 3. Repair adjacent construction and finishes damaged during removal work.
  - 4. Patch as specified for patching new work.

## 3.05 DEBRIS AND WASTE REMOVAL

- A. Remove debris, junk, and trash from site.
- B. Leave site in clean condition, ready for subsequent work.
- C. Clean up spillage and wind-blown debris from public and private lands.

# END OF SECTION 02 4100

# SECTION 03 1000 CONCRETE FORMING AND ACCESSORIES

#### PART 1 GENERAL

#### 1.01SUMMARY

- A. Section Includes:
  - 1. Form-facing materials.
- B. Related Requirements:
  - 1. Section 321313 "Concrete Paving" for formwork related to concrete pavement and walks.
  - 2. Section 321316 "Decorative Concrete Paving" for formwork related to decorative concrete pavement and walks.

#### 1.02 DEFINITIONS

- A. Form-Facing Material: The temporary form materials that come in direct contact with the concrete as part of the formwork components in supporting the concrete while the concrete is setting and gaining sufficient strength to be self-supporting. The most common materials are steel, aluminum, and wood.
- B. Form Lining: Materials used to line the concreting face of formwork to impart a smooth or patterned finish to the concrete surface, to absorb moisture from the concrete, or to apply a set-retarding chemical to the formed surface of the concrete.
- C. Formwork: The total system of support of freshly placed concrete, including the mold or sheathing that contacts the concrete, as well as supporting members, hardware, and necessary bracing.

#### 1.03 PREINSTALLATION MEETINGS

#### 1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

## 1.05 INFORMATIONAL SUBMITTALS

A. Qualification Statements: For testing and inspection agency.

#### 1.06 QUALITY ASSURANCE

A. Testing and Inspection Agency Qualifications: An independent agency,[ acceptable to authorities having jurisdiction,] qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.

#### 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Form Liners: Store form liners under cover to protect from sunlight.
- B. Insulating Concrete Forms: Store forms off ground and under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.
- C. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

## PART 2 PRODUCTS

# 2.01 PERFORMANCE REQUIREMENTS

- A. Concrete Formwork: Design, engineer, erect, shore, brace, and maintain formwork, shores, and reshores in accordance with ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads, so that resulting concrete conforms to the required shapes, lines, and dimensions.
  - 1. Design wood panel forms in accordance with APA's "Concrete Forming Design/Construction Guide."

- 2. Design formwork to limit deflection of form-facing material to 1/240 of center-to-center spacing of supports.
  - a. For architectural concrete specified in Section 033300 "Architectural Concrete," limit deflection of form-facing material, studs, and walers to 0.0025 times their respective clear spans (L/400).

# 2.02 FORM-FACING MATERIALS

- A. As-Cast Surface Form-Facing Material:
  - 1. Provide continuous, true, and smooth concrete surfaces.
  - 2. Furnish in largest practicable sizes to minimize number of joints.
  - 3. Acceptable Materials: As required to comply with Surface Finish designations specified in Section 033000 "Cast-in-Place Concrete, and as follows:
    - a. Plywood, metal, or other approved panel materials.
    - b. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
      - 1) APA HDO (high-density overlay).
      - 2) APA MDO (medium-density overlay); mill-release agent treated and edge sealed.
      - 3) APA Structural 1 Plyform, B-B or better; mill oiled and edge sealed.
      - 4) APA Plyform Class I, B-B or better; mill oiled and edge sealed.
- B. Concealed Surface Form-Facing Material: Lumber, plywood, metal, plastic, or another approved material.
  - 1. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation, with [**straight**][**or**][**tapered**] end forms.

# 2.03 RELATED MATERIALS

- A. Reglets: Fabricate reglets of not less than **0.022-inch-** thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.
- B. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than **0.034 inch** thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.
- C. Chamfer Strips: Wood, metal, PVC, or rubber strips, **3/4 by 3/4 inch**, minimum.
- D. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
- E. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
  - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
  - 2. Form release agent for form liners to be acceptable to form liner manufacturer.
- F. Form Ties: Factory-fabricated, removable or snap-off, glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
  - 1. Furnish units that leave no corrodible metal closer than **1** inch to the plane of exposed concrete surface.
  - 2. Furnish ties that, when removed, leave holes no larger than **1** inch in diameter in concrete surface.
  - 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.
- G. Sealant: One-part moisture cure silicone sealant used with form liners.

# PART 3 EXECUTION

## 3.01 INSTALLATION OF FORMWORK

- A. Comply with **ACI 301**.
- B. Construct formwork, so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 and to comply with the Surface Finish designations specified in Section 033000 "Cast-in-Place Concrete" for as-cast finishes[.][ and Section 033300 "Architectural Concrete."]
- C. Limit concrete surface irregularities as follows:
  - 1. Surface Finish-1.0: ACI 117 Class D, 1 inch.
  - 2. Surface Finish-2.0: ACI 117 Class B, 1/4 inch.
  - 3. Surface Finish-3.0: ACI 117 Class A, 1/8 inch.
- D. Construct forms tight enough to prevent loss of concrete mortar.
  - 1. Minimize joints.
  - 2. Exposed Concrete: Symmetrically align joints in forms.
- E. Construct removable forms for easy removal without hammering or prying against concrete surfaces.
  - 1. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces.
  - 2. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
  - 3. Install keyways, reglets, recesses, and other accessories, for easy removal.
- F. Do not use rust-stained, steel, form-facing material.
- G. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces.
  - 1. Provide and secure units to support screed strips
  - 2. Use strike-off templates or compacting-type screeds.
- H. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible.
  - 1. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar.
  - 2. Locate temporary openings in forms at inconspicuous locations.
- I. [Chamfer][Do not chamfer] exterior corners and edges of permanently exposed concrete.
- J. At construction joints, overlap forms onto previously placed concrete not less than **12 inches**.
- K. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work.
  - 1. Determine sizes and locations from trades providing such items.
  - 2. Obtain written approval of Architect prior to forming openings not indicated on Drawings.
- L. Form Liners: Install per manufacturer's written installation instructions and recommended tolerances.
- M. Construction and Movement Joints:
  - 1. Construct joints true to line with faces perpendicular to surface plane of concrete.
  - 2. Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
  - 3. Place joints perpendicular to main reinforcement.
  - 4. Locate joints for beams, slabs, joists, and girders in the middle third of spans.
    - a. Offset joints in girders a minimum distance of twice the beam width from a beamgirder intersection.

- 5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
- 6. Space vertical joints in walls [as indicated on Drawings]<Insert spacing>.
  - a. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
- N. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection.
  - 1. Locate ports and openings in bottom of vertical forms, in inconspicuous location, to allow flushing water to drain.
  - 2. Close temporary ports and openings with tight-fitting panels, flush with inside face of form, and neatly fitted, so joints will not be apparent in exposed concrete surfaces.
- O. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- P. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- Q. Coat contact surfaces of forms with form-release agent, in accordance with manufacturer's written instructions, before placing reinforcement.

# 3.02 INSTALLATION OF EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete.
  - 1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
  - 3. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
  - 4. Install dovetail anchor slots in concrete structures, as indicated on Drawings.
  - 5. Clean embedded items immediately prior to concrete placement.

# 3.03 REMOVING AND REUSING FORMS

- A. Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for [24]<Insert number> hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.
  - 1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
  - 2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- B. Clean and repair surfaces of forms to be reused in the Work.
  - 1. Split, frayed, delaminated, or otherwise damaged form-facing material are unacceptable for exposed surfaces.
  - 2. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints.
  - 1. Align and secure joints to avoid offsets.
  - 2. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

# 3.04 INSTALLATION OF SHORING AND RESHORING

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- A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.
  - 1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.
- B. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.
- C. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

# 3.05 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a [special inspector][and][qualified testing and inspecting agency] to perform field tests and inspections and prepare test reports.
- B. Testing Agency: [**Owner will engage**][**Engage**] a qualified testing agency to perform tests and inspections.
- C. Inspections:
  - 1. Inspect formwork for shape, location, and dimensions of the concrete member being formed.
  - 2. Inspect insulating concrete forms for shape, location, and dimensions of the concrete member being formed.
- D. Prepare test and inspection reports.

# END OF SECTION 03 1000

## SECTION 05 4000 COLD-FORMED METAL FRAMING

#### PART 1 GENERAL

#### 1.01SUMMARY

- A. Section Includes:
  - 1. Cold-formed steel framing.
  - 2. Exterior non-load-bearing wall framing.
  - 3. Vertical deflection clips, exterior.
  - 4. Soffit framing.
  - 5. Sill sealer/termite barrier.

#### B. Related Requirements:

- 1. Section 055000 "Metal Fabrications" for miscellaneous steel shapes, masonry shelf angles, and connections used with cold-formed metal framing.
- 2. Section 092116.23 "Gypsum Board Shaft Wall Assemblies" for interior non-load-bearing, metal-stud-framed, shaft-wall assemblies, with height limitations.
- 3. Section 092216 "Non-Structural Metal Framing" for standard, interior non-load-bearing, metal-stud framing, within height limitations and ceiling-suspension assemblies.

#### 1.02 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

## 1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings:
  - 1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
  - 2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
  - 3. Signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Delegated Design Submittal: For cold-formed steel framing, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

## 1.04 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Welding certificates.
- C. Product Certificates: For each type of code-compliance certification for studs and track.
- D. Product Test Reports: For each listed product, for tests performed by a qualified testing agency.
  - 1. Steel sheet.
  - 2. Expansion anchors.
  - 3. Power-actuated anchors.
  - 4. Mechanical fasteners.
  - 5. Vertical deflection clips.
  - 6. Horizontal drift deflection clips
  - 7. Miscellaneous structural clips and accessories.
- E. Research Reports:

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- 1. For nonstandard cold-formed steel framing post-installed anchors, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.
- 2. For sill sealer gasket/termite barrier, showing compliance with ICC-ES AC380.
- F. Delegated Design Engineer Qualifications: For cold-formed steel framing.

# 1.05 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Accredited by International Accreditation Service (IAS) to IAS AC98 criteria for testing indicated.
- B. Product Tests: Mill certificates or data from a qualified independent testing agency[, or inhouse testing with calibrated test equipment,] indicating steel sheet complies with requirements, including base-steel thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.
- C. Code-Compliance Certification of Studs and Track: Provide documentation that framing members are certified in accordance with the product-certification program of the Steel Framing Industry Association the Steel Stud Manufacturers Association or the Supreme Steel Framing System Association.
- D. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
  - 1. AWS D1.1/D1.1M, "Structural Welding Code Steel."
  - 2. AWS D1.3/D1.3M, "Structural Welding Code Sheet Steel."
- E. Delegated Design Engineer Qualifications: A professional engineer who is legally qualified to practice in state where Project is located and who is experienced in providing engineering services of the type indicated.

# 1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect and store cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling as required in AISI S202.

# PART 2 PRODUCTS

## 2.01 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer as defined in Section 014000 "Quality Requirements," to design cold-formed steel framing.
- B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.
  - 1. Design Loads: As indicated on Drawings.
  - 2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
    - a. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/240 of the wall height.
  - 3. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of **120 deg F**.
  - 4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
    - a. Upward and downward movement of 3/4 inch.
  - 5. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.
- C. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing complies with AISI S100 and AISI S200 and ASTM C955, Section 8.

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- D. Seismic Performance: Cold-formed steel framing to withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7 and AISI S400.
- E. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Indicate design designations from UL's "Product iQ" or from the listings of another qualified testing agency acceptable to authorities having jurisdiction.
- F. Sound-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, in accordance with ASTM E90 and classified according to ASTM E413 by an independent testing agency.

# 2.02 COLD-FORMED STEEL FRAMING

- A. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
  - 1. [AllSteel & Gypsum Products, Inc.]
  - 2. [CEMCO; California Expanded Metal Products Co.]
  - 3. [ClarkDietrich]
  - 4. [Consolidated Fabricators Corp.; Building Products Division]
  - 5. [CRACO Mfg., Inc.]
  - 6. [Design Shapes in Steel]
  - 7. [Formetal Co. Inc. (The)]
  - 8. [Jaimes Industries, Inc.]
  - 9. [Marino\WARE]
  - 10. [MBA Metal Framing]
  - 11. [Mill Steel Framing; Mill Steel Company]
  - 12. [MRI Steel Framing, LLC]
  - 13. [Olmar Supply, Inc]
  - 14. [Quail Run Building Materials, Inc.]
  - 15. [SCAFCO Steel Stud Company; Stone Group of Companies]
  - 16. [State Building Products, Inc]
  - 17. [Steel Construction Systems; Stone Group of Companies]
  - 18. [Steel Network, Inc. (The)]
  - 19. [Steeler, Inc]
  - 20. [Super Stud Building Products Inc.]
  - 21. [TELLING Industries]
  - 22. [The Mill Steel Co]
  - 23. <Insert manufacturer's name>
- B. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
  - 1. [AllSteel & Gypsum Products, Inc.]
  - 2. [CEMCO; California Expanded Metal Products Co.]
  - 3. [ClarkDietrich]
  - 4. [Consolidated Fabricators Corp.; Building Products Division]
  - 5. [CRACO Mfg., Inc.]
  - 6. [Design Shapes in Steel]
  - 7. [Formetal Co. Inc. (The)]
  - 8. [Jaimes Industries, Inc.]
  - 9. [Marino\WARE]

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- 10. [MBA Metal Framing]
- 11. [Mill Steel Framing; Mill Steel Company]
- 12. [MRI Steel Framing, LLC]
- 13. [Olmar Supply, Inc]
- 14. [Quail Run Building Materials, Inc.]
- 15. [SCAFCO Steel Stud Company; Stone Group of Companies]
- 16. [State Building Products, Inc]
- 17. [Steel Construction Systems; Stone Group of Companies]
- 18. [Steel Network, Inc. (The)]
- 19. [Steeler, Inc]
- 20. [Super Stud Building Products Inc.]
- 21. [TELLING Industries]
- 22. [The Mill Steel Co]
- 23. <Insert manufacturer's name>
- C. Framing Members, General: Comply with [ASTM C955][AISI S200 and ASTM C955, Section 8][AISI S240] for conditions indicated.
- D. Steel Sheet: ASTM A1003/A1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:
  - 1. Grade: [ST33H][ST50H][As required by structural performance]<Insert grade>.
  - 2. Coating: [G60, A60, AZ50, or GF30][G90 or equivalent]<Insert coating designation>.
- E. Steel Sheet for Vertical Deflection Drift Clips: ASTM A653/A653M, structural steel, zinc coated, of grade and coating as follows:
  - 1. Grade: [33][50, Class 1][As required by structural performance]<Insert grade>.
  - 2. Coating: G90 <Insert coating designation>.

## 2.03 LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
  - Minimum Base-Steel Thickness: [0.0329 inch][0.0428 inch][0.0538 inch][0.0677 inch][0.0966 inch][0.1180 inch]<Insert dimension>.
  - 2. Flange Width: [1-3/8 inches][1-5/8 inches][2 inches][2-1/2 inches][3 inches][3-1/2 inches]
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and as follows:
  - Minimum Base-Steel Thickness: [0.0329 inch][0.0428 inch][0.0538 inch][0.0677 inch][0.0966 inch][0.1180 inch][Matchin g steel studs]
  - 2. Flange Width: [1-1/4 inches][1-1/2 inches]<Insert dimension if manufacturer's standard width is insufficient>.
- C. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, unpunched, with stiffened flanges, and as follows:
  - Minimum Base Steel Thickness: [0.0329 inch][0.0428 inch][0.0538 inch][0.0677 inch][0.0966 inch][0.1180 inch]<Insert dimension>.
  - 2. Flange Width: [1-3/8 inches][1-5/8 inches][2 inches][2-1/2 inches]
- D. Steel Single- or Double-L Headers: Manufacturer's standard L-shapes used to form header beams, of web depths indicated, and as follows:

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- Minimum Base-Steel Thickness: [0.0329 inch][0.0428 inch][0.0538 inch][0.0677 inch][0.0966 inch][0.1180 inch]<Insert dimension>.
- Top Flange Width: [1-1/2 inches][1-5/8 inches][2 inches][2-1/2 inches]<Insert dimension>.

# 2.04 EXTERIOR NON-LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
  - 1. Minimum Base-Steel Thickness: 0.0329 inch.
  - 2. Flange Width: 1-3/8 inches.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
  - 1. Minimum Base-Steel Thickness: 0.0329 inch.
  - 2. Flange Width: [1-1/4 inches]<Insert dimension if manufacturer's standard width is insufficient>.
- C. Vertical Deflection Clips, Exterior: Manufacturer's standard bypass clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
  - 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. ClarkDietrich
    - b. SCAFCO Steel Stud Company; Stone Group of Companies
    - c. Simpson Strong-Tie Co., Inc.
    - d. Steel Network, Inc. (The)
  - Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
    - a. ClarkDietrich
    - b. SCAFCO Steel Stud Company; Stone Group of Companies
    - c. Simpson Strong-Tie Co., Inc.
    - d. Steel Network, Inc. (The)
- D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
  - Minimum Base-Steel Thickness: [0.0428 inch][0.0538 inch][0.0677 inch][0.0966 inch][0.1180 inch][0.1180 inch]<Insert dimension>.
  - 2. Flange Width: [1 inch plus the design gap for one-story structures][and][1 inch plus twice the design gap for other applications]<Insert dimension>.
- E. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

# 2.05 JOIST FRAMING

A. Steel Joists: Manufacturer's standard C-shaped steel joists, of web depths indicated, [unpunched][punched with standard holes][punched with enlarged service holes] with stiffened flanges, and as follows:

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- Minimum Base-Metal Thickness: [0.0329 inch][0.0428 inch][0.0538 inch][0.0677 inch][0.0966 inch][0.1180 inch]<Insert dimension>.
- 2. Flange Width: [1-5/8 inches][2 inches][2-1/2 inches][3 inches][3-1/2 inches]<Insert dimension>, minimum.
- B. Steel Rim Joist Track: Manufacturer's standard U-shaped steel rim joist track, of web depths indicated, unpunched or punched at joist spacing, with unstiffened flanges, and as follows:
  - Minimum Base-Metal Thickness: [0.0329 inch][0.0428 inch][0.0538 inch][0.0677 inch][0.0966 inch][0.1180 inch][Matchin g steel joists]<Insert dimension>.
  - 2. Flange Width: [1-1/4 inches][1-1/2 inches][2 inches]

# 2.06 ROOF-RAFTER FRAMING

- A. Steel Rafters: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:
  - Minimum Base-Steel Thickness: [0.0329 inch][0.0428 inch][0.0538 inch][0.0677 inch][0.0966 inch][0.1180 inch]<Insert dimension>.
  - 2. Flange Width: [1-5/8 inches][2 inches][2-1/2 inches][3 inches][3-1/2 inches]<Insert dimension>, minimum.

# 2.07 SOFFIT FRAMING

- A. Exterior Soffit Framing: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:
  - 1. Minimum Base-Metal Thickness: 0.0428 inch.
  - 2. Flange Width: 1-5/8 inches, minimum.

## 2.08 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from ASTM A1003/A1003M, Structural Grade, Type H, metallic-coated steel sheet, of same grade and coating designation used for framing members.
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
  - 1. Supplementary framing.
  - 2. Bracing, bridging, and solid blocking.
  - 3. Web stiffeners.
  - 4. Anchor clips.
  - 5. End clips.
  - 6. Foundation clips.
  - 7. Gusset plates.
  - 8. Stud kickers and knee braces.
  - 9. Joist hangers and end closures.
  - 10. Hole-reinforcing plates.
  - 11. Backer plates.

# 2.09 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A36/A36M, zinc coated by hot-dip process in accordance with ASTM A123/A123M.
- B. Anchor Bolts: ASTM F1554, [Grade 36][Grade 55], threaded carbon-steel [hex-headed bolts][headless, hooked bolts][headless bolts, with encased end threaded] carbon-steel nuts, and flat, hardened-steel washers; zinc coated by [hot-dip process in accordance with

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# ASTM A153/A153M, Class C][mechanically deposition according to ASTM B695, Class 50].

- C. Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, in accordance with an evaluation report acceptable to authorities having jurisdiction, based on [ICC-ES AC01][ICC-ES AC193][ICC-ES AC58][or][ICC-ES AC308] as appropriate for the substrate.
  - 1. Uses: Securing cold-formed steel framing to structure.
  - 2. Type: [Torque-controlled expansion anchor][Torque-controlled adhesive anchor][or][adhesive anchor].
  - 3. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/ASTM F1941M, Class Fe/Zn 5, unless otherwise indicated.
  - 4. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy [Group 1][Group 2] stainless steel bolts, ASTM F593, and nuts, ASTM F594.
- D. Power-Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, in accordance with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- E. Mechanical Fasteners: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.
  - 1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.
- F. Welding Electrodes: Comply with AWS standards.

# 2.10 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: ASTM A780/A780M.
- B. Cement Grout: Portland cement, ASTM C476, Type I; and clean, natural sand, ASTM C404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- C. Nonmetallic, Nonshrink Grout: Factory-packaged, nonmetallic, noncorrosive, nonstaining grout, complying with ASTM C1107/C1107M, and with a fluid consistency and 30-minute working time.
- D. Shims: Load-bearing, high-density, multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.
- E. Sill Sealer Gasket: Closed-cell neoprene foam, **1/4 inch** thick, selected from manufacturer's standard widths to match width of bottom track or rim track members as required.

# 2.11 FABRICATION

- A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, in accordance with AISI S240 and standards, manufacturer's written instructions, and requirements in this Section.
  - 1. Fabricate framing assemblies using jigs or templates.
  - 2. Cut framing members by sawing or shearing; do not torch cut.
  - 3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
    - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    - b. Locate mechanical fasteners and install in accordance with Shop Drawings, with screws penetrating joined members by no fewer than three exposed screw threads.

- 4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, in accordance with Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies by means that prevent damage or permanent distortion.
- C. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of **1/8 inch in 10 ft.** and as follows:
  - 1. Spacing: Space individual framing members no more than plus or minus **1/8 inch** from plan location. Cumulative errors are not to exceed minimum fastening requirements of sheathing or other finishing materials.
  - 2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch.

# PART 3 EXECUTION

## 3.01 EXAMINATION

- A. Examine substrates, areas, conditions, and abutting structural framing 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.

## 3.02 PREPARATION

- A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or track to structural members indicated to receive sprayed fire-resistive materials.
- B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that are required to obtain fire-resistance ratings indicated. Protect remaining fire-resistive materials from damage.
- C. Install load-bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than **1/4 inch** to ensure a uniform bearing surface on supporting concrete or masonry construction.
- D. Install sill sealer gasket at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.
- E. Install sill sealer gasket/termite barrier in accordance with manufacturer's written instructions at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

# 3.03 INSTALLATION OF COLD-FORMED STEEL FRAMING

- A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed steel framing in accordance with ASTM C1007, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
  - 1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.
- D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.
  - 1. Cut framing members by sawing or shearing; do not torch cut.

- 2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
  - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
  - b. Locate mechanical fasteners, install in accordance with Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.
- E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
- F. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.
- H. Install insulation, specified in Section 072100 "Thermal Insulation," in framing-assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- I. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

# 3.04 INSTALLATION OF EXTERIOR NON-LOAD-BEARING WALL FRAMING

- A. Install continuous track sized to match studs. Align track accurately and securely anchor to supporting structure.
- B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:
  - 1. Stud Spacing: As indicated on Shop Drawings.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
  - 1. Install single deep-leg deflection track and anchor to building structure.
  - 2. Connect vertical deflection clips to bypassing studs and anchor to building structure.
  - 3. Connect drift clips to cold-formed steel framing and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than **48 inches** apart. Fasten at each stud intersection.
  - 1. Channel Bridging: Cold-rolled steel U-channel, welded or mechanically fastened to webs of punched studs.
  - 2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
  - 3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

# 3.05 INSTALLATION TOLERANCES

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- A. Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 ft. and as follows:
  - 1. Space individual framing members no more than plus or minus **1/8 inch** from plan location. Cumulative error are not to exceed minimum fastening requirements of sheathing or other finishing materials.

# 3.06 REPAIR

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint in accordance with ASTM A780/A780M and manufacturer's written instructions.

# 3.07 FIELD QUALITY CONTROL

- A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field and shop welds will be subject to testing and inspecting.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.
- D. Cold-formed steel framing will be considered defective if it does not pass tests and inspections.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

# 3.08 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

# END OF SECTION 05 4000

# SECTION 03 2000 CONCRETE REINFORCING

# PART 1 GENERAL

## 1.01SUMMARY

- A. Section Includes:
  - 1. Steel reinforcement bars.
  - 2. Welded-wire reinforcement.
- B. Related Requirements:
  - 1. Section 321313 "Concrete Paving" for reinforcing related to concrete pavement and walks.
  - 2. Section 321316 "Decorative Concrete Paving" for reinforcing related to decorative concrete pavement and walks.

# 1.02 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
  - 1. Review the following:
    - a. Special inspection and testing and inspecting agency procedures for field quality control.
    - b. Construction contraction and isolation joints.
    - c. Steel-reinforcement installation.

# 1.03 ACTION SUBMITTALS

- A. Product Data: For the following:
  - 1. Each type of steel reinforcement.
  - 2. Zinc repair material.
  - 3. Bar supports.
  - 4. Mechanical splice couplers.
- B. Sustainable Design Submittals:
  - 1. Third-Party Certifications: For each product.
  - 2. Third-Party Certified Life Cycle Assessment: For each product.
- C. Shop Drawings: Comply with ACI SP-066:
  - 1. Include placing drawings that detail fabrication, bending, and placement.
  - 2. Include bar sizes, lengths, materials, grades, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, location of splices, lengths of lap splices, details of mechanical splice couplers, details of welding splices, tie spacing, hoop spacing, and supports for concrete reinforcement.
- D. Construction Joint Layout: Indicate proposed construction joints required to build the structure.
   1. Location of construction joints is subject to approval of Architect.

# 1.04 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
  - 1. Reinforcement To Be Welded: Welding procedure specification in accordance with AWS D1.4/D1.4M.
- B. Material Test Reports: For the following, from a qualified testing agency:
  - 1. Steel Reinforcement:
    - a. For reinforcement to be welded, mill test analysis for chemical composition and carbon equivalent of the steel in accordance with ASTM A706/A706M.
  - 2. Mechanical splice couplers.

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- C. Field quality-control reports.
- D. Minutes of preinstallation conference.

## 1.05 QUALITY ASSURANCE

 Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.4/D 1.4M.

#### 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.
  - 1. Store reinforcement to avoid contact with earth.

## PART 2 PRODUCTS

#### 2.01 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A615/A615M, Grade 60, deformed.
- B. Low-Alloy Steel Reinforcing Bars: ASTM A706/A706M, deformed.
- C. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from asdrawn steel wire into flat sheets.
- D. Deformed-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, flat sheet.

#### 2.02 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A615/A615M, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.
- B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place.
  - Manufacture bar supports from steel wire, plastic, or precast concrete in accordance with CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
    - a. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2 stainless steel bar supports.
- C. Mechanical Splice Couplers: ACI 318 [Type 1][Type 2], same material of reinforcing bar being spliced; tension-compression type.
- D. Steel Tie Wire: ASTM A1064/A1064M, annealed steel, not less than 0.0508 inch in diameter.
   1. Finish: Plain.

## FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

# PART 3 EXECUTION

# 3.01 PREPARATION

2.03

- A. Protection of In-Place Conditions:
  - 1. Do not cut or puncture vapor retarder.
  - 2. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

#### 3.02 INSTALLATION OF STEEL REINFORCEMENT

A. Comply with CRSI's "Manual of Standard Practice" for placing and supporting reinforcement.

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**Concrete Reinforcing** 

- B. Accurately position, support, and secure reinforcement against displacement.
  - 1. Locate and support reinforcement with bar supports to maintain minimum concrete cover.
  - 2. Do not tack weld crossing reinforcing bars.
- C. Preserve clearance between bars of not less than **1** inch, not less than one bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.
- D. Provide concrete coverage in accordance with ACI 318.
- E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- F. Splices: Lap splices as indicated on Drawings.
  - 1. Bars indicated to be continuous, and all vertical bars to be lapped not less than 36 bar diameters at splices, or **24 inches**, whichever is greater.
  - 2. Stagger splices in accordance with ACI 318.
  - 3. Mechanical Splice Couplers: Install in accordance with manufacturer's instructions.
  - 4. Weld reinforcing bars in accordance with AWS D1.4/D 1.4M, where indicated on Drawings.
- G. Install welded-wire reinforcement in longest practicable lengths.
  - 1. Support welded-wire reinforcement in accordance with CRSI "Manual of Standard Practice."
    - a. For reinforcement less than W4.0 or D4.0, continuous support spacing to not exceed **12 inches**.
  - 2. Lap edges and ends of adjoining sheets at least one wire spacing plus **2 inches** for plain wire and **8 inches** for deformed wire.
  - 3. Offset laps of adjoining sheet widths to prevent continuous laps in either direction.
  - 4. Lace overlaps with wire.

# 3.03 JOINTS

- A. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
  - 1. Place joints perpendicular to main reinforcement.
  - 2. Continue reinforcement across construction joints unless otherwise indicated.
  - 3. Do not continue reinforcement through sides of strip placements of floors and slabs.
- B. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length, to prevent concrete bonding to one side of joint.

# 3.04 INSTALLATION TOLERANCES

A. Comply with **ACI 117**.

# 3.05 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Inspections:
  - 1. Steel-reinforcement placement.
  - 2. Steel-reinforcement mechanical splice couplers.
  - 3. Steel-reinforcement welding.

# END OF SECTION 03 2000

# SECTION 03 3000 CAST-IN-PLACE CONCRETE

#### PART 1 GENERAL

#### 1.01SUMMARY

- A. Section Includes:
  - 1. Concrete standards.
  - 2. Concrete materials.
  - 3. Floor and slab treatments.
  - 4. Liquid floor treatments.
  - 5. Curing materials.
  - 6. Accessories.
  - 7. Repair materials.
  - 8. Concrete mixture materials.
  - 9. Concrete mixture class types.
  - 10. Concrete mixing.
- B. Related Requirements:
  - 1. Section 031000 "Concrete Forming and Accessories" for form-facing materials, form liners, insulating concrete forms, and waterstops.
  - 2. Section 032000 "Concrete Reinforcing" for steel reinforcing bars and welded-wire reinforcement.
  - 3. Section 033300 "Architectural Concrete" for general building applications of specially finished formed concrete.
  - 4. Section 312000 "Earth Moving" for drainage fill under slabs-on-ground.
  - 5. Section 321313 "Concrete Paving" for concrete pavement and walks.
  - 6. Section 321316 "Decorative Concrete Paving" for decorative concrete pavement and walks.

## 1.02 DEFINITIONS

- A. Cementitious Materials: Portland cement or blended hydraulic cement alone or in combination with one or more of the following:
  - 1. Fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.
- B. Water/Cementitious Materials (w/cm) Ratio: The ratio by weight of mixing water to cementitious materials.

# 1.03 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
  - 1. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
    - a. Contractor's superintendent.
    - b. Independent testing agency responsible for inspections and acceptance testing of concrete at Project site.
    - c. Concrete Subcontractor.
  - 2. Review the following:
    - a. Special inspection and testing and inspecting agency procedures for field quality control.
    - b. Construction joints, control joints, isolation joints, and joint-filler strips.
    - c. Semirigid joint fillers.
    - d. Vapor-retarder installation.

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Cast-In-Place Concrete

- e. Anchor rod and anchorage device installation tolerances.
- f. Cold- and hot-weather concreting procedures.
- g. Concrete finishes and finishing.
- h. Curing procedures.
- i. Forms and form-removal limitations.
- j. Shoring and reshoring procedures.
- k. Methods for achieving specified floor and slab flatness and levelness.
- I. Floor and slab flatness and levelness measurements.
- m. Concrete repair procedures.
- n. Concrete protection.
- o. Initial curing of standard-cured and field curing of field-cured test cylinders (ASTM C31/C31M.)
- p. Protection of field cured field test cylinders.
- q. Distribution of test reports.

# 1.04 ACTION SUBMITTALS

- A. Product Data:
  - 1. Portland cement.
  - 2. Aggregates.
  - 3. Ground calcium carbonate and aggregate mineral fillers.
  - 4. Admixtures:
    - a. Include limitations of use. Admixtures that do not comply with reference ASTM International requirements must be submitted with test data for approval.
  - 5. Vapor retarders.
  - 6. Floor and slab treatments.
  - 7. Liquid floor treatments.
  - 8. Curing materials.
  - 9. Joint fillers.
  - 10. Repair materials.
- B. Design Mixtures: For each concrete mixture, include the following:
  - 1. Mixture identification.
  - 2. Compressive strength at 28 days or other age as specified.
  - 3. Compressive strength required at stages of construction.
  - 4. Durability exposure classes for Exposure Categories F, S, W, and C.
  - 5. Maximum w/cm ratio.
  - 6. Calculated equilibrium and fresh density for lightweight concrete.
  - 7. Slump or slump flow limit.
  - 8. Air content.
  - 9. Nominal maximum aggregate size.
  - 10. Intended placement method.
  - 11. Submit adjustments to design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant changes.
- C. Shop Drawings:
  - 1. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
    - a. Location of construction joints is subject to approval of the Architect.
- D. Concrete Schedule: For each location of each class of concrete indicated in "Concrete Mixture Class Types" Article, including the following:
  - 1. Concrete class designation.

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- 2. Location within Project.
- 3. Exposure class designation.
- 4. Formed surface finish designation and final finish.
- 5. Final finish for floors.
- 6. Floor treatment, if any.

#### 1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For the following:
  - 1. Installer: Include copies of applicable ACI certificates.
- B. Material Certificates: For each of the following:
  - 1. Cementitious materials.
  - 2. Admixtures.
  - 3. Fiber reinforcement.
  - 4. Curing compounds.
  - 5. Floor and slab treatments.
  - 6. Bonding agents.
  - 7. Adhesives.
  - 8. Vapor retarders.
  - 9. Semirigid joint filler.
  - 10. Joint-filler strips.
  - 11. Repair materials.
- C. Material Test Reports: For the following:
  - 1. Portland cement.
  - 2. Aggregates.
  - 3. Ground calcium carbonate and aggregate mineral filler.
  - 4. Admixtures.
- D. Research Reports:
  - 1. For concrete admixtures in accordance with ICC's Acceptance Criteria AC198.
  - 2. For sheet vapor retarder/termite barrier, showing compliance with ICC's Acceptance Criteria AC380.
- E. Preconstruction Test Reports: For each mix design.
- F. Field quality-control reports.
- G. Minutes of preinstallation conference.

## 1.06 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified Installer who employs Project personnel qualified as an ACIcertified Concrete Flatwork Associate and Concrete Flatwork Finisher and a supervisor who is a certified ACI Advanced Concrete Flatwork Finisher/Technician or an ACI Concrete Flatwork Finisher with experience installing and finishing concrete.
  - 1. Post-Installed Concrete Anchors Installers: ACI-certified Adhesive Anchor Installer.
- B. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.
  - 1. Manufacturer's production facilities and delivery vehicles certified in accordance with NRMCA's certification requirements or equivalent approval by a State DOT.
- C. Field Quality-Control Testing Agency Qualifications: An independent agency, qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.

1. Personnel conducting field tests on plastic concrete properties are to be qualified as an ACI Concrete Field Testing Technician, Grade 1, in accordance with policies from ACI CPP 610.1 or an equivalent certification program.

# 1.07 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on each concrete mixture.
  - 1. Include the following information in each test report:
    - a. Admixture dosage rates.
    - b. Slump.
    - c. Air content.
    - d. Seven-day compressive strength.
    - e. 28-day compressive strength.
    - f. Evaluation of permeability-reducing admixtures.

# 1.08 DELIVERY, STORAGE, AND HANDLING

A. Comply with ASTM C94/C94M and ACI 301.

# 1.09 FIELD CONDITIONS

- A. Cold-Weather Placement: Comply with **ACI 301** as follows:
  - 1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
  - 2. When air temperature has fallen to, or is expected to fall below **40 deg F** during the protection period, maintain delivered concrete mixture temperature within the temperature range required by **ACI 301**.
  - 3. Do not use frozen materials or materials containing ice or snow.
  - 4. Do not place concrete in contact with surfaces less than **35 deg F**, other than reinforcing steel.
- B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1, and as follows:
  - 1. Maintain concrete temperature at time of discharge to not exceed 95 deg F.
  - 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

# 1.10 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to furnish replacement sheet vapor retarder/termite barrier material and accessories for sheet vapor retarder/ termite barrier and accessories that do not comply with requirements or that fail to resist penetration by termites within specified warranty period.
  - 1. Warranty Period: 10 years from date of Substantial Completion.

# PART 2 PRODUCTS

## 2.01 CONCRETE STANDARDS

A. ACI Publications: Comply with ACI 301 unless modified by requirements in the Contract Documents.

## 2.02 CONCRETE MATERIALS

- A. Source Limitations:
  - 1. Obtain all concrete mixtures from a single ready-mixed concrete manufacturer for entire Project.
  - 2. Obtain each type of admixture from single source from single manufacturer.
- B. Cementitious Materials:

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- 1. Portland Cement: ASTM C150/C150M, Type I Type II, gray.
- C. Normal-Weight Aggregates:
  - 1. Coarse Aggregate: ASTM C33/C33M, Class 3S
  - 2. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
  - 3. Fine Aggregate: ASTM C33/C33M.

#### 2.03 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C260/C260M.
- B. Chemical Admixtures: Do not use calcium chloride or admixtures containing calcium chloride[ in steel-reinforced concrete].
  - 1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
  - 2. Retarding Admixture: ASTM C494/C494M, Type B.
  - 3. Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type D.
  - 4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
  - 5. High-Range, Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type G.
  - 6. Admixtures with special properties, with documentation of claimed performance enhancement, ASTM C494/C494M, Type S.
- C. Mixing Water for Concrete Mixtures and Water Used to Make Ice: ASTM C1602/C1602M. Include documentation of compliance with limits for alkalis, sulfates, chlorides, or solids content of mixing water from Table 2 in ASTM C1602/C1602M.

# 2.04 FLOOR AND SLAB TREATMENTS

- A. Emery Dry-Shake Floor Hardener: [**Pigmented**][**Unpigmented**], factory-packaged, dry combination of portland cement, graded emery aggregate, and plasticizing admixture; with emery aggregate consisting of no less than 60 percent of total aggregate content.
  - 1. Color: [As indicated by manufacturer's designation][Match Architect's sample][As selected by Architect from manufacturer's full range].
- B. Metallic Dry-Shake Floor Hardener: [**Pigmented**][**Unpigmented**], factory-packaged, dry combination of portland cement, graded metallic aggregate, rust inhibitors, and plasticizing admixture; with metallic aggregate consisting of no less than 65 percent of total aggregate content.
  - 1. Color: [As indicated by manufacturer's designation][Match Architect's sample][As selected by Architect from manufacturer's full range].

# 2.05 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- B. Moisture-Retaining Cover: ASTM C171, polyethylene film burlap-polyethylene sheet.
  - 1. Color:
    - a. Ambient Temperature Below 50 deg F (10 deg C): Black.
    - b. Ambient Temperature between 50 and 85 deg F (10 and 29 deg C): Any color.
    - c. Ambient Temperature Above 85 deg F (29 deg C): White.
- C. Water: Potable water that does not cause staining of the surface.

## 2.06 ACCESSORIES

- A. Expansion- and Isolation-Joint-Filler Strips: [ASTM D1751, asphalt-saturated cellulosic fiber][or][ASTM D1752, cork or self-expanding cork].
- B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, [epoxy resin with a Type A shore durometer hardness of 80][aromatic polyurea with a Type A shore durometer hardness range of 90 to 95] in accordance with ASTM D2240.

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- C. Bonding Agent: ASTM C1059/C1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.
- D. Epoxy Bonding Adhesive: ASTM C881/C881M, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade and class to suit requirements, and as follows:
  - 1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

# 2.07 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
  - 1. Cement Binder: ASTM C150/C150M portland cement or hydraulic or blended hydraulic cement, as defined in ASTM C219.
  - 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
  - 3. Aggregate: Well-graded, washed gravel, **1/8 to 1/4 inch** or coarse sand, as recommended by underlayment manufacturer.
  - 4. Compressive Strength: Not less than [4100 psi]<Insert strength> at 28 days when tested in accordance with ASTM C109/C109M.
- B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.
  - 1. Cement Binder: ASTM C150/C150M portland cement or hydraulic or blended hydraulic cement, as defined in ASTM C219.
  - 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
  - 3. Aggregate: Well-graded, washed gravel, **1/8 to 1/4 inch** or coarse sand as recommended by topping manufacturer.
  - 4. Compressive Strength: Not less than 5000 psi at 28 days when tested in accordance with ASTM C109/C109M.

# 2.08 CONCRETE MIXTURE MATERIALS

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI 301.
  - 1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland or hydraulic cement in concrete assigned to Exposure Class F3 as follows:
- C. Admixtures: Use admixtures in accordance with manufacturer's written instructions.
  1. Use permeability-reducing admixture in concrete mixtures where indicated.

# 2.09 CONCRETE MIXTURE CLASS TYPES

- A. Class A: Normal-weight concrete used for footings, grade beams, and tie beams.
  - 1. Exposure Class: ACI 318 Class F2 Class S0 Class W0 Class C0.
  - 2. Minimum Compressive Strength: 4500 psi at 28 days.
  - 3. Maximum w/cm Ratio: 0.45.
  - 4. Slump Limit: 4 inches, plus or minus 1 inch for concrete < Insert limits>.
  - 5. Air Content:

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- a. Exposure Classes F2 and F3: 6.0 percent, plus or minus 1.5 percent at point of delivery for concrete containing 3/4-inch nominal maximum aggregate size.
- 6. Limit water-soluble, chloride-ion content in hardened concrete to 1.00 percent by weight of cementitious materials.
- 7. Compressive strength or alternative methods of estimating in-place strength of concrete by maturity or other nondestructive testing with acceptable correlation between test results and concrete compressive strength <**Insert strength and age for construction stages**>.
- B. Class C: Normal-weight concrete used for interior slabs-on-ground.
  - 1. Exposure Class: ACI 318 Class F0 Class S0 Class W0 Class C0.
  - 2. Minimum Compressive Strength: 4000 psi at 28 days.
  - 3. Maximum w/cm Ratio : 0.45.
  - 4. Slump Limit: 4 inches, plus or minus 1 inch for concrete < Insert limits>.
  - 5. Air Content:
    - a. Do not use an air-entraining admixture or allow total air content to exceed 3 percent for concrete used in trowel-finished floors.
  - 6. Limit water-soluble, chloride-ion content in hardened concrete to 1.00 percent by weight of cement.
- C. Class D: Normal-weight concrete used for interior suspended slabs.
  - 1. Exposure Class: ACI 318 Class F0 Class S0 Class W0 Class C0.
  - 2. Minimum Compressive Strength: 4000 psi at 28 days.
  - 3. Maximum w/cm Ratio: 0.45.
  - 4. Slump Limit: 5 inches, plus or minus 1.5 inches for concrete < Insert limits >.
  - 5. Air Content:
    - a. Total air content must not exceed 3 percent for concrete used in trowel-finished floors.
  - 6. Limit water-soluble, chloride-ion content in hardened concrete to 1.00 percent by weight of cement.
- D. Class I: Normal-weight concrete used for interior metal pan stairs and landings:
  - 1. Exposure Class: ACI 318 Class F0 Class S0 Class W0 Class C0.
  - 2. Minimum Compressive Strength: 3000 psi at 28 days.
  - 3. Maximum w/cm Ratio: 0.45.
  - 4. Maximum Size Aggregate: 1/2 inch.
  - 5. Slump Limit: **3 inches**, plus **1 inch** or minus **2 inches**.
  - 6. Air Content: 0 percent, plus or minus 1.5 percent at point of delivery.
  - 7. Limit water-soluble, chloride-ion content in hardened concrete to 1.00 percent by weight of cement.

## 2.10 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94/C94M and furnish delivery ticket.

## PART 3 EXECUTION

## 3.01 EXAMINATION

- A. Verification of Conditions:
  - 1. Before placing concrete, verify that installation of concrete forms, accessories, reinforcement, and embedded items is complete and that required inspections have been performed.
  - 2. Do not proceed until unsatisfactory conditions have been corrected.

# 3.02 PREPARATION

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- A. Provide reasonable auxiliary services to accommodate field testing and inspections, acceptable to testing agency, including the following:
  - 1. Daily access to the Work.
  - 2. Incidental labor and facilities necessary to facilitate tests and inspections.
  - 3. Secure space for storage, initial curing, and field curing of test samples, including source of water and continuous electrical power at Project site during site curing period for test samples.
  - 4. Security and protection for test samples and for testing and inspection equipment at Project site.

## 3.03 TOLERANCES

A. Comply with **ACI 117**.

## 3.04 INSTALLATION OF EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.
  - 1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 2. Install reglets to receive waterproofing and through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

### 3.05 INSTALLATION OF VAPOR RETARDERS

## 3.06 INSTALLATION OF CAST-IN-PLACE CONCRETE

- A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.
  - 1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
  - 2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.
- B. Notify Architect and testing and inspection agencies 24 hours prior to commencement of concrete placement.
- C. Water addition in transit or at the Project site must be in accordance with ASTM C94/C94M and must not exceed the permitted amount indicated on the concrete delivery ticket.
- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.
  - 1. If a section cannot be placed continuously, provide construction joints as indicated.
  - 2. Deposit concrete to avoid segregation.
  - 3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
  - 4. Consolidate placed concrete with mechanical vibrating equipment in accordance with **ACI 301**.
    - a. Do not use vibrators to transport concrete inside forms.
    - b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least **6 inches** into preceding layer.
    - c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
    - d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

- E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
  - 1. Do not place concrete floors and slabs in a checkerboard sequence.
  - 2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
  - 3. Maintain reinforcement in position on chairs during concrete placement.
  - 4. Screed slab surfaces with a straightedge and strike off to correct elevations.
  - 5. Level concrete, cut high areas, and fill low areas.
  - 6. Slope surfaces uniformly to drains where required.
  - 7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
  - 8. Do not further disturb slab surfaces before starting finishing operations.

# 3.07 INSTALLATION OF JOINTS

- A. Construct joints true to line, with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.
  - 1. Install so strength and appearance of concrete are not impaired, at locations indicated on Drawings or as approved by Architect.
  - 2. Place joints perpendicular to main reinforcement.
    - a. Continue reinforcement across construction joints unless otherwise indicated.
  - 3. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
  - 4. Locate joints for beams, slabs, joists, and girders at third points of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
  - 5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
  - 6. Space vertical joints in walls [**as indicated on Drawings**]<**Insert spacing**>. Unless otherwise indicated on Drawings, locate vertical joints beside piers integral with walls, near corners, and in concealed locations where possible.
  - 7. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
  - 8. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Control Joints in Slabs-on-Ground: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of concrete thickness as follows:
  - 1. Grooved Joints: Form control joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of control joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
  - 2. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random cracks.
- D. Isolation Joints in Slabs-on-Ground: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
  - 1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated on Drawings.
  - 2. Terminate full-width joint-filler strips not less than **1/2 inch** or more than **1 inch** below finished concrete surface, where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.

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- 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- E. Doweled Joints:
  - 1. Install dowel bars and support assemblies at joints where indicated on Drawings.
  - 2. Lubricate or asphalt coat one-half of dowel bar length to prevent concrete bonding to one side of joint.
- F. Dowel Plates: Install dowel plates at joints where indicated on Drawings.

# 3.08 APPLICATION OF FINISHING FLOORS AND SLABS

- A. Scratch Finish:
  - 1. While still plastic, texture concrete surface that has been screeded and bull-floated or darbied.
  - 2. Use stiff brushes, brooms, or rakes to produce a profile depth of **1/4 inch** in one direction.
  - 3. Apply scratch finish to surfaces [to receive concrete floor toppings][to receive mortar setting beds for bonded cementitious floor finishes]<Insert locations>.
- B. Float Finish:
  - 1. When bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operation of specific float apparatus, consolidate concrete surface with powerdriven floats or by hand floating if area is small or inaccessible to power-driven floats.
  - 2. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture and complies with ACI 117 tolerances for conventional concrete.
  - 3. Apply float finish to surfaces [to receive trowel finish][and][to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo]<Insert locations>.
- C. Trowel Finish:
  - 1. After applying float finish, apply first troweling and consolidate concrete by hand or powerdriven trowel.
  - 2. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance.
  - 3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
  - 4. Do not add water to concrete surface. Use of an approved finishing aid is acceptable.
  - 5. Do not apply troweled finish to concrete, which has a total air content greater than 3 percent.
  - 6. Apply a trowel finish to surfaces [exposed to view][or][to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system]<Insert locations>.
  - 7. Finish surfaces to the following tolerances, in accordance with **ASTM E1155**, for a randomly trafficked floor surface:
    - a. Slabs on Ground:
      - 1) Specified overall values of flatness, FF 25; and of levelness, FL 20; with minimum local values of flatness, FF 17; and of levelness, FL 15.
      - 2) Specified overall values of flatness, FF 35; and of levelness, FL 25; with minimum local values of flatness, FF 24; and of levelness, FL 17.
      - 3) Specified overall values of flatness, FF 45; and of levelness, FL 35; with minimum local values of flatness, FF 30; and of levelness, FL 24.
      - 4) Specified overall values of flatness, FF 50; and of levelness, FL 35; with minimum local values of flatness, FF 40; and of levelness, FL 24.
    - b. Suspended Slabs:

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- 1) Specified overall values of flatness, FF 25; and of levelness, FL 20; with minimum local values of flatness, FF 17; and of levelness, FL 15.
- 2) Specified overall values of flatness, FF 35; and of levelness, FL 20; with minimum local values of flatness, FF 24; and of levelness, FL 15.
- 3) Specified overall values of flatness, FF 45; and of levelness, FL 35; with minimum local values of flatness, FF 30; and of levelness, FL 24.
- D. Trowel and Fine-Broom Finish: First apply a trowel finish to surfaces [indicated on Drawings][where ceramic or quarry tile is to be installed by either thickset or thinset method]. While concrete is still plastic, slightly scarify surface with a fine broom perpendicular to main traffic route.
  - 1. Coordinate required final finish with Architect before application.
  - 2. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.
- E. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and locations indicated on Drawings.
  - 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with a fiber-bristle broom perpendicular to main traffic route.
  - 2. Coordinate required final finish with Architect before application.
- F. Slip-Resistive Finish: Before final floating, apply slip-resistive [**aggregate**][**aluminum granule**] finish to concrete stair treads, platforms, and ramps, as indicated on Drawings.
  - 1. Apply in accordance with manufacturer's written instructions and as follows:
    - a. Uniformly spread [25 lb/100 sq. ft.]<Insert rate> of dampened slip-resistive [aggregate][aluminum granules] over surface in one or two applications.
    - b. Tamp aggregate flush with surface, but do not force below surface.
    - c. After broadcasting and tamping, apply float finish.
    - d. After curing, lightly work surface with a steel wire brush or an abrasive stone and water to expose slip-resistive [aggregate][aluminum granules].
- G. Dry-Shake Floor Hardener Finish: After initial floating, apply dry-shake floor hardener to surfaces in accordance with manufacturer's written instructions and as follows:
  - 1. Uniformly apply dry-shake floor hardener at a rate of [100 lb/100 sq. ft.]<Insert rate> unless greater amount is recommended by manufacturer.
  - 2. Uniformly distribute approximately two-thirds of dry-shake floor hardener over surface by hand or with mechanical spreader, and embed by power floating.
  - 3. Follow power floating with a second dry-shake floor hardener application, uniformly distributing remainder of material, and embed by power floating.
  - 4. After final floating, apply a trowel finish.
  - 5. Cure concrete with curing compound recommended by dry-shake floor hardener manufacturer and apply immediately after final finishing.

# 3.09 APPLICATION OF FINISHING FORMED SURFACES

- A. As-Cast Surface Finishes:
  - 1. ACI 301 (ACI 301M) Surface Finish SF-1.0: As-cast concrete texture imparted by formfacing material.
    - a. Patch voids larger than 1-1/2 inches wide or 1/2 inch deep.
    - b. Remove projections larger than **1** inch.
    - c. Tie holes do not require patching.
    - d. Surface Tolerance: ACI 117, Class D.
    - e. Apply to concrete surfaces for metal lap pan deck formed surfaces and those surfaces that are buried or covered with subsequent installed surfaces.

- 2. ACI 301 (ACI 301M) Surface Finish SF-2.0: As-cast concrete texture imparted by formfacing material, arranged in an orderly and symmetrical manner with a minimum of seams.
  - a. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
  - b. Remove projections larger than 1/4 inch.
  - c. Patch tie holes.
  - d. Surface Tolerance: ACI 117, Class B.
  - e. Locations: Apply to concrete surfaces [exposed to public view,][to receive a rubbed finish,][or to be covered with a coating or covering material applied directly to concrete]<Insert locations>.
- 3. ACI 301 (ACI 301M) Surface Finish SF-3.0:
  - a. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
  - b. Remove projections larger than 1/8 inch.
  - c. Patch tie holes.
  - d. Surface Tolerance: ACI 117 Class A.
  - e. Locations: Apply to concrete surfaces [exposed to public view,][to receive a rubbed finish,][or to be covered with a coating or covering material applied directly to concrete]<Insert locations>.
- B. Rubbed Finish: Apply the following to as-cast surface finishes where indicated on Drawings:
  1. Smooth-Rubbed Finish:
  - a. Perform no later than one day after form removal.
  - b. Moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture.
  - c. If sufficient cement paste cannot be drawn from the concrete by the rubbing process, use a grout made from the same cementitious materials used in the in-place concrete.
  - d. Maintain required patterns or variances as shown on Drawings or to match [design reference sample][field sample panels][mockups].
  - 2. Grout-Cleaned Rubbed Finish:
    - a. Clean concrete surfaces after contiguous surfaces are completed and accessible.
    - b. Do not clean concrete surfaces as Work progresses.
    - c. Mix 1 part portland cement to 1-1/2 parts fine sand, complying with ASTM C144 or ASTM C404, by volume, with sufficient water to produce a mixture with the consistency of thick paint. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces.
    - d. Wet concrete surfaces.
    - e. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap, and keep surface damp by fog spray for at least 36 hours.
    - f. Maintain required patterns or variances as shown on Drawings or to match [design reference sample][field sample panels][mockups].
- C. Abrasive-Blast Finish: Apply the following to as-cast surface finishes where indicated on Drawings:
  - 1. Perform abrasive blasting after compressive strength of concrete exceeds **2000 psi**.
  - 2. Coordinate with formwork removal to ensure that surfaces to be abrasive blasted are treated at the same age.
  - 3. Surface Continuity:
    - a. Perform abrasive-blast finishing as continuous operation, maintaining continuity of finish on each surface or area of Work.
    - b. Maintain required patterns or variances in depths of blast to match [design reference sample][field sample panels][mockups].
  - 4. Abrasive Blasting:

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- a. Abrasive-blast corners and edges of patterns carefully, using backup boards to maintain uniform corner and edge lines.
- b. Determine type of nozzle pressure and blasting techniques required to match field sample.
- c. Depth of Cut: Use an abrasive grit of proper type and gradation to expose aggregate and surrounding matrix surfaces to match field sample, as follows:
  - 1) Brush Texture: Remove cement matrix to dull surface sheen and expose face of fine aggregate, with no significant reveal.
  - 2) Light Texture: Expose fine aggregate with occasional exposure of coarse aggregate and uniform color, with maximum reveal of 1/16 inch.
  - 3) Medium Texture: Generally, expose coarse aggregate with slight reveal and with a maximum reveal of 1/4 inch.
  - 4) Heavy Texture: Expose and reveal coarse aggregate to a maximum projection of one-third its diameter, with reveal range of 1/4 to 1/2 inch.
- d. Maintain required patterns or variances in reveal projection to match [design reference sample][field sample panels][mockups].
- D. High-Pressure Water-Jet Finish: Apply the following to as-cast surface finishes where indicated on Drawings:
  - 1. Perform high-pressure water jetting on concrete that has achieved a minimum compressive strength of **4500 psi**.
  - 2. Coordinate with formwork removal to ensure that surfaces to be high-pressure water-jet finished are treated at same age for uniform results.
  - 3. Surface Continuity: Perform high-pressure water-jet finishing in as continuous an operation as possible, maintaining continuity of finish on each surface or area of Work.
  - 4. Maintain required patterns or variances in reveal projection to match [design reference sample][field sample panels][mockups].
- E. Bushhammer Finish: Apply the following to as-cast surface finishes where indicated on Drawings:
  - 1. Perform bushhammer finish to concrete that has achieved a minimum compressive strength of **4500 psi**.
  - 2. Surface Continuity:
    - a. Perform bushhammer finishing in as continuous an operation as possible, maintaining continuity of finish on each surface or area of Work.
  - 3. Surface Cut:
    - a. Maintain required depth of cut and general aggregate exposure.
    - b. Use power tool with hammer attachments for large, flat surfaces, and use hand hammers for small areas, at corners and edges, and for restricted locations where power tools cannot reach.
  - 4. Remove impressions of formwork and form facings with exception of tie holes.
  - 5. Maintain required patterns or variances of cut as shown on Drawings or to match [design reference sample][field sample panels][mockups].
  - 6. Maintain control of concrete chips, dust, and debris in each Work area, limiting migration of airborne materials and dust by use of tarpaulins, windbreaks, or similar devices.

# 3.10 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

- A. Filling in:
  - 1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
  - 2. Mix, place, and cure concrete, as specified, to match color and texture with in-place construction exposed to view.

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- 3. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations:
  - 1. Coordinate sizes and locations of concrete bases with actual equipment provided.
  - 2. Construct concrete bases 4 inches high unless otherwise indicated on Drawings, and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated on Drawings, or unless required for seismic anchor support.
  - 3. Minimum Compressive Strength: 4000 psi at 28 days.
  - 4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on **18-inch** centers around the full perimeter of concrete base.
  - 5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.
  - 6. Prior to pouring concrete, place and secure anchorage devices.
    - a. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
    - b. Cast anchor-bolt insert into bases.
    - c. Install anchor bolts to elevations required for proper attachment to supported equipment.
- D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items.
  - 1. Cast-in inserts and accessories, as shown on Drawings.
  - 2. Screed, tamp, and trowel finish concrete surfaces.

# 3.11 APPLICATION OF CONCRETE CURING

- A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
  - 1. Comply with ACI 301 for cold weather protection during curing.
  - 2. Comply with ACI 301 and ACI 305.1 for hot-weather protection during curing.
  - 3. Maintain moisture loss no more than **0.2 lb/sq. ft. x h**, calculated in accordance with ACI 305R, before and during finishing operations.
- B. Curing Formed Surfaces: Comply with **ACI 308.1** as follows:
  - 1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.
  - 2. Cure concrete containing color pigments in accordance with color pigment manufacturer's instructions.
  - 3. If forms remain during curing period, moist cure after loosening forms.
  - 4. If removing forms before end of curing period, continue curing for remainder of curing period as follows:
    - a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
    - b. Continuous Sprinkling: Maintain concrete surface continuously wet.
    - c. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.
    - d. Water-Retention Sheeting Materials: Cover exposed concrete surfaces with sheeting material, taping, or lapping seams.
    - e. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
      - 1) Recoat areas subject to heavy rainfall within three hours after initial application.

- 2) Maintain continuity of coating and repair damage during curing period.
- C. Curing Unformed Surfaces: Comply with ACI 308.1 as follows:
  - 1. Begin curing after finishing concrete.
  - 2. Interior Concrete Floors:
    - a. Floors to Receive Floor Coverings Specified in Other Sections: Contractor has option of the following:
      - 1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
      - a) Lap edges and ends of absorptive cover not less than 12 inches.
      - b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.
        - Moisture-Retaining-Cover Curing: Cover concrete surfaces with moistureretaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive.
      - c) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
      - d) Cure for not less than seven days.
        - 3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following not in cold weather:
      - e) Water.
      - f) Continuous water-fog spray.
    - b. Floors to Receive Penetrating Liquid Floor Treatments: Contractor has option of the following:
      - 1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
      - g) Lap edges and ends of absorptive cover not less than 12 inches.
      - h) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.
        - Moisture-Retaining-Cover Curing: Cover concrete surfaces with moistureretaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive.
      - i) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
      - j) Cure for not less than seven days.
        - 3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
      - k) Water.
      - I) Continuous water-fog spray.

c. Floors to Receive Polished Finish: Contractor has option of the following: 22047.01 / VNPCC Expansion &

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- 1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
- m) Lap edges and ends of absorptive cover not less than 12 inches.
- n) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.
  - 2) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
- o) Water.
- p) Continuous water-fog spray.
- d. Floors To Receive Chemical Stain:
  - 1) As soon as concrete has sufficient set to permit application without marring concrete surface, install curing paper over entire area of floor.
  - 2) Install curing paper square to building lines, without wrinkles, and in a single length without end joints.
  - 3) Butt sides of curing paper tight; do not overlap sides of curing paper.
  - 4) Leave curing paper in place for duration of curing period, but not less than 28 days.
- e. Floors To Receive Urethane Flooring:
  - 1) As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
  - 2) Rewet absorptive cover, and cover immediately with polyethylene moistureretaining cover with edges lapped **6** inches and sealed in place.
  - 3) Secure polyethylene moisture-retaining cover in place to prohibit air from circulating under polyethylene moisture-retaining cover.
  - 4) Leave absorptive cover and polyethylene moisture-retaining cover in place for duration of curing period, but not less than 28 days.
- f. Floors To Receive Curing Compound:
  - 1) Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
  - 2) Recoat areas subjected to heavy rainfall within three hours after initial application.
  - 3) Maintain continuity of coating, and repair damage during curing period.
  - 4) Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer.
- g. Floors To Receive Curing and Sealing Compound:
  - 1) Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller in accordance with manufacturer's written instructions.
  - 2) Recoat areas subjected to heavy rainfall within three hours after initial application.
  - 3) Repeat process 24 hours later, and apply a second coat. Maintain continuity of coating, and repair damage during curing period.

## 3.12 APPLICATION OF LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment in accordance with manufacturer's written instructions.

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## 3.13 INSTALLATION OF JOINT FILLING

- A. Prepare, clean, and install joint filler in accordance with manufacturer's written instructions.
  1. Defer joint filling until concrete has aged at least [one][six] month(s).
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.
- C. Install semirigid joint filler full depth in saw-cut joints and at least **2 inches** deep in formed joints.
- D. Overfill joint, and trim joint filler flush with top of joint after hardening.

## 3.14 INSTALLATION OF CONCRETE SURFACE REPAIRS

- A. Defective Concrete:
  - 1. Repair and patch defective areas when approved by Architect.
  - 2. Remove and replace concrete that cannot be repaired and patched to meet specification requirements.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a **No. 16** sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks in excess of **0.01 inch** spalls, air bubbles exceeding surface finish limits, honeycombs, rock pockets, fins and other projections on the surface exceeding surface finish limits, and stains and other discolorations that cannot be removed by cleaning.
  - Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete.
    - a. Limit cut depth to 3/4 inch.
    - b. Make edges of cuts perpendicular to concrete surface.
    - c. Clean, dampen with water, and brush-coat holes and voids with bonding agent.
    - d. Fill and compact with patching mortar before bonding agent has dried.
    - e. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
  - 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement, so that, when dry, patching mortar matches surrounding color.
    - a. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching.
    - b. Compact mortar in place and match surrounding surface.
  - 3. Repair defects on concealed formed surfaces that will affect concrete's durability and structural performance, as determined by Architect.
- D. Repairing Unformed Surfaces:
  - 1. Test unformed surfaces, such as floors and slabs, for finish, and verify surface tolerances specified for each surface.
    - a. Correct low and high areas.
    - b. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
  - Repair finished surfaces containing surface defects, including spalls, popouts, honeycombs, rock pockets, crazing, and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width.
  - 3. After concrete has cured at least 14 days, correct high areas by grinding.
  - 4. Correct localized low areas during, or immediately after, completing surface-finishing operations by adding patching mortar.

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- a. Finish repaired areas to blend into adjacent concrete.
- 5. Correct other low areas scheduled to receive floor coverings with a repair underlayment.
  - a. Prepare, mix, and apply repair underlayment and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
  - b. Feather edges to match adjacent floor elevations.
- 6. Correct other low areas scheduled to remain exposed with repair topping.
  - a. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations.
  - b. Prepare, mix, and apply repair topping and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
- 7. Repair defective areas, except random cracks and single holes **1** inch or less in diameter, by cutting out and replacing with fresh concrete.
  - a. Remove defective areas with clean, square cuts, and expose steel reinforcement with at least a 3/4-inch clearance all around.
  - b. Dampen concrete surfaces in contact with patching concrete and apply bonding agent.
  - c. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate.
  - d. Place, compact, and finish to blend with adjacent finished concrete.
  - e. Cure in same manner as adjacent concrete.
- 8. Repair random cracks and single holes **1** inch or less in diameter with patching mortar.
  - a. Groove top of cracks and cut out holes to sound concrete, and clean off dust, dirt, and loose particles.
  - b. Dampen cleaned concrete surfaces and apply bonding agent.
  - c. Place patching mortar before bonding agent has dried.
  - d. Compact patching mortar and finish to match adjacent concrete.
  - e. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

# 3.15 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.
- B. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
  - 1. Testing agency to be responsible for providing curing facility for initial curing of strength test specimens on-site and verifying that test specimens are cured in accordance with standard curing requirements in ASTM C31/C31M.
  - 2. Testing agency to immediately report to Architect, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.
  - 3. Testing agency to report results of tests and inspections, in writing, to Owner, Architect, Contractor, and concrete manufacturer within 48 hours of inspections and tests.
    - Test reports to include reporting requirements of ASTM C31/C31M, ASTM C39/C39M, and ACI 301, including the following as applicable to each test and inspection:
      - 1) Project name.
      - 2) Name of testing agency.

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- 3) Names and certification numbers of field and laboratory technicians performing inspections and testing.
- 4) Name of concrete manufacturer.
- 5) Date and time of inspection, sampling, and field testing.
- 6) Date and time of concrete placement.
- 7) Location in Work of concrete represented by samples.
- 8) Date and time sample was obtained.
- 9) Truck and batch ticket numbers.
- 10) Design compressive strength at 28 days.
- 11) Concrete mixture designation, proportions, and materials.
- 12) Field test results of fresh concrete, including slump or slump flow, air content, temperature and density.
- 13) Information on storage and curing of samples at the Project site, including curing method and maximum and minimum temperatures during initial curing period.
- 14) Type of fracture and compressive break strengths at seven days and 28 days.
- 4. Provide a space and source of power or other resources for curing and access to test specimens by the testing agency.
- C. Delivery Tickets: comply with ASTM C94/C94M.
- D. Inspections:
  - 1. Headed bolts and studs.
  - 2. Verification of use of required design mixture.
  - 3. Concrete placement, including conveying and depositing.
  - 4. Curing procedures and maintenance of curing temperature.
  - 5. Verification of concrete strength before removal of shores and forms from beams and slabs.
  - 6. Batch Plant Inspections: On a random basis, as determined by Architect.
- E. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M to be performed in accordance with the following requirements:
  - Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 150 cu. yd. or fraction thereof.
    - a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing is to be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
  - 2. Slump: ASTM C143/C143M:
    - a. One test at point of delivery for each composite sample, but not less than one test for each day's pour of each concrete mixture.
    - b. Perform additional tests as needed.
  - 3. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete; .
    - a. One test for each composite sample when strength test specimens are cast, but not less than one test for each day's pour of each concrete mixture.
  - 4. Concrete Temperature: ASTM C1064/C1064M:
    - a. One test hourly when air temperature is **40 deg F** and below or **80 deg F** and above, and one test for each composite sample when strength test specimens are cast.
  - 5. Concrete Density: ASTM C138/C138M:
  - a. One test for each composite sample when strength test specimens are cast.
  - 6. Unit Weight: ASTM C138/C138M density of fresh structural lightweight concrete.

- a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture. The fresh density should be consistent with that associated with the equilibrium density within a tolerance of plus or minus 4 lb/ft.3.
- 7. Compression Test Specimens: ASTM C31/C31M:
  - a. Cast and standard cure two sets of [two][three][four] 6 inches by 12-inches or 4inch by 8-inch cylindrical specimens for each composite sample.
- 8. Compressive-Strength Tests: ASTM C39/C39M.
  - a. Test one set of [**two**][**three**][**four**] standard cured specimens at seven days and one set of two specimens at 28 [**other age**] days.
  - b. A compressive-strength test to be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
- 9. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests of standard cured cylinders equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi if specified compressive strength is 5000 psi, or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5000 psi.
- 10. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
- 11. Additional Tests:
  - a. Testing and inspecting agency to make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
  - b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Architect.
    - 1) Acceptance criteria for concrete strength to be in accordance with ACI 301, Section 1.7.6.3.
- 12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- 13. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- F. Measure floor and slab flatness and levelness in accordance with **ASTM E1155** within 24 hours of completion of floor finishing and promptly report test results to Architect.

# 3.16 PROTECTION

- A. Protect concrete surfaces as follows:
  - 1. Protect from petroleum stains.
  - 2. Diaper hydraulic equipment used over concrete surfaces.
  - 3. Prohibit vehicles from interior concrete slabs.
  - 4. Prohibit use of pipe-cutting machinery over concrete surfaces.
  - 5. Prohibit placement of steel items on concrete surfaces.
  - 6. Prohibit use of acids or acidic detergents over concrete surfaces.
  - 7. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.
  - 8. Protect concrete surfaces scheduled to receive surface hardener or polished concrete finish using floor slab protective covering.

# END OF SECTION 03 3000

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Cast-In-Place Concrete

#### SECTION 04 2000 UNIT MASONRY

## PART 1 GENERAL

## 1.01 SECTION INCLUDES

A. Concrete block.

## 1.02 RELATED REQUIREMENTS

- A. Section **<u>03 1000 Concrete Forming and Accessories</u>**: Dovetail slots for masonry anchors.
- B. Section <u>03 2000 Concrete Reinforcing</u>: Reinforcing steel for grouted masonry.
- C. Section 03 3000 Cast-in-Place Concrete: Installation of dovetail slots for masonry anchors.
- D. Section <u>07 1113 Bituminous Dampproofing</u>: Dampproofing<< <u>parged</u>; or None N/A>> masonry surfaces.

### 1.03 REFERENCE STANDARDS

- A. ASTM A951/A951M Standard Specification for Steel Wire for Masonry Joint Reinforcement; 2016, with Editorial Revision (2018).
- B. ASTM C55 Standard Specification for Concrete Building Brick; 2017.
- C. ASTM C90 Standard Specification for Loadbearing Concrete Masonry Units; 2016a.
- D. ASTM C270 Standard Specification for Mortar for Unit Masonry; 2019.
- E. ASTM C404 Standard Specification for Aggregates for Masonry Grout; 2018.
- F. ASTM C476 Standard Specification for Grout for Masonry; 2020.
- G. TMS 402/602 Building Code Requirements and Specification for Masonry Structures; 2016.

### 1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting << <u>one week;</u> or \_\_\_\_>> before starting work of this section; require attendance by all relevant installers.

### 1.05 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements for submittal procedures.
- B. Product Data: Provide data for << <u>masonry units</u>; <u>fabricated wire reinforcement</u>; <u>masonry accessories</u>; and \_\_\_\_\_>>.
- C. Shop Drawings: Indicate pertinent dimensions, materials, anchorage, size and type of fasteners, and accessories for brickwork support system.
  - 1. Include calculations or selections from the manufacturer's prescriptive design tables that indicate compliance with the applicable building code and project conditions.
- D. Samples: Submit << <u>four</u>; or \_\_\_\_>> samples of << <u>decorative block</u>; facing brick; ceramic glazed facing brick; ceramic glazed structural clay facing tile; and \_\_\_\_\_>> units to illustrate color, texture, and extremes of color range.
- E. Manufacturer's Qualification Statement.
- F. Installer's Qualification Statement.

### 1.06 QUALITY ASSURANCE

- A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.
- B. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section with minimum << <u>three</u>; or \_\_\_\_\_>> years of<< <u>documented</u>; or None N/A>> experience.
- C. Installer Qualifications: Company specializing in performing work of the type specified and with at least << <u>three</u>; or \_\_\_\_\_>> years of<< <u>documented</u>; \_\_\_\_; or None N/A>> experience<< and approved by manufacturer; or <u>None N/A</u>>>.

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## 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.
- B. Handle and store << ceramic glazed masonry units; pre-faced concrete block units; and masonry units>> in protective cartons or trays. Do not remove from protective packaging until ready for installation.

### PART 2 PRODUCTS

## 2.01 CONCRETE MASONRY UNITS

- A. Concrete Block: Comply with referenced standards and as follows:
  - 1. Size: Standard units with nominal face dimensions of <u>16 by 8 inches</u> and nominal depth of << 4 inches; 6 inches; <u>8 inches</u>; 10 inches; 12 inches; or \_\_\_\_\_>>.
  - 2. Pre-Faced Units: ASTM C90, << <u>hollow</u>; solid; or \_\_\_\_>> block, with smooth resinous facing complying with ASTM C744.
    - a. Colors and styles: << As indicated on drawings; As scheduled; or Color: Sable, Face: Ground>>.
    - b. Manufacturers:
      - 1) Mutual Materials or equal.

END OF SECTION 04 2000

#### SECTION 05 5000 METAL FABRICATIONS

#### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

A. Shop fabricated << steel; aluminum; and \_\_\_\_\_>> << items.; or items, including:>>

### 1.02 RELATED REQUIREMENTS

- A. Section <u>03 3000 Cast-in-Place Concrete</u>: Placement of metal fabrications in concrete.
- B. Section <u>04 2000 Unit Masonry</u>: Placement of metal fabrications in masonry.
- C. Section <u>05 1200 Structural Steel Framing</u>: Structural steel << <u>column</u>; or \_\_\_\_\_>> anchor bolts.
- D. Section <u>05 2100 Steel Joist Framing</u>: Structural << joist; or \_\_\_\_\_>> bearing << plates; or \_\_\_\_\_>>, including anchorage.
- E. Section <u>05 3100 Steel Decking</u>: Bearing << <u>plates</u>; angles; and \_\_\_\_\_>> for metal deck bearing, including anchorage.
- F. Section 05 5100 Metal Stairs.
- G. Section 05 5133 Metal Ladders.
- H. Section 05 5213 Pipe and Tube Railings.
- I. Section 09 9113 Exterior Painting: Paint finish.
- J. Section <u>09 9123 Interior Painting</u>: Paint finish.

#### 1.03 REFERENCE STANDARDS

- A. ASTM A36/A36M Standard Specification for Carbon Structural Steel; 2014.
- B. ASTM A53/A53M Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2020.
- C. ASTM A123/A123M Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- D. ASTM A240/A240M Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; 2020a.
- E. ASTM A283/A283M Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2018.
- F. ASTM A307 Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.
- G. ASTM A501/A501M Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2014.
- H. ASTM A666 Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.
- I. AWS A2.4 Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.
- J. AWS B2.1/B2.1M Specification for Welding Procedure and Performance Qualification; 2014 (Amended 2015).
- K. AWS D1.1/D1.1M Structural Welding Code Steel; 2020.
- L. AWS D1.2/D1.2M Structural Welding Code Aluminum; 2014, with Errata.
- M. SSPC-Paint 15 Steel Joist Shop Primer/Metal Building Primer; 1999 (Ed. 2004).
- N. SSPC-Paint 20 Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).
- O. SSPC-SP 2 Hand Tool Cleaning; 2018.

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# 1.04 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
  - 1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
  - 2. Design data: Submit drawings and supporting calculations, signed and sealed by a qualified professional structural engineer.
    - a. Include the following, as applicable:
      - 1) Design criteria.
      - 2) Engineering analysis depicting stresses<< <u>and deflections;</u> or None N/A>>.
      - 3) Member sizes<< <u>and gauges;</u> or None N/A>>.
      - 4) Details of connections.
      - 5) Support reactions.
      - 6) Bracing requirements.
- C. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than << <u>12 months</u>; or \_\_\_\_>> before start of scheduled welding work.
- D. Designer's Qualification Statement.

#### 1.05 QUALITY ASSURANCE

A. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and AWS D1.2/D1.2M and dated no more than << <u>12 months</u>; or \_\_\_\_>> before start of scheduled welding work.

#### PART 2 PRODUCTS

### 2.01 MATERIALS - STEEL

- A. Steel Sections: << <u>ASTM A36/A36M;</u> or \_\_\_\_\_>>.
- B. Steel Tubing: << ASTM A500/A500M Grade B cold-formed; <u>ASTM A501/A501M hot-</u> <u>formed;</u> or \_\_\_\_\_>> structural tubing.
- C. Plates: << <u>ASTM A283/A283M</u>; or \_\_\_\_>>.
- D. Pipe: << <u>ASTM A53/A53M, Grade B Schedule 40</u>; ASTM A53/A53M Grade B Schedule 80; ASTM A53/A53M Grade \_\_\_\_ Schedule 40; ASTM A53/A53M Grade \_\_\_\_ Schedule \_\_\_; or \_\_\_\_\_>>, << <u>black finish</u>; hot-dip galvanized finish; black and hot-dip galvanized finish, as indicated; or \_\_\_\_\_\_>>.
- E. Stainless Steel, General: ASTM A666, << <u>Type 304;</u> Type 316; or \_\_\_\_\_>>.
- F. Bolts, Nuts, and Washers: ASTM A307<< <u>. Grade A</u>; , Grade B; , \_\_\_\_; or None N/A>><< <u>. plain</u>; , galvanized to ASTM A153/A153M where connecting galvanized components; or None N/A>>.
- G. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- H. Shop and Touch-Up Primer: << <u>SSPC-Paint 15</u>; or \_\_\_\_\_>>, complying with VOC limitations of authorities having jurisdiction.
- I. Touch-Up Primer for Galvanized Surfaces: << <u>SSPC-Paint 20, Type I Inorganic;</u> SSPC-Paint 20 Type II - Organic; or \_\_\_\_\_>>, complying with VOC limitations of authorities having jurisdiction.

#### 2.02 FABRICATION

- A. Fit and shop assemble items in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured.

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- C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- D. Furnish components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

### 2.03 FABRICATED ITEMS

- A. Bumper << Posts; <u>Guard Rails</u>; and \_\_\_\_>>: As detailed; << <u>prime paint</u>; galvanized; or \_\_\_\_>> finish.
- Bollards: 6" dia. Steel pipe, concrete filled, crowned cap, as detailed; << prime paint; galvanized; or \_\_\_\_\_>> finish. Provide foundation design by a registered engineering licensed to practice in the state where the project is located.
- C. << <u>Ledge Angles;</u> <u>Shelf Angles;</u> <u>Channels;</u> <u>Plates;</u> and \_\_\_\_\_>> Not Attached to Structural Framing: For support of << <u>metal decking;</u> joists; masonry; and \_\_\_\_\_>; << <u>prime paint;</u> galvanized; natural; or \_\_\_\_\_>> finish.
- D. Door Frames for << Overhead Door Openings; Wall Openings; and coiling and roll-up doors>>: << Channel; Angle; and Tube>> sections; << prime paint; galvanized; or \_\_\_\_\_\_\_\_\_>> finish.
- E. Elevator Hoistway Divider Beams: << <u>Beam;</u> or \_\_\_\_>> sections; << <u>prime paint;</u> or \_\_\_\_\_>> finish.

#### 2.04 FINISHES - STEEL

- A. Prime paint steel items.
- B. Prepare surfaces to be primed in accordance with << <u>SSPC-SP2</u>; or \_\_\_\_>>.
- C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- D. Prime Painting: << <u>One coat</u>; Two coats; or \_\_\_\_>>.
- E. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.
- F. Stainless Steel Finish: << <u>No. 4 Bright Polished finish</u>; No. 8 Reflective Polished finish; or \_\_\_\_\_>>.

### 2.05 FABRICATION TOLERANCES

- A. Squareness: << <u>1/8 inch</u>; or \_\_\_\_\_ inch>> maximum difference in diagonal measurements.
- B. Maximum Offset Between Faces: << <u>1/16 inch</u>; or \_\_\_\_\_ inch>>.
- C. Maximum Misalignment of Adjacent Members: << <u>1/16 inch</u>; or \_\_\_\_\_ inch>>.
- D. Maximum Bow: << <u>1/8 inch</u>; or \_\_\_\_\_ inch>> in << <u>48 inches</u>; or \_\_\_\_\_ inches>>.
- E. Maximum Deviation From Plane: << <u>1/16 inch</u>; or \_\_\_\_ inch>> in << <u>48 inches</u>; or \_\_\_\_ inches>>.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

#### 3.02 PREPARATION

A. Clean and strip << <u>primed steel items to bare metal</u>; aluminum; and \_\_\_\_\_>> where site welding is required.

# 3.03 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

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C. Obtain approval prior to site cutting or making adjustments not scheduled.

# 3.04 TOLERANCES

- A. Maximum Variation From Plumb: << <u>1/4 inch;</u> or \_\_\_\_\_ inch>> per story, non-cumulative.
- B. Maximum Offset From True Alignment: << <u>1/4 inch;</u> or \_\_\_\_\_ inch>>.
- C. Maximum Out-of-Position: << <u>1/4 inch;</u> or \_\_\_\_\_ inch>>.

# END OF SECTION 05 5000

#### SECTION 05 5100 METAL STAIRS

#### PART 1 GENERAL

#### **1.01 SECTION INCLUDES**

- A. Stairs with concrete treads.
- B. Stairs with grating treads.
- C. Prefabricated stairs.
- D. Structural steel stair framing and supports.

#### 1.02 RELATED REQUIREMENTS

- A. Section <u>03 3000 Cast-in-Place Concrete</u>: Concrete fill in stair pans<< <u>and landings</u>; or <u>None N/A>><<</u>; mesh reinforcement for landings; or <u>None N/A>>.</u>
- B. Section 03 3000 Cast-in-Place Concrete: Placement of metal anchors in concrete.
- C. Section 05 5000 Metal Fabrications.
- D. Section <u>05 5213 Pipe and Tube Railings</u>: Metal handrails for the stairs specified in this section.
- E. Section 09 9113 Exterior Painting: Paint finish.
- F. Section 09 9123 Interior Painting: Paint finish.

#### 1.03 REFERENCE STANDARDS

- A. ADA Standards Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. AISC 201 AISC Certification Program for Structural Steel Fabricators, Standard for Steel Building Structures; 2006.
- C. ASTM A6/A6M Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling; 2019.
- D. ASTM A36/A36M Standard Specification for Carbon Structural Steel; 2014.
- E. ASTM A123/A123M Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- F. ASTM A153/A153M Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.
- G. ASTM A283/A283M Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2018.
- H. ASTM A500/A500M Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2021.
- I. ASTM A501/A501M Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2014.
- J. ASTM A653/A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.
- K. ASTM A1008/A1008M Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2020.
- L. ASTM A1011/A1011M Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2018a.
- M. ASTM F3125/F3125M Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile

Strength; 2019, with Editorial Revision (2020).

- N. AWS A2.4 Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.
- O. AWS B2.1/B2.1M Specification for Welding Procedure and Performance Qualification; 2014 (Amended 2015).
- P. AWS D1.1/D1.1M Structural Welding Code Steel; 2020.
- Q. NAAMM AMP 510 Metal Stairs Manual; 1992.
- R. NAAMM MBG 531 Metal Bar Grating Manual; 2017.
- S. NAAMM MBG 532 Heavy Duty Metal Bar Grating Manual; 2009.
- T. SSPC-Paint 20 Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).
- U. SSPC-SP 2 Hand Tool Cleaning; 2018.
- V. UL 1994 Luminous Egress Path Marking Systems; Current Edition, Including All Revisions.

# 1.04 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements, for submittal procedures.
- B. Product Data:
- C. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.
  - 1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
  - 2. Include the design engineer's seal and signature on each sheet of shop drawings.
- D. Design Data: As required by authorities having jurisdiction.
- E. Design Data, Seismic Performance: Submit documentation that stairs meet performance requirements specified.
- F. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than << <u>12 months</u>; or \_\_\_\_>> before start of scheduled welding work.
- G. Designer's Qualification Statement.
- H. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is certified under AISC 201.

### 1.05 QUALITY ASSURANCE

- A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located, or personnel under direct supervision of such an engineer.
- B. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and dated no more than << <u>12 months</u>; or \_\_\_\_>> before start of scheduled welding work.
- C. Fabricator Qualifications:
  - 1. A qualified steel fabricator that is certified by the American Institute for Steel Construction (AISC) under AISC 201.
  - A company specializing in manufacturing products specified in this section, with not less than << <u>ten</u>; five; three; or \_\_\_\_>> years of<< documented; or <u>None - N/A</u>>> experience.

## PART 2 PRODUCTS

### 2.01 METAL STAIRS - GENERAL

A. Metal Stairs: Provide stairs of the design specified, complete with landing platforms, vertical and horizontal supports, railings, and guards, fabricated accurately for anchorage to each other and to building structure.

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- 1. Regulatory Requirements: Provide stairs and railings that comply with most stringent requirements of local, state, and federal regulations; where requirements of Contract Documents exceed those of regulations, comply with Contract Documents.
- 2. Handrails: Comply with applicable accessibility requirements of ADA Standards.
- 3. Structural Design: Provide complete stair and railing assemblies that comply with << <u>the</u> <u>applicable local code.</u>; the following:; or \_\_\_\_\_.>>
- 4. Dimensions: As indicated on drawings.
- 5. Shop assemble components; disassemble into largest practical sections suitable for transport and access to site.
- 6. No sharp or rough areas on exposed travel surfaces and surfaces accessible to touch.
- 7. Separate dissimilar metals using paint or permanent tape.
- B. Metal Jointing and Finish Quality Levels:
  - 1. Architectural: All joints as inconspicuous as possible, whether welded or mechanical.
    - a. Welded Joints: Continuously welded and ground smooth and flush.
    - b. Mechanical Joints: Butted tight, flush, and hairline; concealed fastenings only.
    - c. Exposed Edges and Corners: Eased to small uniform radius.
    - d. Metal Surfaces to be Painted: Sanded or ground smooth, suitable for highest quality gloss finish.
  - 2. Service: Exposed joints tight with face surfaces aligned; underside of stair not covered by soffit is not considered exposed to view.
    - a. Welded Joints: Welded on back side wherever possible.
    - b. Welds Exposed to View: Ground smooth; not required to be flush.
    - c. Bolts Exposed to View: Countersunk flat or oval head bolts; no exposed nuts or screw threads.
    - d. Metal Surfaces to be Painted: Sanded smooth, suitable for satin or matte finish.
- C. Fasteners: Same material or compatible with materials being fastened; type consistent with design and specified quality level.
- D. Anchors and Related Components: Same material and finish as item to be anchored, except where specifically indicated otherwise; provide all anchors and fasteners required.

#### 2.02 METAL STAIRS WITH CONCRETE TREADS

- A. Jointing and Finish Quality Level: << Industrial; Service; Commercial; <u>Architectural</u>; or \_\_\_\_\_\_>>, as defined above.
- B. Risers: << Closed; Open; or Match existing on Stair S1>>.
- C. Treads: Metal pan with << <u>field-installed concrete fill;</u> precast concrete tread; or \_\_\_\_\_>>.
  - 1. << <u>Concrete Depth;</u> Precast Concrete Tread Thickness; or \_\_\_\_\_>>: << <u>1-1/2 inches;</u> or \_\_\_\_\_ inches>>, minimum.
  - 2. Tread Pan Material: Steel sheet.
  - 3. Tread Pan Thickness: As required by design; << <u>14 gauge, 0.075 inch</u>; or <u>gauge,</u> <u>inch>></u> minimum.
  - Pan Anchorage to Stringers: << Welded or bolted; <u>Welded</u>; Bolted; or \_\_\_\_\_>> to carrier angles << welded or bolted; <u>welded</u>; bolted; or \_\_\_\_\_>> to stringers.
  - 5. Concrete Reinforcement: << <u>Welded wire mesh</u>; or \_\_\_\_>>.
  - Concrete Finish: << <u>For resilient floor covering</u>; Steel troweled; Applied abrasive grit; or \_\_\_\_\_>>.
- D. Risers: Same material and thickness as tread pans.
  - 1. Nosing Depth: Not more than << <u>1-1/2 inch</u>; or \_\_\_\_\_ inch>> overhang.
  - Nosing Return: Flush with top of concrete fill, not more than << <u>1/2 inch</u>; or \_\_\_\_\_ inch>> wide.
- E. Stringers: << Rolled steel channels; Steel plate; or as indicated in the drawings>>.
   1. Stringer Depth (Stair S1): Match existing

- 2. End Closure: Sheet steel of same thickness as risers welded across ends.
- F. Landings: Same construction as treads, supported and reinforced as required to achieve design load capacity.
- G. Under Side of Stair: Exposed to view, to be finished same as specified for other exposed to view surfaces.

### 2.03 METAL STAIRS WITH GRATING TREADS

- A. Jointing and Finish Quality Level: << Industrial; <u>Service</u>; Commercial; Architectural; or \_\_\_\_\_>>, as defined above.
- B. Risers: << <u>Closed;</u> Open; or \_\_\_\_>>.
- C. Treads: << Steel; Stainless steel; Aluminum; or \_\_\_\_\_>> bar grating.
  - 1. Grating Type: << <u>Welded</u>; Pressure locked; Riveted; or \_\_\_\_>>.
  - 2. Bearing Bar Depth: << <u>3/4 inch;</u> 1 inch; or \_\_\_\_\_ inch>>, minimum.
  - 3. Top Surface: **<< Standard;** <u>Serrated</u>; or \_\_\_\_>>.
  - 4. Nosing: << <u>Checkered plate;</u> Abrasive cast aluminum; Abrasive finished fiberglass; or \_\_\_\_\_>>.
  - 5. Nosing Width: << <u>1-1/4 inch;</u> or \_\_\_\_\_ inch>>, minimum.
  - 6. Photoluminescent Nosing: Factory fabricated aluminum nosing with embedded photoluminescent strip; field applied to front edge of tread.
  - 7. Anchorage to Stringers: End plates welded to grating, bolted to stringers.
- D. Stringers: << Rolled steel channels; Steel plate; or \_\_\_\_>>.
  - 1. Stringer Depth: << 10 inches; <u>12 inches;</u> inches; or As indicated on drawings>>.
  - End Closure: Sheet steel, << <u>14 gauge, 0.075 inch</u>; or <u>gauge, inch>></u> minimum; welded across ends.
- E. Landings: Same construction as treads, supported and reinforced as required to achieve design load capacity.
- F. Finish: Galvanized after fabrication.

#### 2.04 PREFABRICATED STAIRS

- A. Prefabricated Stair (Roof): Welded unit, factory fabricated to greatest degree practical and in the largest components possible.
  - 1. Design Requirements: Comply with structural design criteria stated elsewhere in this section and applicable local code.
  - 2. Materials: Manufacturer's standard << <u>steel</u>; aluminum; or \_\_\_\_\_>> tubes, plates, bars, shapes, sheets, wire and mesh that comply with requirements of MATERIALS article of this section.
    - a. Rails: << <u>Manufacturer's standard rails;</u> No rails; install adjacent to wall with surface mounted rail by others; or \_\_\_\_>>.
      - 1) Guardrails: <u>42 inches</u> high.
      - 2) Handrails: <u>30 inches</u> to <u>38 inches</u> high.
      - Infill: Manufacturer's standard << <u>pickets</u>; expanded metal; perforated metal; mesh; or \_\_\_\_\_>>.
    - b. Finish: << <u>Hot-dipped galvanizing; comply with ASTM A153/A153M;</u> Red oxide primer; manufacturer's standard; or \_\_\_\_\_>>.
  - 3. Manufacturers:
    - a. Lapeyre Stair, Inc<< <u>; 10AA</u>; ; \_\_\_\_\_; or None N/A>>: www.lapeyrestair.com/#sle.
    - b. Precision Ladders, LLC<< <u>; Fixed Aluminum Industrial Stairway</u>; <u>; \_\_\_\_</u>; or None - N/A>>: www.precisionladders.com/#sle.
    - c. UPNOVR: Crossover with Pplatform Ladder.
    - d. Substitutions: << <u>See Section 01 6000 Product Requirements;</u> or Not permitted>>.

#### 2.05 HANDRAILS AND GUARDS

- A. Wall-Mounted Rails: See Section 05 5213.
- B. floor or stair mounted Rails: see Section 05
- C. Guards: Pipe railings, see Section 05 5213.

#### 2.06 MATERIALS

- A. Steel Sections: << <u>ASTM A36/A36M</u>; or \_\_\_\_\_>>.
- B. Steel Tubing: ASTM A500/A500M or ASTM A501/A501M structural tubing, round and shapes as indicated.
- C. Stainless Steel Pipe: ASTM A312, ASTM A554, ASME SA312/A554
- D. Steel Plates: ASTM A6/A6M or ASTM A283/A283M.
- E. Ungalvanized Steel Sheet: << Hot- or cold-rolled, unless otherwise indicated; Cold-rolled only; <u>Hot- or cold-rolled, except use cold-rolled where finished work will be exposed to</u> <u>view</u>; or \_\_\_\_\_>>.
  - Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Designation << <u>CS (commercial steel)</u>; SS (structural steel), Grade 33; or \_\_\_\_>.
  - Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Designation << <u>CS (commercial steel)</u>; SS (structural steel), Grade 33, Type 1; or \_\_\_\_>.
- F. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS) Grade << <u>33/230</u>; <u>37/255</u>; <u>50/340</u>; or \_\_\_\_\_>> with << <u>G40/Z120</u>; <u>G60/Z180</u>; <u>G90/Z275</u>; or \_\_\_\_\_>> coating.
- G. Gratings: Bar gratings that comply with NAAMM MBG 531 or NAAMM MBG 532, whichever applies based on bar sizes.
- H. Concrete Fill: See Section 03 3000.

#### 2.07 ACCESSORIES

- A. Photoluminescent Nosing: Factory fabricated aluminum extrusion with replaceable embedded photoluminescent and slip-resistant strip, complies with << <u>UL 1994</u>; and ASTM E2072>>.
  - 1. Finish: << <u>Manufacturer's standard clear anodized;</u> Manufacturer's standard powder coat; or \_\_\_\_\_>>.
  - 2. Color: To be selected by Architect from manufacturer's standard range.
  - 3. Attachment: Provide manufacturer approved << <u>field applied adhesive</u>; factory applied adhesive; <u>mechanical fasteners</u>; and \_\_\_\_\_>>.
- B. Steel Bolts, Nuts, and Washers: ASTM F3125/F3125M<< <u>, Type 1</u>; , Type 3; , \_\_\_\_; or None N/A>><< <u>, and galvanized to ASTM A153/A153M</u> where connecting galvanized <u>components</u>; , plain; or None N/A>>.
- C. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- D. Touch-Up Primer for Galvanized Surfaces: << <u>SSPC-Paint 20</u> <u>Type I Inorganic</u>; SSPC-Paint 20 Type II - Organic; or \_\_\_\_\_>>, and comply with VOC limitations of authorities having jurisdiction.

#### 2.08 SHOP FINISHING

- A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- B. Do not prime surfaces in direct contact with concrete or where field welding is required.
- C. Galvanizing: Hot-dip galvanize to minimum requirements of ASTM A123/A123M.
  - 1. Touch up abraded areas after fabrication using specified touch-up primer for galvanized surfaces.

### PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

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## 3.02 PREPARATION

- A. When field welding is required, clean and strip primed steel items to bare metal.
- B. Supply items required to be << <u>cast into concrete</u>; embedded in masonry; and \_\_\_\_\_>> with setting templates.

# 3.03 INSTALLATION

- A. Install components plumb and level, accurately fitted, free from distortion or defects.
- B. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Provide welded field joints where specifically indicated on << <u>drawings</u>; shop drawings; or \_\_\_\_\_\_>>. Perform field welding in accordance with AWS D1.1/D1.1M.
- D. Other field joints may be either welded or bolted provided the result complies with the limitations specified for jointing quality levels.
- E. Obtain approval prior to site cutting or creating adjustments not scheduled.
- F. After erection, prime welds, abrasions, << and surfaces not shop primed; <u>and surfaces not</u> <u>shop primed or galvanized;</u> or \_\_\_\_\_>>, except surfaces to be in contact with concrete.

### 3.04 TOLERANCES

- A. Maximum Variation From Plumb: << <u>1/4 inch</u>; or \_\_\_\_\_ inch>> per story, non-cumulative.
- B. Maximum Offset From True Alignment: << <u>1/4 inch;</u> or \_\_\_\_\_ inch>>.

## END OF SECTION 05 5100

## SECTION 05 1200 STRUCTURAL STEEL FRAMING

#### PART 1 GENERAL

#### 1.01SUMMARY

- 1. Structural-steel materials.
- 2. Shrinkage-resistant grout.
- 3. Shear stud connectors.
- B. Related Requirements:
  - 1. Section 051213 "Architecturally Exposed Structural Steel Framing" for additional requirements for architecturally exposed structural steel.
  - 2. Section 053100 "Steel Decking" for field installation of shear stud connectors through deck.
  - 3. Section 055000 "Metal Fabrications" for miscellaneous steel fabrications and other steel items not defined as structural steel.
  - 4. [Section 099113 "Exterior Painting" and Section 099123 "Interior Painting"][and][Section 099600 "High-Performance Coatings"] for painting requirements.

## 1.02 DEFINITIONS

- A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in ANSI/AISC 303.
- B. Seismic-Load-Resisting System: Elements of structural-steel frame designated as "SLRS" or along grid lines designated as "SLRS" on Drawings, including columns, beams, and braces and their connections.
- C. Heavy Sections: Rolled and built-up sections as follows:
  1. Shapes included in ASTM A6/A6M with flanges thicker than 1-1/2 inches.
- D. Protected Zone: Structural members or portions of structural members indicated as "protected zone" on Drawings. Connections of structural and nonstructural elements to protected zones are limited.
- E. Demand-Critical Welds: Those welds, the failure of which would result in significant degradation of the strength and stiffness of the seismic-load-resisting system and which are indicated as "demand critical" or "seismic critical" on Drawings.

### 1.03 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

#### 1.04 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

### 1.05 ACTION SUBMITTALS

- A. Product Data:
  - 1. Structural-steel materials.
  - 2. High-strength, bolt-nut-washer assemblies.
  - 3. Shear stud connectors.
  - 4. Anchor rods.

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- 5. Threaded rods.
- 6. Shop primer.
- 7. Galvanized-steel primer.
- 8. Galvanized repair paint.
- 9. Shrinkage-resistant grout.
- B. Shop Drawings: Show fabrication of structural-steel components.
  - 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
  - 2. Include embedment Drawings.
  - 3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
  - 4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.
  - 5. Identify members and connections of the seismic-load-resisting system.
  - 6. Indicate locations and dimensions of protected zones.
  - 7. Identify demand-critical welds.
  - 8. Identify members not to be shop primed.
- C. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide in accordance with AWS D1.1/D1.1M for each welded joint whether prequalified or qualified by testing, including the following:
  - 1. Power source (constant current or constant voltage).
  - 2. Electrode manufacturer and trade name, for demand-critical welds.

## 1.06 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer fabricator shop-painting applicators testing agency.
- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- D. Mill test reports for structural-steel materials, including chemical and physical properties.
- E. Product Test Reports: For the following:
  - 1. Bolts, nuts, and washers, including mechanical properties and chemical analysis.
  - 2. Direct-tension indicators.
  - 3. Tension-control, high-strength, bolt-nut-washer assemblies.
  - 4. Shear stud connectors.
- F. Survey of existing conditions.
- G. Source quality-control reports.
- H. Field quality-control reports.

# 1.07 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU or is accredited by the IAS Fabricator Inspection Program for Structural Steel (Acceptance Criteria 172).
- B. Installer Qualifications: A qualified Installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.
- C. Shop-Painting Applicator Qualifications: Qualified in accordance with AISC's Sophisticated Paint [Endorsement P1][Endorsement P2][Endorsement P3] or to SSPC-QP 3.

- D. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.
  - 1. Welders and welding operators performing work on bottom-flange, demand-critical welds are to pass the supplemental welder qualification testing, as required by AWS D1.8/D1.8M. FCAW-S and FCAW-G are to be considered separate processes for welding personnel qualification.

# 1.08 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
  - 1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
  - 1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
  - 2. Clean and relubricate bolts and nuts that become dry or rusty before use.
  - Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F3125/F3125M, Grade F1852 bolt assemblies and for retesting bolt assemblies after lubrication.

# PART 2 PRODUCTS

# 2.01 PERFORMANCE REQUIREMENTS

- A. Comply with applicable provisions of the following specifications and documents:
  - 1. ANSI/AISC 303.
  - 2. ANSI/AISC 341.
  - 3. ANSI/AISC 360.
  - 4. RCSC's "Specification for Structural Joints Using High-Strength Bolts."
- B. Connection Design Information:
  - 1. Option 1: Connection designs have been completed and connections indicated on the Drawings.
- C. Moment Connections: Type FR, fully restrained.
- D. Construction: Moment frame.

# 2.02 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: ASTM A992/A992M.
- B. Channels, Angles, M-Shapes: ASTM A36/A36M.
- C. Channels, Angles, S-Shapes: ASTM A36/A36M.
- D. Plate and Bar: ASTM A36/A36M ASTM A572/A572M, Grade 50.
- E. Cold-Formed Hollow Structural Sections: ASTM A500/A500M, Grade C structural tubing.
- F. Steel Pipe: ASTM A53/A53M, Type E or Type S, Grade B.
  - 1. Weight Class: [Standard][Extra strong][Double-extra strong].
  - 2. Finish: [Black][Galvanized][Black except where indicated to be galvanized].
- G. Welding Electrodes: Comply with AWS requirements.

# 2.03 BOLTS AND CONNECTORS

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- A. High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.
  - 1. Direct-Tension Indicators: ASTM F959/F959M, **Type 325-1**, compressible-washer type with plain finish.
- B. High-Strength A490 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A490, Type 1, heavy-hex steel structural bolts[ or Grade F2280 tension-control, bolt-nut-washer assemblies with splined ends]; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.
  - 1. Direct-Tension Indicators: ASTM F959/F959M, **Type 490-1**, compressible-washer type with plain finish.
- C. Zinc-Coated High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.
  - 1. Finish: Hot-dip zinc coating.
  - 2. Direct-Tension Indicators: ASTM F959/F959M, **Type 325-1**, compressible-washer type with [mechanically deposited zinc coating][mechanically deposited zinc coating, baked epoxy-coated] finish.
- D. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F3125/F3125M, Grade F1852, Type 1, [heavy-hex][round] head assemblies, consisting of steel structural bolts with splined ends; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.
  - 1. Finish: [Plain][Mechanically deposited zinc coating].
- E. Shear Stud Connectors: ASTM A108, AISI C-1015 through C-1020, headed-stud type, coldfinished carbon steel; AWS D1.1/D1.1M, Type B.

# 2.04 RODS

- A. Headed Anchor Rods: [ASTM F1554, Grade 36][ASTM F1554, Grade 55, weldable][ASTM A354][ASTM A449], straight.
  - 1. Nuts: ASTM A563 [heavy-]hex carbon steel.
  - 2. Plate Washers: ASTM A36/A36M carbon steel.
  - 3. Washers: ASTM F436, Type 1, hardened carbon steel.
  - 4. Finish: [Plain][Hot-dip zinc coating, ASTM A153/A153M, Class C][Mechanically deposited zinc coating, ASTM B695, Class 50].
- B. Threaded Rods: [ASTM A36/A36M][ASTM A193/A193M, Grade B7][ASTM A354, Grade BD][ASTM A449][ASTM A572/A572M, Grade 50].
  - 1. Nuts: ASTM A63 [heavy-]hex carbon steel.
  - 2. Washers: [ASTM F436, Type 1, hardened][ASTM A36/A36M] carbon steel.
  - 3. Finish: [Plain][Hot-dip zinc coating, ASTM A153/A153M, Class C][Mechanically deposited zinc coating, ASTM B695, Class 50].

# 2.05 FORGED-STEEL STRUCTURAL HARDWARE

- A. Clevises and Turnbuckles: Made from cold-finished carbon-steel bars, ASTM A108, AISI C-1035.
- B. Eye Bolts and Nuts: Made from cold-finished carbon-steel bars, ASTM A108, AISI C-1030.
- C. Sleeve Nuts: Made from cold-finished carbon-steel bars, ASTM A108, AISI C-1018.

# 2.06 PRIMER

A. Steel Primer:

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- 1. Comply with [Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."][Section 099600 "High-Performance Coatings."][Section 099113 "Exterior Painting," Section 099123 "Interior Painting," and Section 099600 "High-Performance Coatings."]
- 2. SSPC-Paint 23, latex primer.
- 3. Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.
- B. Galvanized-Steel Primer: [MPI#26][MPI#80,][MPI#134].
  - 1. Etching Cleaner: MPI#25, for galvanized steel.
  - 2. Galvanizing Repair Paint: [MPI#18, MPI#19, or SSPC-Paint 20][ASTM A780/A780M].

## 2.07 SHRINKAGE-RESISTANT GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

## 2.08 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate in accordance with ANSI/AISC 303 and to ANSI/AISC 360.
  - 1. Camber structural-steel members where indicated.
  - 2. Fabricate beams with rolling camber up.
  - 3. Identify high-strength structural steel in accordance with ASTM A6/A6M and maintain markings until structural-steel framing has been erected.
  - 4. Mark and match-mark materials for field assembly.
  - 5. Complete structural-steel assemblies, including welding of units, before starting shoppriming operations.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
  1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
- C. Bolt Holes: Cut, drill, [mechanically thermal cut,]or punch standard bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted in accordance with [SSPC-SP 1.][SSPC-SP 2.][SSPC-SP 3.]
- F. Shear Stud Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Weld using automatic end welding of headed-stud shear connectors in accordance with AWS D1.1/D1.1M and manufacturer's written instructions.
- G. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.
  - 1. Cut, drill, or punch holes perpendicular to steel surfaces.[ **Do not thermally cut bolt** holes or enlarge holes by burning.]
  - 2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
  - 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

# 2.09 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.
  - 1. Joint Type: [Snug tightened][Pretensioned][Slip critical].

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- B. Weld Connections: Comply with AWS D1.1/D1.1M[ and AWS D1.8/D1.8M] for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
  - 1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.

# 2.10 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel in accordance with ASTM A123/A123M.
  - 1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.

## 2.11 SHOP PRIMING

- A. Shop prime steel surfaces, except the following:
  - 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of **2 inches**.
  - 2. Surfaces to be field welded.
  - 3. Surfaces of high-strength bolted, slip-critical connections.
  - 4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
  - 5. Galvanized surfaces [unless indicated to be painted].
  - 6. Corrosion-resisting (weathering) steel surfaces.
  - 7. Surfaces enclosed in interior construction.
- B. Surface Preparation of Steel: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces in accordance with the following specifications and standards:
  - 1. SSPC-SP 2.
  - 2. SSPC-SP 3.
  - 3. SSPC-SP 11.
  - 4. SSPC-SP 5 (WAB)/NACE WAB-1.
- C. Surface Preparation of Galvanized Steel: Prepare galvanized-steel surfaces for shop priming by thoroughly cleaning steel of grease, dirt, oil, flux, and other foreign matter, and treating with etching cleaner [or in accordance with SSPC-SP 16].
- D. Priming: Immediately after surface preparation, apply primer in accordance with manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
  - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
  - 2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

# 2.12 SOURCE QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform shop tests and inspections.
  - 1. Allow testing agency access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
  - 2. Bolted Connections: Inspect and test shop-bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
  - 3. Welded Connections: Visually inspect shop-welded connections in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
    - a. Liquid Penetrant Inspection: ASTM E165/E165M.

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- b. Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
- c. Ultrasonic Inspection: ASTM E164.
- d. Radiographic Inspection: ASTM E94/E94M.
- 4. In addition to visual inspection, test and inspect shop-welded shear stud connectors in accordance with requirements in AWS D1.1/D1.1M for stud welding and as follows:
  - a. Perform bend tests if visual inspections reveal either a less-than-continuous 360degree flash or welding repairs to any shear stud connector.
  - b. Conduct tests in accordance with requirements in AWS D1.1/D1.1M on additional shear stud connectors if weld fracture occurs on shear stud connectors already tested.
- 5. Prepare test and inspection reports.

# PART 3 EXECUTION

# 3.01 EXAMINATION

- A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
  - 1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.02 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated on Drawings.

### 3.03 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and in accordance with ANSI/AISC 303 and ANSI/AISC 360.
- B. Baseplates, Bearing Plates, and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
  - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
  - 2. Weld plate washers to top of baseplate.
  - 3. [**Snug-tighten**][**Pretension**] anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
  - 4. Promptly pack shrinkage-resistant grout solidly between bearing surfaces and plates, so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for grouting.
- C. Maintain erection tolerances of structural steel within ANSI/AISC 303.
- D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
  - 1. Level and plumb individual members of structure. Slope roof framing members to slopes indicated on Drawings.

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- 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated.
- F. Do not use thermal cutting during erection[ unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M].
- G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

#### 3.04 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt and joint type specified.
   1. Joint Type: Pretensioned.
- B. Weld Connections: Comply with AWS D1.1/D1.1M[ **and AWS D1.8/D1.8M**] for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
  - 1. Comply with ANSI/AISC 303 and ANSI/AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
  - 2. Remove backing bars or runoff tabs where indicated, back gouge, and grind steel smooth.
  - 3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.
- C. Shear Stud Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Weld using end welding of headed-stud shear connectors in accordance with AWS D1.1/D1.1M and manufacturer's written instructions.

### 3.05 REPAIR

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing, and repair galvanizing to comply with ASTM A780/A780M.
- B. Touchup Painting:
  - 1. Immediately after erection, clean exposed areas where primer is damaged or missing, and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
    - a. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 powertool cleaning.
  - Cleaning and touchup painting are specified in [Section 099113 "Exterior Painting."][Section 099123 "Interior Painting."][Section 099600 "High-Performance Coatings."]
- C. Touchup Priming: Cleaning and touchup priming are specified in Section 099600 "High-Performance Coatings."

### 3.06 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector to perform the following special inspections:
  - 1. Verify structural-steel materials and inspect steel frame joint details.
  - 2. Verify weld materials and inspect welds.
  - 3. Verify connection materials and inspect high-strength bolted connections.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
   1. Bolted Connections: Inspect and test bolted connections in accordance with RCSC's
  - "Specification for Structural Joints Using High-Strength Bolts."
  - 2. Welded Connections: Visually inspect field welds in accordance with AWS D1.1/D1.1M.

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- a. In addition to visual inspection, test and inspect field welds in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
  - 1) Liquid Penetrant Inspection: ASTM E165/E165M.
  - Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
  - 3) Ultrasonic Inspection: ASTM E164.
  - 4) Radiographic Inspection: ASTM E94/E94M.
- 3. Shear Stud Connectors: In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
  - a. Perform bend tests if visual inspections reveal either a less-than-continuous 360degree flash or welding repairs to any shear connector.
  - b. Conduct tests according to requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors already tested.

## END OF SECTION 05 1200

## SECTION 05 1213 ARCHITECTURALLY EXPOSED STRUCTURAL STEEL FRAMING

## PART 1 GENERAL

### 1.01 SUMMARY

- A. Section Includes:
  - 1. Architecturally exposed structural steel (AESS).
  - 2. Section 051200 "Structural Steel Framing" requirements that also apply to AESS.
- B. Related Requirements:
  - 1. Section 055000 "Metal Fabrications" for [steel lintels and shelf angles not attached to structural-steel frame][miscellaneous steel fabrications][and][other metal items] not defined as structural steel.
  - 2. [Section 099113 "Exterior Painting"][Section 099123 "Interior Painting"][and][Section 099600 "High-Performance Coatings"] for surface preparation and priming requirements.

# 1.02 DEFINITIONS

- A. AESS: Architecturally exposed structural steel.
- B. Category AESS 3: Structural steel that is categorized by ANSI/AISC 303, Section 10, as AESS 3 and is designated as AESS 3 or Category AESS 3 in the Contract Documents.
- C. SEAC/RMSCA Guide Specification: SEAC/RMSCA's "Sample Specification, Section 05 02 13: Architecturally Exposed Structural Steel."

### 1.03 COORDINATION

- A. Coordinate surface preparation requirements for shop-primed items.
- B. 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.

# **1.04 ACTION SUBMITTALS**

- A. Product Data:
  - 1. Tension-control, high-strength, bolt-nut-washer assemblies.
  - 2. Corrosion-resisting (weathering steel), tension-control, high-strength, bolt-nut-washer assemblies.
  - 3. Filler.
  - 4. Primer.
  - 5. Galvanized-steel primer.
  - 6. Etching cleaner.
  - 7. Galvanized repair paint.
- B. Shop Drawings: Show fabrication of AESS components.
  - 1. Identify AESS category for each steel member and connection, including transitions between AESS categories and between AESS and non-AESS.
  - 2. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
  - 3. Include embedment Drawings.
  - 4. Indicate orientation of mill marks and HSS seams.
  - 5. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain. Indicate grinding, finish, and profile of welds.

- 6. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections. Indicate orientation and location of bolt heads.
- 7. Indicate exposed surfaces and edges and surface preparation being used.
- 8. Indicate special tolerances and erection requirements.
- 9. Indicate weep holes for HSS and vent holes for galvanized HSS.
- 10. Indicate surface preparation, primer, and coating requirements, including systems specified in other Sections.
- C. Samples: Submit Samples to set quality standards for AESS.
  - 1. Two steel plates, **3/8 by 8 by 4 inches**, with long edges joined by a groove weld[ **and with weld ground smooth**].
  - Steel plate, 3/8 by 8 by 8 inches, with one end of a short length of rectangular steel tube, 4 by 6 by 3/8 inches, welded to plate with a continuous fillet weld[ and with weld ground smooth and blended].
  - 3. Round steel tube or pipe, minimum 8 inches in diameter, with end of another round steel tube or pipe, approximately 4 inches in diameter, welded to its side at a 45-degree angle with a continuous fillet weld[ and with weld ground smooth and blended].

## 1.05 INFORMATIONAL SUBMITTALS

A. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

## 1.06 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU, or is accredited by the IAS Fabricator Inspection Program for Structural Steel (AC 172) and is experienced in fabricating AESS similar to that indicated on this Project.
- B. Installer Qualifications: A qualified Installer who participates in the AISC Quality Certification Program, is designated an AISC-Certified Erector, Category CSE, and is experienced in erecting AESS similar to that indicated on this Project.
- C. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint [Endorsement P1][Endorsement P3] or SSPC-QP 3.
- D. Mockups: Build mockups of AESS to set quality standards for fabrication and installation.
  1. Build mockup of typical portion of AESS as shown on Drawings.
  - Coordinate painting requirements with Section 099113 "Exterior Painting." Section 099123 "Interior Painting."
  - 3. Coordinate high-performance coatings requirements with Section 099600 "High-Performance Coatings."
  - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

# 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Use special care in handling AESS to prevent twisting, warping, nicking, and other damage during fabrication, delivery, and erection. Store materials to permit easy access for inspection and identification. Keep AESS members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect AESS members and packaged materials from corrosion and deterioration.
  - 1. Do not store AESS materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

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## 1.08 FIELD CONDITIONS

A. Field Measurements: Where AESS is indicated to fit against other construction, verify actual dimensions by field measurements before fabrication.

#### PART 2 PRODUCTS

#### 2.01 PERFORMANCE REQUIREMENTS

A. Comply with requirements of ANSI/AISC 303, Sections 1 through 9 and as modified in Section 10, "Architecturally Exposed Structural Steel."

#### 2.02 BOLTS, CONNECTORS, AND ANCHORS

- A. Tension-Control, High-Strength, Bolt-Nut-Washer Assemblies: ASTM F3125/F3125M, Grade F1852, Type 1, round-head assemblies consisting of steel structural bolts with splined ends; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.
  - 1. Finish: [Plain][Mechanically deposited zinc coating].
- B. Corrosion-Resisting (Weathering) Steel, Tension-Control, High-Strength, Bolt-Nut-Washer Assemblies: ASTM F3125/F3125M, Grade F1852, Type 3, round-head assemblies consisting of steel structural bolts with splined ends; ASTM A563, Grade DH3, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 3, hardened carbon-steel washers.

#### 2.03 FILLER

A. Polyester filler intended for use in repairing dents in automobile bodies.

#### 2.04 PRIMER

- A. Steel Primer:
  - 1. Comply with Section 099113 "Exterior Painting," Section 099123 "Interior Painting," and Section 099600 "High-Performance Coatings."
  - 2. SSPC-Paint 23, latex primer.
  - 3. Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.
- B. Galvanized-Steel Primer: [MPI#26][MPI#80][MPI#134].
  - 1. Etching Cleaner: MPI#25, for galvanized steel.
  - 2. Galvanizing Repair Paint: [MPI#18, MPI#19, or SSPC-Paint 20][ASTM A780/A780M].

## 2.05 FABRICATION

- A. Shop fabricate and assemble AESS to the maximum extent possible. Locate field joints at concealed locations if possible. Detail assemblies to minimize handling and to expedite erection.
  - 1. Use special care handling and fabricating AESS before and after shop painting to minimize damage to shop finish.
- B. Category AESS 3:
  - 1. Comply with overall profile dimensions of AWS D1.1/D1.1M for welded built-up members. Keep appearance and quality of welds consistent. Maintain true alignment of members without warp exceeding specified tolerances.
  - Prepare surfaces according to Part 2 "Shop Priming" Article and SSPC-SP 6 (WAB)/NACE WAB-3.
  - 3. Grind sheared, punched, and flame-cut edges to remove burrs and provide smooth surfaces and eased edges.
  - 4. Make intermittent welds appear continuous, using filler or additional welding.
  - 5. Seal weld open ends of hollow structural sections with **3/8-inch** closure plates.
  - 6. Limit butt and plug weld projections to **1/16 inch**.

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- 7. Install bolt heads on the same side of each connection and maintain orientation consistently from one connection to another.
- 8. Remove weld spatter, slivers, and similar surface discontinuities.
- 9. Remove blemishes and surface irregularities resulting from temporary braces or fixtures by filling or grinding, before cleaning, treating, and shop priming.
- 10. Grind tack welds smooth unless incorporated into final welds.
- 11. Remove backing and runoff tabs, and grind welds smooth.
- 12. Limit as-fabricated straightness tolerance to one-half that permitted for structural-steel materials in ANSI/AISC 303.
- 13. Limit as-fabricated curved structural steel tolerance to that permitted for structural-steel materials in ANSI/AISC 303.
- 14. Limit as-fabricated straightness tolerance of welded built-up members to one-half that permitted by AWS D1.1/D1.1M.
- 15. Conceal fabrication and erection markings from view in the completed structure.
- 16. Make welds uniform and smooth.
- 17. Cut out mill marks from mill material or hide these markings from view in the completed structure. Where neither method is possible, remove mill marks by grinding and filling surfaces as approved by Architect.
- 18. Grind butt and plug welds smooth or fill, removing weld splatter exposed to view.
- 19. Orient HSS seams as indicated or away from view.
- 20. Align and match abutting member cross sections.
- 21. At visible open joints of copes, miters, and cuts, maintain uniform clear gaps of 1/8 inch. At closed joints, maintain uniform contact within 1/16 inch.
- 22. Fabricate with exposed surfaces smooth, square, and of surface quality approved by Architect.
- C. Erection marks, painted marks, and other marks are permitted on [galvanized-][corrosion-resisting (weathering)] steel surfaces of completed structure.
- D. Cleaning Corrosion-Resisting (Weathering) AESS: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 6 (WAB)/NACE WAB-3.

# 2.06 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.
  1. Joint Type: [Snug tightened][Pretensioned][Slip critical].
- B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

# 2.07 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A123/A123M.
  - 1. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
  - 2. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
  - 3. Galvanize AESS [lintels]<Insert description> attached to structural-steel frame and located in exterior walls.

## 2.08 SHOP PRIMING

A. Shop prime steel surfaces, except the following:

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- 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of **2 inches**.
- 2. Surfaces to be field welded.
- 3. Surfaces to be high-strength bolted with slip-critical connections.
- 4. Corrosion-resisting (weathering) steel surfaces.
- 5. Galvanized surfaces [unless indicated to be painted].
- B. Surface Preparation: Clean nongalvanized surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
  - 1. SSPC-SP 2.
  - 2. SSPC-SP 3.
  - 3. SSPC-SP 7 (WAB)/NACE WAB-4.
  - 4. SSPC-SP 14 (WAB)/NACE WAB-8.
  - 5. SSPC-SP 11.
  - 6. SSPC-SP 6 (WAB)/NACE WAB-3.
  - 7. SSPC-SP 10 (WAB)/NACE WAB-2.
  - 8. SSPC-SP 5 (WAB)/NACE WAB-1.
  - 9. SSPC-SP 8.
- C. Preparing Galvanized Steel for Shop Priming: After galvanizing, thoroughly clean steel of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner [or according to SSPC-SP 16].
- D. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
  - 1. Stripe paint corners, crevices, bolts, welds, and eased edges.
  - 2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

# PART 3 EXECUTION

## 3.01 EXAMINATION

- A. Verify, with steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
  - 1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments, showing dimensions, locations, angles, and elevations.
- B. Examine AESS for twists, kinks, warping, gouges, and other imperfections before erecting.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.02 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep AESS secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.

## 3.03 ERECTION

A. Take special care during erection to avoid marking or distorting the AESS and to minimize damage to shop painting. Set AESS accurately in locations and to elevations indicated and according to ANSI/AISC 303 and ANSI/AISC 360.

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- 1. Remove welded tabs that were used for attaching temporary bracing and safety cabling and that are exposed to view in the completed Work. Take care to avoid any blemishes, holes, or unsightly surfaces resulting from the use or removal of temporary elements.
- 2. Grind tack welds smooth.
- 3. Remove backing and runoff tabs, and grind welds smooth.
- 4. Orient bolt heads on the same side of each connection and maintain orientation consistently from one connection to another.
- 5. Conceal fabrication and erection markings from view in the completed structure.
- B. In addition to ANSI/AISC 303, Section 10 requirements, comply with the following.
  - 1. Erection of Category AESS 3:
    - a. Erect AESS to the standard frame tolerances specified in ANSI/AISC 303 for non-AESS.
    - b. Comply with AWS D1.1/D1.1M. Keep appearance and quality of welds consistent. Maintain true alignment of members without warp exceeding specified tolerances.
    - c. Remove weld spatter, slivers, and similar surface discontinuities.
    - d. Grind off butt and plug weld projections larger than 1/16 inch.
    - e. Continuous welds are to be of uniform size and profile.
    - f. Ream holes that must be enlarged. Use of drift pins or burning is not permitted. Replace misaligned connection plates where holes cannot be aligned with acceptable appearance.
    - g. Splice members only where indicated on Drawings.
    - h. No torch cutting or field fabrication is permitted.
    - i. Weld profiles, quality, and finish are be as approved by Architect.
    - j. Make joint welds, including tack welds, appear continuous by filling intermittent welds.

# 3.04 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.
  1. Joint Type: [Snug tightened][Pretensioned][Slip critical].
- B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

## 3.05 REPAIR

- A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and touchup galvanizing to comply with ASTM A780/A780M.
- B. Touchup Painting:
  - 1. 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.
    - a. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 powertool cleaning.
  - Cleaning and touchup painting are specified in [Section 099113 "Exterior Painting."][Section 099123 "Interior Painting."][Section 099600 "High-Performance Coatings."]
- C. Touchup Priming: Cleaning and touchup priming are specified in Section 099600 "High-Performance Coatings."

# 3.06 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to inspect AESS as specified in Section 051200 "Structural Steel Framing." The testing agency is not responsible for enforcing requirements relating to aesthetic effect.
- B. Architect will observe AESS in place to determine acceptability relating to aesthetic effect.

# END OF SECTION 05 1213

# SECTION 05 3100 STEEL DECKING

## PART 1 GENERAL

#### 1.01SUMMARY

- A. Section Includes:
  - 1. Roof deck.
  - 2. Composite floor deck.
- B. Related Requirements:
  - 1. Section 033000 "Cast-in-Place Concrete" for normal-weight and lightweight structural concrete fill over steel deck.
  - 2. Section 051200 "Structural Steel Framing" for shop- and field-welded shear connectors.
  - 3. Section 055000 "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.

# 1.02 ACTION SUBMITTALS

- A. Product Data:
  - 1. Roof deck.
  - 2. Composite floor deck.
- B. Shop Drawings:
  - 1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

# 1.03 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Product Certificates: For each type of steel deck.
- C. Test and Evaluation Reports:
  - 1. Product Test Reports: For tests performed by a qualified testing agency, indicating that each of the following complies with requirements:
    - a. Power-actuated mechanical fasteners.
    - b. Acoustical roof deck.
  - 2. Research Reports: For steel deck, from ICC-ES showing compliance with the building code.
- D. Field Quality-Control Submittals:
  - 1. Field quality-control reports.
- E. Qualification Statements: For welding personnel.

## 1.04 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with SDI QA/QC and the following welding codes:
  - 1. AWS D1.1/D1.1M.
  - 2. AWS D1.3/D1.3M.
- B. FM Approvals' RoofNav Listing: Provide steel roof deck evaluated by FM Approvals and listed in its "RoofNav" for Class 1 fire rating and [Class 1-60][Class 1-75][Class 1-90] windstorm ratings. Identify materials with FM Approvals Certification markings.

## 1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

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- B. Store products in accordance with SDI MOC3. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.
  - 1. Protect and ventilate acoustical cellular roof deck with factory-installed insulation to maintain insulation free of moisture.

# PART 2 PRODUCTS

# 2.01 PERFORMANCE REQUIREMENTS

- A. AISI Specifications: Comply with calculated structural characteristics of steel deck in accordance with AISI S100.
- B. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Indicate design designations from UL's "Fire Resistance Directory" or from listings of another qualified testing agency.

# 2.02 ROOF DECK

- A. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
  - 1. [ASC Steel Deck; ASC Profiles, LLC]
  - 2. [Canam Buildings US Inc.; Canam Group Inc.]
  - 3. [Cordeck]
  - 4. [CSM Metal Deck]
  - 5. [DACS, Inc.]
  - 6. [Epic Metals Corporation]
  - 7. [Marlyn Steel Decks, Inc.]
  - 8. [Miami Metal Deck]
  - 9. [New Millennium Building Systems, LLC]
  - 10. [OEG Building Materials Inc]
  - 11. [Roof Deck, Inc]
  - 12. [Tristate Decking, Inc.]
  - 13. [Valley Joist]
  - 14. [Verco Decking, Inc.; a Nucor company]
  - 15. [Vulcraft Group; Division of Nucor Corp.]
  - 16. [Vulcraft/Verco Group; a division of Nucor Corp.]
  - 17. <Insert manufacturer's name>
- B. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
  - 1. [ASC Steel Deck; ASC Profiles, LLC]
  - 2. [Canam Buildings US Inc.; Canam Group Inc.]
  - 3. [Cordeck]
  - 4. [CSM Metal Deck]
  - 5. [DACS, Inc.]
  - 6. [Epic Metals Corporation]
  - 7. [Marlyn Steel Decks, Inc.]
  - 8. [Miami Metal Deck]
  - 9. [New Millennium Building Systems, LLC]
  - 10. [OEG Building Materials Inc]

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- 11. [Roof Deck, Inc]
- 12. [Tristate Decking, Inc.]
- 13. [Valley Joist]
- 14. [Verco Decking, Inc.; a Nucor company]
- 15. [Vulcraft Group; Division of Nucor Corp.]
- 16. [Vulcraft/Verco Group; a division of Nucor Corp.]
- 17. <Insert manufacturer's name>
- C. Fabrication of Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with SDI RD and with the following:
  - Prime-Painted Steel Sheet: ASTM A1008/A1008M, Structural Steel (SS), [Grade 33][Grade 40][Grade 80] minimum, shop primed with manufacturer's standard baked-on, rust-inhibitive primer.
    - a. Color: [Manufacturer's standard][Gray][White][Gray top surface with white underside].
  - Galvanized-Steel Sheet: ASTM A653/A653M, Structural Steel (SS), [Grade 33][Grade 40][Grade 80], [G60][G90] zinc coating.
  - 3. Galvanized- and Shop-Primed Steel Sheet: ASTM A653/A653M, Structural Steel (SS), [Grade 33][Grade 40][Grade 80], G60 zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer.
    - a. Color: [Manufacturer's standard][Gray][White][Gray top surface with white underside].
  - 4. Aluminum-Zinc-Alloy-Coated Steel Sheet: ASTM A792/A792M, Structural Steel (SS), Grade 33 minimum, AZ50 aluminum-zinc-alloy coating.
  - 5. Deck Profile: [As indicated][Type NR, narrow rib][Type IR, intermediate rib][Type WR, wide rib][Type 3DR, deep rib][Long span].
  - 6. Cellular Deck Profile: [As indicated][Type WR, wide rib][Type 3DR, deep rib][Long span], with bottom plate.
  - Profile Depth: [As indicated][1-1/2 inches][2 inches][3 inches][4-1/2 inches][6 inches][7-1/2 inches].
  - Design Uncoated-Steel Thickness: [As indicated][0.0295 inch][0.0358 inch][0.0474 inch][0.0598 inch][0.0747 inch].
  - Design Uncoated-Steel Thicknesses; Deck Unit/Bottom Plate: [As indicated][0.0358/0.0358 inch][0.0358/0.0474 inch][0.0474/0.0474 inch][0.0474/0.0598 inch][0.0598/0.0474 inch][0.0598/0.0598 inch].
  - 10. Span Condition: [As indicated][Simple span][Double span][Triple span or more].
  - 11. Side Laps: [Overlapped][Interlocking seam][Overlapped or interlocking seam at Contractor's option].

# 2.03 ACCESSORIES

- A. Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.
- C. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.
- D. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- E. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of **33,000 psi**, of same material and finish as deck, and of thickness and profile indicated.
- F. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.

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- G. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, [0.0598 inch][0.0747 inch] thick, with factory-punched hole of 3/8-inch minimum diameter.
- H. Shear Stud Connectors: ASTM A108, AISI C-1015 through C-1020, headed-stud type, coldfinished carbon steel; AWS D1.1/D1.1M, Type B.
- I. Flat Sump Plates: Single-piece steel sheet, **0.0747 inch** thick, of same material and finish as deck. For drains, cut holes in the field.
- J. Recessed Sump Pans: Single-piece steel sheet, **0.0747 inch** thick, of same material and finish as deck, with **3-inch-** wide flanges and **[level][sloped]** recessed pans of **1-1/2-inch** minimum depth. For drains, cut holes in the field.
- K. Galvanizing Repair Paint: ASTM A780/A780M.
- L. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

# PART 3 EXECUTION

## 3.01 EXAMINATION

- A. Examine supporting frame and field conditions 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.

## 3.02 INSTALLATION, GENERAL

- A. Install deck panels and accessories in accordance with SDI C, SDI NC, and SDI RD, as applicable; manufacturer's written instructions; and requirements in this Section.
- B. Install temporary shoring before placing deck panels if required to meet deflection limitations.
- C. Locate deck bundles to prevent overloading of supporting members.
- D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
- I. Shear Stud Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Weld using end welding of headed-stud shear connectors in accordance with AWS D1.1/D1.1M and manufacturer's written instructions.

# 3.03 INSTALLATION OF ROOF DECK

- A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, and as follows:
  - 1. Weld Diameter: 3/4 inch, nominal.
  - Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds [18 inches apart, maximum][12 inches apart in Zone 1 and 6 inches apart in Zones 2 and 3, based on roof-area definitions in FM Global Loss Prevention Data Sheet 1-28][as indicated].

- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of one-half of the span or [18 inches][36 inches], and as follows:
  - 1. Mechanically clinch or button punch.
  - 2. Fasten with a minimum of **1-1/2-inch-** long welds.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
  - 1. End Joints: Lapped 2 inches minimum.
- D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and [weld][mechanically fasten] flanges to top of deck. Space [welds][mechanical fasteners] not more than 12 inches apart with at least one [weld][fastener] at each corner.
  - 1. Install reinforcing channels or zees in ribs to span between supports and [weld][or][mechanically fasten].
- E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels in accordance with deck manufacturer's written instructions. [Weld][or][mechanically fasten] to substrate to provide a complete deck installation.
  1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.
- F. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive in accordance with manufacturer's written instructions to ensure complete closure.

# 3.04 INSTALLATION OF FLOOR DECK

- A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:
  - 1. Weld Diameter: 3/4 inch, nominal.
  - 2. Weld Spacing:
    - a. Weld edge ribs of panels at each support. Space additional welds an average of **16 inches** apart, but not more than **18 inches** apart.
    - b. Space and locate welds as indicated.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of one-half of the span or **36 inches**, and as follows:
  - 1. Mechanically clinch or button punch.
  - 2. Fasten with a minimum of 1-1/2-inch- long welds.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of [1-1/2 inches]<Insert dimension>, with end joints as follows:
  - 1. End Joints: Butted.
- D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure in accordance with SDI recommendations unless otherwise indicated.
- E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, in accordance with SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.
- F. Install piercing hanger tabs at [14 inches]<Insert dimension> apart in both directions, within 9 inches of walls at ends, and not more than 12 inches from walls at sides unless otherwise indicated.

## 3.05 REPAIR

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A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint in accordance with ASTM A780/A780M and manufacturer's written instructions.

# 3.06 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Tests and Inspections:
  - 1. Special inspections and qualification of welding special inspectors for cold-formed steel floor and roof deck in accordance with quality-assurance inspection requirements of SDI QA/QC.
    - a. Field welds will be subject to inspection.
  - 2. Steel decking will be considered defective if it does not pass tests and inspections.
  - 3. Shear Stud Connectors: In addition to visual inspection, test and inspect field-welded shear connectors in accordance with requirements in AWS D1.1/D1.1M for stud welding and as follows:
    - a. Perform bend tests if visual inspections reveal either a less-than-continuous 360degree flash or welding repairs to any shear connector.
    - b. Conduct tests in accordance with requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors that are already tested.
- C. Prepare test and inspection reports.

# END OF SECTION 05 3100

#### SECTION 05 5213 PIPE AND TUBE RAILINGS

#### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Wall mounted handrails and guardrails.
- B. Exterior stair railings and guardrails.

#### 1.02 RELATED REQUIREMENTS

- A. Section <u>03 3000 Cast-in-Place Concrete</u>: Placement of anchors in concrete.
- B. Section 04 2000 Unit Masonry: Placement of anchors in masonry.
- C. Section <u>05 5100 Metal Stairs</u>: Handrails other than those specified in this section.
- D. Section 06 2000 Finish Carpentry: Wood handrail.
- E. Section **09 2116 Gypsum Board Assemblies**: Placement of backing plates in stud wall construction.
- F. Section 09 9113 Exterior Painting: Paint finish.
- G. Section 09 9123 Interior Painting: Paint finish.

#### 1.03 REFERENCE STANDARDS

- A. ADA Standards Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. AISC 201 AISC Certification Program for Structural Steel Fabricators, Standard for Steel Building Structures; 2006.
- C. ASTM A53/A53M Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2020.
- D. ASTM A500/A500M Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2021.
- E. ASTM A780/A780M Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2009 (Reapproved 2015).
- F. ASTM E935 Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings; 2013, with Editorial Revision.
- G. AWS A2.4 Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.
- H. AWS B2.1/B2.1M Specification for Welding Procedure and Performance Qualification; 2014 (Amended 2015).
- I. AWS D1.1/D1.1M Structural Welding Code Steel; 2020.
- J. AWS D1.6/D1.6M Structural Welding Code Stainless Steel; 2017.
- K. SSPC-Paint 15 Steel Joist Shop Primer/Metal Building Primer; 1999 (Ed. 2004).

## 1.04 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.
  - 1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
- C. Samples: Submit << <u>two;</u> or \_\_\_\_\_>>, <u>24 inch</u> long samples of handrail. Submit << <u>two;</u> or \_\_\_\_>> samples of << <u>elbow;</u> Tee; <u>wall bracket;</u> escutcheon; <u>end stop;</u> and \_\_\_\_\_>>.
- D. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated within the previous << <u>12 months</u>; or \_\_\_\_>>.

E. Fabricator's Qualification Statement.

#### 1.05 QUALITY ASSURANCE

- A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located, or personnel under direct supervision of such an engineer.
- B. Welder Qualifications: Welding processes and welding operators qualified within previous << <u>12 months</u>; or \_\_\_\_>>.
- C. Fabricator Qualifications:
  - 1. A qualified steel fabricator that is certified by the American Institute for Steel Construction (AISC) under AISC 201.
  - A company specializing in manufacturing products specified in this section, with not less than << ten; <u>five</u>; three; or \_\_\_\_>> years of<< documented; or <u>None - N/A</u>>> experience.

#### PART 2 PRODUCTS

#### 2.01 RAILINGS - GENERAL REQUIREMENTS

- A. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of applicable local code.
- B. Distributed Loads: Design railing assembly, wall rails, and attachments to resist distributed force of << <u>75 pounds per linear foot</u>; 50 pounds per linear foot; or <u>pounds per linear foot</u>, or <u>pounds per linear foot</u>, without damage or permanent set. << <u>Test in accordance with ASTM E935</u>; or None N/A>>
- C. Concentrated Loads: Design railing assembly, wall rails, and attachments to resist a concentrated force of << <u>200 pounds</u>; or <u>pounds</u>>> applied at any point on the top of the assembly and in any direction, without damage or permanent set. << <u>Test in accordance</u> with <u>ASTM E935</u>; or None N/A>>
- D. Dimensions: See drawings for configurations and heights.
- E. Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.
  - For anchorage to concrete, provide inserts to be cast into concrete, for << <u>bolting</u>; welding; or \_\_\_\_\_>> anchors.
  - For anchorage to masonry, provide brackets to be embedded in masonry, for << <u>bolting</u>; welding; or \_\_\_\_\_>> anchors.
- F. Provide << slip-on non-weld mechanical fittings; welding fittings; mechanical and welding fittings where indicated; or \_\_\_\_\_>> to join lengths, seal open ends, and conceal exposed mounting bolts and nuts, including but not limited to elbows, T-shapes, splice connectors, flanges, escutcheons, and wall brackets.
- G. Welded and Brazed Joints: Make visible joints butt tight, flush, and hairline; use methods that avoid discoloration and damage of finish; grind smooth, polish, and restore to required finish.
  - 1. Ease exposed edges to a small uniform radius.
  - 2. Welded Joints:
    - a. Carbon Steel: Perform welding in accordance with AWS D1.1/D1.1M.
    - b. Stainless Steel: Perform welding in accordance with AWS D1.6/D1.6M.

#### 2.02 STEEL RAILING SYSTEM (RAIL-1)

A. Steel Tube: << <u>ASTM A500/A500M</u> <u>Grade B cold-formed</u>; ASTM A501/A501M hot-formed; or \_\_\_\_\_\_>> structural tubing.

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Design Development Phase	03 32 13 - 2	Fipe and Tube Rainings

- B. Steel Pipe: << ASTM A53/A53M Grade B Schedule 40; <u>ASTM A53/A53M Grade B</u> <u>Schedule 80</u>; ASTM A53/A53M Grade \_\_\_\_\_ Schedule 40; ASTM A53/A53M Grade \_\_\_\_\_ Schedule \_\_\_; or \_\_\_\_\_ >>, << <u>black finish</u>; galvanized finish; or black and galvanized finish, as indicated>>.
- C. Welding Fittings: Factory- or shop-welded from matching pipe or tube; seams continuously welded; joints and seams ground smooth.
- D. Exposed Fasteners: No exposed bolts or screws.
- E. Shop and Touch-Up Primer: << <u>SSPC-Paint 15;</u> or \_\_\_\_\_>>, complying with VOC limitations of authorities having jurisdiction.

# 2.03 STEEL RAILING SYSTEM (RAIL-2)

A. Non-Weld Stainless Steel Pipe Fittings: Basis of design: CR Laurence P9 Series.

## 2.04 STEEL RAILING SYSTEM (RAIL-3)

- A. Steel Tube: ASTM A500/A500MGrade B cold-formed structural tubing.
- B. Steel Pipe: ASTM A53/A53MGrade B Schedule 80, black finish.
- C. Welding Fittings: Factory- or shop-welded from matching pipe or tube; seams continuously welded; joints and seams ground smooth.Exposed Fasteners: No exposed bolts or screws.
- D. welded; joints and seams ground smooth
- E. Galvanizing: In accordance with requirements of ASTM A123/A123M.Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20Type I Inorganic.

#### 2.05 FABRICATION

- A. Accurately form components to suit specific project conditions and for proper connection to building structure.
- B. Fit and shop assemble components in largest practical sizes for delivery to site.
- C. Fabricate components with joints tightly fitted and secured. << <u>Provide spigots and sleeves</u> to accommodate site assembly and installation.; or None - N/A>>
- D. Welded Joints:
  - Exterior Components: Continuously seal joined pieces by << <u>intermittent welds and</u> <u>plastic filler</u>; continuous welds; or \_\_\_\_\_>>. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.
  - Interior Components: Continuously seal joined pieces by << <u>intermittent welds and</u> <u>plastic filler</u>; continuous welds; or \_\_\_\_>>.
  - 3. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- E. Weld connections that cannot be shop welded due to size limitations.
  - 1. Weld in accordance with AWS D1.1/D1.1M.
  - 2. Match shop welding and bolting.
  - 3. Clean welds, bolted connections, and abraded areas.
  - 4. Touch up shop primer and factory-applied finishes.
  - 5. Repair galvanizing with galvanizing repair paint per ASTM A780/A780M.

# PART 3 EXECUTION

## 3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

#### 3.02 PREPARATION

A. Clean and strip << primed steel items to bare metal; aluminum; or \_\_\_\_\_>> where site welding is required.

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Design Development Phase	00 02 13 - 3	Fipe and Tube Railings

B. Supply items required to be << <u>cast into concrete</u>; <u>embedded in masonry</u>; placed in partitions; or \_\_\_\_\_>> with setting templates, for installation as work of other sections.

# 3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.
- C. Install railings in compliance with ADA Standards for accessible design at applicable locations.
- D. Anchor railings securely to structure.
- E. Field weld anchors as indicated on << <u>drawings;</u> shop drawings; or \_\_\_\_\_>>. Touch-up welds with primer. Grind welds smooth.
- F. Conceal anchor bolts and screws whenever possible. << <u>Where not concealed, use flush</u> <u>countersunk fastenings.;</u> or None N/A>>

## 3.04 TOLERANCES

- A. Maximum Variation From Plumb: << <u>1/4 inch;</u> or \_\_\_\_\_ inch>> per floor level, non-cumulative.
- B. Maximum Offset From True Alignment: << <u>1/4 inch;</u> or \_\_\_\_\_ inch>>.
- C. Maximum Out-of-Position: << <u>1/4 inch;</u> or \_\_\_\_\_ inch>>.

END OF SECTION 05 5213

#### SECTION 05 5305 METAL GRATINGS AND FLOOR PLATES

## PART 1 GENERAL

# 1.01 SECTION INCLUDES

- A. Formed metal << <u>floor;</u> <u>mezzanine;</u> <u>stair tread;</u> and \_\_\_\_\_>> gratings.
- B. Flat surface << <u>floor;</u> <u>stair tread;</u> and \_\_\_\_\_>> plating.
- C. Perimeter closure.

# 1.02 RELATED REQUIREMENTS

- A. Section 05 5000 Metal Fabrications.
- B. Section 05 5100 Metal Stairs: Framing for grating<< and stair treads; or None N/A>>.
- C. Section 09 9113 Exterior Painting: Field paint finish.
- D. Section 09 9123 Interior Painting: Field paint finish.

# 1.03 REFERENCE STANDARDS

- A. ASTM A36/A36M Standard Specification for Carbon Structural Steel; 2014.
- B. ASTM A123/A123M Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- C. ASTM A153/A153M Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.
- D. ASTM A786/A786M Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates; 2015.
- E. ASTM B211/B211M Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire; 2019.
- F. AWS A2.4 Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.
- G. AWS B2.1/B2.1M Specification for Welding Procedure and Performance Qualification; 2014 (Amended 2015).
- H. AWS D1.1/D1.1M Structural Welding Code Steel; 2020.
- I. NAAMM MBG 531 Metal Bar Grating Manual; 2017.
- J. SSPC-Paint 20 Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).
- K. SSPC-SP 2 Hand Tool Cleaning; 2018.

# 1.04 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements, for submittal procedures.
- B. Product Data: Provide span and deflection tables.
- C. Shop Drawings: Indicate details of component supports,<< <u>openings</u>; or None N/A>> perimeter construction details, and tolerances.
  - 1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
  - 2. Include the design engineer's seal and signature on each sheet of shop drawings.
- D. Samples: Submit << <u>two;</u> or \_\_\_\_>> samples, <u>12 by 12 inch</u> in size illustrating surface finish, color, and texture.
- E. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated within the previous << <u>12 months</u>; or \_\_\_\_>>.

# 1.05 QUALITY ASSURANCE

- A. Designer Qualifications: Design << <u>gratings</u>; and <u>plates</u>>> under direct supervision of a Professional Structural Engineer experienced in design of this type of work and licensed in the State in which the Project is located.
- B. Welder Qualifications: Welding processes and welding operators qualified within previous << <u>12 months;</u> or \_\_\_\_>> in accordance with AWS D1.1/D1.1M.

## PART 2 PRODUCTS

## 2.01 PERFORMANCE REQUIREMENTS

A. Comply with << <u>applicable;</u> or \_\_\_\_\_>> code for loading requirements.

#### 2.02 MATERIALS

- A. Steel Floor Plate: ASTM A786/A786M<< ; manufacturer's standard pattern; ; Pattern No. 2; ; Pattern No. 4; ; Pattern No. 5; ; \_\_\_\_\_; or None N/A>>.
- B. Steel Framing: ASTM A36/A36M shapes, << <u>unfinished</u>; galvanized per ASTM A123/A123M; or \_\_\_\_\_>>.
- C. Cross Bars: << <u>ASTM B211/B211M</u> solid bars; or \_\_\_\_>>.
- D. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- E. Touch-Up Primer for Galvanized Surfaces: << <u>SSPC-Paint 20</u> <u>Type I Inorganic;</u> SSPC-Paint 20 Type II - Organic; or \_\_\_\_\_>>, complying with VOC limitations of authorities having jurisdiction.

#### 2.03 ACCESSORIES

- A. Fasteners and << <u>Saddle Clips;</u> Flange Blocks; J-Hooks; or \_\_\_\_\_>>: << <u>Galvanized steel;</u> Stainless steel; Unfinished steel; or \_\_\_\_\_>>:
- B. Perimeter Closure: << <u>Of same material as grating;</u> or \_\_\_\_>>.

# 2.04 FABRICATION

- A. Grating Type: NAAMM MBG 531, << <u>Pressure Locked</u>; Welded; Riveted; or \_\_\_\_\_>> Type.
- B. << <u>Mechanically clinch</u>; Bolt; Weld; Rivet; or \_\_\_\_\_>> joints of intersecting metal sections.
- C. Fabricate support framing for << <u>openings;</u> or \_\_\_\_\_>>.
- D. Top Surface: << Serrated; Non-slip; Raised lug; or \_\_\_\_>>.

## 2.05 FINISHES

A. Galvanizing for Steel Hardware: ASTM A153/A153M.

## PART 3 EXECUTION

## 3.01 EXAMINATION

- A. Verify that field measurements are as << <u>indicated on drawings</u>; <u>indicated on shop</u> drawings; <u>instructed by the manufacturer</u>; or \_\_\_\_\_\_>>.
- B. Verify that opening sizes and dimensional tolerances are acceptable.
- C. Verify that << <u>supports;</u> anchors; or \_\_\_\_\_>> are correctly positioned.

## 3.02 INSTALLATION

- A. Install components in accordance with manufacturer's instructions.
- B. Place frames in correct position, plumb and level.
- C. Mechanically cut << galvanized; or \_\_\_\_\_>> finish surfaces. Do not flame cut.
- D. Anchor by << welding; bolting through saddle clips; or bolting through flange blocks>>.

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Design Development Phase	03 3303 - 2	Metal Gratings and Floor Flates

- E. Set perimeter closure flush with top of grating and surrounding construction.
- F. Secure to prevent movement.

# 3.03 TOLERANCES

A. Comply with NAAMM MBG 531.

#### SECTION 05 7500 DECORATIVE FORMED METAL

## PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Interior fabrications made of formed metal sheet, secondary supports, and anchors to structure, including:
  - 1. Factory fabricated column covers.

## 1.02 RELATED REQUIREMENTS

- A. Section 05 5000 Metal Fabrications: Non-decorative metal fabrications.
- B. Section 07 6200 Sheet Metal Flashing and Trim: Formed metal flashings and trim.

#### 1.03 REFERENCE STANDARDS

- A. AAMA 2604 Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2017a.
- B. ASTM A123/A123M Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- C. ASTM A449 Standard Specification for Hex Cap Screws, Bolts and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use; 2014 (Reapproved 2020).
- D. ASTM B209 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
- E. ASTM B209M Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.
- F. ASTM B209/B209M Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021.
- G. ASTM C920 Standard Specification for Elastomeric Joint Sealants; 2018.
- H. ASTM D523 Standard Test Method for Specular Gloss; 2014 (Reapproved 2018).
- I. ASTM D1056 Standard Specification for Flexible Cellular Materials—Sponge or Expanded Rubber; 2020.
- J. ASTM D2244 Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates; 2016.
- K. ASTM D4214 Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films; 2007 (Reapproved 2015).
- L. NAAMM AMP 500-06 Metal Finishes Manual; 2006.

## 1.04 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements, for submittal procedures.
- B. Product Data Sheet Metal Material: Manufacturer's data sheets on each product to be used, including:
  - 1. Preparation instructions and recommendations.
  - 2. Storage and handling requirements and recommendations.
  - 3. Installation methods.
  - 4. Specimen warranty.
- C. Product Data Metal Composite Material (MCM) Sheets: Manufacturer's data sheets on each product to be used, including thickness, physical characteristics, and finish, and:
  - 1. Finish manufacturer's data sheet showing physical and performance characteristics.
  - 2. Storage and handling requirements and recommendations.
  - 3. Fabrication instructions and recommendations.
  - 4. Specimen warranty for finish, as specified herein.

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- D. Shop Drawings: Show layout and elevations, dimensions and thickness of panels, connections, details and location of joints, sealants and gaskets, method of anchorage, number of anchors, supports, reinforcement, trim, flashings, and accessories.
  - 1. Differentiate between shop and field fabrication.
  - 2. Indicate substrates and adjacent work with which the fabrications must be coordinated.
  - 3. Include large-scale details of anchorages and connecting elements.
  - Include large-scale details or schematic, exploded or isometric diagrams to fully explain << <u>flashing</u>; drainage system; rainscreen interface; and \_\_\_\_\_>> at a scale of not less than << 1-1/2 inches per 12 inches; or \_\_\_\_\_ inches per \_\_\_\_\_ inches>>.
- E. Verification Samples: For each finish product specified, minimum size << <u>12 inches</u>; 6 inches; or \_\_\_\_\_ inches>> square, representing actual product in color<< <u>and texture</u>; or None N/A>>.
- F. Fabricator's Qualification Statement.
- G. Installer's Qualification Statement.
- H. Maintenance Data: Care of finishes and warranty requirements.
- I. Executed Warranty: Submit warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

#### 1.05 QUALITY ASSURANCE

- A. Fabricator Qualifications: Company specializing in fabricating products specified in this section.
  1. With not less than << <u>three</u>; or \_\_\_\_>> years of<< <u>documented</u>; or None N/A>> experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified in this section.
  - 1. With minimum << <u>3 years;</u> or \_\_\_\_>> of<< <u>documented;</u> or None N/A>> experience.

## 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products in manufacturer's original, unopened, undamaged containers with identification labels intact.
  - 1. Protect finishes by applying heavy duty removable plastic film during production.
  - 2. Package for protection against transportation damage.
  - 3. Provide markings to identify components consistently with drawings.
  - 4. Exercise care in unloading, storing and installing panels to prevent bending, warping, twisting and surface damage.
- B. Store products protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.
  - 1. Store in well-ventilated space out of direct sunlight.
  - 2. Protect from moisture and condensation with tarpaulins or other suitable weathertight covering installed to provide ventilation.
  - 3. Store at a slope to ensure positive drainage of accumulated water.
  - 4. Do not store in enclosed space where ambient temperature can exceed **<u>120 degrees F</u>**.
  - 5. Avoid contact with other materials that might cause staining, denting, or other surface damage.

# 1.07 WARRANTY

- A. See Section <u>01 7800 Closeout Submittals</u>, for additional warranty requirements.
- B. MCM Sheet Manufacturer's Finish Warranty: Provide manufacturer's written warranty stating that the finish will perform as follows for minimum of << <u>5</u>; 10; 20; or \_\_\_\_> years:
  - 1. Chalking: No more than that represented by a No.8 rating based on ASTM D4214.
  - 2. Color Retention: No fading or color change in excess of << <u>5 Hunter color difference</u> <u>units;</u> or \_\_\_\_>>, calculated in accordance with ASTM D2244.

3. Gloss Retention: Minimum of 30 percent gloss retention, when tested in accordance with ASTM D523.

## PART 2 PRODUCTS

#### 2.01 MANUFACTURERS

A. Metal Composite Material Sheet Manufacturers:

#### 1. Substitutions: << <u>See Section 01 6000 - Product Requirements;</u> or Not permitted>>.

#### 2.02 FORMED METAL FABRICATIONS - GENERAL

- A. Shop Assembly: Preassemble items to greatest extent possible. Minimize field splices and field assembly. Disassemble only as necessary for transportation and handling. Mark items clearly for assembly and installation.
- B. Coordination: Match dimensions and attachment of formed metal items to adjacent construction. Produce integrated assemblies. Closely fit joints; align edges and flat surfaces unless indicated otherwise.
- C. Forming: Profiles indicated. Maximize lengths. Fold exposed edges to form hem indicated or ease edges to radius indicated with concealed stiffener. Provide flat, flush surfaces without cracking or grain separation at bends.
- D. Reinforcement: Increase metal thickness; use concealed stiffeners, backing materials or both. Provide stretcher leveled standard of flatness and stiffness required to maintain flatness and hold adjacent items in flush alignment.
- E. Anchors: Straps, plates and anchors as required to support and anchor items to adjacent construction.
- F. Supports: Miscellaneous framing, mounting, clips, sleeves, fasteners and accessories required for installation.
- G. Welding and Brazing: Weld or braze joints continuously. Grind, fill or dress to produce smooth, flush, exposed surfaces. Do not discolor metal. Grind smooth, polish, and restore damaged finishes to required condition.
- H. Performance Requirements:
  - 1. Thermal Movements:
    - a. Allow for thermal movements in exterior metal fabrications due to temperature changes. Prevent buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
    - b. Temperature Change Range: <u>120 degrees F</u>, ambient; <u>180 degrees F</u>, on material surfaces.
  - 2. Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

#### 2.03 FACTORY FABRICATED COLUMN COVERS

- A. Factory Fabricated Column Covers: Factory fabricated and factory finished, sheet metal column covers, mechanically fastened to structural support.
  - 1. Material: << <u>Aluminum sheet</u>, <u>ASTM B209/B209M</u> <u>alloy 3003 or 5005</u>; Stainless steel sheet; ASTM A666 Type 304; or \_\_\_\_\_>>.
  - 2. Sheet Thickness: << <u>0.125 inch</u>; 16 gauge (0.0625 inch); or \_\_\_\_\_>>, minimum.
  - 3. Column Section Length: << <u>12 feet;</u> or \_\_\_\_\_ inch>>, maximum<< <u>, between</u> horizontal joints; or None N/A>>.
  - 4. Column diameter: 30" OD inless noted otherwise
  - 5. Fasteners: Self-drilling; ASTM A449 heat treated steel, with manufacturer's standard corrosion resistant coating.

  - 7. Color: match project aluminum curtainwall.
  - 8. Manufacturers:

## 2.04 MATERIALS

- A. General: Provide sheet metal without pitting, seam marks, roller marks, stains, discolorations, or other imperfections exposed to view on finished units.
- B. Aluminum Sheet: ASTM B209/B209M, 5005-H32 minimum; alloy and temper recommended by aluminum producer and finisher for use and finish indicated.
- C. Fasteners, General: Same basic metal and alloy as formed metal sheet unless indicated otherwise. Do not use metals incompatible with the materials joined.
- D. Gaskets: As required to seal joints in decorative formed metal and remain << <u>airtight;</u> weathertight; or \_\_\_\_\_>; as recommended in writing by decorative formed metal manufacturer.
  - 1. ASTM D1056, Type 1, Class A, grade as recommended by gasket manufacturer to obtain seal for application indicated.
- E. Bituminous Coating: Cold-applied asphalt mastic, noncorrosive compound free of asbestos, sulfur, and other deleterious impurities; << <u>15 mil</u>; or <u>\_\_\_\_</u> mil>> dry film thickness per coat.
- F. Joint Sealer, Exterior: ASTM C920; elastomeric << <u>silicone</u>; polyurethane; polysulfide; or \_\_\_\_\_>> sealant; of type, grade, class, and use classifications required to seal joints in decorative formed metal and remain weathertight; and as recommended in writing by decorative formed metal manufacturer.

#### 2.05 FINISHES

- A. Finishes, General: Comply with NAAMM AMP 500-06.
  - 1. Complete mechanical finishes before fabrication. After fabrication, finish joints, bends, abrasions and surface blemishes to match sheet.
  - 2. Protect mechanical finishes on exposed surfaces from damage.
  - 3. Apply organic and anodic finishes to formed metal after fabrication unless otherwise indicated.
  - 4. Appearance: Limit variations in appearance of adjacent pieces to one-half of range represented in approved samples. Noticeable variations in same piece are not acceptable. Install components within range of approved samples to minimize contrast.
- B. Aluminum Finishes:
  - 1. High Performance Organic Coatings: AAMA 2604; multiple coats, thermally cured fluoropolymer system.
  - 2. Color: << As indicated on drawings; As indicated; or match project aluminum curtainwall mullions>>.

## PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Verify dimensions, tolerances, and interfaces with other work.
- B. Verify substrate on-site to determine that conditions are acceptable for product installation in accordance with manufacturer's written instructions.
- C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- D. Notify Architect in writing of conditions detrimental to proper and timely completion of work. Do not proceed with erection until unsatisfactory conditions have been corrected.

#### 3.02 PREPARATION

- A. Protect adjacent work areas and finish surfaces from damage during installation.
- B. Coat concrete and masonry surfaces that will be in contact with metal surfaces with bituminous coating.

# 3.03 INSTALLATION - SHEET METAL AND PLATE FABRICATIONS

- A. Locate and place decorative formed sheet metal items level and plumb; align with adjacent construction. Cut, drill and fit as required to install.
- B. Do not cut or abrade sheet metal finishes that cannot be completely restored in the field. Return such items to manufacturer or fabricator for required alterations and refinishing or provide new items.
- C. Use concealed anchorages where possible. Provide washers where needed on bolts or screws to protect metal surfaces and make weathertight connection.
- D. Form tight joints with exposed connections accurately fitted together. Provide reveals and openings for sealants and joint fillers indicated.
- E. Corrosion Protection: Apply permanent separation materials on concealed surfaces where metals would otherwise be in direct contact with incompatible substrate materials. Prevent corrosion damage to material and finish.

## 3.04 CLEANING

- A. Restore finishes damaged during installation and construction period. Return items that cannot be refinished in the field to manufacturer or fabricator. Refinish entire unit or provide new units.
- B. Remove protective film after installation of joint sealers, after cleaning of adjacent materials, and immediately prior to completion of work.
- C. Remove temporary coverings and protection of adjacent work areas.
- D. Clean installed products in accordance with manufacturer's instructions.

## 3.05 PROTECTION

A. Protect installed products from damage during construction.

## END OF SECTION 05 7500

#### SECTION 06 0573 WOOD TREATMENT

## PART 1 GENERAL

#### 1.01 SECTION INCLUDES

A. Field-applied preservative treatment for wood materials.

#### 1.02 RELATED REQUIREMENTS

- A. Section 03 3000 Cast-in-Place Concrete.
- B. Section 06 1000 Rough Carpentry: Factory treatment for wood products.
- C. Section 06 1800 Glued-Laminated Construction: Factory treatment for wood products.

#### 1.03 SUBMITTALS

- A. See Section **01 3000 Administrative Requirements** for submittal procedures.
- B. Product Data: Provide technical data for << <u>insulated sheathing</u>; <u>wood preservative</u> <u>materials</u>; <u>application instructions</u>; and \_\_\_\_\_>>.
- C. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

#### 1.04 DELIVERY, STORAGE, AND HANDLING

- A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.
- B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, and installation.

#### PART 2 PRODUCTS

#### 2.01 FIELD-APPLIED WOOD TREATMENT

- A. Field-Applied Wood Preservative: For treated or untreated, existing or new wood or woodbased materials.
  - 1. Liquid Wood Preservative: Roller, spray, or injection formula.
    - a. Preservative Action: Fungicidal, insecticidal, and moldicidal effects.
    - b. Active Ingredients: Clear solution of << <u>19.6</u>; or \_\_\_>> percent disodium octaborate tetrahydrate with << <u>1.0</u>; or \_\_\_>> percent didecyl dimethyl ammonium chloride.
    - c. Carrier: Proprietary mix of propylene glycol and water.
    - d. VOC: << <u>6.51 lb/gal;</u> or \_\_\_\_\_ lb/gal>>.

# PART 3 EXECUTION

#### 3.01 PREPARATION

A. Remove dust, dirt and other contaminants from treatment surfaces. Remove tarpaulins, dropcloths, strippable protective films, etc., from areas to be treated. Move equipment and stored materials that block or prevent product application.

#### 3.02 INSTALLATION - GENERAL

A. Provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

#### 3.03 FIELD-APPLIED WOOD TREATMENT

- A. Comply with manufacturer's written mixing and application instructions.
- B. Liquid Preservative: Apply to wood and wood-based building materials indicated in accordance with manufacturer's instructions.
  - 1. Apply by roller, spray, or injection.
  - 2. Do not apply when raining or in extremely high humidity conditions.

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3. Allow preservative to dry prior to application of surface coatings.

# END OF SECTION 06 0573

#### SECTION 06 1000 ROUGH CARPENTRY

## PART 1 GENERAL

# 1.01 SECTION INCLUDES

- A. Rough opening framing for doors, windows, and roof openings.
- B. Roof-mounted curbs.
- C. Roofing nailers.
- D. Preservative treated wood materials.
- E. Fire retardant treated wood materials.
- F. Communications and electrical room mounting boards.
- G. Concealed wood blocking, nailers, and supports.
- H. Miscellaneous wood nailers, furring, and grounds.

## 1.02 RELATED REQUIREMENTS

- A. Section <u>03 3000 Cast-in-Place Concrete</u>: Setting anchors in << <u>concrete</u>; masonry; or \_\_\_\_\_\_>>.
- B. Section <u>05 1200 Structural Steel Framing</u>: Prefabricated << girders; <u>beams</u>; <u>columns</u>; hangers; and \_\_\_\_\_>> for support of wood framing.
- C. Section <u>05 5000 Metal Fabrications</u>: Miscellaneous << <u>steel connectors</u>; <u>support angles</u>; and \_\_\_\_\_>> for wood framing.
- D. Section 07 2500 Weather Barriers.
- E. Section 07 6200 Sheet Metal Flashing and Trim.
- F. Section 09 2116 Gypsum Board Assemblies: Gypsum-based sheathing.

## 1.03 REFERENCE STANDARDS

- A. ASTM A153/A153M Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.
- B. AWPA U1 Use Category System: User Specification for Treated Wood; 2018.
- C. ICC (IBC) International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. ICC (IECC) International Energy Conservation Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. PS 20 American Softwood Lumber Standard; 2020.

## 1.04 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements for submittal procedures.
- B. Product Data: Provide technical data on << insulated sheathing; <u>wood preservative</u> <u>materials; application instructions;</u> and \_\_\_\_\_>>.

## 1.05 DELIVERY, STORAGE, AND HANDLING

- A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.
- B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, and installation.

## PART 2 PRODUCTS

## 2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.

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Design Development Phase	00 1000 - 1	Rough Carpentry

- 1. If no species is specified, provide species graded by the agency specified; if no grading agency is specified, provide lumber graded by grading agency meeting the specified requirements.
- 2. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee at www.alsc.org, and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

# 2.02 DIMENSION LUMBER << FOR CONCEALED APPLICATIONS; OR NONE - N/A>>

- A. Sizes: Nominal sizes as indicated on drawings, << <u>S4S</u>; Rough (unsurfaced); or \_\_\_\_\_\_>>.
- B. Moisture Content: << S-dry or MC19; Kiln-dry or MC15; or \_\_\_\_>>.
- C. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
  - 1. Lumber: S4S, << No. 1 or Construction Grade; <u>No. 2 or Standard Grade</u>; No. 3 or Utility Grade; or \_\_\_\_\_>>.
  - 2. Boards: << Standard or No. 3; or \_\_\_\_>>.

# 2.03 ACCESSORIES

- A. Fasteners and Anchors:
  - Metal and Finish: << <u>Hot-dipped galvanized steel complying with ASTM</u> <u>A153/A153M</u>; Stainless steel; or \_\_\_\_\_>> for high humidity and preservativetreated wood locations, unfinished steel elsewhere.
  - Drywall Screws: Bugle head, hardened steel, power driven type, << <u>length three times</u> <u>thickness of sheathing</u>; length to achieve full penetration of sheathing substrate; or \_\_\_\_\_>>.
- B. Sill Gasket on Top of Foundation Wall: << <u>1/4 inch</u>; or \_\_\_\_\_ inch>> thick, << <u>plate width</u>; or \_\_\_\_\_ inch wide>>, << <u>closed cell plastic foam from continuous rolls</u>; glass fiber strip; or \_\_\_\_\_\_>>.
- C. Sill Flashing: See Section 07 6200.
- D. Vapor Retarder: See Section <u>07 2600</u>.

## 2.04 FACTORY WOOD TREATMENT

- A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
  - 1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
  - 2. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

## PART 3 EXECUTION

## 3.01 PREPARATION

- A. Install sill gasket under sill plate of framed walls bearing on foundations; puncture gasket cleanly to fit tightly around protruding anchor bolts.
- B. Coordinate installation of rough carpentry members specified in other sections.

## 3.02 INSTALLATION - GENERAL

- A. Select material sizes to minimize waste.
- B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.
- C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

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Design Development Phase	00 1000 - 2	Rough Carpenity

# 3.03 BLOCKING, NAILERS, AND SUPPORTS

- A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim. Contractor shall include blocking where required where ever there is something afixed to a surface if not indicated specifically in the drawings.
- B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to authorities having jurisdiction may be used in lieu of solid wood blocking.
- C. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.
- D. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.
- E. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.
- F. Provide the following specific nonstructural framing and blocking:
  - 1. Cabinets and shelf supports.
  - 2. Wall brackets.
  - 3. Handrails.
  - 4. Grab bars.
  - 5. Towel and bath accessories.
  - 6. Wall-mounted door stops.
  - 7. Chalkboards and marker boards.
  - 8. Wall paneling and trim.
  - 9. Joints of rigid wall coverings that occur between studs.

#### 3.04 SITE APPLIED WOOD TREATMENT

- A. Apply preservative treatment compatible with factory applied treatment at site-sawn cuts, complying with manufacturer's instructions.
- B. Allow preservative to dry prior to erecting members.

## 3.05 TOLERANCES

- A. Framing Members: << <u>1/4 inch</u>; or \_\_\_\_\_ inch>> from true position, maximum.
- B. Variation from Plane, Other than Floors: << <u>1/4 inch in 10 feet</u>; or \_\_\_\_\_ inch in 10 feet>> maximum, and << <u>1/4 inch in 30 feet</u>; <u>1/2 inch in 30 feet</u>; or \_\_\_\_ inch in 30 feet>> maximum.

## 3.06 FIELD QUALITY CONTROL

A. See Section <u>01 4000 - Quality Requirements</u> for additional requirements.

## 3.07 CLEANING

- A. Waste Disposal: See Section 01 7419 Construction Waste Management and Disposal.
  - 1. Comply with applicable regulations.
  - 2. Do not burn scrap on project site.
  - 3. Do not burn scraps that have been pressure treated.
  - 4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or "waste-to-energy" facilities.
- B. Do not leave wood, shavings, sawdust, etc. on the ground or buried in fill.
- C. Prevent sawdust and wood shavings from entering the storm drainage system.

## END OF SECTION 06 1000

## SECTION 06 1053 MISCELLANEOUS ROUGH CARPENTRY

# PART 1 GENERAL

# 1.01 SECTION INCLUDES

- A. Roofing nailers.
- B. Roofing cant strips.
- C. Preservative treated wood materials.
- D. Fire retardant treated wood materials.
- E. Communications and electrical room mounting boards.
- F. Concealed wood blocking, nailers, and supports.
- G. Miscellaneous wood nailers, furring, and grounds.

# 1.02 RELATED REQUIREMENTS

- A. Section 06 0573 Wood Treatment
- B. Section 09 2116 Gypsum Board Assemblies: Gypsum-based sheathing.
- C. Section 12 2413 Roller Window Shades
- D. Section 10 2800 Toilet, Bath, and Laundry Accessories
- E. Section 12 3200 Manufactured Wood Casework

# 1.03 REFERENCE STANDARDS

- A. ASTM A153/A153M Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.
- B. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials; 2021.
- C. AWPA U1 Use Category System: User Specification for Treated Wood; 2018.
- D. PS 1 Structural Plywood; 2009 (Revised 2019).
- E. PS 20 American Softwood Lumber Standard; 2020.

## 1.04 DELIVERY, STORAGE, AND HANDLING

- A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.
- B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, and installation.

## PART 2 PRODUCTS

## 2.01 GENERAL REQUIREMENTS

- A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
  - 1. If no species is specified, provide species graded by the agency specified; if no grading agency is specified, provide lumber graded by grading agency meeting the specified requirements.
  - 2. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

## 2.02 DIMENSION LUMBER << FOR CONCEALED APPLICATIONS; OR NONE - N/A>>

- A. Sizes: Nominal sizes as indicated on drawings, << <u>S4S</u>; Rough (unsurfaced); or \_\_\_\_\_\_\_
- B. Moisture Content: << <u>S-dry or MC19;</u> Kiln-dry or MC15; or \_\_\_\_>>.

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- C. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
  - 1. Lumber: S4S, << No.1 or Construction Grade; <u>No.2 or Standard Grade</u>; No.3 or Utility Grade; or \_\_\_\_\_>>.
  - 2. Boards: << <u>Standard or No.3;</u> or \_\_\_\_>>.

## 2.03 CONSTRUCTION PANELS

A. Communications and Electrical Room Mounting Boards: PS 1, A-D plywood, or medium density fiberboard; << <u>3/4 inch</u>; or \_\_\_\_\_ inch>> thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

# 2.04 ACCESSORIES

- A. Fasteners and Anchors:
  - Metal and Finish: << <u>Hot-dipped galvanized steel complying with ASTM</u> <u>A153/A153M</u>; Stainless steel; or \_\_\_\_\_>> for high humidity and preservativetreated wood locations, unfinished steel elsewhere.

## 2.05 FACTORY WOOD TREATMENT

- A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
  - 1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
  - 2. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.
- B. Fire Retardant Treatment:
  - Interior Type A: AWPA U1, Use Category UCFA, Commodity Specification H, low temperature, low hygroscopic type, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.
    - a. Kiln dry wood after treatment to a maximum moisture content of << <u>19</u>; **18**; **or** \_\_\_\_>> percent for lumber and << <u>15</u>; **or** \_\_\_\_>> percent for plywood.
    - b. Interior rough carpentry items are to be fire retardant treated.
    - c. Do not use treated wood in applications exposed to weather or where the wood may become wet.
- C. Preservative Treatment:
  - Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A<< <u>using waterborne preservative</u>; using \_\_\_\_; or None - N/A>><< to 0.10 lb/cu ft retention; <u>to</u> <u>lb/cu ft retention</u>; or None -N/A>>.
    - a. Kiln dry lumber after treatment to maximum moisture content of << <u>19</u>; **18**; or \_\_\_\_> percent.
    - b. Treat lumber exposed to weather.
    - c. Treat lumber in contact with << <u>roofing</u>; <u>flashing</u>; <u>waterproofing</u>; or \_\_\_\_\_\_\_\_
    - d. Treat lumber in contact with << <u>masonry</u>; <u>concrete</u>; or \_\_\_\_>>.
    - e. Treat lumber less than << <u>18 inches;</u> or \_\_\_\_\_ inches>> above grade.

## PART 3 EXECUTION

## 3.01 PREPARATION

A. Coordinate installation of rough carpentry members specified in other sections.

## 3.02 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

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- B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.
- C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

## 3.03 BLOCKING, NAILERS, AND SUPPORTS

- A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.
- B. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.
- C. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.
- D. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.
- E. Provide the following specific nonstructural framing and blocking:
  - 1. Cabinets and shelf supports.
  - 2. Wall brackets.
  - 3. Handrails.
  - 4. Grab bars.
  - 5. Towel and bath accessories.
  - 6. Wall-mounted door stops.
  - 7. Chalkboards and marker boards.
  - 8. Wall paneling and trim.
  - 9. Joints of rigid wall coverings that occur between studs.
  - 10. as required elsewhere for backing and mounting. Contractor shall include all backing and blocking.

#### 3.04 ROOF-RELATED CARPENTRY

A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.

## 3.05 INSTALLATION OF CONSTRUCTION PANELS

- A. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum << <u>24 inches</u>; or \_\_\_\_\_ inches>> on center on edges and into studs in field of board.
  - 1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
  - 2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
  - 3. Install adjacent boards without gaps.
  - 4. Size: << <u>48 by 96 inches;</u> or \_\_\_\_\_ inches>>, installed horizontally at ceiling height.

## 3.06 SITE APPLIED WOOD TREATMENT

- A. Apply preservative treatment compatible with factory applied treatment at site-sawn cuts, complying with manufacturer's instructions.
- B. Allow preservative to dry prior to erecting members.

#### 3.07 CLEANING

- A. Waste Disposal: See Section 01 7419 Construction Waste Management and Disposal.
  - 1. Comply with applicable regulations.
  - 2. Do not burn scrap on project site.
  - 3. Do not burn scraps that have been pressure treated.

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- 4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or "waste-to-energy" facilities.
- B. Do not leave wood, shavings, sawdust, etc. on the ground or buried in fill.
- C. Prevent sawdust and wood shavings from entering the storm drainage system.

# END OF SECTION 06 1053

# SECTION 06 1719 CROSS-LAMINATED TIMBER

#### PART 1 GENERAL

#### 1.01SUMMARY

- A. Section Includes: Cross-Laminated Timber (CLT) Panels as shown on drawings.
- B. Related Sections: Section(s) related to this section include:
  - 1. Section 01 33 00 Submittal Procedures
  - 2. Section 01 60 00 Product Requirements
  - 3. Section 03 30 00 Cast-in Place Concrete
  - 4. Section 06 10 00 Rough Carpentry

#### 1.02 REFERENCES

- A. ANSI/APA PRG 320 Standard for Performance-Rated Cross-Laminated Timber, Standard for Performance Rated Cross-Laminated Timber.
- B. APA Standard for Performance Rated CLT ANSI/APA PRG 320/2012.
- C. AWC NDS, National Design Specification (NDS) for Wood Construction.
- D. CAN/CSA O122-06, ANSI D3737-07 Structural Glued Laminated Timber.
- E. CSA O86-14, Engineering Design in Wood, including Annex B.
- F. CSA O112 SERIES-M1977 (R2006), CSA Standards for Wood Adhesives.
- G. CSA O177-16, Qualification Code for Manufacturers of Structural Glued Laminated Timber.
- H. SP-529E, CLT Handbook, Cross-Laminated Timber (U.S. Edition), 2013 or most recent edition.

#### 1.03 DESIGN REQUIREMENTS

- A. Provide CLT panels which have been manufactured, fabricated and installed to withstand specified loads as determined by design in accordance with the local building codes and to maintain performance criteria as stated by the CLT manufacturer without defects, damage or product failure.
- B. Structural design for all CLT panels and their connections as per CLT structural notes.
- C. Design to include fall restraint recommendations.
- D. Unsolicited alternative proposals, and unsolicited substitutions of materials, structure, connections or otherwise, must be submitted with sketches and calculations sealed by a Professional Engineer registered in the State of Alaska and will require reviews by the consultants. Detailed reviews such as these, including changes to construction drawings and coordination, will be undertaken on an additional fee basis, at the Contractor's cost. This cost must be included in the proposal by the Contractor. Such review does not guarantee acceptance of the unsolicited alternative proposal(s).

#### 1.04 SUBMITTALS

- A. Certifications: Submit certificates for cross-laminated timber panels. Include a product report or laboratory report issued by a U.S. product certification agency accredited under ISO ISO/IEC 17065 or a U.S. product inspection agency accredited under ISO ISO/IEC 17020. Include the following information in the certification:
  - 1. CLT Manufacturer's Standards
  - 2. CLT stress grade and appearance classification
  - 3. Lay-up of wood, species and grades used
  - 4. Connection Hardware Standards in accordance with CLT Manufacturer's specifications

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**Cross-Laminated Timber** 

- 5. Manufacturer's panel durability tests and testing results. Ensure material tested is typical of production run of the same material used in the project.
- B. Product data: Submit product data for proprietary connectors.
- C. Shop Drawings: Shop drawings may take the form of paper drawings or PDF files.
  - 1. Submit detailed shop drawings of the CLT panels including:
    - a. panel thickness
    - b. dimensions
    - c. panel layup
    - d. connection details
    - e. stress grade
    - f. appearance grade
    - g. connection details
    - h. shop applied finishes
    - i. shop and erection details, including cuts, holes, fastenings, camber, and connection hardware.
  - 2. Submit PDF shop drawings showing all applicable details and material specifications to the Engineer for review prior to fabrication. Shop drawings must be accompanied by a certificate of conformance to manufacturing standard.
  - 3. Drawings to be signed by a Registered Professional Structural Engineer, registered in the State of Washington for items designed by supplier.
  - 4. Do not fabricate until shop drawings are reviewed without further changes.
- D. Samples: submit a 12" x 12" sample of CLT material.
- E. Calculation: Provide structural calculation stamped and signed by a design professional registered in the jurisdiction where the work is being performed when required.
- F. Warranty: Provide limited warranty documents as specified herein.

## 1.05 QUALITY ASSURANCE

- A. CLT panels must comply with ANSI/APA PRG 320 Standard for Performance-Rated Cross-Laminated Timber.
- B. CLT panels must be produced by an American Institute of Timber Construction (AITC) or APA The Engineered Wood Association (APA) licensed manufacturer. Manufacture of panels must conform to AWC NDS and SP-529E.
- C. Product marking: CLT panels must be identified with a tag or stamp indicating layup, mill name, approved agency, and the symbol of ANSI/APA PRG 320. Factory mark every panel with AITC Quality Mark or APA-EEWS trademark. Marks must not be visible in final assembly.
- D. Installer Qualifications: Installer to have demonstrated experience acceptable to CLT Manufacturer for installation work similar in scope and size to this project. Manufacturer to confirm availability of site advisory service.
- E. Source limitations: Obtain all CLT panels through one source. All accessories to be furnished or recommended by the CLT manufacturer.

## 1.06 REGULATORY REQUIREMENTS AND MANUFCTURER QUALIFICATIONS:

- A. CLT panels must be recognized for compliance with the applicable building code with an ICC-ES evaluation report demonstrating compliance with the International Building Code (IBC).
- B. Manufacturer must be certified by the American Plywood Association Engineered Wood Systems (APA EWS) and bonded with polyurethane resin (white) adhesive meeting the requirements of ANSI A190.1-1992, DIN 68 141 and EN 301 and 302.

## 1.07 DELIVERY, STORAGE AND HANDLING

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- A. Ordering: Comply with CLT panel manufacturer ordering instructions and lead time requirements to avoid construction delays.
- B. Delivery: Deliver materials from CLT panel manufacturer with identification labels or markings intact. Off-load CLT panels from delivery truck and handle using means to prevent damage to CLT panels.
- C. Protection: Keep CLT panels dry and protected from damage during delivery and storage:
  - 1. Protect against exposure to rain, water, dirt, mud, and other residue that may affect CLT performance.
  - 2. Slit underside of membrane covering during storage at site to avoid accumulation of condensation. Do not deface members.
  - 3. Store CLT panels, blocked off ground and separated with striping, so air may circulate around all faces of members.
  - 4. Cover top and sides with opaque moisture resistant membrane if outside Protect corners with wood blocking.
- D. Replacement: Replace damaged or deteriorated panels.

## 1.08 WARRANTY

- A. Project Warranty: Refer to Conditions of the Contract for project warranty conditions and provisions.
- B. CLT Panel Manufacturer Warranty: Submit CLT panel manufacturer standard warranty document for execution by an authorized company official. CLT Panel Manufacturer Warranty is in addition to and not a limitation of other rights the Owner may have under Contract Documents.

## PART 2 PRODUCTS AND MATERIALS

#### 2.01 CROSS-LAMINATED TIMBER

- A. CLT panels fabricated in accordance with ANSI/PRG 320. Panels must meet the following:
  - 1. Moisture content: at the time of manufacturing, moisture content of lumber must be 12% +/- 3% and compatible with the adhesive applied.
  - 2. CLT Layup: As indicated.
  - 3. Appearance classification: Architectural.
- B. Finish of CLT panels: Coating per Section 9900, field applied.
- C. Adhesive: Adhesives must be certified by test for use with the species to which it is applied in accordance with ANSI/APA PRG 320. Apply and allow set times as required by the adhesive manufacturer's instructions. Also, apply pressure on the panels and for the duration during manufacture as required by the adhesive manufacturer's instructions.

# 2.02 ACCESSORIES

- A. Steel Connectors: Design connections to AWC NDS, and AISC 360 unless specifically detailed by the Engineer of Record, to resist shears, moments and forces indicated. Fabricate connective hardware in accordance with AISC 360.
  - 1. Clean oil, dirt, rust, and foreign matter from all metal surfaces.
- B. Wrapping material: Weatherproof, lightproof, stain free material. Cut holes on site on underside of wrapping to avoid accumulation of condensation.

#### 2.03 FABRICATION

A. Fabricate Cross Laminated Timber (CLT) panels in accordance with ANSI/APA PRG 320/2012 except where specified otherwise and to following classifications. Use multiple layers of 19 mm (¾ in) minimum to 38 mm (1½ in) maximum thick laminations. Exceptions only with written consent of the Consultant.

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- B. CLT panels must be fabricated in strict conformance to approved shop drawings. Fabrication prior to receipt of approved shop drawings must be at the Contractor's risk.
- C. CLT panels must be fabricated to join tightly and in proper alignment.
- D. Cross Laminated Timber (CLT) panels to be joined at edges using a continuous spline. All required fastener and spline geometry by manufacturer. To be pre-approved by Engineer prior to fabrication.
- E. Mark panels for identification during erection, ensure that marks will be concealed in final assembly for appearance grade panels. Clearly mark top surface.
- F. All structural steel connecting CLT panels to each other and to supporting panels must be detailed, supplied and test fitted in the shop by the CLT supplier.

# 2.04 PRODUCT SUBSTITUTIONS

A. Substitutions: No substitutions permitted without fourteen day (14) prior approval.

## PART 3 EXECUTION

# 3.01 MANUFACTURER INSTRUCTIONS

A. Compliance: Comply with CLT panel manufacturer ICC-ES evaluation reports, published Load Design Charts, Construction Assembly Drawings, Approved Shop Drawings and product data including Technical Bulletins and Product Information Bulletins for design and installation.

# 3.02 EXAMINATION

- A. Prior to fabrication, check all dimensions relating to this section of work. Report any discrepancies to Engineer.
- B. Prior to site erection, examine all site conditions and ensure an acceptable condition.

## 3.03 ERECTION

- A. Field measure and verifying that the foundations and any structural framing that supports the CLT panels are in the correct location, alignment, and at the proper elevation. The Contractor must not proceed with work until unsatisfactory conditions have been corrected in an acceptable manner. Commencement of erection implies acceptance of conditions.
- B. Erect CLT panels in accordance with final reviewed shop drawings.
- C. Make adequate provision for possible erection stresses. Set panels level and plumb to correct positions. Securely brace panels and anchor in place to maintain plumb until permanently secured by finished structure.
- D. Fit CLT panels closely and accurately, without trimming, cutting or other modifications, unless approved in writing by Engineer. D. Site cutting or boring of CLT panels, other than shown on shop drawings not permitted without written consent of Engineer
- E. The Contractor must be responsible for all temporary shoring and bracing necessary to maintain the stability of the CLT system during erection.
- F. After installation, cover each panel with temporary waterproof protection to maintain the low moisture content of the wood. Protect panels against excessive and repeated water deposits and standing water at all times. Maintain protection until members are enclosed within the building and final coats are ready for application. Take precautions to closely maintain the manufacturer's standard for moisture content. Elevate initial building heating/cooling gradually to the desired level. Do not reduce the relative humidity of the building rapidly.

# END OF SECTION 06 1719
## SECTION 06 1800 GLUED-LAMINATED CONSTRUCTION

#### PART 1 GENERAL

#### 1.01SUMMARY

- 1. Structural glued-laminated timber.
- B. Related Requirements:
  - 1. Section 061000 "Rough Carpentry" for dimension lumber items associated with structural glued-laminated timber.
  - 2. Section 061516 "Wood Roof Decking" for glued-laminated wood roof decking.

#### 1.02 DEFINITIONS

A. Structural Glued-Laminated (Glulam) Timber: An engineered, stress-rated timber product assembled from selected and prepared wood laminations bonded together with adhesives and with the grain of the laminations approximately parallel longitudinally.

## 1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include data on lumber, adhesives, fabrication, and protection.
  - 2. For preservative-treated wood products. Include chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.
  - 3. For connectors. Include installation instructions.
- B. Shop Drawings:
  - 1. Show layout of structural glued-laminated timber system and full dimensions of each member.
  - 2. Indicate species and laminating combination.
  - 3. Include large-scale details of connections.

## 1.04 INFORMATIONAL SUBMITTALS

- A. Certificates of Conformance: Issued by a qualified testing and inspecting agency indicating that structural glued-laminated timber complies with requirements in ANSI A190.1.
- B. Material Certificates: For preservative-treated wood products, from manufacturer. Indicate type of preservative used and net amount of preservative retained.
- C. Research/Evaluation Reports: For structural glued-laminated timber and timber connectors, from ICC-ES.

#### 1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: An AITC- or APA-EWS-licensed firm.

## 1.06 DELIVERY, STORAGE, AND HANDLING

- A. General: Comply with provisions in AITC 111.
- B. Individually wrap members using plastic-coated paper covering with water-resistant seams.

## PART 2 PRODUCTS

## 2.01 PERFORMANCE REQUIREMENTS

A. Structural Performance: Structural glued-laminated timber and connectors are to withstand the effects of structural loads shown on Drawings without exceeding allowable design working stresses listed in ANSI 117 or determined according to ASTM D3737 and acceptable to authorities having jurisdiction.

22047.01 / VNPCC Expansion & Renovation Design Development Phase B. Seismic Performance: Structural glued-laminated timber and connectors are to withstand the effects of earthquake motions determined according to ASCE/SEI 7.

## 2.02 STRUCTURAL GLUED-LAMINATED TIMBER

- A. General: Provide structural glued-laminated timber that complies with ANSI A190.1 and ANSI 117 or research/evaluation reports acceptable to authorities having jurisdiction.
  - 1. Factory mark each piece of structural glued-laminated timber with AITC Quality Mark or APA-EWS trademark. Place mark on surfaces that are not exposed in the completed Work.
  - 2. Provide structural glued-laminated timber made from single species.
  - 3. Provide structural glued-laminated timber made from solid lumber laminations; do not use laminated veneer lumber.
  - 4. Provide structural glued-laminated timber made with wet-use adhesive complying with ANSI A190.1.
- B. Species and Grades for Structural Glued-Laminated Timber:
  - 1. Douglas fir-larch that complies with combination symbols indicated.
- C. Species and Grades: For beams.
  - 1. Species and Beam Stress Classification: Douglas fir-larch, 24F-1.8E.
  - 2. Lay-up: Balanced.
- D. Appearance Grade: Architectural, complying with AITC 110.
  - 1. For Premium and Architectural appearance grades, fill voids as required by AITC 110.[ For Premium appearance grade, use clear wood inserts, of matching grain and color, for filling voids and knot holes more than 1/4 inch wide.]

## 2.03 PRESERVATIVE TREATMENT

- Preservative Treatment: Where preservative-treated structural glued-laminated timber is indicated, comply with AWPA U1, Use [Category 1][Category 2][Category 3A][Category 3B][Category 4A].
  - 1. Use preservative solution without[ water repellents or] substances that might interfere with application of indicated finishes.
  - 2. Do not incise structural glued-laminated timber or wood used to produce structural glued-laminated timber.
- B. Preservative: [One of the following:]
  - 1. Oxine copper (copper-8-quinolinolate) in a light petroleum solvent.
  - 2. Pentachlorophenol in light petroleum solvent.
  - 3. Copper naphthenate in a light petroleum solvent.
  - 4. Ammoniacal zinc copper arsenate (ACZA) in a water solution.
  - 5. Chromated copper arsenate (CCA) in a water solution.
  - 6. Ammoniacal copper quat Type A (ACQ-C) in a water solution.
  - 7. Propiconazole tebuconazole imidacloprid (PTI) in a water emulsion.
- C. After dressing members, apply a copper naphthenate field-treatment preservative to comply with AWPA M4 to surfaces cut to a depth of more than 1/16 inch.

## 2.04 MISCELLANEOUS MATERIALS

- A. End Sealer: Manufacturer's standard, transparent, colorless wood sealer that is effective in retarding the transmission of moisture at cross-grain cuts and is compatible with indicated finish.
- B. Penetrating Sealer: Manufacturer's standard, transparent, penetrating wood sealer that is compatible with indicated finish.

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## 2.05 FABRICATION

- A. Shop fabricate for connections to greatest extent possible, including cutting to length and drilling bolt holes.
  - 1. Dress exposed surfaces as needed to remove planing and surfacing marks.
- B. Camber: Fabricate horizontal and inclined members of less than 1:1 slope with either circular or parabolic camber equal to 1/500 of span.
- C. Where preservative-treated members are indicated, fabricate (cut, drill, surface, and sand) before treatment to greatest extent possible. Where fabrication must be done after treatment, apply a field-treatment preservative to comply with AWPA M4.
  - 1. Use inorganic boron (SBX) treatment for members not in contact with the ground and continuously protected from liquid water.
  - 2. Use copper naphthenate treatment for members in contact with the ground or not continuously protected from liquid water.
- D. End-Cut Sealing: Immediately after end cutting each member to final length, apply a saturation coat of end sealer to ends and other cross-cut surfaces, keeping surfaces flood coated for not less than 10 minutes.
- E. Seal Coat: After fabricating, sanding, and end-coat sealing, apply a heavy saturation coat of penetrating sealer on surfaces of each unit.

## 2.06 FACTORY FINISHING

- A. Clear Finish: Manufacturer's standard, resistant to mildew and fungus.
  - 1. Water repellent.
  - 2. Film-forming two-coat, [varnish][urethane].
- B. Semitransparent Stain Finish: Manufacturer's standard oil-based stain, resistant to mold and fungus.
  - 1. Color: [As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color>.
- C. Solid-Color Stain Finish: Manufacturer's standard [**oil-based**][**latex**] penetrating stain, resistant to mildew and fungus.
  - 1. Color: [As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color>.
- D. Painted Finish: Acrylic latex system.
  - 1. Prime Coat: Stain blocking primer as recommended by topcoat manufacturer.
  - 2. Intermediate Coat: Matching topcoat.
  - 3. Topcoat: High-performance architectural coating, [low sheen][eggshell][satin][semigloss].
  - 4. Color: [Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color>.

## PART 3 EXECUTION

## 3.01 EXAMINATION

- A. Examine substrates in areas to receive structural glued-laminated timber, with Installer present, for compliance with requirements, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.02 INSTALLATION

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- A. General: Erect structural glued-laminated timber true and plumb and with uniform, close-fitting joints. Provide temporary bracing to maintain lines and levels until permanent supporting members are in place.
  - 1. Handle and temporarily support glued-laminated timber to prevent surface damage, compression, and other effects that might interfere with indicated finish.
- B. Framing Built into Masonry: Provide 1/2-inch clearance at tops, sides, and ends of members built into masonry; bevel cut ends 3 inches; and do not embed more than 4 inches unless otherwise indicated.
- C. Cutting: Avoid extra cutting after fabrication. Where field fitting is unavoidable, comply with requirements for shop fabrication.
- D. Fit structural glued-laminated timber by cutting and restoring exposed surfaces to match specified surfacing[ **and finishing**].
  - 1. Predrill for fasteners using timber connectors as templates.
  - 2. Finish exposed surfaces to remove planing or surfacing marks and to provide a finish equivalent to that produced by machine sanding with No. 120 grit sandpaper.
  - 3. Coat cross cuts with end sealer.
  - 4. Where preservative-treated members must be cut during erection, apply a field-treatment preservative to comply with AWPA M4.
    - a. Use inorganic boron (SBX) treatment for members not in contact with the ground and continuously protected from liquid water.
    - b. Use copper naphthenate treatment for members in contact with the ground or not continuously protected from liquid water.
- E. Install timber connectors as indicated.
  - 1. Unless otherwise indicated, install bolts with same orientation within each connection and in similar connections.
  - 2. Install bolts with orientation as indicated or, if not indicated, as directed by Architect.

# 3.03 ADJUSTING

A. Repair damaged surfaces[ **and finishes**] after completing erection. Replace damaged structural glued-laminated timber if repairs are not approved by Architect.

# 3.04 PROTECTION

- A. Do not remove wrappings on individually wrapped members until they no longer serve a useful purpose, including protection from weather, sunlight, soiling, and damage from work of other trades.
  - 1. Coordinate wrapping removal with finishing work. Retain wrapping where it can serve as a painting shield.
  - 2. Slit underside of wrapping to prevent accumulation of moisture inside the wrapping.

## END OF SECTION 06 1800

## SECTION 06 2000 FINISH CARPENTRY

## PART 1 GENERAL

## 1.01 SECTION INCLUDES

- A. Finish carpentry items.
- B. Wood door frames, glazed frames.
- C. Wood casings and moldings.
- D. Wood trim and base.
- E. Hardware and attachment accessories.

## 1.02 RELATED REQUIREMENTS

- A. Section <u>06 1000 Rough Carpentry</u>: Support framing, grounds, and concealed blocking.
- B. Section <u>06 4100 Architectural Wood Casework</u>: Shop fabricated custom cabinet work.
- C. Section 06 4200 Wood Paneling: Shop fabricated custom paneling.
- D. Section 09 9123 Interior Painting: Painting of finish carpentry items.

# 1.03 REFERENCE STANDARDS

- A. AWI/AWMAC/WI (AWS) Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).
- B. AWMAC/WI (NAAWS) North American Architectural Woodwork Standards, U.S. Version 3.1; 2017, with Errata (2019).
- C. HPVA HP-1 American National Standard for Hardwood and Decorative Plywood; 2016.
- D. NEMA LD 3 High-Pressure Decorative Laminates; 2005.

# 1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the work with << plumbing rough-in; electrical rough-in; installation of associated and adjacent components; and other interiors components>>.
- B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

## 1.05 SUBMITTALS

- A. See Section <u>01 3000 Administrative Requirements</u> for submittal procedures.
- B. Product Data:
  - 1. Provide manufacturer's product data, storage and handling instructions for factoryfabricated units.
  - 2. Provide instructions for << <u>attachment hardware</u>; <u>finish hardware</u>; and \_\_\_\_>>.
- C. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
  - 1. Scale of Drawings: << <u>1-1/2 inch to 1 foot;</u> or \_\_\_\_ inch to \_\_\_\_ foot>>, minimum.
  - Provide information as required by << <u>AWI/AWMAC/WI (AWS)</u>; <u>AWMAC/WI (NAAWS)</u>; or \_\_\_\_>>.
  - 3. Include certification program label.
- D. Samples: Submit << two; or three>> samples of finish plywood, <u>12 x 12 inch</u> in size illustrating wood grain and specified finish.
- E. Samples: Submit << <u>two;</u> or \_\_\_\_>> samples of wood trim <u>12 inch</u> long.
- F. Samples: Submit << two; one; or \_\_\_\_>> samples of << Cap; Base; Column Shaft; and \_\_\_\_>>, << <u>None N/A</u>; one-quarter; one-half; or \_\_\_\_>>full size, illustrating << <u>None N/A</u>; one-quarter; one-half; or \_\_\_\_>> << <u>finish</u>; construction; and \_\_\_\_>>.

G. Samples: Submit << <u>two</u>; one; or \_\_\_\_>> samples of << <u>Column Shaft</u>; and \_\_\_\_\_>>, <u>12</u> <u>inch</u> deep full size, illustrating << <u>finish</u>; <u>construction</u>; and \_\_\_\_\_>>.

## 1.06 QUALITY ASSURANCE

- A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum << <u>five</u>; three; or \_\_\_\_>> years of << <u>documented</u>; or None N/A>> experience.
  - 1. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.

## B. Quality Certification:

- Provide labels or certificates indicating that work complies with << <u>AWI/AWMAC/WI</u> (<u>AWS</u>); <u>AWMAC/WI (NAAWS</u>); or \_\_\_\_\_>> requirements for grade or grades specified.
- 2. Provide designated labels on shop drawings as required by certification program.
- 3. Provide designated labels on installed products as required by certification program.
- 4. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.

## 1.07 MOCK-UPS

- A. << <u>Provide</u>; or Construct>> one column wrap mock-up, full size, illustrating << <u>finish</u>; <u>construction</u>; and \_\_\_\_>>.
- B. Provide 10' of wall base mock-up, full size, illustrating finish and construction.
- C. Provide of wood panel mock-up, full size, illustrating finish and construction.
- D. See Section 01 4000 Quality Requirements for additional requirements.
- E. Locate << <u>where directed;</u> as indicated on drawings; or \_\_\_\_\_>>.
- F. Mock-up << <u>may;</u> or may not>> remain as part of the work.

## 1.08 DELIVERY, STORAGE, AND HANDLING

- A. Store finish carpentry items under cover, elevated above grade, and in a dry, well-ventilated area not exposed to heat or sunlight.
- B. Protect from moisture damage.
- C. Handle materials and products to prevent damage to edges, ends, or surfaces.

# PART 2 PRODUCTS

## 2.01 FINISH CARPENTRY ITEMS

- A. Quality Standard: << Premium Grade; <u>Custom Grade</u>; Economy Grade; Grades as indicated; or \_\_\_\_\_>>, in accordance with << <u>AWI/AWMAC/WI (AWS)</u>; <u>AWMAC/WI</u> (<u>NAAWS</u>); or \_\_\_\_>>, unless noted otherwise.
- B. Interior Woodwork Items:
  - 1. Moldings, Bases, Casings, Wraps, and Miscellaneous Trim: See Drawings.
  - 2. Stairs, Balustrades, and Handrails: See Drawings...
  - 3. Loose Shelving: See Drawings.

## 2.02 LUMBER MATERIALS

- A. Softwood Lumber: see drawings
- B. Hardwood Lumber: see drawings.

## 2.03 SHEET MATERIALS

A. Hardwood Plywood: Face species << <u>as indicated</u>; or \_\_\_\_\_>>, << plain sawn; <u>rift cut</u>; quarter cut; rotary cut; cut as indicated; or \_\_\_\_\_>><< <u>book matched</u>; <u>book matched</u>; <u>bolance</u> matched; <u>so running matched</u>; <u>so running matched</u>;

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**None - N/A>>**, glue type as recommended for application.

- B. Softwood Plywood: see drawings
- C. Hardwood Plywood: see drawings

# 2.04 FASTENINGS

- A. Adhesive for Purposes Other Than Laminate Installation: Suitable for the purpose; not containing formaldehyde or other volatile organic compounds.
- B. Adhesive for factory-fabricated units: Manufacturer's recommended adhesive for application.
- C. Fasteners: Of size and type to suit application; **galvanized** finish in concealed locations and **brushed stainless steel** finish in exposed locations. See drawings for type of heads depending on application.
- D. Fasteners for Exterior Applications: << <u>Stainless steel</u>; Hot-dipped galvanized steel complying with ASTM A153/A153M; or \_\_\_\_\_>; length required to penetrate wood substrate <u>1-1/2 inch</u> minimum.
- E. Concealed Joint Fasteners: Threaded steel.

## 2.05 ACCESSORIES

- A. Adhesive: << GSA CID A-A-1936 contact adhesive; <u>Type recommended by AWI/AWMAC</u> <u>to suit application</u>; Type recommended by WI to suit application; Type recommended by fabricator to suit application; or \_\_\_\_\_>>.
- B. Safety Glass: ASTM C1048, fully tempered; << <u>clear</u>; or \_\_\_\_>>; << <u>1/8 inch</u>; <u>5/32 inch</u>; <u>1/4 inch</u>; or \_\_\_\_inch>> thick, minimum.
- C. Primer: << <u>Alkyd primer sealer</u>; For factory-primed units, manufacturer's recommended primer; 09 9113 Exterior Painting; or \_\_\_\_>>.
- D. Wood Filler: **<< <u>Solvent</u>; Oil; or \_\_\_\_\_>>** base, tinted to match surface finish color.

## 2.06 SITE FINISHING MATERIALS

A. << <u>Stain</u>; Shellac; <u>Varnish</u>; Finishing; and \_\_\_\_>> Materials: Comply with << <u>AWI/AWMAC/WI (AWS)</u>; <u>AWMAC/WI (NAAWS)</u>; or \_\_\_\_>>, unless noted otherwise.

## 2.07 FABRICATION

- A. Shop assemble work for delivery to site, permitting passage through building openings.
- B. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

## 2.08 SHOP FINISHING

- A. Apply wood filler in exposed nail<< <u>and screw;</u> ; or None N/A>> indentations.
- B. Finish work in accordance with << <u>AWI/AWMAC/WI (AWS)</u>; <u>AWMAC/WI (NAAWS)</u>; or \_\_\_\_\_\_>>, Section 5 Finishing for grade specified and as follows:
  - 1. Transparent:
    - a. << <u>System 1, Lacquer, Nitrocellulose</u>; System 2, Lacquer, Precatalyzed; System - 3, Lacquer, Postcatalyzed; System - 4, Latex Acrylic, Water-based; System - 5, Varnish, Conversion; System - 6, Oil, Synthetic Penetrating (transparent only); System - 7, Vinyl, Catalyzed; System - 8, Acrylic Cross Linking, Water-based; System - 9, UV Curable, Acrylated Epoxy, Polyester or Urethane; System - 10, UV Curable, Water-based; System - 11, Polyurethane, Catalyzed; System - 12, Polyurethane, Water-based; System - 13, Polyester, Catalyzed; or \_\_\_\_\_>>
    - b. Sheen: << Flat; Satin; Semigloss; Gloss; or \_\_\_\_>>.

## PART 3 EXECUTION

## 3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

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# 3.02 INSTALLATION

- B. Set and secure materials and components in place, plumb and level.
- C. Carefully scribe work abutting other components, with maximum gaps of << <u>1/32 inch</u>; or \_\_\_\_\_ inch>>. Do not use additional overlay trim to conceal larger gaps.

## 3.03 TOLERANCES

- A. Maximum Variation from True Position: << <u>1/16 inch</u>; or \_\_\_\_\_ inch>>.
- B. Maximum Offset from True Alignment with Abutting Materials: << <u>1/32 inch</u>; or \_\_\_\_\_ inch>>.

# END OF SECTION 06 2000

#### SECTION 06 4200 WOOD PANELING

#### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

A. Custom wood veneer paneling.

#### 1.02 RELATED REQUIREMENTS

- A. Section <u>06 1000 Rough Carpentry</u>: Grounds and concealed blocking.
- B. Section 09 9123 Interior Painting: Field finishing.

#### 1.03 REFERENCE STANDARDS

- A. AWI/AWMAC/WI (AWS) Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).
- B. AWMAC/WI (NAAWS) North American Architectural Woodwork Standards, U.S. Version 3.1; 2017, with Errata (2019).

#### 1.04 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
- C. Samples: Submit << <u>two;</u> or \_\_\_\_>> samples of finished plywood, \_\_\_\_\_ inch in size, illustrating wood grain and specified finish.
- D. Samples: Submit << <u>two;</u> or \_\_\_\_>> samples of wood trim, \_\_\_\_<u>inch</u> long.

#### PART 2 PRODUCTS

#### 2.01 PANELING

A. Quality Standard: << Premium Grade; <u>Custom Grade;</u> Economy Grade; Grades as indicated; or \_\_\_\_\_\_>>, in accordance with << <u>AWI/AWMAC/WI (AWS)</u>; <u>AWMAC/WI (NAAWS)</u>; or \_\_\_\_\_>>, unless otherwise indicated.

## 2.02 WOOD-BASED MATERIALS - GENERAL

#### 2.03 FABRICATION

- A. Prepare panels for delivery to site, permitting passage through building openings.
- B. Finish exposed edges of panels as specified by grade requirements.

#### PART 3 EXECUTION

#### 3.01 INSTALLATION

- B. Do not begin installation until wood materials have been fully acclimated to interior conditions.
- C. Set and secure materials and components in place, plumb and level, using concealed fasteners wherever possible.

#### END OF SECTION 06 4200

#### SECTION 06 6100 CAST POLYMER FABRICATIONS

#### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

A. Cast plastic << washroom vanities; washroom vanities with integral sink; counter top; contoured bathtub; contoured bathtub and tub surround; shower stall; table surfaces; and Suspended Partition, Glazing>>.

#### 1.02 RELATED REQUIREMENTS

A. Section 09 5100 - Acoustical Ceilings

#### 1.03 REFERENCE STANDARDS

- A. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials; 2021.
- B. ICC (IBC) International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

## 1.04 SUBMITTALS

- A. See Section <u>01 3000 Administrative Requirements</u>, for submittal procedures.
- B. Product Data: Manufacturer's data for << <u>fabricated units</u>; and \_\_\_\_>>.
  - 1. Include << <u>maximum allowable load data</u>; structural properties data; structural load data; allowable load tables; and \_\_\_\_>>.
- C. Shop Drawings: << For each type of cast polymer, indicate:; \_\_\_\_\_:; or None N/A>>
  - << <u>Plans; Elevations;</u> Sections; and \_\_\_\_>>: Include << panel layout; shapes; <u>dimensions;</u> thicknesses; <u>unit serial numbers;</u> field measurements; and \_\_\_\_>; indicate location of << <u>fabricated units;</u> and \_\_\_\_\_>>.
    - a. Drawing Scale: << 1/8 inch to 1 foot; <u>1/4 inch to 1 foot;</u> or \_\_\_\_\_ inch to 1 foot>>, minimum.
  - Details: Include << fabrication shapes and dimensions; required clearances; allowances for material tolerences; thicknesses; <u>connections</u>; fastenings; anchorages; holes; openings; <u>plumbing system accommodations</u>; electrical system accommodations; setting templates for anchorages by others; methods of support; and \_\_\_\_>>.
    - a. Drawing Scale: << <u>1-1/2 inches to 1 foot;</u> 3 inches to 1 foot; or \_\_\_\_\_ inches to 1 foot>>, minimum.
- D. Samples: For each type, << two; or \_\_\_\_>><< samples; or \_\_\_\_>>, << 5 inches by 5 inches; <u>12 inches by 12 inches;</u> or \_\_\_\_ inches by \_\_\_\_ inches>> in size, << indicating; showing; or \_\_\_\_>> specified << color; texture; finish; and \_\_\_\_>>.
- E. Delegated Design Documents: Structural design calculations signed and sealed by << <u>Engineer of Record for design of loadbearing columns</u>; or \_\_\_\_\_>; sufficient for submission to authorities having jurisdiction (AHJ).
- F. Test Reports: Indicate compliance with reference standard performance requirements.
- G. Manufacturer's Instructions: Indicate << <u>installation</u>; <u>handling</u>; and \_\_\_\_\_>> instructions.
   1. Include templates for << <u>anchorages</u>; supporting members; and \_\_\_\_\_>> by others.
- H. Shop Drawings: Indicate dimensions, thicknesses, required clearances, tolerances, materials, colors, finishes, fabrication details, field jointing, adjacent construction, << <u>design load</u> <u>parameters</u>; or None N/A>> methods of support, integration of << <u>plumbing</u>; electrical; and \_\_\_\_\_>> components, and anchorages.
- I. Manufacturer's Installation Instructions: Indicate preparation of opening required, rough-in sizes; << provide templates for cast-in or placed frames or anchors;; or <u>None N/A</u>>> tolerances for item placement, temporary bracing of components<< , and \_\_\_\_\_\_</p>

#### or <u>None - N/A</u>>>.

- J. Operation and Maintenance Data: Maintenance instructions, including recommended cleaning procedures and materials.
- K. Executed warranty.

## 1.05 MOCK-UPS

- A. See Section <u>01 4000 Quality Requirements</u> for additional requirements.
- B. Locate << where directed; as indicated on drawings; or \_\_\_\_\_> by Architect.
- C. Mock-up << <u>may</u>; may not; or \_\_\_\_\_>> remain as part of the work.

#### 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to project site in original packages, containers, or bundles bearing brand name and identification.
- B. Store products under cover, elevated above grade, and in dry, well-ventilated areas not exposed to heat or sunlight. Protect from moisture damage.
- C. Handle products to prevent damage to edges, ends, or surfaces, and in accordance with manufacturer's written instructions.

#### 1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

#### PART 2 PRODUCTS

#### 2.01 MANUFACTURERS

A. Basis of Design 3Form, Chroma: see drawings

#### 2.02 ACCESSORIES

- A. General: Accessories recommended by cast polymer manufacturer for complete installation.
- B. Fasteners: Threaded fasteners as recommended by cast polymer manufacturer; type and size to suit application:
- C. Connectors: As recommended by cast polymer manufacturer; type and size to suit application:

## 2.03 FASTENINGS

## PART 3 EXECUTION

## 3.01 EXAMINATION

- A. Verify field measurements are as << <u>indicated on shop drawings</u>; or \_\_\_\_\_>>. Installers responsibility to make field measurements.
- B. Verify that joint preparation and affected dimensions are acceptable.
- C. Verify substrates are prepared to receive cast polymer fabrications.
- D. Verify mechanical, electrical, and other building components affecting work of this section are placed and ready to receive work of this section.

## 3.02 PREPARATION

- A. Prepare substrates in accordance with manufacturer's written instructions.
- B. Clean surfaces thoroughly prior to installation.
- C. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- D. Provide anchoring devices for installation << and embedding; or <u>None N/A</u>>>.

## 3.03 INSTALLATION

 Install cast polymer units in accordance with << <u>manufacturer's written instructions</u>; approved shop drawings; and \_\_\_\_\_>>.

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B. Align work plumb and level.

# 3.04 TOLERANCES

- A. Maximum Variation from True Position: << <u>1/4 inch;</u> or \_\_\_\_\_ inch>>.
- B. Maximum Variation from Plumb: << <u>1/4 inch in 10 feet;</u> or \_\_\_\_\_ inch in \_\_\_\_\_ feet>>.
- C. Maximum Variation from Level: << <u>1/4 inch in 10 feet;</u> or \_\_\_\_\_ inch in \_\_\_\_\_ feet>>.

# 3.05 CLEANING

- A. See Section 01 7000 Execution and Closeout Requirements for additional requirements.
- B. Clean exposed surfaces of installed units in accordance with << <u>manufacturer's</u>; fabricator's; or \_\_\_\_> instructions.

## 3.06 PROTECTION

- A. Protect installed cast polymer units from subsequent construction operations.
- B. Do not permit construction near unprotected surfaces.

# END OF SECTION 06 6100

#### SECTION 06 8316 FIBERGLASS REINFORCED PANELING

#### PART 1 GENERAL

#### **1.01 SECTION INCLUDES**

A. Fiberglass reinforced plastic panels.

#### 1.02 REFERENCE STANDARDS

- A. ASTM D256 Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics; 2010 (Reapproved 2018).
- B. ASTM D2583 Standard Test Method for Indentation Hardness of Rigid Plastics by Means of Barcol Impressor; 2013a.
- C. ASTM D3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2016.
- D. ASTM D5319 Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels; 2017.
- E. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials; 2021.

#### 1.03 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

#### 1.04 DELIVERY, STORAGE, AND HANDLING

A. Store panels flat, indoors, on a clean, dry surface. Remove packaging and allow panels to acclimate to room temperature for 48 hours prior to installation.

#### **PART 2 PRODUCTS**

#### 2.01 MANUFACTURERS

- A. Fiberglass Reinforced Plastic Panels:
  - 1. Marlite, Inc<< ; Standard; or None N/A>>: www.marlite.com/#sle.
  - 2. Substitutions: << See Section 01 6000 Product Requirements; or Not permitted>>.

#### 2.02 PANEL SYSTEMS

- A. Wall Panels**<< at \_\_\_\_\_; or <u>None N/A</u>>>**:
  - 1. Panel Size: << 4 by 8 feet; 4 by 9 feet; 4 by 10 feet; 4 by 12 feet; or \_\_\_\_\_ feet>>.
  - 2. Panel Thickness: << 0.075 inch; 0.09 inch; 0.10 inch; 0.12 inch; or \_\_\_\_ inch>>.
  - 3. Surface Design: << <u>Embossed</u>; Smooth; or \_\_\_\_>>.
  - 4. Color: << <u>White;</u> As selected by Architect; or \_\_\_\_>>.
  - 5. Attachment Method: << <u>Adhesive only, sealant joints, no trim</u>; Adhesive only, with trim and sealant in joints; Mechanical fasteners concealed by trim, with sealant in joints; or \_\_\_\_\_>>.

# 2.03 MATERIALS

- A. Panels: Fiberglass reinforced plastic (FRP), complying with ASTM D5319.
  - Surface Burning Characteristics: Maximum flame spread index of << 25; 75; 200; or >> and smoke developed index of 450; when system tested in accordance with ASTM E84.
  - 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
  - 3. Scratch Resistance: Barcol hardness score greater than << <u>35</u>; **40**; **45**; **or** \_\_\_\_>, when tested in accordance with ASTM D2583.
  - 4. Impact Strength: Greater than << <u>6 ft lb force per inch</u>; or \_\_\_\_\_ft lb force per inch>>, when tested in accordance with ASTM D256.

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B. Sealant: << Type recommended by panel manufacturer; Silicone; Latex; or \_\_\_\_>; << white; clear; color matching panel; or \_\_\_\_>>.

# PART 3 EXECUTION

# 3.01 EXAMINATION

- A. Verify existing conditions and substrate flatness before starting work.
- B. Verify that substrate conditions are ready to receive the work of this section.

# 3.02 INSTALLATION - WALLS

- A. Install panels in accordance with manufacturer's instructions.
- B. Cut and drill panels with carbide tipped saw blades, drill bits, or snips.
- C. Apply adhesive to the back side of the panel using trowel as recommended by adhesive manufacturer.
- D. Apply panels to wall with seams plumb and pattern aligned with adjoining panels.
- E. Install panels with manufacturer's recommended gap for panel field and corner joints.
- F. Seal gaps at floor, ceiling, and between panels with applicable sealant to prevent moisture intrusion.
- G. Remove excess sealant after paneling is installed and prior to curing.

# END OF SECTION 06 8316

#### **SECTION 07 1113 BITUMINOUS DAMPPROOFING**

## PART 1 GENERAL

#### **1.01 SECTION INCLUDES**

- A. Bituminous dampproofing.
- B. Protection boards.
- C. Drainage panels.

## 1.02 RELATED REQUIREMENTS

- A. Section 03 3000 Cast-In-Place Concrete
- B. Section 04 2000 Unit Masonry
- C. Section 07 2100 Thermal Insulation: Rigid insulation
- D. Section 31 2323 Fill.
- E. Section 33 4100 Subdrainage.

#### 1.03 REFERENCE STANDARDS

- A. ASTM D41/D41M Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing; 2011 (Reapproved 2016).
- B. ASTM D1227/D1227M Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing; 2019.
- C. ASTM D4479/D4479M Standard Specification for Asphalt Roof Coatings Asbestos-Free; 2007 (Reapproved 2018).
- D. NRCA (WM) The NRCA Waterproofing Manual; 2005.

## 1.04 SUBMITTALS

- A. See Section **01 3000 Administrative Requirements** for submittal procedures.
- B. Product Data: Provide properties of primer, bitumen, and mastics.
- C. Shop Drawings: Plans, sections, or elevations indicating where all products in this section are to be installed. Include vertical dimensions along with plans
- Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions D. requiring special attention.
- E. Installer's qualification statement.
- F. Warranty: provide manufacturer's standard warranty

#### 1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with at >> years of << documented; or None - N/A>> experience << and least << three; or approved by manufacturer; or None - N/A>>.

#### **1.06 FIELD CONDITIONS**

A. Maintain ambient temperatures above << 40 degrees F; or degrees F>> for << 24; or >> hours before and during application until dampproofing has cured.

## PART 2 PRODUCTS

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#### 2.01 MANUFACTURERS

- Bituminous Dampproofing Manufacturers: A.
  - Karnak Corporation<< ; \_\_\_\_\_; or <u>None N/A</u>>>: www.karnakcorp.com/. 1.
  - 2.
  - Mar-Flex Systems, Inc<< ; \_\_\_\_\_; or <u>None N/A</u>>>: www.mar-flex.com/ W. R. Meadows, Inc<< ; \_\_\_\_\_; or <u>None N/A</u>>>: www.wrmeadows.com/ 3.
  - 4. Henry Company, Inc.: www.henry.com/

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5. Substitutions: << See Section 01 6000 - Product Requirements; or Not permitted>>.

#### 2.02 BITUMINOUS DAMPPROOFING

- A. Bituminous Dampproofing: Cold-applied, spray-grade; asphalt base, volatile petroleum solvents, and other content, suitable for application by spray, brush, roller, or squeegee; asbestos-free; suitable for application on vertical and horizontal surfaces.
  - 1. Composition: ASTM D4479/D4479M Type I, asbestos free.
  - 2. VOC Content: Not more than permitted by local, State, and federal regulations.
  - 3. Applied Thickness: << 1/16 inch; <u>1/8 inch;</u> or \_\_\_\_\_ inch>>, minimum, wet film.
- B. Primers, Mastics, and Related Materials: Type as recommended by dampproofing manufacturer.

#### 2.03 BITUMEN MATERIALS

- A. Cold Asphaltic Type:
  - 1. Emulsified Asphalt: ASTM D1227/D1227M, << <u>with fiber reinforcement other than</u> <u>asbestos, Type II, Class 1 or 2;</u> unreinforced, Type III, Class 1 or 2; or \_\_\_\_>>.
  - 2. Asphalt Primer: ASTM D41/D41M, compatible with substrate.

#### 2.04 ACCESSORIES

- A. Drainage Panel: << 1/4-inch; 3/8-inch; or \_\_\_\_-inch>> thick << formed plastic; molded flexible rubber; or \_\_\_\_\_>>, << hollowed sandwich; embossed with cover sheet; embossed without cover sheet; or \_\_\_\_\_>>.
- B. Protection
  - 1. Board: 1/2 inch thick minimum asphalt wood fiberboard unless otherwise noted.
  - 2. Product: EPS foam plastic appropriate for use per manufacturer's recommendation. 2 inch thickness unless otherwise noted. For locations where thermal insulation adjacent to interior heated spaces and foundations.

## PART 3 EXECUTION

## 3.01 EXAMINATION

- A. Verify existing conditions are acceptable prior to starting this work.
- B. Verify substrate surfaces are durable, free of matter detrimental to adhesion or application of dampproofing system.
- C. Verify that items penetrating surfaces to receive dampproofing are securely installed.

#### 3.02 PREPARATION

- A. Protect adjacent surfaces not designated to receive dampproofing.
- B. Clean and prepare surfaces to receive dampproofing in accordance with manufacturer's instructions.
- C. Do not apply dampproofing to surfaces unacceptable to manufacturer.
- D. Apply mastic to seal penetrations, small cracks, or minor honeycombs in substrate.

#### 3.03 APPLICATION

- A. << <u>Foundation Walls</u>; or \_\_\_\_\_>>: Apply << <u>two</u>; or \_\_\_\_>> coats of<< <u>asphalt</u>; coal tar; \_\_\_\_\_; or None N/A>> dampproofing.
- B. << <u>Foundation Walls:</u>; Basement Walls:; \_\_\_\_:; or None N/A>>Patch disturbed areas of existing dampproofing with two additional coats of dampproofing of the same generic type.
- C. Perform this work in accordance with << <u>manufacturer's instructions</u>; <u>NRCA (WM)</u> <u>applicable requirements</u>; and \_\_\_\_>>.
- D. Prime surfaces in accordance with << <u>manufacturer's instructions</u>; <u>NRCA (WM)</u> <u>applicable</u> <u>requirements</u>; and \_\_\_\_\_>>.

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Design Development Phase	07 1113 - 2	Biturninous Dampprooning

- E. Seal items watertight with mastic, that project through dampproofing surface.
- F. Place drainage panel directly over dampproofing, butt joints, and position to ensure downward drainage.
- G. Place protection board over drainage panel, butt joints, and adhere with mastic.
- H. Scribe and cut boards around projections, penetrations, and interruptions.
- I. Provide drainage mat flow into footing drains

# END OF SECTION 07 1113

#### SECTION 07 1300 SHEET WATERPROOFING

## PART 1 GENERAL

## 1.01 SECTION INCLUDES

- A. Self-adhered modified bituminous sheet membrane.
- B. EPDM rubber sheet membrane.

## 1.02 RELATED REQUIREMENTS

- A. Section <u>03 3000 Cast-in-Place Concrete</u>: Concrete substrate.
- B. Section 07 2100 Thermal Insulation: Rigid Insulation.
- C. Section 07 2500 Weather Barriers.
- D. Section <u>07 6200 Sheet Metal Flashing and Trim</u>: Metal << <u>parapet</u>; <u>coping</u>; <u>counterflashing</u>; and \_\_\_\_\_>>.

# 1.03 REFERENCE STANDARDS

- A. ASTM C836/C836M Standard Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course; 2018.
- B. ASTM D412 Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2016, with Editorial Revision (2021).
- C. ASTM D882 Standard Test Method for Tensile Properties of Thin Plastic Sheeting; 2018.
- D. ASTM D903 Standard Test Method for Peel or Stripping Strength of Adhesive Bonds; 1998 (Reapproved 2017).
- E. ASTM D1876 Standard Test Method for Peel Resistance of Adhesives (T-Peel Test); 2008, with Editorial Revision (2015).
- F. ASTM D1970/D1970M Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2020.
- G. ASTM D4541 Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers; 2017.
- H. ASTM D4637/D4637M Standard Specification for EPDM Sheet Used in Single-Ply Roof Membrane; 2015.
- I. ASTM D5295/D5295M Standard Guide for Preparation of Concrete Surfaces for Adhered (Bonded) Membrane Waterproofing Systems; 2018.
- J. ASTM D5602/D5602M Standard Test Method for Static Puncture Resistance of Roofing Membrane Specimens; 2018.
- K. ASTM D6134/D6134M Standard Specification for Vulcanized Rubber Sheets Used in Waterproofing Systems; 2007, with Editorial Revision (2019).
- L. ASTM E96/E96M Standard Test Methods for Water Vapor Transmission of Materials; 2016.
- M. NRCA (WM) The NRCA Waterproofing Manual; 2005.

## 1.04 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements for submittal procedures.
- B. Product Data: Provide data for << <u>membrane</u>; surface conditioner; flexible flashings; joint cover sheet; and joint and crack sealants>>.
- C. Certificate: Certify that products meet or exceed specified requirements.
- D. Manufacturer's Installation Instructions: Indicate << <u>special procedures; perimeter</u> <u>conditions requiring special attention;</u> and <u>acceptable installation temperatures</u>>>.
- E. Installer's qualification statement.

F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

## 1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than << <u>three</u>; or \_\_\_\_>> years of<< <u>documented</u>; \_\_\_\_; or None N/A>> experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least << <u>three</u>; or \_\_\_\_\_>> years of<< <u>documented</u>; \_\_\_\_; or None N/A>> experience<< and approved by manufacturer; or <u>None N/A</u>>>.

## 1.06 FIELD CONDITIONS

A. Maintain ambient temperatures above << <u>40 degrees F</u>; or <u>degrees F>></u> for << <u>24</u>; or <u>>></u> hours before and during application and until liquid or mastic accessories have cured.

## 1.07 WARRANTY

- A. See Section <u>01 7800 Closeout Submittals</u> for additional warranty requirements.
- B. Provide << <u>five</u>; or \_\_\_\_>> year manufacturer warranty for waterproofing failing to resist penetration of water<< and \_\_\_\_; or <u>None N/A</u>>><< <u>, except where such failures are the result of structural failures of building. Hairline cracking of concrete due to temperature change or shrinkage is not considered a structural failure; or None N/A>>.</u>

#### PART 2 PRODUCTS

#### 2.01 SHEET WATERPROOFING APPLICATIONS

- A. Self-Adhered Modified Bituminous Sheet Membrane:
  1. Location: transitions from concrete foundations to wall weather barriers.
- B. EPDM Rubber Sheet Membrane:
  - 1. Location: see drawings.
  - Vertical Surfaces: << <u>Adhesive bonded to substrate</u>; <u>Mechanically attached</u>; or \_\_\_\_\_\_\_>>.
  - Horizontal Surfaces: << <u>Adhesive bonded to substrate</u>; <u>Mechanically attached</u>; Loose-laid; or \_\_\_\_\_>>.

## 2.02 SHEET WATERPROOFING MATERIALS

- A. Self-Adhered Modified Bituminous Sheet Membrane:
  - 1. Thickness: << <u>60 mil, 0.060 inch;</u> 75 mil, 0.075 inch; 95 mil, 0.095 inch; or \_\_\_ mil, \_\_\_ inch>>, minimum.
  - 2. Sheet Width: << <u>36 inches;</u> 39-3/8 inches; 50 inches; or \_\_\_\_ inches>>, minimum.
  - 3. Tensile Strength:
    - a. Film: << <u>5,000 psi</u>; or <u>psi</u> >>, minimum, measured in accordance with ASTM D882 and at grip-separation rate of << <u>2 inches</u>; or <u>inches</u>>> per minute.
    - b. Membrane: << <u>325 psi</u>; or \_\_\_\_ psi>>, minimum, measured in accordance with ASTM D412 Method A, using die C and at spindle-separation rate of << <u>2 inches</u>; or \_\_\_\_ inches>> per minute.
  - 4. Peel Strength: << 7 lb per inch; or \_\_\_\_ lb per inch>>, minimum, when tested in accordance with ASTM D903.
  - 5. Lap Adhesion Strength: << <u>5 lb per inch</u>; or \_\_\_\_ lb per inch>>, minimum, when tested in accordance with ASTM D1876.
  - 6. Adhesives, Sealants, Tapes, and Accessories: As recommended by membrane manufacturer.
  - 7. Products:
    - a. Carlisle Coatings & Waterproofing Inc<< <u>; MiraDRI 860/861</u>; ; MiraDRI 860-ULT (Ultra Low Temperature); ; \_\_\_\_; or None - N/A>>: www.carlisleccw.com/#sle.

# b. Substitutions: << <u>See Section</u> <u>01 6000 - Product Requirements</u>; or Not permitted>>.

- B. Mechanically Attached Elastomeric Sheet Membrane: Composite membrane formed of elastomeric materials bonded to an inner core and covered by a nonwoven geotextile fabric, recommended by the manufacturer for direct concrete contact in negative-side waterproofing applications.
  - 1. Membrane Thickness: 73 mil, 0.073 inch, minimum.
  - 2. Low Temperature Flexibility, ASTM D1970/D1970M: Pass.
  - 3. Elongation, ASTM D412: Greater than 400 percent.
  - 4. Tensile Strength (film), ASTM D882: 9,200 psi.
  - 5. Crack Cycling, ASTM C836/C836M: Pass.
  - 6. Adhesion: << <u>150 psi;</u> or \_\_\_\_ psi>>, minimum, measured in accordance with ASTM D4541.
  - 7. Water Vapor Transmission, ASTM E96/E96M (Water Method): 0.0011 perm.
  - 8. Adhesives, Sealants, Tapes and Accessories: As recommended by membrane manufacturer
- C. EPDM Rubber Sheet Membrane: Complying with ASTM D6134/D6134M.
  - 1. Thickness: << <u>60 mil, 0.060 inch;</u> 90 mil, 0.090 inch; 120 mil, 0.120 inch; or \_\_\_ mil, \_\_\_ inch>>, minimum.
  - 2. Sheet Width: As large as is practical, with factory vulcanized splices.
  - 3. Field Seaming: << Contact cement and lap edge sealant; Seam sealant and lap edge sealant; Splicing tape; or Per manufacturer's recommendation>>.
  - Tensile Strength: << <u>1,200 psi</u>; or \_\_\_\_ psi>>, measured in accordance with ASTM D412.
  - 5. Puncture Resistance: Withstanding << <u>55 lbf;</u> or <u>lbf>></u>, minimum, when tested in accordance with ASTM D5602/D5602M.
  - 6. Adhesives, Sealants, Tapes, and Accessories: As recommended by membrane manufacturer.
  - 7. Flashing: Cured EPDM rubber sheet.

## 2.03 ACCESSORIES

- A. Seaming Materials: As recommended by membrane manufacturer.
- B. Sealant for Cracks and Joints In Substrates: Resilient elastomeric joint sealant compatible with substrates and waterproofing materials.
- C. Self-Adhered Flashing: Composite membrane with top layer consisting of Ketone Ethylene Ester (KEE) reinforced membrane and backed by bottom layer of << <u>synthetic butyl</u>; SBS rubberized asphalt; or \_\_\_\_\_> adhesive covered with release paper.
  - 1. Width: << 12 inches; 18 inches; 24 inches; 36 inches; or \_\_\_\_ inches>>, nominal.
  - 2. Color: << Black; Gray; Tan; <u>White;</u> or \_\_\_\_>>.
- D. Termination Bars: << <u>Aluminum;</u> Stainless steel; or \_\_\_\_>; compatible with membrane and adhesives.
- E. Adhesives: As recommended by membrane manufacturer.
- F. Thinner and Cleaner: As recommended by adhesive manufacturer, compatible with sheet membrane.

## PART 3 EXECUTION

## 3.01 EXAMINATION

- A. Verify existing conditions are acceptable prior to starting work.
- B. Verify substrate surfaces are durable; free of matter detrimental to adhesion or application of waterproofing system.
- C. Verify that items penetrating surfaces to receive waterproofing are securely installed.

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D. Where existing conditions are responsibility of another installer, notify Architect of unsatisfactory conditions.

## 3.02 PREPARATION

- A. Protect adjacent surfaces from damage not designated to receive waterproofing.
- B. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions<< ; vacuum substrate clean; or <u>None N/A</u>>>.
- C. Do not apply waterproofing to surfaces unacceptable to membrane manufacturer.
- D. Fill nonmoving joints and cracks with a filler compatible with waterproofing materials.
- E. Concrete Surfaces for Adhesive Bonding: Prepare concrete substrate in accordance with ASTM D5295/D5295M.
  - 1. Remove substances that inhibit adhesion including form release agents, curing compounds admixtures, laitance, moisture, dust, dirt, grease and oil.
  - 2. Repair surface defects including honeycombs, fins, tie holes, bug holes, sharp offsets, rutted cracks, ragged corners, deviations in surface plane, spalling and delaminations, as described in reference standard.
  - 3. Remove and replace areas of defective concrete; see Section **<u>03 3000</u>**.
  - 4. Prepare concrete for adhesive bonded waterproofing using mechanical or chemical methods described in referenced standard.
  - 5. Test concrete surfaces as described in referenced standards, and verify surfaces are ready to receive adhesive bonded waterproofing membrane system.

#### 3.03 INSTALLATION - MEMBRANE

- A. Install membrane waterproofing in accordance with manufacturer's instructions<< <u>and NRCA</u> (<u>WM</u>) <u>applicable requirements;</u> and \_\_\_\_; or None N/A>>.
- B. Roll out membrane, and minimize wrinkles and bubbles.
- C. << <u>Self-Adhering Membrane:</u>; or None N/A>>Remove release paper layer, and roll out onto substrate with a mechanical roller to provide full contact bond.
- D. << <u>Mechanically Fastened Membrane:</u>; or None N/A>>Install << <u>mechanical fasteners</u>; or \_\_\_\_\_\_>> in accordance with manufacturer's instructions<< <u>, and bond sheet to membrane discs</u>; or None N/A>>.
- E. Overlap edges and ends, minimum << <u>3 inches</u>; or \_\_\_\_\_ inches>>, seal permanently waterproof by << <u>method recommended by manufacturer</u>; solvent welding; heat welding; contact tape; contact adhesive; or \_\_\_\_\_>><< <u>, and apply uniform bead of sealant to joint edge</u>; or None N/A>>.
- F. Reinforce membrane with multiple thickness of membrane material over joints, whether joints are static or dynamic.
- G. Weather lap joints on sloped substrate in direction of drainage, and seal joints and seams.
- H. Flexible Flashings: Seal items watertight that penetrate through waterproofing membrane with flexible flashings.
- I. Seal membrane and flashings to adjoining surfaces.

#### 3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements for additional requirements.

END OF SECTION 07 1300

#### SECTION 07 2100 THERMAL INSULATION

#### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Board insulation<< and integral vapor retarder; \_\_\_\_; or <u>None N/A</u>>> at << cavity wall construction; <u>perimeter foundation wall</u>; <u>underside of floor slabs</u>; <u>over roof deck</u>; over roof sheathing; <u>exterior wall behind</u> rain screen <u>wall finish</u>; interior wall with facer providing exposed finish; and \_\_\_\_>>.
- B. Batt insulation<< and vapor retarder; \_\_\_\_; or <u>None N/A</u>>> in exterior << <u>wall</u>; ceiling; roof; floor; and parapet>> construction.
- C. Batt insulation for filling << perimeter window and door shim spaces; crevices in exterior wall and roof; and \_\_\_\_>>.
- D. Accessories: Zee and other shapes for installation of rigid insulation

#### 1.02 RELSECTION 03 2000 - CAST-IN-PLACE CONCRETATED REQUIREMENTS

- A. Section 03 2000 Cast-in-place Comcrete
- B. Section 07 1000 Bituminous Dampproofing
- C. Section 07 1300 Sheet Waterproofing
- D. Section 07 2500 Weather Barriers
- E. Section <u>07 2600 Vapor Retarders</u>: Separate vapor retarder materials.
- F. Section 07 2700 Air Barriers: Separate air barrier materials.
- G. Section 07 5323 Ethylene-Propylene-Diene-Monomer Roofing
- H. Section 09 2116 Gypsum Board Assemblies

#### 1.03 REFERENCE STANDARDS

- A. ASTM C518 Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2017.
- B. ASTM C552 Standard Specification for Cellular Glass Thermal Insulation; 2021.
- C. ASTM C553 Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013 (Reapproved 2019).
- D. ASTM C578 Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2019.
- E. ASTM C612 Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014 (Reapproved 2019).
- F. ASTM C665 Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2017.
- G. ASTM C726 Standard Specification for Mineral Wool Roof Insulation Board; 2017.
- H. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials; 2021.
- I. ASTM E136 Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750°C; 2019a.

## 1.04 SUBMITTALS

- A. See Section **01 3000 Administrative Requirements** for submittal procedures.
- B. Product Data: Provide data on << product characteristics; performance criteria; product limitations; and \_\_\_\_\_>>.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

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D. Manufacturer's Installation Instructions: Include information on << <u>special environmental</u> <u>conditions required for installation; installation techniques;</u> and \_\_\_\_\_>>.

# 1.05 FIELD CONDITIONS

A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

## PART 2 PRODUCTS

## 2.01 APPLICATIONS

- A. Insulation Under Concrete Slabs: << Extruded polystyrene (XPS); Cellular glass; Graphite polystyrene; or Expanded polystyrene (EPS)>> board.
- B. Insulation at Perimeter of Foundation: << <u>Expanded polystyrene (EPS)</u>; Extruded polystyrene (XPS); Graphite polystyrene (GPS); Cellular glass; or \_\_\_\_>> board.
- C. Insulation Over Metal Stud Framed Walls, Continuous: << <u>Expanded polystyrene (EPS)</u>; Extruded polystyrene (XPS); Extruded polystyrene (XPS) carbon black; Graphite polystyrene (GPS); Polyisocyanurate; Glass fiber; Mineral fiber; or \_\_\_\_\_> board.
- D. Insulation in Metal Framed Walls: Batt insulation with << <u>separate</u>; integral; no; or \_\_\_\_\_\_\_\_\_> vapor retarder.
- E. Insulation in Metal Framed Soffit: Batt insulation with << <u>separate</u>; integral; no; or \_\_\_\_\_>> vapor retarder.
- F. Insulation Above Lay-In Acoustical Ceilings: Batt insulation with no vapor retarder.
- G. Insulation Over Roof Deck: << Extruded polystyrene (XPS); Polyisocyanurate; or Expanded polystyrene (EPS).>> board.
- H. Insulation in aluminum curtain wall: Semi-rigid mineral wool

## 2.02 FOAM BOARD INSULATION MATERIALS

- A. Expanded Polystyrene (EPS) Board Insulation: Comply with ASTM C578.
  - 1. Flame Spread Index (FSI): << <u>Class A 0 to 25</u>; Class B 26 to 75; or Class C 76 to 200>>, when tested in accordance with ASTM E84.
  - 2. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
  - 3. Board Size: << <u>48 inch by 96 inch;</u> or \_\_\_\_ inch by \_\_\_\_ inch>>.
  - 4. Board Thickness: << 1-1/2 inch; <u>2 inch</u>; <u>3 inch</u>; or <u>inch</u>>>. Multiple layers where drawings indicate thickness greater than 2".
  - 5. Board Edges:
    - a. Square: at foundations, under slabs, & roofs
    - b. Keyed: for walls where there are 'Z' furing
  - 6. Type and Compressive Resistance: As required for intended purpose and locations based on manufacturer's recommendations.
  - 7. Type and Water Absorption: As required for intended purpose and locations based on manufacturer's recommendations.
  - 8. Thermal Resistance: Minimum R-4 per inch at 40 degrees F mean temperature
  - 9. Basis of Design Products:
    - a. InsulFoam LLC<< ; InsulFoam \_\_\_\_; ; \_\_\_\_; or <u>None N/A</u>>>: www.insulfoam.com/.

## 2.03 MINERAL FIBER BOARD INSULATION MATERIALS

- A. Mineral Wool Block and Board Thermal Insulation: Complying with ASTM C612.
  - 1. Facing: << <u>None, unfaced</u>; Aluminum foil, reinforced fiberglass scrim, kraft paper laminate (FSK); White kraft paper, fiberglass scrim, aluminum foil laminate (ASJ); Black non-woven mat; or \_\_\_\_\_>>.
  - 2. Flame Spread Index: 25 or less, when tested with facing, if any, in accordance with ASTM E84.

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- Smoke Developed Index: 50 or less, when tested with facing, if any, in accordance with 3. ASTM E84.
- 4. Board Thickness: per application indicated in the drawings
- Board Edges: << Square; Shiplap; or >>. 5.
- Thermal Conductivity (k-factor): Btu inch/hr sq ft degrees F of << 0.26; or 0.23>> per 6. inch, minimum, at **75 degrees F** when tested in accordance with ASTM C518.
- Maximum Density: << 8 pcf; 11 pcf; or \_\_\_\_ pcf>>, nominal. 7.
- 8. Basis of Design Product:
  - **Owens Corning: Thermafiber Firespan 40.** a.
  - b. Substitutions: << See Section 01 6000 - Product Requirements; or Not permitted>>.

# 2.04 BATT INSULATION MATERIALS

- A. Glass Fiber Batt Insulation: Flexible preformed batt or blanket, comply with ASTM C665: friction fit.
  - Flame Spread Index: << 25 or less; 75 or less; or \_\_\_\_>, when tested in accordance 1. with ASTM E84.
  - Smoke Developed Index: << 450 or less; 50 or less; or \_\_\_\_>>, when tested in 2. accordance with ASTM E84.
  - Combustibility: Non-combustible, when tested in accordance with ASTM E136<<, except 3. <u>for facing, if any;</u>, \_\_\_\_; or None - N/A>>. Formaldehyde Content: Zero.
  - 4.
  - 5. Thermal Resistance: **R-value** of **3 per inch**.
  - Thickness: As indicated in the drawings. 6.
  - Products: 7.
    - a. Owens Corning Corporation<< ; EcoTouch PINK FIBERGLAS Insulation; ; ; ; or None - N/A>>: www.ocbuildingspec.com/#sle.
    - Substitutions: << See Section 01 6000 Product Requirements; or Not b. permitted>>.

## 2.05 ACCESSORIES

- A. Sheet Vapor Retarder: See Section 07 2600.
- B. Sheet Weather Barriers: See Section 07 2500.
- C. Tape: Reinforced polyethylene film with acrylic pressure sensitive adhesive.
  - Application: Sealing of interior circular penetrations, such as pipes or cables. 1.
  - Width: << Are required for application; 2.4 inches; 3.9 inches; 5.9 inches; or \_\_\_\_ 2. inches>>.
  - 3. Products:
    - a. SIGA Cover Inc<<; SIGA-Rissan; ; ; or None N/A>>: www.siga.swiss/global en/#sle.
    - Substitutions: << See Section 01 6000 Product Requirements; or Not b. permitted>>.
- D. Self-Adhered Transition Flashing: Multipurpose, self-adhered flashing with modified butyl adhesive, polyester fiber top sheet, and polypropylene interlayer.
  - Application: Primerless adhesion for use as through-wall flashings and wall transitions to 1. roof and below-grade systems.
  - Thickness: << 45 mil, 0.045 inch; or \_\_\_ mil, \_\_\_ inch>>, nominal. 2.
  - Size: << 6 inches; 9 inches; 12 inches; 18 inches; 24 inches; 36 inches; or 3. inches>> wide, in rolls << 75 feet; or feet>> long.
- E. Flashing Tape: Special reinforced film with high performance adhesive.
  - Application: Window and door opening flashing tape. 1
  - Width: << As required for application; 3 inch; 3.9 inch; 5.9 inch; 7.9 inch; 9.8 2. inch; 11.8 nch; or \_\_\_\_ inch>>.

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- F. Sill Plate Sealer: Closed-cell foam tape with rubberized adhesive membrane; bridges gap between foundation structure and sill plate or skirt board.
  - 1. Width: << 3-1/2 inches; <u>5-1/2 inches;</u> or \_\_\_\_ inches>>.
  - Ultraviolet (UV) and Weathering Resistance: Approved in writing by manufacturer for up to << <u>30 days</u>; 180 days; 365 days; or <u>days</u>>> of weather exposure.
  - 3. Products:
    - a. Protecto Wrap Company<< <u>; Triple Guard Energy Sill Sealer</u>; <u>;</u> <u>;</u> or None N/A>>: www.protectowrap.com/#sle.
    - b. Substitutions: << <u>See Section 01 6000 Product Requirements</u>; or Not permitted>>.
- G. Tape joints of rigid insulation in accordance with roofing and insulation manufacturers' instructions.
- H. Continuous Insulation (CI) Support Systems: Composite framing support (CFS) system consisting of insulated fiberglass reinforced plastic (FRP) girts that support CI and provide cladding attachment support integrated with << <u>metal wall panels</u>; brick veneer; CMU veneer; or \_\_\_\_>> exterior wall cladding.
  - Substrate: Attach CFS system components to << open metal stud framing without sheathing; open wood stud framing without sheathing; <u>exterior sheathing over</u> <u>metal stud framing</u>; exterior sheathing over wood stud framing; concrete masonry units (CMU); poured concrete; or \_\_\_\_>>.
  - Depth of Girts: << <u>As required for thickness of insulation</u>; As indicated on drawings; 1-1/2 inch; 2 inch; 2-1/2 inch; 3 inch; 3-1/2 inch; 4 inch; or \_\_\_\_\_ inch>>.
  - 3. Spacing of Girts: << 16 inches; <u>24 inches</u>; or \_\_\_\_ inches>> on center, << vertically; <u>horizontally</u>; or \_\_\_\_>>.
  - 4. Basis of Design Product:
    - a. Strongwell: Strong Girt. www.strongirt.com/.
    - b. Substitutions: << <u>See Section 01 6000 Product Requirements</u>; or Not permitted>>.
- I. Adhesive: Type recommended by insulation manufacturer for application.

## PART 3 EXECUTION

## 3.01 EXAMINATION

- A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation<< and adhesive; \_\_\_\_\_; or <u>None N/A</u>>>.
- B. Verify substrate surfaces are flat, free of << <u>honeycomb;</u> <u>fins;</u> <u>irregularities;</u> <u>materials or</u> <u>substances that may impede adhesive bond;</u> or \_\_\_\_\_>>.

## 3.02 BOARD INSTALLATION AT FOUNDATION PERIMETER

- - 1. Tape seal joints.
- B. Apply<< \_\_\_\_; or <u>None N/A</u>>> adhesive to back of boards:
  - 1. **<< Three; or 4>>** continuous beads per board length.
  - 2. Full bed << 1/8 inch; or <u>1/2 inch</u>>> thick.
- C. Install boards << vertically; <u>horizontally</u>; or \_\_\_\_\_>> on foundation perimeter.
  - 1. Place boards to maximize adhesive contact.
  - 2. Install in running bond pattern.
  - 3. Butt edges and ends tightly to adjacent boards and to protrusions.
- D. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

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# 3.03 BOARD INSTALLATION AT EXTERIOR WALLS

- A. Install boards << vertically; horizontally; or \_
  - 1. Place boards to maximize adhesive contact.
  - 2. Install in running bond pattern.
  - 3. Butt edges and ends tightly to adjacent boards and protrusions.
  - 4. Install tightly between pultruded cladding support girts.
- B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.
- C. Install pultruded FRP Cladding supports horizontally @ nominally 2'-0" o.c. (max).
- D. Fit rigid insulation boards tightly between pultruded supports.
- E. Place << <u>6 inches</u>; or <u>inches</u>>> wide << <u>polyethylene</u>; or <u>>></u> sheet at perimeter of wall openings, from adhesive vapor retarder bed to << <u>window</u>; <u>door</u>; and >> frames, and tape seal in place to ensure continuity of vapor retarder and air seal.
- F. Tape insulation board joints.

## 3.04 BOARD INSTALLATION UNDER CONCRETE SLABS

- A. Place insulation under slabs on grade after base for slab has been compacted.
- B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.
- C. Prevent insulation from being displaced or damaged while<< <u>placing vapor retarder and;</u> \_\_\_\_; or None - N/A>> placing slab.

## 3.05 BOARD INSTALLATION OVER LOW SLOPE ROOF DECK

- A. Board Installation Over Roof Deck, General:
  - 1. See applicable roofing specification section for specific board installation requirements.
  - 2. Fasten insulation to deck in accordance with roofing manufacturer's written instructions<< <u>and applicable Factory Mutual requirements;</u> \_\_\_\_; or None N/A>>.
  - 3. Do not apply more insulation than can be covered with roofing on the same day.

## 3.06 BATT INSTALLATION

- A. Install insulation<< <u>and vapor retarder;</u> ; or None N/A>> in accordance with manufacturer's instructions.
- B. Install in exterior << <u>wall</u>; roof; ceiling; raised floor; and soffit>> spaces without gaps or voids. Do not compress insulation.
- C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
- D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.
- E. Retain insulation batts in place with spindle fasteners at << <u>12 inches</u>; or \_\_\_\_ inches>> on center.
- F. At metal framing, place vapor retarder<< <u>on warm side of insulation</u>; on cold side of insulation; or None N/A>>; lap and seal sheet retarder joints over face of member
- G. Tape seal tears or cuts in vapor retarder.
- H. Extend vapor retarder tightly to full perimeter of adjacent window and door frames and other items interrupting the plane of the membrane; tape seal in place.
- I. Coordinate work of this section with requirements for vapor retarder, see Section 07 2600.

## 3.07 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements for additional requirements.

## 3.08 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

## END OF SECTION 07 2100

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#### SECTION 07 2500 WEATHER BARRIERS

#### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

A. Water-resistive barriers.

#### 1.02 RELATED REQUIREMENTS

- A. Section <u>06 1000 Rough Carpentry</u>: Water-resistive barrier under exterior cladding.
- B. Section 07 2100 Thermal Insulation
- C. Section 07 2500 Weather Barriers
- D. Section 07 4213 Metal Wall Panels
- E. Section 07 4213.19 Insulated Metal Wall Panels
- F. Section <u>07 6200 Sheet Metal Flashing and Trim</u>: Metal flashings installed in conjunction with weather barriers.
- G. Section 08 1000 Doors & Frames
- H. Section 08 1116 Aluminum Doors and Frames
- I. Section 08 3323 Overhead Coiling Doors
- J. Section 08 4400 Curtain Wall and Glazed Assemblies

#### **1.03 DEFINITIONS**

- A. Weather Barriers: Assemblies that form either water-resistive barriers, air barriers, or vapor retarders.
- B. Water-Resistive Barrier: A material behind an exterior wall covering that is intended to resist liquid water that has penetrated behind the exterior covering from further intruding into the exterior wall assembly.

#### 1.04 REFERENCE STANDARDS

- A. AATCC Test Method 127 Water Resistance: Hydrostatic Pressure Test; 2018.
- B. ASTM D779 Standard Test Method for Determining the Water Vapor Resistance of Sheet Materials in Contact with Liquid Water by the Dry Indicator Method; 2016.
- C. ASTM D1970/D1970M Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2020.
- D. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials; 2021.
- E. ASTM E96/E96M Standard Test Methods for Water Vapor Transmission of Materials; 2016.

#### 1.05 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on << <u>material characteristics</u>; performance criteria; limitations; and \_\_\_\_\_>>.
- C. Manufacturer's Installation Instructions: Indicate << preparation; installation methods; storage and handling criteria; and \_\_\_\_>>.

#### 1.06 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by materials manufacturers before, during, and after installation.

# PART 2 PRODUCTS

#### 2.01 WATER-RESISTIVE BARRIER MATERIALS

- A. Weather Barrier (infiltration barrier):
  - 1. Self-adhered, water resistive vapor permeable air barrier sheet membrane.
    - a. Water Resistance: At least 120 minutes when tested in accordance with ASTM D779.
    - b. Water Vapor Permeance: << <u>7.6 perms</u>; or \_\_\_\_ perms>>, minimum, when tested in accordance with ASTM E96/E96M using Procedure A Desiccant Method, at <u>73.4</u> <u>degrees F</u>.
    - c. Basis of Design Product:
      - 1) Vaproshield: Revealshield SA, self-adhered.
      - Substitutions: << <u>See Section 01 6000 Product Requirements</u>; or Not permitted>>.
    - d. Applications: Walls, Soffits

## 2.02 ACCESSORIES

- A. Sealants, Tapes, and Accessories Used for Sealing Water-Resistive Barrier and Adjacent Substrates: As indicated or complying with water-resistive barrier manufacturer's installation instructions.
- B. Sealant for Cracks and Joints In Substrates: Resilient elastomeric joint sealant compatible with substrates and weather barrier materials.
  - 1. Application: Apply at << <u>30 to 40 mil, 0.030 to 0.040 inch;</u> or <u>to mil, to</u> <u>inch>></u> nominal thickness.
  - 2. Color: << Green; or match surface where applied>>.
- C. Flexible Flashing: Self-adhesive sheet flashing complying with ASTM D1970/D1970M, except slip resistance requirement is waived if not installed on a roof.
  - 1. Width: << <u>4 inches;</u> 6 inches; 9 inches; or <u>inches>></u>.

## PART 3 EXECUTION

#### 3.01 EXAMINATION

A. Verify that surfaces and conditions comply with requirements of this section.

#### 3.02 PREPARATION

A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.

#### 3.03 INSTALLATION

- A. Install materials in accordance with manufacturer's installation instructions.
- B. Weather Barriers: Install continuous weather barrier over surfaces indicated, with sheets lapped to shed water.
- C. Self-Adhered Sheets:
  - 1. Prepare substrate in accordance with sheet manufacturer's installation instructions; fill and tape joints in substrate and between dissimilar materials.
  - 2. Lap sheets shingle-fashion to shed water and seal laps airtight.
  - 3. Upon placement of sheets, firmly press onto substrate with resilient hand roller; ensure that laps are firmly adhered with no gaps or fishmouths.
  - 4. Use same material, or other material approved by sheet manufacturer, to seal sheets to adjacent substrates, and as flashing.
  - 5. At expansion joints, provide transition to joint assemblies approved by sheet manufacturer.
- D. Openings and Penetrations in Exterior Weather Barriers:
  - 1. Install flashing over sills, covering entire sill framing member, and extend at least << <u>5</u> <u>inches;</u> or <u>inches>></u> onto water-resistive barrier and at least << <u>6 inches;</u> or <u>\_\_\_</u>

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inches>> up jambs; mechanically fasten stretched edges.

- At openings filled with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with sealing tape at least << <u>4 inches</u>; or \_\_\_\_ inches>> wide; do not seal sill flange.
- 3. At openings filled with non-flanged frames, seal water-resistive barrier to each side of framing at opening using flashing at least << <u>9 inches</u>; or <u>inches</u>>> wide, and covering entire depth of framing.
- 4. At head of openings, install flashing under water-resistive barrier extending at least << <u>2</u> <u>inches</u>; or <u>inches</u>>> beyond face of jambs; seal water-resistive barrier to flashing.
- 5. At interior face of openings, seal gaps between window and door frames and rough framing using appropriate joint sealant over backer rod.
- 6. Service and Other Penetrations: Form flashing around penetrating items and seal to surface of water-resistive barrier.

# 3.04 FIELD QUALITY CONTROL

## A. See Section 01 4000 - Quality Requirements for additional requirements.

## 3.05 PROTECTION

A. Do not leave materials exposed to weather longer than recommended by manufacturer.

# END OF SECTION 07 2500

#### SECTION 07 2600 VAPOR RETARDERS

## PART 1 GENERAL

## 1.01 SECTION INCLUDES

A. Vapor retarders.

# 1.02 RELATED REQUIREMENTS

- A. Section **<u>03 3000 Cast-in-Place Concrete</u>**: Vapor retarder under concrete slabs on grade.
- B. Section <u>06 1000 Rough Carpentry</u>: Vapor retarders on exterior wall sheathing.
- C. Section <u>07 2100 Thermal Insulation</u>: Vapor retarder installed in conjunction with rigid insulation.
- D. Section <u>07 5300 Elastomeric Membrane Roofing</u>: Vapor retarder installed as part of roofing system.
- E. Section **07 6200 Sheet Metal Flashing and Trim**: Metal flashings installed in conjunction with vapor retarders.

## 1.03 DEFINITIONS

- A. Vapor Retarder: Airtight barrier made of material that is relatively water vapor impermeable, to degree specified, with seams and joints sealed to adjacent surfaces.
- B. Vapor Retarder Class: A measure of a material or assembly's ability to limit the amount of moisture that passes through that material or assembly. Vapor retarder class is defined using Procedure A, Desiccant Method at <u>73 degrees F</u> and 50 percent Relative Humidity (RH), in accordance with ASTM E96/E96M and ICC (IBC)-2018, as follows:
  - 1. Class I: 0.1 perm or less.
  - 2. Class II: Greater than 0.1 perm to 1.0 perm.
  - 3. Class III: Greater than 1.0 perm to 10 perms.
  - 4. Vapor Permeable: 5 perms or greater.

## 1.04 REFERENCE STANDARDS

- A. ASTM D412 Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2016, with Editorial Revision (2021).
- B. ASTM D751 Standard Test Methods for Coated Fabrics; 2019.
- C. ASTM D903 Standard Test Method for Peel or Stripping Strength of Adhesive Bonds; 1998 (Reapproved 2017).
- D. ASTM D1970/D1970M Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2020.
- E. ASTM E96/E96M Standard Test Methods for Water Vapor Transmission of Materials; 2016.
- F. ICC (IBC)-2018 International Building Code; 2018.

## 1.05 SUBMITTALS

- A. See Section <u>01 3000 Administrative Requirements</u> for submittal procedures.
- B. Product Data: Provide data on << <u>material characteristics</u>; <u>performance criteria</u>; <u>limitations</u>; and \_\_\_\_\_>>.
- C. Manufacturer's Installation Instructions: Indicate << preparation; installation methods; storage and handling criteria; and \_\_\_\_>>.
- D. Installer's qualification statement.

## 1.06 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum << <u>three</u>; or \_\_\_\_\_>> years<< <u>documented</u>; \_\_\_\_; or None - N/A>> experience<<, and approved by manufacturer; or <u>None - N/A</u>>>.

# 1.07 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by materials manufacturers before, during, and after installation.

# PART 2 PRODUCTS

# 2.01 VAPOR RETARDERS

- A. Underslab Vapor Retarder:
  - 1. Sheet Material: ASTM E1745, Class A; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs. Single ply polyethylene is prohibited
  - 2. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations.
- B. Vapor Retarder Sheet: ASTM D1970/D1970M.
  - 1. Type: << <u>Rubberized asphalt bonded to thermoplastic sheet</u>; Rubberized asphalt bonded to fire-resistant aluminum foil sheet; Nonasphaltic adhesive bonded to polyethylene sheet; Nonasphaltic adhesive bonded to manufacturer's proprietary sheet; or \_\_\_\_>><< , self-adhesive; or None N/A>>.
  - 2. Thickness: << <u>40 mil, 0.040 inch;</u> or <u>mil, inch>><< , nominal;</u> or None N/A>>.
  - 3. Sheet Width: << 18 inches; 24 inches; <u>36 inches;</u> or \_\_\_\_ inches>>.
  - 4. Water Vapor Permeance: << <u>0.05 perm</u>; or <u>perm</u>>>, maximum, when tested in accordance with ASTM E96/E96M.
  - 5. Seam and Perimeter Tape: As recommended by sheet manufacturer.
  - 6. Basis of Design Products:
    - a. Henry Company<< <u>; Blueskin SA;</u> ; \_\_\_\_; or None N/A>>: www.henry.com/#sle.
    - b. Substitutions: << <u>See Section 01 6000 Product Requirements</u>; or Not permitted>>.
  - 7. Applications: walls, roofs

# 2.02 ACCESSORIES

- A. Sealants, Tapes, and Accessories for Sealing Vapor Retarder and Adjacent Substrates: As indicated, complying with vapor retarder manufacturer's installation instructions.
- B. Sealant for Cracks and Joints in Substrates: Resilient elastomeric joint sealant compatible with substrates and vapor retarder materials.
  - 1. Application: Apply at << <u>30 to 40 mil, 0.030 to 0.040 inch;</u> or <u>to mil, to</u> <u>inch>></u>, nominal thickness.
  - Elongation: << <u>1,300 percent</u>; or \_\_\_\_ percent>>, measured in accordance with ASTM D412.
  - 3. Peel Adhesion: << <u>28 lb/inch;</u> or \_\_\_\_ lb/inch>>, minimum, when tested in accordance with ASTM D903.
  - 4. Hydrostatic Head Pressure: Resists head pressure of << <u>57 feet</u>; or <u>feet</u>>>, maximum, when tested in accordance with ASTM D751.
- C. Primer: Liquid applied polymer.
  - 1. Color: << <u>Green;</u> or \_\_\_\_>>.
- D. Flexible Flashing: Self-adhesive sheet flashing complying with ASTM D1970/D1970M; slip resistance requirement waived if not installed on roof.
  - 1. Width: << <u>4 inches;</u> 6 inches; 9 inches; or <u>inches</u>>>.
  - Ultraviolet (UV) and Weathering Resistance: Approved by manufacturer for up to << <u>30</u> <u>days</u>; 180 days; 365 days; or \_\_\_\_>> of weather exposure.
  - 3. Products:
    - a. As recommended by manufacturer.

# b. Substitutions: << <u>See Section 01 6000 - Product Requirements</u>; or Not permitted>>.

E. Thinners and Cleaners: As recommended by vapor retarder manufacturer.

# PART 3 EXECUTION

## 3.01 EXAMINATION

A. Verify that surfaces and conditions comply with requirements of this section.

#### 3.02 PREPARATION

A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.

#### 3.03 INSTALLATION

- A. Install materials in accordance with manufacturer's installation instructions.
- B. Vapor Retarders: Install continuous airtight barrier over surfaces indicated, with sealed seams and sealed joints to adjacent surfaces.
- C. Apply sealants and adhesives within recommended temperature range in accordance with manufacturer's installation instructions.
- D. Self-Adhered Sheets:
  - 1. Prepare substrate in accordance with sheet manufacturer's installation instructions; fill and tape joints in substrate and between dissimilar materials.
  - 2. Lap sheets shingle fashion to shed water and seal laps airtight.
  - 3. Once sheets are in place, press firmly into substrate with resilient hand roller; ensure that laps are firmly adhered with no gaps or fishmouths.
  - 4. Use same material, or other material approved by sheet manufacturer, to seal sheets to adjacent substrates, and as flashing.
  - 5. At expansion joints, provide transition to joint assemblies approved by sheet manufacturer.
- E. Openings and Penetrations in Exterior Vapor Retarders:
  - Install flashing over sills, covering entire sill framing member, and extend at least << <u>5</u> inches; or \_\_\_\_ inches>> onto vapor retarder and at least << <u>6 inches;</u> or \_\_\_\_ inches>> up jambs; mechanically fasten stretched edges.
  - At openings with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with sealing tape at least << <u>4 inches</u>; or \_\_\_\_\_ inches>> wide; do not seal sill flange.
  - 3. At openings with non-flanged frames, seal vapor retarder to each side of framing at opening using flashing at least << <u>9 inches</u>; or \_\_\_\_ inches>> wide, and covering entire depth of framing.
  - At head of openings, install flashing under vapor retarder extending at least << <u>2 inches</u>; or \_\_\_\_\_ inches>> beyond face of jambs; seal vapor retarder to flashing.
  - 5. At interior face of openings, seal gaps between window/door frame and rough framing using appropriate joint sealant over backer rod.
  - 6. Service and Other Penetrations: Form flashing around penetrating items and seal to surface of vapor retarder.

## 3.04 FIELD QUALITY CONTROL

- A. See Section <u>01 4000 Quality Requirements</u> for additional requirements.
- B. Do not cover installed vapor retarders until required inspections have been completed.

## 3.05 PROTECTION

A. Do not leave materials exposed to weather longer than recommended by manufacturer.

## END OF SECTION 07 2600

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#### SECTION 07 4213 METAL WALL PANELS

#### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

A. Manufactured metal panels for << <u>exterior wall panels</u>; <u>interior liner panels</u>; <u>soffit panels</u>; <u>subgirt framing assembly</u>; and \_\_\_\_\_>>, with << <u>insulation</u>; <u>related flashings</u>; and <u>accessory components</u>>>.

#### 1.02 RELATED REQUIREMENTS

- A. Section <u>05 4000 Cold-Formed Metal Framing</u>: Wall panel substrate.
- B. Section 07 2100 Thermal Insulation.
- C. Section <u>07 2500 Weather Barriers</u>: Water-resistive barrier under wall panels.
- D. Section <u>07 2600 Vapor Retarders</u>: Vapor retarder barrier under wall panels.
- E. Section 07 4213.19 Insulated Metal Wall Panels
- F. Section <u>07 9200 Joint Sealants</u>: Sealing joints between metal wall panel system and adjacent construction.
- G. Section 08 4313 Aluminum-Framed Storefronts
- H. Section 08 4400 Curtain Wall and Glazed Assemblies

#### 1.03 REFERENCE STANDARDS

- A. AAMA 609 & 610 Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document); 2015.
- B. ASTM B209/B209M Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021.
- C. NFPA 285 Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components; 2019.

#### 1.04 SUBMITTALS

- A. Product Data Wall System: Manufacturer's data sheets on each product to be used, including:
  - 1. Physical characteristics of components shown on shop drawings.
  - 2. Storage and handling requirements and recommendations.
  - 3. Installation instructions and recommendations.
- B. Shop Drawings: Indicate dimensions, layout, joints, construction details, support clips<< , ; or None N/A>>, and methods of anchorage.
- C. Samples: Submit << <u>two</u>; or \_\_\_\_\_>> samples of << <u>wall panel</u>; or wall panel and soffit panel>>, << <u>12 inches by 12 inches</u>; or \_\_\_\_ inches by \_\_\_\_ inches>> in size illustrating finish color, sheen, and texture.
- D. Test Reports: Submit test report verifying compliance with NFPA 285 for << <u>previously-</u> <u>tested</u>; project-specific; or \_\_\_\_>> exterior wall assembly.
- E. Manufacturer's qualification statement.
- F. Installer's qualification statement.
- G. Warranty Documentation for Installation of Building Rainscreen Assembly: Submit installer warranty and ensure that forms have been completed in Owner's name and registered with installer.

#### **1.05 QUALITY ASSURANCE**

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum << <u>three</u>; or \_\_\_\_\_>> years of<< <u>documented</u>; \_\_\_\_\_; or None - N/A>> experience<< and certified by the panel supplier for fabrication of wall</p>

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# panel system; \_\_\_\_; or <u>None - N/A</u>>>.

B. Installer Qualifications: Company specializing in installing products specified in this section with minimum << <u>three</u>; or \_\_\_\_\_>> years of<< <u>documented</u>; \_\_\_\_\_; or None - N/A>> experience<< and approved by manufacturer; or <u>None - N/A</u>>>.

## 1.06 MOCK-UPS

- A. See Section 01 4000 Quality Requirements for additional requirements.
- B. Construct mock-ups: 12 feet wide section, full height, include panel<< <u>and soffit;</u> ; or <u>None N/A>></u> system<< <u>, glazing;</u> , \_\_\_\_; or <u>None N/A>></u>, attachments to building frame, associated vapor retarder and air seal materials, weep drainage system, sealants and seals<< , \_\_\_\_; or <u>None N/A>></u>, and related insulation in mock-up.
- C. Locate << as directed by Architect; as indicated on drawings; or \_\_\_\_>>.
- D. Mock-up << may; or may not>> remain as part of work.

## 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.
- B. Store prefinished material off the ground and protected from weather; prevent twisting, bending, or abrasion; provide ventilation; slope metal sheets to ensure proper drainage.
- C. Prevent contact with materials that may cause discoloration or staining of products.

#### **1.08 FIELD CONDITIONS**

A. Do not install wall panels when air temperature or relative humidity are outside manufacturer's limits.

#### 1.09 WARRANTY

- A. See Section 01 7800 Closeout Submittals for additional warranty requirements.
- B. Finish Warranty: Provide << <u>5-year</u>; 10-year; 20-year; or \_\_\_\_>> manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking. Complete forms in Owner's name and register with warrantor.

## PART 2 PRODUCTS

## 2.01 METAL WALL PANEL SYSTEM

- A. Wall Panel System: Factory fabricated prefinished metal panel system, site assembled.
  - 1. Design and size components to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of wall.
  - 2. Design Pressure: In accordance with << applicable codes; ASCE 7; or \_\_\_\_\_>
  - Maximum Allowable Deflection of Panel: << L/180; L/90; L/60; or L/ \_\_>> for length(L) of span.
  - 4. Movement: Accommodate movement within system without damage to components or deterioration of seals, movement between system and perimeter components when subject to seasonal temperature cycling; dynamic loading and release of loads; and deflection of structural support framing.
  - 5. Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.
  - 6. Fabrication: Formed true to shape, accurate in size, square, and free from distortion or defects; pieces of longest practical lengths.
  - Corners: Factory-fabricated in one continuous piece with minimum << <u>2-inch</u>; 18-inch; or \_\_\_\_-inch>> returns.
- B. Exterior Wall Panels:MP-2
  - 1. See Drawings for specifics.
  - Color: << <u>As indicated on drawings;</u> As scheduled; To match existing; or \_\_\_\_\_\_>>.

- C. Soffit Panels:MP-3
  - 1. Basis of Design Product: Northclad AL-PR
  - Profile: << <u>Style as indicated;</u> or \_\_\_\_>>, with << <u>venting provided;</u> venting not provided; or \_\_\_\_>>.
  - Color: << <u>As indicated on drawings</u>; As indicated; To match existing; or \_\_\_\_\_>>.

4.

- D. Internal and External Corners: Same material, thickness, and finish as exterior sheets;<</p>
  ; or <u>None N/A</u>>> profile to suit system; << <u>shop cut and factory mitered</u>; or brake formed>> to required angles.
- E. Expansion Joints: Same material, thickness and finish as exterior sheets; << manufacturer's standard brake formed; infill; or custom, profile>> type, of profile << to suit system; or <u>as detailed</u>>>.
- F. << <u>Trim</u>; Closure Pieces; Caps; Flashings; Facias; Infills; and \_\_\_\_\_>>: Same material, thickness and finish as exterior sheets; brake formed to required profiles.
- G. Anchors: << Galvanized steel; Aluminum; <u>Stainless steel; or</u> \_\_\_\_\_>>.

## 2.02 MATERIALS

1. Thickness: 3/16"

## 2.03 FINISHES

- A. Panel Backside Finish: Panel manufacturer's standard << acrylic; polyester; <u>siliconized</u> <u>polyester</u>; or \_\_\_\_\_>> wash coat.
- B. Fluoropolymer Coil Coating System: Manufacturer's standard multi-coat metal coil coating system complying with AAMA 2605, including at least 70 percent polyvinylidene fluoride (PVDF) resin, and at least 80 percent of coil coated metal surfaces having minimum total dry film thickness (DFT) of <u>0.9 mil, 0.0009 inch</u>; color and gloss << <u>to match sample</u>; as selected from manufacturer's standards; as scheduled; as indicated on drawings; or >>.

## 2.04 ACCESSORIES

- A. Aluminum Cladding Support System: Thermally isolated from substrate with << vertical face fastening; vertical to horizontal adaptor; <u>hidden mechanical fastening</u>; or \_\_\_\_\_>>. Comply with ASHRAE Std 90.1 I-P and NFPA 285.
  - 1. Substrate: << <u>As indicated on drawings;</u> Exterior sheathing over steel studs; Exterior sheathing over wood studs; Concrete masonry units (CMU); or \_\_\_\_>>.
  - 2. Fasteners: Provide support system and cladding attachment fasteners as recommended by system manufacturer in accordance with requirements.
- B. Gaskets: Manufacturer's standard type suitable for use with system, permanently resilient<< :\_ <u>ultraviolet and ozone resistant</u>; or None N/A>>.

## PART 3 EXECUTION

## 3.01 EXAMINATION

- A. Verify that building framing members are ready to receive panels.
- B. Verify that water-resistive barrier, see Section <u>07 2500</u>, has been properly installed over substrate; see Section << <u>05 4000</u>; 06 1000; 09 2116; or \_\_\_\_>>.

#### 3.02 PREPARATION

A. Install subgirts perpendicular to panel length, securely fastened to substrates and shimmed and leveled to uniform plane, and spaced at << <u>intervals indicated</u>; 24 inches on center, maximum; or \_\_\_\_ inches on center, maximum>>.

# 3.03 INSTALLATION

A. Install panels on << <u>walls;</u> <u>soffits;</u> and \_\_\_\_\_>> in accordance with manufacturer's instructions.

## 3.04 TOLERANCES

- A. Offset From True Alignment Between Adjacent Members Abutting or In Line: << <u>1/16 inch</u>; or \_\_\_\_\_ inch>>, maximum.
- B. Variation from Plane or Location As Indicated on Drawings: << <u>1/4 inch</u>; <u>1/8 inch</u>; or \_\_\_\_\_ inch>>, maximum.

#### 3.05 CLEANING

- A. Remove site cuttings from finish surfaces.
- B. Remove protective material from wall panel surfaces.

#### 3.06 PROTECTION

- A. Protect metal wall panels until completion of project.
- B. Touch-up, repair, or replace damaged wall panels or accessories to factory condition before Date of Substantial Completion.

# END OF SECTION 07 4213
#### SECTION 07 4213.19 INSULATED METAL WALL PANELS - KINGSPAN

# PART 1 GENERAL

# 1.01 SECTION INCLUDES

A. Factory-assembled, insulated metal panels for walls, with trim, and accessory components.

# 1.02 RELATED REQUIREMENTS

- A. Section 05 1200 Structural Steel Framing: Structural steel building frame.
- B. Section <u>05 4000 Cold-Formed Metal Framing</u>: Metal framing members supporting insulated metal wall panels.
- C. Section <u>07 2100 Thermal Insulation</u>. Pultruded RFP Cladding Attachment Support System.
- D. Section 07 2500 Weather Barriers.
- E. Section 07 4213 Metal Wall Panels
- F. Section 08 4313 Aluminum-Framed Storefronts
- G. Section 08 4400 Curtain Wall and Glazed Assemblies
- H. Section 07 6200 Sheet Metal Flashing and Trim.
- I. Section <u>07 9200 Joint Sealants</u>: Sealing joints between metal wall panel system and adjacent construction.

## 1.03 REFERENCE STANDARDS

- A. ASTM A653/A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.
- B. ASTM A755/A755M Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products; 2018.
- C. ASTM A924/A924M Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process; 2019.
- D. ASTM C518 Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2017.
- E. ASTM C591 Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation; 2021.
- F. ASTM C920 Standard Specification for Elastomeric Joint Sealants; 2018.
- G. ASTM D2244 Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates; 2016.
- H. ASTM D4214 Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films; 2007 (Reapproved 2015).
- I. ASTM E330/E330M Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.

## **1.04 ADMINISTRATIVE REQUIREMENTS**

A. Preinstallation Meeting: Conduct a preinstallation meeting<< <u>one week</u>; at least one week; ; or None - N/A>> prior to the start of the work of this section; require attendance by affected installers.

## 1.05 SUBMITTALS

- A. See Section **<u>01 3000 Administrative Requirements</u>** for submittal procedures.
- B. Product Data: Provide manufacturer documentation on tested << <u>structural</u>; <u>thermal</u>; <u>fire</u> <u>resistance</u>; and \_\_\_\_>> capabilities of assembled panel.

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- C. Shop Drawings: Indicate << panel profiles; layout; exterior sheet gauge; interior sheet gauge; joints; dimensions; spans; sealant locations; construction details; methods of anchorage; sequence of installation; and \_\_\_\_>>.
- D. Selection Samples: For each finish product specified, submit at least << two; three; or</li>
  >> sample color chips representing manufacturer's << <u>full</u>; standard; custom; or
  >> range of available colors, sheen, and texture; << <u>3 by 5 inch</u>; or <u>by</u>
  inch>> minimum.
- F. Design Data: Provide calculations verifying panels will withstand design wind loads indicated without detrimental effects or exceeding deflection criteria.
- G. Manufacturer's Instructions: Indicate << <u>special handling criteria</u>; <u>installation sequence</u>; <u>cleaning procedures</u>; and \_\_\_\_>>.
- H. Installer's qualification statement.
- I. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

## 1.06 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of type specified in this section and authorized by panel manufacturer.

#### 1.07 MOCK-UPS

- A. Construct mock-up, 17 feet long section full height, including << <u>panels</u>; <u>sub-girts</u>; <u>attachments to building frame</u>; <u>associated vapor retarder and air seal materials</u>; <u>sealants and seals</u>; <u>related insulation</u>; and <u>aluminum curtain wall>></u>.
- B. Locate << where directed; or \_\_\_\_>>.
- C. Mock-up << may; may not; or \_\_\_\_\_>> remain as part of work.

## 1.08 DELIVERY, STORAGE, AND HANDLING

- A. Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.
- B. Store prefinished material above ground with weather protection to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

# 1.09 WARRANTY

- A. See Section 01 7800 Closeout Submittals for additional warranty requirements.
- B. Finish Warranty: Standard form in which manufacturer agrees to repair or replace metal panels that evidence deterioration of fluoropolymer finish. Deterioration includes flaking or peeling from approved primed metal substrate, chalk over 8 when tested in accordance with ASTM D4214, Method A, and color fading over 5 delta units on panels when tested in accordance with ASTM D2244.
- C. Thermal Warranty: Standard form in which manufacturer agrees to repair or replace panels that exhibit greater than 10 percent reduction from published R-value (RSI-value) at time of manufacture, as measured in compliance with ASTM C518 within specified warranty period.
  - 1. Warranty Period: Thirty years from Date of Substantial Completion, or 30 years and three months from date of shipment from manufacturer's plant, whichever occurs first.

## PART 2 PRODUCTS

#### 2.01 MANUFACTURERS

- A. Kingspan Insulated Panels<< ; \_\_\_\_\_; ; KS Series \_\_\_\_\_; ; Optimo; ; Designwall 4000; or <u>None N/A</u>>>: www.kingspan.com.
  - 1. MP-1: Designwall 2000

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- 2. FIN: Accent Fin
- B. Substitutions: << See Section 01 6000 Product Requirements; or Not permitted>>.

#### 2.02 PANEL SYSTEM

- A. Metal Panel System: Factory-assembled metal panel system, with trim, related flashings and accessory components.
  - 1. Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.
  - 2. Accommodate tolerances of building structural framing.
  - 3. Provide continuity of thermal barrier at building enclosure elements in conjunction with thermal insulating materials; see Section <u>07 2100</u>.

#### 2.03 PERFORMANCE REQUIREMENTS

- A. Thermal Performance: Provide thermal resistance through entire system; <u>**R-value**</u> of <u>5.8</u> <u>degrees F hr sq ft/Btu per inch</u>, minimum.
- B. Structural Performance: Design and size to withstand dead loads and wind loads caused by positive and negative wind pressure acting normal to plane of panel.
  - Verify structural performance in accordance with ASTM E330/E330M, using test pressure << <u>1.5</u>; or \_\_\_\_>> times design wind pressure, with << <u>10 seconds</u>; or \_\_\_\_>> duration of maximum load.
  - 2. Design wind loads: Perstructural drawings.
- C. Movement: Accommodate movement caused by following items without damage to system, components, or deterioration of seals:
  - 1. Normal movement between system components.
  - 2. Seasonal temperature cycling.
  - 3. Deflection of structural support framing.

#### 2.04 PANELS AND TRIM

- A. << <u>Wall</u>; Wall and Soffit; \_\_\_\_\_\_; or None N/A>>Panels (MP-1): Factory-assembled, foamed-in-place, insulated metal panels with exterior and interior sheet metal skins; panels interlock at edges<<, fitted with continuous gaskets; , \_\_\_\_\_; or <u>None N/A</u>>>.
  - 1. Panel Width and Orientation: << Horizontally applied; Vertically applied; <u>As indicated</u> on drawings; or \_\_\_\_\_>>.
  - Exterior Panel Face Profile: << Flat; Striated; Shadowline; Mini Micro-Rib; Micro-Rib; Mini-Wave; Flat with Granitestone; Flat with Granitestone Quartz; or As indicated on drawings.>>.
  - Panel Thickness: << 2 inches; 2-1/2 inches; 3 inches; 4 inches; 5 inches; 6 inches; or \_\_\_\_\_ inches>>.
  - 4. Horizontal Joints Between Panels: << <u>1/8 inch</u>; 3/8 inch; or \_\_\_\_ inch>> wide joint reveal.
  - 5. Vertical Joints Between Panels: << <u>1/8-inch reveals</u>; \_\_\_\_-inch reveals; Panel trimless ends with black EPDM gasket insert; Surface-mounted aluminum extrusion with reveal and flush aluminum insert; Surface-mounted aluminum extrusion with reveal and recessed aluminum insert; Surface-mounted top hat metal flashing; Extruded TPE rubber gasket; or \_\_\_\_\_>>.
    - a. Gasket Color: << <u>Standard black gasket</u>; <u>Standard light gray gasket</u>; <u>Custom color gasket</u>, <u>nonmetallic to match panel color</u>; or \_\_\_\_>>.
  - Sealant at Exposed Joints (Horizontal Panel Applications): << <u>Elastomeric</u> <u>polyurethane</u>; Neutral cure silicone; or \_\_\_\_>> sealant complying with ASTM C920.
  - 7. Fabricate panels in longest practicable lengths.
  - 8. Exterior Face of Panel Paint Finish: << <u>Two-coat</u>,; or <u>Three-coat</u>,>>< <u>polyvinylidene</u> <u>fluoride (PVDF)</u>; or \_\_\_\_\_>><< <u>1.0 mil</u>, <u>0.001 inch</u>; 1.5 mil, 0.0015 inch; 2.4 mil, 0.0024 inch; or \_\_\_\_\_mil, \_\_\_\_ inch>> system; << <u>0.2 mil</u>, <u>0.0002 inch</u>; 0.8 mil, 0.0008 inch; or \_\_\_\_mil, \_\_\_\_ inch>> primer with << <u>0.8 mil</u>, <u>0.0008 inch</u>; or \_\_\_\_mil, \_\_\_\_ inch>> Kynar 500 (70 percent) << <u>SOLID</u>; MICA; METALLIC; or \_\_\_\_>> color coat<<

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and clear coat; \_\_\_\_; or None - N/A>>.

- a. Color: << <u>As selected from manufacturer's current insulated wall panel color</u> <u>chart;</u> Custom color; Color as indicated on drawings; or \_\_\_\_>>.
- B. << <u>Trim</u>; <u>Closure Pieces</u>; <u>Expansion Joints</u>; <u>Caps</u>; <u>Flashings</u>; Fascias; <u>Infills</u>; <u>External Corners</u>; Internal Corners; and \_\_\_\_>: Same material<<, <u>thickness</u>,; or None - N/A>> and finish as exterior face of insulated metal panel; << factory fabricated; or <u>brake formed</u>>> to required profiles; fabricated in longest practicable lengths.

# 2.05 PANEL MATERIALS

- A. Precoated Galvanized Steel Sheet: ASTM A755/A755M steel coil material with Grade 33, G90 galvanized steel in accordance with ASTM A653/A653M and ASTM A924/A924M.
  - 1. Color of Exposed Exterior Surfaces: << <u>As indicated on drawings;</u> or \_\_\_\_>>.
- B. Gaskets: Manufacturer's standard type suitable for use with panel system, permanently resilient<< ; ultraviolet and ozone resistant; ; \_\_\_\_; or <u>None N/A</u>>><< <u>; color as</u> <u>selected by Architect;</u> ; \_\_\_\_ color; or None N/A>>.
- C. Panel Sealants: Manufacturer's standard type suitable for use with installation of panel system; << <u>nonstaining</u>; <u>skinning</u>; <u>nonshrinking</u>; <u>nonsagging</u>; <u>ultraviolet</u>; and <u>ozone</u> <u>resistant</u>>><< ; <u>color as selected by Architect</u>; ; <u>color; or None - N/A>>.</u>

# 2.06 ACCESSORIES

- A. Fasteners: Manufacturer's standard corrosion-resistant type to suit application; << <u>hot-dip</u> <u>galvanized steel</u>; stainless steel; or \_\_\_\_\_>><< <u>with soft neoprene washers</u>; \_\_\_\_; or None N/A>>. Where exposed fasteners are required, provide cap color to match exterior panel.
- B. Clips: Manufacturer's standard stainless steel clips with PVC or neoprene sealing pads adhered to underside of clips; designed to prevent water infiltration around fastener penetrations.
- C. Concealed Sealants: Noncuring butyl sealant or tape sealant; type as recommended by panel manufacturer.

# PART 3 EXECUTION

## 3.01 EXAMINATION

A. Verify that structural << <u>framing</u>; substrate; or \_\_\_\_>> is ready to receive panel system.

# 3.02 INSTALLATION

- A. Install panel system on walls<< and soffits; \_\_\_\_\_; or <u>None N/A</u>>> in accordance with manufacturer's instructions.
- B. Install panels plumb, level, and true-to-line with dimensions and layout indicated on approved shop drawings.
- C. Permanently fasten panel system to structural supports; aligned, level, and plumb, within specified tolerances.
- D. Locate panel joints over supports.
- E. Use concealed fasteners unless otherwise indicated by Architect.
- F. Seal and place gaskets to prevent weather penetration, and maintain neat appearance.
- G. Install trim and trim fasteners as indicated on approved shop drawings.

## 3.03 TOLERANCES

- A. Maximum Offset from True Alignment between Adjacent Members Butting or in Line: << <u>1/16</u> <u>inch</u>; or \_\_\_\_ inch>>.
- B. Maximum Variation from Plane or as Indicated on Drawings: << <u>1/4 inch</u>; 1/8 inch; or \_\_\_\_\_ inch>>.

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# 3.04 REPAIR

A. Touch-up, repair, or replace metal panels and trim that have been damaged to orginal factory condition.

# 3.05 FIELD QUALITY CONTROL

A. See Section <u>01 4000 - Quality Requirements</u> for additional requirements.

# 3.06 CLEANING

- A. Remove protective film from metal panels immediately after installation.
- B. Clean and wash prefinished surfaces of metal panels with mild soap and water; rinse with clean water.
- C. Clear metal panel weep holes and drainage channels of obstructions, dirt, and sealant.

# END OF SECTION 07 4213.19

#### SECTION 07 5323 ETHYLENE-PROPYLENE-DIENE-MONOMER (EPDM) ROOFING

# PART 1 GENERAL

# 1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

# 1.02 RELATED SECTIONS

- A. Section 05 3100 Steel Decking
- B. Section 05 5100 Metal Stairs: Roof access stairs and ladders
- C. Section 06 1053 Miscellaneous Rough Carpentry: for wood nailers, curbs, and blocking.
- D. Section 07 2100 Thermal Insulation
- E. Seciton 07 2500 Weather Barriers
- F. Section 07 2600 Vapor Retarders
- G. Section 07 9200 Joint Sealants
- H. Section 07 9513 Expansion Joint Cover Assemblies
- I. Section 07 6200 Sheet Metal Flashing and Trim: for metal roof flashings and counterflashings.
- J. Section 07 7100 Roof Specialties: Seismic/expansion joints, safety anchors
- K. Section 07 7200 Roofing Accessories: for roof curbs and access hatches
- L. Section 22 1900 Plumbing Specialties: for roof drains.

# 1.03 SUMMARY

- A. Section Includes:
  - 1. Adhered ethylene-propylene-diene-terpolymer (EPDM) roofing system.
  - 2. Substrate board.
  - 3. Vapor retarder.
  - 4. Roof insulation.
  - 5. Cover board.
  - 6. Walkways.

## **1.04 DEFINITIONS**

A. Roofing Terminology: Definitions in ASTM D1079 and glossary of NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" apply to work of this Section.

## **1.05 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. For insulation and roof system component fasteners, include copy of FM Approvals' RoofNav listing.
- B. Shop Drawings: Include roof plans, sections, details, and attachments to other work, including the following:
  - 1. Layout and thickness of insulation.
  - 2. Base flashings and membrane terminations.
  - 3. Flashing details at penetrations.
  - 4. Tapered insulation, thickness, and slopes.
  - 5. Roof plan showing orientation of orientation of roof membrane and fastening spacings and patterns for mechanically fastened roofing system.
  - 6. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
  - 7. Tie-in with air barrier.

C. Wind Uplift Resistance Submittal: For roofing system, indicating compliance with wind uplift performance requirements.

# **1.06 INFORMATIONAL SUBMITTALS**

- A. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install specified roofing system and system is eligible to receive the standard roofing manufacturer's warranty.
- B. Manufacturer Certificates:
  - 1. Performance Requirement Certificate: Signed by roof membrane manufacturer, certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
    - a. Submit evidence of complying with performance requirements.
  - 2. Special Warranty Certificate: Signed by roof membrane manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty.
- C. Evaluation Reports: For components of roofing system, from ICC-ES.
  - 1. Fastener-pullout test results and manufacturer's revised requirements for fastener patterns.
- D. Submit copy of manufacturer's affidavit of intent to warrant.
- E. FM Approval Letter: Provide letter from FM Global accepting roof assembly or list of noncomplying items accepted by Project Manager.
- F. Sample Warranties: For manufacturer's special warranties.

## 1.07 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing system to include in maintenance manuals.

## 1.08 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is listed in FM Approvals' RoofNav for roofing system identical to that used for this Project or as approved by the Project Manager. Deviations in the assembly are subject to approval by Project Manager.
- 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 special warranty.
- C. Perform work in accordance with NRCA Roofing Manual.

## 1.09 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, approval or listing agency markings, and directions for storing and mixing with other components.
- B. 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.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

## **1.10 FIELD 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

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and warranty requirements.

- B. Do not apply roofing membrane during unsuitable weather.
- C. Do not apply roofing membrane when ambient temperature is below <u>40 degrees Fahrenheit</u>.
- D. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.
- E. Do not expose material vulnerable to water or sun damage in quantities greater than can be weather-proofed in one day.

#### 1.11 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period. Failure includes roof leaks and blow off to 120 MPH winds specified in this Section. Conform to ICC and IBC as adopted by the Municipality of Anchorage for roof assembly fire hazards and wind uplift resistance requirements. Design for 150 mph wind, 3-second gust, exposure B.
  - 1. Special no-dollar limit warranty includes roof membrane, base flashings, roof insulation, fasteners, cover boards, substrate board, sheet metal flashings, and other components of roofing system.
  - 2. Warranty Period: 20 years from Date of Substantial Completion.
- B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering the Work of this Section, including all components of roofing system such as roof membrane, base flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, and walkway products, for the following warranty period:
  - 1. Warranty Period: Two years from Date of Substantial Completion.

## PART 2 PRODUCTS

#### 2.01 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed roofing system and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing and flashings shall remain watertight.
  - 1. Accelerated Weathering: Roof membrane shall withstand 2000 hours of exposure when tested according to ASTM G152, ASTM G154, or ASTM G155.
  - 2. Impact Resistance: Roof membrane shall resist impact damage when tested according to ASTM D3746, ASTM D4272, or the Resistance to Foot Traffic Test in FM Approvals 4470.
- B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roof membrane manufacturer based on testing and field experience.
- C. Wind Uplift Resistance: Design roofing system to resist the following wind uplift pressures when tested according to FM Approvals 4474, UL 580, or UL 1897: Resist wind loads indicated on Drawings.
- D. Conform to ICC and IBC as adopted by the Municipality of Anchorage for roof assembly fire hazards and wind uplift resistance requirements. Design for 150 mph wind, 3-second gust, exposure B.
- E. FM Approvals' RoofNav Listing: Roof membrane, base flashings, and component materials shall comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system, and shall be listed in FM Approvals' RoofNav for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals Certification markings.
  1. Fire/Windstorm Classification: Class 1A-90.
- F. Exterior Fire-Test Exposure: ASTM E108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

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G. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.

# 2.02 SYSTEM DESIGN

- A. Fully adhered EPDM roof membrane over rigid insulation over wood and steel decks.
  - 1. Carlisle SynTec: Sure-Seal Design A.
  - 2. Elevate: Rubberguard Roofing System.
  - 3. No substitutions.

## 2.03 ETHYLENE-PROPYLENE-DIENE-TERPOLYMER (EPDM) ROOFING

- A. EPDM Sheet: ASTM D4637/D4637M, Type I, nonreinforced, EPDM sheet with factory-applied seam tape.
  - 1. Thickness: <u>60 mils</u>, nominal.
  - 2. Exposed Face Color: Black.
  - 3. Source Limitations: Obtain components for roofing system from roof membrane manufacturer or manufacturers approved by roof membrane manufacturer.

#### 2.04 AUXILIARY ROOFING MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with other roofing components.
  - 1. Adhesive and Sealants: Comply with VOC limits of authorities having jurisdiction.
- B. Sheet Flashing: 60-mil-thick EPDM, partially cured or cured, according to application.
- C. Warning Strips: Yellow non-reinforced thermoplastic polyolefin (TPO), 30-mil-inch thick laminated to 30-mil-thick fully cured synthetic rubber pressure sensitive adhesive, 6-inch nominal width.
- D. Prefabricated Pipe Flashings: As recommended by roof membrane manufacturer, color white.
- E. Bonding Adhesive: Manufacturer's standard.
- F. Seaming Material: Manufacturer's standard, synthetic-rubber polymer primer and 3-inch-wide minimum, butyl splice tape with release film Factory-applied seam tape, width as recommended by manufacturer.
- G. Lap Sealant: Manufacturer's standard, single-component sealant, colored to match membrane roofing.
- H. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.
- I. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately 1 by <u>1/8 inch</u> thick; with anchors.
- J. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately <u>1 inch</u> wide by <u>0.05 inch</u> thick, prepunched.
- K. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosionresistance provisions in FM Approvals 4470, designed for fastening components to substrate, and acceptable to roofing system manufacturer.
- L. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, molded pipe boot flashings, preformed inside and outside corner sheet flashings, reinforced EPDM securement strips, T-joint covers, in-seam sealants, termination reglets, cover strips, and other accessories. Color white

#### 2.05 SUBSTRATE BOARDS

- A. Substrate Board: ASTM C1177/C1177M, glass-mat, water-resistant gypsum board or ASTM C1278/C1278M, fiber-reinforced gypsum board.
  - 1. Thickness: <u>1/2 inch</u> and <u>5/8 inch</u> as indicated on Drawings.
  - 2. Surface Finish: Factory primed.

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> B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosionresistance provisions in FM Approvals 4470, designed for fastening substrate panel to roof deck.

# 2.06 VAPOR RETARDER

A. Self-Adhering-Sheet Vapor Retarder: ASTM D1970/D1970M, polyethylene or foil film laminated to layer of rubberized asphalt adhesive, minimum 40-mil-total thickness; maximum permeance rating of 0.1 perm; cold applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor retarder manufacturer.

# 2.07 ROOF INSULATION

A. See section 07 2100 - Thermal Insulation

# 2.08 INSULATION ACCESSORIES

- A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with other roofing system components.
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosionresistance provisions in FM Approvals 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.
- C. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:
  - 1. Bead-applied, low-rise, one-component or multicomponent urethane adhesive approved by insulation manufacturer and FM Approved.
- D. Cover Board: ASTM C1289 Type II, Class 4, Grade 1, 1/2-inch-thick polyisocyanurate, with a minimum compressive strength of **80 psi**.
- E. Cover Board (When Required by Roofing Manufacturer to Achieve Fire Rating): ASTM C1177/C1177M, glass-mat, water-resistant gypsum substrate, or ASTM C1278/C1278M, fiber-reinforced gypsum board.
  - 1. Thickness: <u>1/2 inch</u>.
  - 2. Surface Finish: Primed or Unprimed.

## 2.09 WALKWAYS

- A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, solid-rubber, slip-resisting, surface-textured walkway pads, approximately 0.188-inch thick and acceptable to roofing system manufacturer.
  - 1. Size: Approximately 30 by **<u>30 inches</u>**
  - 2. Color: Black

## 2.10 SIGNAGE

A. Provide a typewritten laser-etched <u>0.032 inch</u> thick aluminum card. Card shall be 8 by <u>10</u> <u>inches</u> minimum. Information card shall identify facility name; contract number; approximate roof area; detailed roof system description, including deck type, membrane, thickness, method of application, manufacturer, insulation and cover board system and thickness; presence of tapered insulation for primary drainage, presence of vapor retarder; date of completion; installing Contractor identification and contact information; membrane manufacturer warranty expiration, warranty reference number, and contact information. Install card at each roof access point location as directed by Owner's Representative.

## **PART 3 EXECUTION**

# 3.01 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 roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.

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- 2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
- 3. Verify that surface plane flatness. Notify Project Manager if deformations or deflection is noted.
- B. Verify that surface plane flatness. Notify Project Manager if deformations or deflection is noted. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.02 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing system installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- B. 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.
- C. Perform fastener-pullout tests according to roof system manufacturer's written instructions.
  - 1. Submit test result within 24 hours of performing tests.
    - a. Include manufacturer's requirements for revisions to previously submitted fastener patterns required to achieve specified wind uplift requirements.

#### 3.03 INSTALLATION OF ROOFING, GENERAL

- A. Install roofing system according to roofing system manufacturer's written instructions, FM Approvals' RoofNav assembly requirements, and FM Global Property Loss Prevention Data Sheet 1-29.
- B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.
- C. Install roof membrane and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition.
- D. Install sound-absorbing insulation strips according to acoustical roof deck manufacturer's written instructions.

## 3.04 INSTALLATION OF SUBSTRATE BOARD

- A. Install substrate board with long joints in continuous straight lines, with end joints staggered not less than <u>24 inches</u> in adjacent rows.
  - 1. Tightly butt substrate boards together.
  - 2. Cut substrate board to fit tight around penetrations and projections, and to fit tight to intersecting sloping roof decks.
  - 3. Fasten substrate board to resist uplift pressure at corners, perimeter, and field of roof according to roofing system manufacturers' written instructions.
  - 4. Survey below deck for conduit locations. Contractor to repair damaged conduits and conductors at no additional expense to Owner.

## 3.05 INSTALLATION OF VAPOR RETARDER

- A. Self-Adhering-Sheet Vapor Retarder: Prime substrate if required by manufacturer. Install selfadhering-sheet vapor retarder over area to receive vapor retarder, side and end lapping each sheet a minimum of 3-1/2 and <u>6 inches</u>, respectively.
  - 1. Extend vertically up parapet walls and projections to a minimum height equal to height of insulation and cover board.
  - 2. Seal laps by rolling.
- B. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into roofing system.
- C. Turn vapor barrier up at perimeter and penetrations through insulation to envelope insulation. Terminate vapor retarder to wall flashings. Height of vapor retarder to include all insulation

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and cover board.

# 3.06 INSTALLATION OF INSULATION

- A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at end of workday.
- B. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.
- C. Installation Over Decking:
  - 1. Install base layer of insulation with end joints staggered not less than <u>12 inches</u> in adjacent rows and with long joints continuous at right angle to flutes of decking.
    - a. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
    - b. Make joints between adjacent insulation boards not more than <u>1/4 inch</u> in width.
    - c. Fill gaps exceeding <u>1/4 inch</u> with insulation.
    - d. Cut and fit insulation within <u>1/4 inch</u> of nailers, projections, and penetrations.
    - e. Loosely lay base layer of insulation units over substrate.
  - 2. Install upper layers of insulation and tapered insulation with joints of each layer offset not less than **<u>12 inches</u>** from previous layer of insulation.
    - a. Staggered end joints within each layer not less than <u>24 inches</u> in adjacent rows.
    - b. Install with long joints continuous and with end joints staggered not less than <u>12</u> <u>inches</u> in adjacent rows.
    - c. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
    - d. Make joints between adjacent insulation boards not more than <u>1/4 inch</u> in width.
    - e. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus <u>24 inches</u>.
    - f. Trim insulation so that water flow is unrestricted.
    - g. Fill gaps exceeding <u>1/4 inch</u> with insulation.
    - h. Cut and fit insulation within <u>1/4 inch</u> of nailers, projections, and penetrations.
    - i. Mechanically fasten insulation to roof deck according to FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification and FM Global Property Loss Prevention Data Sheet 1-29.
    - j. Where insulation exceeds screw lengths, adhere each layer of insulation to substrate using adhesive according to FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification and FM Global Property Loss Prevention Data Sheet 1-29, as follows:
      - 1) Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.

## 3.07 INSTALLATION OF COVER BOARDS

- A. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of <u>6 inches</u> in each direction.
  - 1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
  - At internal roof drains, conform to slope of drain sump.
    a. Trim cover board so that water flow is unrestricted.
  - 3. Cut and fit cover board tight to nailers, projections, and penetrations.
  - 4. Adhere cover board to substrate using adhesive according to FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification and FM Global Property Loss Prevention Data Sheet 1-29, as follows:
    - a. Set cover board in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.

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# 3.08 INSTALLATION OF ADHERED ROOF MEMBRANE

- A. Adhere roof membrane over area to receive roofing according to roofing system manufacturer's written instructions.
- B. Unroll membrane roof membrane and allow to relax before installing.
- C. Start installation of roofing in presence of roofing system manufacturer's technical personnel.
- D. Accurately align roof membrane, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- E. Bonding Adhesive: Apply to substrate and underside of roof membrane at rate required by manufacturer, and allow to partially dry before installing roof membrane. Do not apply to splice area of roof membrane.
- F. In addition to adhering, mechanically fasten roof membrane securely at terminations, penetrations, and perimeters.
- G. Apply roof membrane with side laps shingled with slope of roof deck where possible.
- H. Tape Seam Installation: Clean and prime both faces of splice areas, apply splice tape.
  - 1. Firmly roll side and end laps of overlapping roof membrane to ensure a watertight seam installation.
  - 2. Apply lap sealant and seal exposed edges of roofing terminations.
- I. Factory-Applied Seam Tape Installation: Clean and prime surface to receive tape.
  - 1. Firmly roll side and end laps of overlapping roof membrane to ensure a watertight seam installation.
  - 2. Apply lap sealant and seal exposed edges of roofing terminations.
- J. Repair tears, voids, and lapped seams in roof membrane that do not comply with requirements.
- K. Spread sealant or mastic bed over deck-drain flange at roof drains, and securely seal roof membrane in place with clamping ring.
- L. Adhere protection sheet over roof membrane at locations indicated.

## 3.09 INSTALLATION OF BASE FLASHING

- A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.
- B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
- D. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.
- E. Turn membrane over top of curbs and over outer face of parapet minimum 2-inches. Secure flashing to exterior face of curb at 8-inches on center.
- F. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars. Set termination bars at top of flashing at a straight and level plane. Provide sealant at top of termination bars at full depth and sloped to shed water.
- G. Seal pipe and conduit penetrations with pipe flashing boots. Set neck of boot in sealant bed and clamp with stainless steel drawband. Flash to roof membrane. Provide continuous sealant at toe of flashing membrane.

## 3.10 INSTALLATION OF WALKWAYS

A. Flexible Walkways: Install walkway products according to manufacturer's written instructions.

- 1. Install flexible walkways at the following locations:
  - a. Top and bottom of each roof access ladder.

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- b. Locations indicated on Drawings.
- c. As required by roof membrane manufacturer's warranty requirements.
- 2. Provide 6-inch clearance between adjoining pads.
- 3. Adhere walkway products to substrate with compatible tape according to roofing system manufacturer's written instructions.

# 3.11 PROTECTING AND CLEANING

- A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing system, inspect roofing system for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
- B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

# 3.12 ROOFING INSTALLER'S WARRANTY

A. WHEREAS \_\_\_\_\_

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herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:

- 1. Owner: Southcentral Foundation.
- 2. Address: 4320 Diplomacy Drive, Anchorage, Alaska 99508.
- 3. Building Name/Type: Valley Native Primary Care Center.
- 4. Address: 1001 Sout Knik Goose Bay Road, Wasilla, Alaska 99654.
- 5. Area of Work: **VNPCC Expansion**.
- 6. Acceptance Date:
- 7. Warranty Period: 2-years.
- 8. Expiration Date: \_\_\_\_\_
- B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,
- C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period Roofing Installer will, at Roofing Installer's own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.
- D. This Warranty is made subject to the following terms and conditions:
  - 1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
    - a. lightning;
    - b. peak gust wind speed exceeding 120 mph;
    - c. fire;
    - d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
    - e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
    - f. vapor condensation on bottom of roofing; and
    - g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
  - 2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense

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thereof have been paid by Owner or by another responsible party so designated.

- 3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
- 4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
- 5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
- 6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
- 7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.
- E. IN WITNESS THEREOF, this instrument has been duly executed this \_\_\_\_\_\_ day of
  - 1. Authorized Signature:
  - 2. Name: \_\_\_\_\_\_.
  - 3. Title: \_\_\_\_\_



#### SECTION 07 6200 SHEET METAL FLASHING AND TRIM

#### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Fabricated sheet metal items, including << <u>flashings; counterflashings; gutters;</u> <u>downspouts;</u> sheet metal roofing; exterior penetrations; \_\_\_\_; and other items indicated in Schedule>>.
- B. Sealants for joints within sheet metal fabrications.
- C. << Precast concrete splash pads; or <u>Sheet metal splash pans</u>>>.

#### **1.02 RELATED REQUIREMENTS**

- A. Section <u>06 1000 Rough Carpentry</u>: Wood nailers for sheet metal work.
- B. Section <u>06 1000 Rough Carpentry</u>: Field fabricated roof curbs.
- C. Section 07 4213 Metal Wall Panels
- D. Section 07 4213.19 Insulated Metal Wall Panels
- E. Section 07 7100 Roof Specialties: Manufactured copings, flashings, and expansion joint covers.
- F. Section 07 7200 Roof Accessories: Manufactured metal roof curbs.
- G. Section 07 5323 EPDM Thermoset Single-Ply Roofing.
- H. Section **07 9200 Joint Sealants**: Sealing non-lap joints between sheet metal fabrications and adjacent construction.
- I. Section 08 1113 Hollow Metal Doors and Frames
- J. Section 08 3323 Overhead Coiling Doors
- K. Section 08 4313 Aluminum-Framed Storefronts
- L. Section 08 4400 Curtain Wall and Glazed Assemblies

#### 1.03 REFERENCE STANDARDS

- A. AAMA 611 Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).
- B. AAMA 2604 Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2017a.
- C. AAMA 2605 Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2017a.
- D. ASTM A653/A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.
- E. ASTM A666 Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.
- F. ASTM B209/B209M Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021.
- G. ASTM C920 Standard Specification for Elastomeric Joint Sealants; 2018.
- H. CDA A4050 Copper in Architecture Handbook; current edition.
- I. SMACNA (ASMM) Architectural Sheet Metal Manual; 2012.

## 1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

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- B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.
- C. Samples: Submit << <u>two;</u> or \_\_\_\_>> samples, \_\_\_<u>by</u>\_\_inches in size, illustrating metal finish color.

## 1.05 QUALITY ASSURANCE

- A. Perform work in accordance with << <u>SMACNA (ASMM)</u>; <u>CDA A4050</u>; and \_\_\_\_> requirements<< <u>and standard details</u>; \_\_\_\_; or None - N/A>>, except as otherwise indicated.
- B. << <u>Fabricator and</u>; or None N/A>>Installer Qualifications: Company specializing in sheet metal work with five years of<< <u>documented</u>; \_\_\_\_\_; or None N/A>> experience.

#### 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- B. Prevent contact with materials that could cause discoloration or staining.

## PART 2 PRODUCTS

## 2.01 SHEET MATERIALS

- A. Galvanized Steel: ASTM A653/A653M, with << <u>G90/Z275</u>; or \_\_\_\_>> zinc coating; minimum << <u>24-gauge, 0.0239-inch</u>; 26-gauge, 0.0179-inch; or \_\_\_\_gauge, \_\_\_-inch>> thick base metal.
- B. Pre-Finished Galvanized Steel: ASTM A653/A653M, with << <u>G90/Z275</u>; or \_\_\_\_> zinc coating; minimum << <u>24-gauge</u>, <u>0.0239-inch</u>; or \_\_\_\_-gauge, \_\_\_-inch>> thick base metal, shop pre-coated with << modified silicone; <u>PVDF</u>; or \_\_\_\_\_> coating.
  - 1. Polyvinylidene Fluoride (PVDF) Coating: Superior performing organic powder coating, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system.
  - 2. Color: << <u>As indicated on drawings;</u> To match approved sample; or \_\_\_\_>>.
- - 1. Color Anodized Finish: AAMA 611, AA-M12C22A42/44, Class I, integrally or electrolytically colored anodic coating not less than **0.7 mil, 0.0007 inch** thick.
    - a. Color: match adjacent and << <u>As indicated on drawings;</u> To match approved sample; or \_\_\_\_\_>>.
- D. Pre-Finished Aluminum: ASTM B209/B209M<< , \_\_\_\_\_ alloy, \_\_\_\_ temper; , 3005 alloy, H12 or H14 temper; or <u>None N/A</u>>>; << 18 gauge, 0.040 inch; <u>20 gauge, 0.032 inch</u>; or \_\_\_\_\_ gauge, \_\_\_\_ inch>> thick; << <u>plain</u>; embossed; or \_\_\_\_\_>> finish shop pre-coated with << <u>silicone modified polyester</u>; acrylic polyester; fluoropolymer; PVDF; FEVE; or \_\_\_\_\_>> coating.
  - 1. Fluoropolymer Coating: High performance organic powder coating, AAMA 2604; multiple coat, thermally cured fluoropolymer finish system.
  - Color: match adjacent and << <u>As indicated on drawings</u>; As indicated; To match approved sample; or \_\_\_\_\_>>.
- E. Stainless Steel: ASTM A666, Type << <u>304</u>; or \_\_\_\_>> alloy, soft temper, << <u>28 gauge</u>, <u>0.0156 inch</u>; or \_\_\_\_ gauge, \_\_\_ inch>> thick; << <u>smooth</u>; or \_\_\_\_ patterned>><< <u>No. 4 -</u> <u>Brushed</u>; or \_\_\_\_>> finish.

#### 2.02 FABRICATION

- A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
- B. Form pieces << in longest possible lengths; in single length sheets; or \_\_\_\_\_>>.

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- C. Hem exposed edges on underside << <u>1/2 inch</u>; or \_\_\_\_\_ inch>>; miter and seam corners.
- D. Form material with << standing; batten; <u>flat lock</u>; or \_\_\_\_\_>> seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

# 2.03 SCUPP AND DOWNSPOUT FABRICATION

- A. Downspouts: << Rectangular profile; <u>Square profile</u>; Round profile; \_\_\_\_\_ profile; or Profile as indicated>>.
- B. Scupper & Downspouts: << <u>Size;</u> Sizes; or \_\_\_\_>> indicated in drawings
- C. Splash Pads: Precast concrete type, of << <u>size</u>; <u>sizes</u>; or \_\_\_\_\_>> and profiles indicated; minimum << <u>3,000 psi</u>; or \_\_\_\_ psi>> at 28 days, with minimum 5 percent air entrainment.
- D. Downspout << <u>Boots;</u> Shoes; or \_\_\_\_>>: << <u>Steel;</u> Cast iron; Plastic; or \_\_\_\_\_>>.
- E. Downspout Extenders: << <u>Same material and finish as downspouts;</u> Same material as downspouts; or \_\_\_\_\_>>.
- F. Seal metal joints.

# 2.04 EXTERIOR PENETRATION FLASHING PANELS

A. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for conduits and facade materials to be installed.

## 2.05 ACCESSORIES

- A. Fasteners: << <u>Galvanized steel</u>; Aluminum; Stainless steel; Copper; Same material and finish as flashing metal; or \_\_\_\_\_\_>><< <u>, with soft neoprene washers</u>; or None N/A>>.
- B. Slip Sheet: << <u>Rosin sized building paper;</u> or \_\_\_\_>>.
- C. Primer: << Zinc chromate; Galvanized iron; Iron oxide linseed oil; or \_\_\_\_\_>> type.
- D. Concealed Sealants: Non-curing butyl sealant.
- E. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; << black; white; translucent; color to match adjacent material; color as selected by Architect; or \_\_\_\_>>.

## PART 3 EXECUTION

## 3.01 EXAMINATION

- A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
- B. Verify roofing termination and base flashings are in place, sealed, and secure.

## 3.02 PREPARATION

- A. Install starter and edge strips, and cleats before starting installation.
- B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of << <u>15 mil, 0.015 inch</u>; or <u>mil, inch</u>>>.

# 3.03 INSTALLATION

- A. Comply with drawing details.
- B. Secure flashings in place using concealed fasteners<< <u>, and use exposed fasteners only</u> <u>where permitted.</u>; or None N/A>>.
- C. Apply plastic cement compound between metal flashings and felt flashings.
- D. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.

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- E. Exterior Flashing Receivers: Install in accordance with manufacturer's recommendations, and in proper relationship with adjacent construction, and as follows:
- F. Seal metal joints watertight.
- G. Connect downspouts to << <u>downspout boots;</u> downspout shoes; storm sewer system; or \_\_\_\_\_>>, and << grout; <u>seal;</u> or \_\_\_\_\_>> connection watertight.
- H. Set splash << pans; pads; or \_\_\_\_>> under << downspouts; roof and canopy drain outlets; roof and canopy overflow outlets; and \_\_\_\_>><< , and set in place with \_\_\_\_; or <u>None N/A</u>>>.

# 3.04 FIELD QUALITY CONTROL

- A. See Section **<u>01 4000 Quality Requirements</u>** for field inspection requirements.
- B. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

## END OF SECTION 07 6200

#### SECTION 07 7100 ROOF SPECIALTIES

## PART 1 GENERAL

## 1.01 SECTION INCLUDES

- Manufactured roof specialties, including << <u>copings</u>; fascias; gravel stops; vents; and \_\_\_\_\_>>.
- B. Roof penetration flashings

## 1.02 RELATED REQUIREMENTS

- A. Section 07 5323 EPDM Thermoset Single-Ply Roofing.
- B. Section 07 7200 Roof Accessories: Manufactured curbs, roof hatches, and snow guards.
- C. Section 07 2100 Thermal Insulation: rigid insulation for roofs
- D. Section 07 2500 Weather Barriers

#### 1.03 REFERENCE STANDARDS

- A. AAMA 2604 Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2017a.
- B. AAMA 2605 Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2017a.
- C. ANSI/SPRI/FM 4435/ES-1 Test Standard for Edge Systems Used with Low Slope Roofing Systems; 2017.
- D. ASTM E283/E283M Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.
- E. NRCA (RM) The NRCA Roofing Manual; 2019.
- F. SMACNA (ASMM) Architectural Sheet Metal Manual; 2012.

## 1.04 SUBMITTALS

- A. Product Data: Provide data on shape of components, materials and finishes, anchor types and locations.
- B. Shop Drawings: Indicate configuration and dimension of components, adjacent construction, required clearances and tolerances, and other affected work.
- C. Samples: Submit << two; three; or \_\_\_\_>> appropriately sized samples of << coping; gravel stop; control joint cover; expansion joint cover; roof vent; attic vent; snow guard; and \_\_\_\_\_>>.
- D. Manufacturer's Installation Instructions: Indicate special procedures, fasteners, supporting members, and perimeter conditions requiring special attention.

# PART 2 PRODUCTS

## 2.01 COMPONENTS

- A. Copings: Factory fabricated to sizes required and as indicated in the drawings; corners << <u>mitered</u>; welded; and \_\_\_\_>; concealed fasteners.
  - 1. Configuration: Concealed<< <u>continuous;</u> ; or None N/A>> hold down cleat at both legs; internal splice piece at joints of same material, thickness, and finish as cap; concealed stainless steel fasteners.
  - Pull-Off Resistance: Tested in accordance with ANSI/SPRI/FM 4435/ES-1 using test method RE-3 to positive and negative design wind pressure as defined by << <u>applicable</u> <u>local building code</u>; or \_\_\_\_>>.

- 3. Wall Width: << <u>As indicated on drawings;</u> 10 inches; 16 inches; or \_\_\_\_ inches>>.
- 4. Outside Face Height: << <u>As indicated on drawings;</u> 6 inches; or \_\_\_\_ inches>>.
- 5. Inside Face Height: << <u>As indicated on drawings;</u> 4 inches; or \_\_\_\_ inches>>.
- 6. Material: Formed aluminum sheet, << 0.040 inch; <u>0.050 inch</u>; 0.063 inch; or \_\_\_\_\_ inch>> thick, minimum.
- 7. Material: Match adjacent cladding material
- 8. Finish: 70 percent polyvinylidene fluoride.
- 9. Color: << <u>As indicated on drawings;</u> or \_\_\_\_\_>> and to match adjacent material.
- B. Pipe and Penetration Flashing: Base of << <u>rounded aluminum</u>; galvanized steel; thermoplastic; or \_\_\_\_\_>, compatible with << sheet metal; shingle; or EPDM>> roof systems, and capable of accomodating << <u>pipes</u>; tubes; angle irons; and \_\_\_\_>> sized between << 3/8 inch; or <u>1 inch</u>>> and << <u>12 inches</u>; or \_\_\_ inches>>.
  - 1. Caps: << EPDM; Color anodized; Clear anodized; or \_\_\_\_>>.
  - 2. Color: << As indicated on drawings; or black>>.
- C. Roof Penetration Sealing Systems: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for conduits and roofing system to be installed; designed to accommodate existing penetrations where applicable.
- D. Pipe Penetration Wall Seal: Seal for HVAC piping wall penetrations with wall mounted rigid plastic outlet cover and elastomeric wall seal gasket.
  - 1. Outlet Cover Color: << Gray; White; or black>>.
  - 2. Wall Outlet Water Penetration: Complies with ASTM E331 performance tests.
  - 3. Wall Outlet Air Leakage: Complies with ASTM E283/E283M performance tests.
  - 4. Wall Outlet Air Permeance: Complies with ASTM E2178 performance tests.
- E. Pipe Penetration Wall Seal and Insulated Piping Protection System: Seal for HVAC piping wall penetrations with wall mounted rigid plastic outlet cover and elastomeric wall seal gasket and having mechanical line insulation with PVC protective cover.
  - 1. Outlet Cover Color: << Gray; White; or black>>.
  - PVC Insulation Cover Color: << <u>Black</u>; White; or \_\_\_\_>> with full-length velcro fastener.

#### 2.02 FINISHES

- A. Fluoropolymer Coating: High Performance Organic Finish, AAMA 2604; multiple coat, thermally cured fluoropolymer finish system; << <u>color as indicated</u>; color as selected from manufacturer's standard colors; custom color to match approved sample; or color no. \_\_\_\_\_, manufactured by \_\_\_\_>>.
- B. PVDF (Polyvinylidene Fluoride) Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system; << <u>color as indicated</u>; color as selected from manufacturer's standard colors; custom color to match approved sample; or color no. \_\_\_\_\_, manufactured by \_\_\_\_>>.

## 2.03 ACCESSORIES

- A. Sealant for Joints in Linear Components: As recommended by component manufacturer.
- B. Adhesive for Anchoring to Roof Membrane: Compatible with roof membrane and approved by roof membrane manufacturer.
- C. Insulation Board Adhesive: Two-component, low-rise polyurethane foam adhesive used for adhering insulation to low slope roof deck materials.

## PART 3 EXECUTION

#### 3.01 EXAMINATION

A. Verify that deck, curbs, roof membrane, base flashing, and other items affecting work of this Section are in place and positioned correctly.

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# 3.02 INSTALLATION

A. Install components in accordance with manufacturer's instructions<< <u>and NRCA (RM)</u> <u>applicable requirements;</u> <u>; or None - N/A>></u>.

END OF SECTION 07 7100

#### SECTION 07 7200 ROOF ACCESSORIES

## PART 1 GENERAL

## **1.01 SECTION INCLUDES**

- A. Roof curbs.
- B. Roof penetrations mounting curbs.
- C. Roof hatches with access ladders.
- D. Non-penetrating pedestals.

#### **1.02 RELATED REQUIREMENTS**

- A. Section <u>07 6200 Sheet Metal Flashing and Trim</u>: Roof accessory items fabricated from sheet metal.
- B. Section 07 5323 EPDM Thermoset Single-Ply Roofing.
- C. Section 07 7123 Manufactured Gutters and Downspouts.
- D. Section 22 0000 Plumbing: for roof penetrations
- E. Section 23 0000 HVAC: for roof penetrations
- F. Section 26 0000 Electrical: for roof penetrations

## 1.03 REFERENCE STANDARDS

- A. 29 CFR 1910.23 Ladders; current edition.
- B. ASTM A123/A123M Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- C. ASTM A153/A153M Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.
- D. MSS SP-58 Pipe Hangers and Supports Materials, Design, Manufacture, Selection, Application, and Installation; 2018.

#### 1.04 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used.
  - 1. Preparation instructions and recommendations.
    - 2. Storage and handling requirements and recommendations.
    - 3. Installation methods.
    - 4. Maintenance requirements.
- C. Shop Drawings: Submit detailed layout developed for this project and provide dimensioned location and number for each type of roof accessory.
- D. Warranty Documentation:
  - 1. Submit manufacturer warranty.
  - 2. Ensure that forms have been completed in Owner's name and registered with manufacturer.
  - 3. Submit documentation that roof accessories are acceptable to roofing manufacturer, and do not limit the roofing warranty.

# 1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store products under cover and elevated above grade.

## 1.06 WARRANTY

A. See Section <u>01 7800 - Closeout Submittals</u> for additional warranty requirements.

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B. Correct defective Work within a << <u>five</u>; or \_\_\_\_>> year period after Date of Substantial Completion.

# PART 2 PRODUCTS

## 2.01 ROOF CURBS

- A. Roof Curbs Manufacturers:
  - 1. AES Industries Inc<< ; \_\_\_\_\_; or None N/A>>: www.aescurb.com/#sle.
  - 2. The Pate Company<< ; \_\_\_\_; or None N/A>>: www.patecurbs.com/#sle.
  - 3. MKT Metal Manufacturing<< ; \_\_\_\_; or None N/A>>: www.mktduct.com/#sle.
  - 4. Roof Products & Systems (RPS)<< ; \_\_\_\_; or None N/A>>: www.rpscurbs.com/#sle.
  - 5. Substitutions: << See Section 01 6000 Product Requirements; or Not permitted>>.
- B. Roof Curbs Mounting Assemblies: Factory fabricated hollow sheet metal construction, internally reinforced, and capable of supporting superimposed live and dead loads and designated equipment load with fully mitered and sealed corner joints welded or mechanically fastened, and integral counterflashing with top and edges formed to shed water.
  - Roof Curb Mounting Substrate: Curb substrate consists of << <u>standing seam metal roof</u> <u>panel system</u>; concealed fastener metal roof panel system; exposed fastener metal roof panel system; corrugated metal roof deck with insulation; flat roof deck sheathing with insulation; or \_\_\_\_>>.
  - 2. Sheet Metal Material:
    - a. Aluminum: << 0.080 inch; or \_\_\_\_ inch>> minimum thickness, with << 3003 alloy, and H14 temper; \_\_\_\_ alloy, and \_\_\_\_ temper; or manufacturer's standard alloy and temper>.
      - Finish: << <u>Mill finish</u>; Factory primed; Clear anodized; Color anodized; Baked enamel; Powder coat; or \_\_\_\_>>.
      - Color: << <u>As selected by Architect from manufacturer's standard line of</u> <u>colors;</u> Light bronze; Dark bronze; or \_\_\_\_>>.
  - 3. Roofing Cants: Provide integral sheet metal roofing cants dimensioned to begin slope at top of roofing system at 1:1 slope; minimum cant height << <u>4 inches</u>; or \_\_\_\_ inches>>.
  - 4. Fabricate curb bottom and mounting flanges for installation directly on metal roof panel system to match slope and configuration of system.
    - a. Extend side flange to next adjacent roof panel seam and comply with seam configurations and seal connection, providing at least <u>6 inch</u> clearance between curb and metal roof panel flange allowing water to properly flow past curb.
    - b. Where side of curb aligns with metal roof panel flange, attach fasteners on upper slope of flange to curb connection allowing water to flow past below fasteners, and seal connection.
    - c. Maintain at least <u>12 inch</u> clearance from curb, and lap upper curb flange on underside of down sloping metal roof panel, and seal connection.
    - d. Lap lower curb flange overtop of down sloping metal roof panel and seal connection.
  - 5. Provide layouts and configurations indicated on drawings.
- C. Equipment Rail Curbs: Straight curbs on each side of equipment, with top of curbs horizontal and level with each other for equipment mounting.
  - Height Above Finished Roof Surface: << <u>8 inches</u>; 6 inches; or \_\_ inches>>, minimum.
- D. Equipment Support: Straight curbs on each side of equipment, with top of curbs parallel with metal roofing system and each other for equipment mounting.
- E. Pipe, Duct, or Conduit Mounting Curbs: Vertical posts, minimum << <u>8 inches</u>; or \_\_\_\_\_ inches>> square unless otherwise indicated.
  - 1. Height Above Roof Deck: << <u>14 inches;</u> 16 inches; or \_\_\_\_ inches>>, minimum.

#### 2.02 ROOF HATCHES AND VENTS<< , MANUAL AND AUTOMATIC OPERATION; OR <u>NONE -</u> <u>N/A</u>>>

- A. Roof Hatches and Smoke Vents: Factory-assembled **<< galvanized steel; stainless steel;** <u>aluminum; or</u> \_\_\_\_\_>> frame and cover, complete with operating and release hardware.
  - 1. Style: Provide << <u>flat metal</u>; skylight; or \_\_\_\_>> covers unless otherwise indicated.
  - Mounting Substrate: Provide frames and curbs suitable for mounting on << <u>standing</u> <u>seam metal roof panel system</u>; concealed fastener metal roof panel system; exposed fastener metal roof panel system; corrugated metal roof deck with insulation; flat roof deck sheathing with insulation; or \_\_\_\_\_>>.
  - 3. Thermally Broken Hatches: Provide insulation within frame and cover.
  - 4. Size: As indicated on drawings; single-leaf style unless otherwise indicated.
- B. Frames and Curbs: One-piece curb and frame with integral cap flashing to receive roof flashings; extended bottom flange to suit mounting.
  - Insulation: Manufacturer's standard; << <u>1 inch</u>; <u>2 inches</u>; <u>3 inch</u>; or <u>inch>></u> rigid
    << <u>glass fiber</u>; wood fiber board; polyisocyanurate; or <u>>></u>, located on << <u>outside face of curb</u>; inside hollow curb; or <u>>></u>.
  - Curb Height: << 12 inches; or <u>16 inches</u>>> from << <u>finished surface of roof;</u> surface of roof; surface of roof deck; or \_\_\_\_\_>>, minimum.
- C. Roof Fall Protection System: Anchor and cable systems attached to roof structure with base plate.

## 2.03 NON-PENETRATING ROOFTOP SUPPORTS/ASSEMBLIES

- A. Non-Penetrating Rooftop Support/Assemblies: Manufacturer-engineered and factoryfabricated, with pedestal bases that rest on top of roofing membrane, and not requiring any attachment to roof structure and not penetrating roofing assembly.
  - 1. Design Loadings and Configurations: As required by applicable codes.
  - 2. Height: Provide minimum clearance of << <u>6 inches</u>; or <u>inches</u>>> under supported items to top of roofing.
  - 3. Support Spacing and Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
  - 4. Steel Components: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.
  - 5. Hardware, Bolts, Nuts, and Washers: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A153/A153M.
- B. Pipe Supports: Provide attachment fixtures complying with MSS SP-58 and as indicated.
  - 1. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports; corrosion resistant material.
- C. Non-Penetrating Pedestals: Steel pedestals with square, round, or rectangular bases.
  - 1. Bases: High density polypropylene.
  - 2. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
  - 3. Steel Components: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.

## PART 3 EXECUTION

## 3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

#### 3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

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B. Prepare surfaces using methods recommended by manufacturer for achieving acceptable results for applicable substrate under project conditions.

# 3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions, in manner that maintains roofing system weather-tight integrity.

# 3.04 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

# END OF SECTION 07 7200

#### SECTION 07 8400 FIRESTOPPING

#### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Firestopping systems.
- B. Firestopping of joints and penetrations in fire-resistance-rated and smoke-resistant assemblies<< <u>, whether indicated on drawings or not</u>; or None N/A>><< <u>, and other</u> <u>openings indicated</u>; or None N/A>>.

#### 1.02 RELATED REQUIREMENTS

- A. Section **<u>01 7000 Execution and Closeout Requirements</u>:** Cutting and patching.
- B. Section 07 0553 Fire and Smoke Assembly Identification.
- C. Section 09 2116 Gypsum Board Assemblies: Gypsum wallboard fireproofing.

#### 1.03 REFERENCE STANDARDS

- ASTM E119 Standard Test Methods for Fire Tests of Building Construction and Materials; 2020.
- B. ASTM E814 Standard Test Method for Fire Tests of Penetration Firestop Systems; 2013a (Reapproved 2017).
- C. ASTM E1966 Standard Test Method for Fire-Resistive Joint Systems; 2015 (Reapproved 2019).
- D. ASTM E2174 Standard Practice for On-Site Inspection of Installed Firestop Systems; 2020a.
- E. ASTM E2393 Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers; 2020a.
- F. ASTM E2307 Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-story Test Apparatus; 2020.
- G. ASTM E2837 Standard Test Method for Determining the Fire Resistance of Continuity Headof-Wall Joint Systems Installed Between Rated Wall Assemblies and Nonrated Horizontal Assemblies; 2013 (Reapproved 2017).
- H. ITS (DIR) Directory of Listed Products; current edition.
- I. FM (AG) FM Approval Guide; current edition.
- J. UL 1479 Standard for Fire Tests of Penetration Firestops; Current Edition, Including All Revisions.
- K. UL 2079 Standard for Tests for Fire Resistance of Building Joint Systems; Current Edition, Including All Revisions.
- L. UL (DIR) Online Certifications Directory; Current Edition.
- M. UL (FRD) Fire Resistance Directory; Current Edition.

#### 1.04 SUBMITTALS

- A. See Section **01 3000 Administrative Requirements** for submittal procedures.
- B. Schedule of Firestopping: List << <u>each type of penetration</u>; <u>fire rating of the penetrated</u> <u>assembly</u>; <u>firestopping test or design number</u>; and \_\_\_\_>>.
- C. Product Data: Provide data on << <u>product characteristics; performance ratings;</u> <u>limitations; and \_\_\_\_\_>></u>.
- D. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.
- E. Manufacturer's qualification statement.
- F. Installer's qualification statement.

## 1.05 QUALITY ASSURANCE

- A. Fire Testing: Provide firestopping assemblies of designs that provide the << specified; or <u>scheduled</u>>> fire ratings when tested in accordance with << <u>methods indicated</u>; ASTM E119; ASTM E814; and \_\_\_\_\_>>.
  - 1. Listing in << <u>UL (FRD);</u> FM (AG); ITS (DIR); or \_\_\_>> will be considered as constituting an acceptable test report.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum << <u>three</u>; or \_\_\_\_>> years<< <u>documented</u>; \_\_\_\_; or None N/A>> experience.
- C. Installer Qualifications: Company specializing in performing the work of this section and:
  - Verification of minimum << <u>three</u>; or \_\_\_\_>> years<< documented; \_\_\_\_\_; or <u>None - N/A</u>>> experience installing work of this type.
  - 2. Licensed by local authorities having jurisdiction (AHJ).

#### **1.06 FIELD CONDITIONS**

 Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for << <u>three</u>; or \_\_\_\_>> days after installation of materials.

## PART 2 PRODUCTS

## 2.01 MANUFACTURERS

- A. Firestopping Manufacturers:
  - 1. 3M Fire Protection Products<< ; \_\_\_\_\_; or <u>None N/A</u>>>: www.3m.com/firestop/#sle.
  - 2. Hilti, Inc<< ; \_\_\_\_\_; or <u>None N/A</u>>>: www.us.hilti.com/#sle.
  - 3. Substitutions: << See Section 01 6000 Product Requirements; or Not permitted>>.

# 2.02 MATERIALS

- A. Firestopping Materials: << <u>Any materials meeting requirements</u>; Foam; Caulk or putty; Manufactured device; or \_\_\_\_>>.
- B. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.
- C. Fire Ratings: Refer to drawings for required systems and ratings.

## 2.03 FIRESTOPPING ASSEMBLY REQUIREMENTS

- A. Perimeter Fire Containment Firestopping: Use system that has been tested according to ASTM E2307 to have fire resistance F Rating equal to required fire rating of floor assembly.
  - 1. Where floor assembly is not required to have a fire rating, provide systems that have been tested to show L Rating as indicated.
- B. Head-of-Wall (HW) Joint System Firestopping at Joints Between Fire-Rated Wall Assemblies and Non-Rated Horizontal Assemblies: Use system that has been tested according to ASTM E2837 to have fire resistance F Rating equal to required fire rating of wall assembly.
- C. Floor-to-Floor (FF), Floor-to-Wall (FW), Head-of-Wall (HW), and Wall-to-Wall (WW) Joints, Except Perimeter, Where Both Are Fire-Rated: Use system that has been tested according to ASTM E1966 or UL 2079 to have fire resistance F Rating equal to required fire rating of the assembly in which the joint occurs.
- D. Through Penetration Firestopping: Use system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.
  - 1. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.

# 2.04 FIRESTOPPING FOR PERIMETER CONTAINMENT

## 2.05 FIRESTOPPING FOR FLOOR-TO-FLOOR, FLOOR-TO-WALL, HEAD-OF-WALL, AND WALL-TO-WALL JOINTS

- A. Gypsum Board Walls:
  - 1. Wall-to-Wall Joints That Have Not Been Tested For Movement Capabilities (Static-S):
    - a. 2 Hour Construction: UL System WW-S-0063; Specified Technologies Inc. SpeedFlex TTG Track Top Gasket.
    - b. 1 Hour Construction: UL System WW-S-0063; Specified Technologies Inc. SpeedFlex TTG Track Top Gasket.
  - 2. Wall-to-Wall Joints That Have Movement Capabilities (Dynamic-D):
    - a. 2 Hour Construction: UL System WW-D-0180; Specified Technologies Inc. SpeedFlex TTG Track Top Gasket.
    - b. 2 Hour Construction: UL System WW-D-0067; Hilti CP 606 Flexible Firestop Sealant.
    - c. 1 Hour Construction: UL System WW-D-0067; Hilti CP 606 Flexible Firestop Sealant.
  - 3. Head-of-Wall Joints at Underside of Steel Beam and Concrete Over Metal Deck Floor with Sprayed On Fireproofing:
    - a. 2 Hour Construction: UL System HW-D-0259; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
    - b. 1 Hour Construction: UL System HW-D-0259; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
  - 4. Head-of-Wall Joints at Concrete Over Metal Deck:
    - a. 2 Hour Construction: UL System HW-D-0099; Specified Technologies Inc. SpeedFlex Joint Profile System.
    - b. 1 Hour Construction: UL System HW-D-0099; Specified Technologies Inc. SpeedFlex Joint Profile System.

## 2.06 FIRESTOPPING FOR FLOOR-TO-WALL MOVABLE JOINTS

- A. Floor-To-Wall Joint System That Have Movement Capabilities (Dynamic-D):
  - 1. 2 Hour Construction: UL System FW-D-1069; Tremco, TREMstop Acrylic Firestop Sealant.

# 2.07 FIRESTOPPING PENETRATIONS THROUGH CONCRETE AND CONCRETE MASONRY CONSTRUCTION

- A. Penetrations Through Floors or Walls By:
  - 1. Multiple Penetrations in Large Openings:
    - a. 2 Hour Construction: UL System C-AJ-2863; HoldRite HydroFlame 100 Intumescent Firestop Sealant.
  - 2. Uninsulated Metallic Pipe, Conduit, and Tubing:
    - a. 2 Hour Construction: UL System C-AJ-1090; Specified Technologies Inc. SSP Firestop Putty.
  - 3. Uninsulated Non-Metallic Pipe, Conduit, and Tubing:
  - a. 2 Hour Construction: UL System C-AJ-2109; Hilti CP 643N/644 Firestop Collar.
  - 4. Electrical Cables Not In Conduit:
    - a. 2 Hour Construction: UL System W-J-3046; Specified Technologies Inc. SSP Firestop Putty.
  - 5. Cable Trays with Electrical Cables:
    - a. 2 Hour Construction: UL System C-AJ-4094; Hilti CFS-BL Firestop Block.
  - 6. Insulated Pipes:
    - a. 2 Hour Construction: UL System C-AJ-5087; Specified Technologies Inc. SSS Intumescent Firestop Sealant.
  - 7. HVAC Ducts, Uninsulated:
    - a. 2 Hour Construction: UL System C-AJ-7111; Hilti FS-ONE MAX Intumescent Firestop Sealant.

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B. Penetrations Through Floors By:

1.

- Multiple Penetrations in Large Openings:
  - a. 2 Hour Construction: UL System F-A-8012; Hilti CFS-S SIL GG Firestop Silicone Sealant Gun-Grade or CFS-S SIL SL Firestop Silicone Sealant Self-Leveling.
- 2. Uninsulated Metallic Pipe, Conduit, and Tubing:
  - a. 2 Hour Construction: UL System F-A-1129; Specified Technologies Inc. Closet Flange Firestop Gasket.
- 3. Uninsulated Non-Metallic Pipe, Conduit, and Tubing:
  - a. 2 Hour Construction: UL System F-A-2213; Hilti CFS-DID Drop-In Device.
- 4. Electrical Cables Not In Conduit:
  - a. 2 Hour Construction: UL System F-A-3032; Specified Technologies Inc. Ready Split Sleeve.
- 5. Insulated Pipes:
  - a. 2 Hour Construction: UL System F-A-5041; Specified Technologies Inc. CID Cast-In Device.
- C. Penetrations Through Walls By:
  - 1. Uninsulated Metallic Pipe, Conduit, and Tubing:
    - a. 2 Hour Construction: UL System W-J-1067; Hilti FS-ONE MAX Intumescent Firestop Sealant.
    - b. 1 Hour Construction: UL System W-J-1067; Hilti FS-ONE MAX Intumescent Firestop Sealant.
  - 2. Electrical Cables Not In Conduit:
    - a. 2 Hour Construction: UL System W-J-3182; Specified Technologies Inc. Ready-Sleeve.
  - 3. Insulated Pipes:
    - a. 1 Hour Construction: UL System C-AJ-5091; Hilti FS-ONE MAX Intumescent Firestop Sealant.
  - 4. HVAC Ducts, Uninsulated:
    - a. 2 Hour Construction: UL System W-J-7109; Hilti FS-ONE MAX Intumescent Firestop Sealant, or CP 606 Flexible Firestop Sealant.
  - 5. HVAC Ducts, Insulated:
    - a. 2 Hour Construction: UL System W-J-7112; Hilti FS-ONE MAX Intumescent Firestop Sealant.

# 2.08 FIRESTOPPING PENETRATIONS THROUGH GYPSUM BOARD WALLS

- A. Blank Openings:
  - 1. 2 Hour Construction: UL System W-L-3334; Hilti CP 653 Speed Sleeve.
  - 2. 1 Hour Construction: UL System W-L-3334; Hilti CP 653 Speed Sleeve.
- B. Penetrations By:
  - 1. Multiple Penetrations in Large Openings:
    - a. 2 Hour Construction: UL System W-L-8079; Hilti FS-ONE MAX Intumescent Firestop Sealant.
    - b. 1 Hour Construction: UL System W-L-8079; Hilti FS-ONE MAX Intumescent Firestop Sealant.
  - 2. Uninsulated Metallic Pipe, Conduit, and Tubing:
    - a. 2 Hour Construction: UL System W-L-1054; Hilti FS-ONE MAX Intumescent Firestop Sealant.
    - b. 2 Hour Construction: UL System W-L-1164; Hilti FS-ONE MAX Intumescent Firestop Sealant.
    - c. 1 Hour Construction: UL System W-L-1054; Hilti FS-ONE MAX Intumescent Firestop Sealant.
    - d. 1 Hour Construction: UL System W-L-1164; Hilti FS-ONE MAX Intumescent Firestop Sealant.

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- 3. Uninsulated Non-Metallic Pipe, Conduit, and Tubing:
  - a. 2 Hour Construction: UL System W-L-2078; Hilti CP 643N/644 Firestop Collar.
  - b. 2 Hour Construction: UL System W-L-2128; Hilti FS-ONE MAX Intumescent Firestop Sealant.
  - c. 1 Hour Construction: UL System W-L-2078; Hilti CP 643N/644 Firestop Collar.
  - d. 1 Hour Construction: UL System W-L-2128; Hilti FS-ONE MAX Intumescent Firestop Sealant.
- 4. Electrical Cables Not In Conduit:
  - a. 2 Hour Construction: UL System W-L-3395; Hilti CP653 Speed Sleeve.
  - b. 2 Hour Construction: UL System W-L-3414; Hilti CFS-D Firestop Cable Disc.
  - c. 1 Hour Construction: UL System W-L-3065; Hilti FS-ONE MAX Intumescent Firestop Sealant, CP 606 Flexible Firestop Sealant, CD 601S Elastomeric Firestop Sealant, or CP 618 Firestop Putty Stick.
  - d. 1 Hour Construction: UL System W-L-3334; Hilti CP 653 Speed Sleeve.
- 5. Insulated Pipes:
  - a. 2 Hour Construction: UL System W-L-5028; Hilti FS-ONE MAX Intumescent Firestop Sealant.
  - b. 2 Hour Construction: UL System W-L-5029; Hilti FS-ONE Intumescent Firestop Sealant.
  - c. 1 Hour Construction: UL System W-L-5028; Hilti FS-ONE MAX Intumescent Firestop Sealant.
  - d. 1 Hour Construction: UL System W-L-5029; Hilti FS-ONE Intumescent Firestop Sealant.
- 6. HVAC Ducts, Insulated:
  - a. 2 Hour Construction: UL System W-L-7156; Hilti FS-ONE MAX Intumescent Firestop Sealant.
  - b. 1 Hour Construction: UL System W-L-7156; Hilti FS-ONE MAX Intumescent Firestop Sealant.

## 2.09 FIRESTOPPING SYSTEMS

- A. Firestopping: << <u>Any material meeting requirements.</u>; Foam.; Caulk or putty.; Manufactured device.; \_\_\_\_\_.; or None - N/A>>
- B. Firestopping Between Top of Partition Wall and << <u>Roof Slab</u>; Floor Slab; or \_\_\_\_>>: << <u>Fiber firestopping with smoke seal coating</u>; or \_\_\_\_\_>><< ITS (DIR); FM; <u>UL</u>; or \_\_\_\_\_>> Design No. \_\_\_\_, F Rating << 1-1/2 hour; 1 hour; or 1 <u>hour</u>>><< <u>provide at</u> <u>locations as indicated on drawings</u>; , \_\_\_\_\_; or None N/A>>.

## PART 3 EXECUTION

## 3.01 EXAMINATION

A. Verify openings are ready to receive the work of this section.

#### 3.02 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.
- B. Remove incompatible materials that could adversely affect bond.

#### 3.03 INSTALLATION

A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.

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- B. Do not cover installed firestopping until inspected by authorities having jurisdiction.
- C. Install labeling required by code.

# 3.04 FIELD QUALITY CONTROL

- A. Independent Testing Agency: Inspection agency employed and paid by Owner, will examine penetration firestopping in accordance with ASTM E2174 and ASTM E2393.
- B. Repair or replace penetration firestopping and joints at locations where inspection results indicate firestopping or joints do not meet specified requirements.

#### 3.05 CLEANING

A. Clean adjacent surfaces of firestopping materials.

#### 3.06 PROTECTION

A. Protect adjacent surfaces from damage by material installation.

#### END OF SECTION 07 8400

#### SECTION 07 9200 JOINT SEALANTS

## PART 1 GENERAL

# 1.01 SECTION INCLUDES

- A. Nonsag gunnable joint sealants.
- B. Joint backings and accessories.

# 1.02 RELATED REQUIREMENTS

- A. Section <u>07 2500 Weather Barriers</u>: Sealants required in conjunction with water-resistive barriers.
- B. Section <u>07 2600 Vapor Retarders</u>: Sealants required in conjunction with vapor retarders.
- C. Section <u>07 8400 Firestopping</u>: Firestopping sealants.
- D. Section <u>08 7100 Door Hardware</u>: Setting exterior door thresholds in sealant.
- E. Section <u>08 8000 Glazing</u>: Glazing sealants and accessories.
- F. Section <u>09 2116 Gypsum Board Assemblies</u>: Sealing acoustical and sound-rated walls and ceilings.
- G. Section <u>09 2216 Non-Structural Metal Framing</u>: Sealing between framing and adjacent construction in acoustical and sound-rated walls and ceilings.
- H. Section **<u>09 3000 Tiling</u>**: Sealant between tile and plumbing fixtures and at junctions with other materials and changes in plane.

## 1.03 REFERENCE STANDARDS

- A. ASTM C834 Standard Specification for Latex Sealants; 2017.
- B. ASTM C919 Standard Practice for Use of Sealants in Acoustical Applications; 2018.
- C. ASTM C920 Standard Specification for Elastomeric Joint Sealants; 2018.
- D. ASTM C1193 Standard Guide for Use of Joint Sealants; 2016.
- E. ASTM C1248 Standard Test Method for Staining of Porous Substrate by Joint Sealants; 2018.
- F. ASTM C1330 Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants; 2018.

## 1.04 SUBMITTALS

- A. See Section **<u>01 3000 Administrative Requirements</u>** for submittal procedures.
- B. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes the following.
  - 1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
  - 2. List of backing materials approved for use with the specific product.
  - 3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
  - 4. Substrates the product should not be used on.
- C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.
- D. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.
- E. Manufacturer's qualification statement.
- F. Executed warranty.

# 1.05 QUALITY ASSURANCE

#### 1.06 WARRANTY

- A. See Section <u>01 7800 Closeout Submittals</u> for additional warranty requirements.
- B. Correct defective work within a << <u>five;</u> or \_\_\_\_> year period after Date of Substantial Completion.
- C. Warranty: Include coverage for installed sealants and accessories that fail to achieve watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

## PART 2 PRODUCTS

#### 2.01 MANUFACTURERS

- A. Non-Sag Sealants: Permits application in joints on vertical surfaces without sagging or slumping.
  - 1. Dow<<; \_\_\_\_; or None N/A>>: www.dow.com/#sle.
  - 2. Henry Company<<; \_\_\_\_; or None N/A>>: www.henry.com/#sle.
  - 3. Sherwin-Williams Company<< ; \_\_\_\_; or None N/A>>: www.sherwinwilliams.com/#sle.
  - 4. Substitutions: << See Section 01 6000 Product Requirements; or Not permitted>>.

#### 2.02 JOINT SEALANT APPLICATIONS

- A. Scope:
  - 1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to, the following items.
    - a. Joints between door, window, and other frames and adjacent construction.
    - b. Joints between different exposed materials.
    - c. Other joints indicated below.
  - 2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
    - a. Joints between door, window, and other frames and adjacent construction.
    - b. In sound-rated wall and ceiling assemblies, gaps at electrical outlets, wiring devices, piping, and other openings; between wall/ceiling and other construction; and other flanking sound paths.
    - c. Other joints indicated below.
  - 3. Do not seal the following types of joints.
    - a. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
    - b. Joints where installation of sealant is specified in another section.
    - c. Joints between suspended panel ceilings/grid and walls.
- B. << Type \_\_\_\_-; or <u>None N/A</u>>>Exterior Joints: Use non-sag << <u>non-staining silicone</u>; silyl-terminated polyether/polyurethane; polyurethane; acrylic-urethane; or \_\_\_\_\_>> sealant, unless otherwise indicated.
- C. << Type \_\_\_\_ ; or <u>None N/A</u>>>Interior Joints: Use non-sag << <u>polyurethane</u>; or \_\_\_\_\_>> sealant, unless otherwise indicated.
  - 1. << Type \_\_\_\_\_ ; or <u>None N/A</u>>>Joints between Fixtures in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant; << <u>white</u>; clear; or \_\_\_\_\_>>.
  - 2. << Type \_\_\_\_ ; or <u>None N/A</u>>>In Sound-Rated Assemblies: << <u>Acrylic emulsion</u> <u>latex;</u> or \_\_\_\_\_> sealant.
- D. Interior Wet Areas: << <u>Bathrooms</u>; <u>restrooms</u>; <u>kitchens</u>; <u>food service areas</u>; <u>food processing areas</u>; and \_\_\_\_\_>; fixtures in wet areas include << <u>plumbing fixtures</u>; food service equipment; <u>countertops</u>; cabinets; other similar items; and \_\_\_\_\_>>.
- E. Sound-Rated Assemblies: Walls and ceilings identified as "STC-rated", "sound-rated", or "acoustical".

# 2.03 NONSAG JOINT SEALANTS

- A. << Type \_\_\_\_\_- ; or <u>None N/A</u>>>Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
  - Non-Staining to Porous Stone: Non-staining to light-colored << <u>natural stone</u>; marble; or \_\_\_\_\_>> when tested in accordance with ASTM C1248.
  - 2. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
  - Color: << <u>Match adjacent finished surfaces</u>; As scheduled; As shown on drawings; or \_\_\_\_\_>>.
  - 4. Manufacturers:
    - a. Dow<< <u>; DOWSIL 756 SMS Building Sealant;</u> ; \_\_\_\_; or None N/A>>: www.dow.com/#sle.
    - b. Dow<< <u>; DOWSIL 791 Silicone Weatherproofing Sealant;</u> ; \_\_\_\_; or None N/A>>: www.dow.com/#sle.
- B. << Type \_\_\_\_\_-; or <u>None N/A</u>>>Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.
  - 1. Color: << White; Clear; Aluminum; Black; or \_\_\_\_>>.
  - 2. Manufacturers:
    - a. Sika Corporation<< <u>; Sikasil GP;</u> ; \_\_\_\_\_; or None N/A>>: www.usa.sika.com/#sle.
    - b. Substitutions: << <u>See Section 01 6000 Product Requirements</u>; or Not permitted>>.
- C. << Type \_\_\_\_-; or <u>None N/A</u>>>Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; << <u>single or multi-component</u>; single component; multi-component; or \_\_\_\_>>; not expected to withstand continuous water immersion or traffic.
  - Movement Capability: << Plus 100 percent, minus 50 percent; Plus and minus 50 percent; Plus and minus 35 percent; Plus and minus 25 percent; Plus and minus 12.5 percent; Plus and minus \_\_\_\_\_\_ percent; or \_\_\_\_\_>>, minimum.
  - Color: << <u>Match adjacent finished surfaces</u>; As shown on drawings; As scheduled; or \_\_\_\_\_>>.
  - 3. Manufacturers:
    - a. Sika Corporation<< <u>; Sikaflex-15 LM</u>; <u>;</u> ; or None N/A>>: www.usa.sika.com/#sle.
    - b. Substitutions: << <u>See Section 01 6000 Product Requirements</u>; or Not permitted>>.
- D. **<< Type** -; or <u>None N/A</u>>>Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use.
  - Color: To be selected by Architect from manufacturer's << <u>standard</u>; full; custom; or \_\_\_\_\_\_>> range.
  - 2. Manufacturers:
    - a. Sherwin-Williams Company<< <u>; 850A Acrylic Latex Caulk;</u> ; \_\_\_\_\_; or None N/A>>: www.sherwin-williams.com/#sle.
    - b. Substitutions: << <u>See Section 01 6000 Product Requirements</u>; or Not permitted>>.

## 2.04 ACCESSORIES

- A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.
  - << Type for Joints Not Subject to Pedestrian or Vehicular Traffic; or \_\_\_\_\_>>: ASTM C1330<< ; Type O - Open Cell Polyurethane; ; Type C - Closed Cell Polyethylene; ; Type B - Bi-Cellular Polyethylene; or ; \_\_\_\_\_>>.

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- 2. Type for Joints Subject to Pedestrian or Vehicular Traffic: ASTM C1330<< ; Type C Closed Cell Polyethylene; ; Type B Bi-Cellular Polyethylene; or ; \_\_\_\_>>.
- 3. Open Cell: << 40 to 50; or \_\_\_\_>> percent larger in diameter than joint width.
- 4. Closed Cell and Bi-Cellular: << <u>25 to 33;</u> or \_\_\_\_>> percent larger in diameter than joint width.
- B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.

# PART 3 EXECUTION

## 3.01 EXAMINATION

- A. Verify that joints are ready to receive work.
- B. Verify that backing materials are compatible with sealants.
- C. Verify that backer rods are of the correct size.

#### 3.02 PREPARATION

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
- D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

#### 3.03 INSTALLATION

- A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Perform installation in accordance with ASTM C1193.
- C. Perform acoustical sealant application work in accordance with ASTM C919.
- D. Install bond breaker backing tape where backer rod cannot be used.
- E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
- F. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.
- G. Nonsag Sealants: Tool surface << <u>concave</u>; flush; slightly recessed; or \_\_\_\_\_>>, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

## END OF SECTION 07 9200
### SECTION 07 9513 EXPANSION JOINT COVER ASSEMBLIES

# PART 1 GENERAL

# 1.01 SECTION INCLUDES

A. Expansion joint cover assemblies for << <u>floor;</u> <u>wall;</u> <u>ceiling;</u> <u>soffit;</u> and \_\_\_\_\_>> surfaces.

# 1.02 RELATED REQUIREMENTS

- A. Section <u>05 5000 Metal Fabrications</u>: Custom fabricated metal expansion and control joint devices.
- B. Section 07 4213 Metal Wall Panels
- C. Section 07 4213.19 Insulated Metal Wall Panels
- D. Section 07 5323 Ethylene-Propylenediene-Monomer (EPDM) Roofing
- E. Section 07 6200 Sheet Metal Flashing and Trim: Roof expansion and control joint covers.
- F. Section 07 7100 Roof Specialties: Roof expansion and control joint covers.
- G. Section <u>07 9200 Joint Sealants</u>: Sealing expansion and control joints using gunnable and pourable sealants.
- H. Section 09 2116 Gypsum Board Assemblies: Gypsum board control joint trim.
- I. Section **09 2116 Gypsum Board Assemblies**: Placement of expansion joint assemblies in gypsum board walls and ceilings.
- J. Section <u>09 5100 Acoustical Ceilings</u>: Expansion joint assemblies in suspended ceiling grids.

# 1.03 REFERENCE STANDARDS

- A. ASTM B221 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2020.
- B. ASTM B221M Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.
- C. ASTM B308/B308M Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles; 2020.

# 1.04 ADMINISTRATIVE REQUIREMENTS

A. Installation Templates: For frames and anchors to be embedded in concrete or masonry, furnish templates to relevant installers; include installation instructions and tolerances.

# 1.05 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements for submittal procedures.
- B. Product Data: Provide joint assembly profiles, profile dimensions, << <u>anchorage devices</u>; <u>available colors and finish</u>; and \_\_\_\_>>.
- C. Shop Drawings: Indicate joint and splice locations, miters, layout of the work, << <u>affected</u> <u>adjacent construction</u>; <u>anchorage locations</u>; and \_\_\_\_\_>>.
- D. Samples: Submit << <u>two</u>; or \_\_\_\_>> samples <u>12 inch</u> long, illustrating profile, dimension, color, and finish selected.
- E. Manufacturer's Installation Instructions: Indicate rough-in sizes and required tolerances for item placement.

# PART 2 PRODUCTS

# 2.01 MANUFACTURERS

- A. Expansion Joint Cover Assemblies:
  - 1. Substitutions: << See Section 01 6000 Product Requirements; or Not permitted>>.

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# 2.02 EXPANSION JOINT COVER ASSEMBLY APPLICATIONS

- A. Interior Floor Joints Subject to Seismic Movement:
- B. Interior Non-Fire-Rated Wall/Ceiling Joints Subject to Seismic Movement:
- C. Interior Fire-Rated Wall/Ceiling Joints Subject to Seismic Movement:
- D. Interior Fire-Rated Floor/Wall Joints Subject to Seismic Movement:
- E. Exterior Wall Joints Subject to Seismic Movement:
- F. Exterior Roof Bellows with Metal Flange Expansion Joint Covers:

# 2.03 EXPANSION JOINT COVER ASSEMBLIES

- A. Expansion Joint Cover Assemblies General: Factory-fabricated and assembled; designed to completely fill joint openings, sealed to prevent passage of air, dust, water, smoke; suitable for traffic expected.
  - 1. Joint Dimensions and Configurations: As indicated on drawings.
  - 2. Joint Cover Sizes: Selected to suit joint width and configuration, based on manufacturer's published recommendations and limitations.
  - 3. Joint Movement Capability: 12 inches minimum.
  - 4. Lengths: Provide covers in full lengths required; avoid splicing.
  - 5. Anchors, Fasteners, and Fittings: Provided by cover manufacturer.
- B. Floor Joint Covers: Coordinate with indicated floor coverings.
- C. Covers in Fire Rated Assemblies: Provide cover assembly having fire rating equivalent to that of assembly into which it is installed.

# 2.04 MATERIALS

- A. Extruded Aluminum: ASTM B221 (ASTM B221M)<< , <u>6063 alloy, T6 temper;</u>, <u>alloy,</u> temper; or None N/A>>; or ASTM B308/B308M, 6061 alloy, T6 temper.
  - 1. Exposed Finish Outdoors: << Natural anodized; Medium bronze anodized; Dark bronze anodized; or match adjacent material>>.
  - 2. Exposed Finish at Floors: Mill finish or natural anodized.
  - 3. Exposed Finish at Walls and Ceilings: << Natural anodized; Medium bronze anodized; Dark bronze anodized; or match adjacent material>>.
- B. Anchors and Fasteners: As recommended by cover manufacturer.
- C. Backing Paint for Aluminum Components in Contact with Cementitious Materials: << <u>Asphaltic;</u> or \_\_\_\_\_>> type.

# 2.05 ACCESSORIES

A. Resilient Fire Barrier: For use with metal expansion joint covers and elastomeric seals without use of mechanical fasteners, with fire rating in accordance with surrounding construction performance capabilities.

# PART 3 EXECUTION

# 3.01 EXAMINATION

- A. Verify that joint preparation and dimensions are acceptable and in accordance with manufacturer's requirements.
- B. Verify that frames and anchors installed by others are in correct locations and suitable for installation of remainder of assembly.

# 3.02 INSTALLATION

- A. Install components and accessories in accordance with manufacturer's instructions.
- B. Align work plumb and level<< <u>, flush with adjacent surfaces;</u> or None N/A>>.
- C. Rigidly anchor to substrate to prevent misalignment.

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Design Development Phase	07 9513 - 2	Assemblies

# 3.03 PROTECTION

- A. Do not permit traffic over unprotected floor joint surfaces.
- B. Provide << <u>strippable coating;</u> reinforced cloth tape; or \_\_\_\_\_>> to protect finish surface.

END OF SECTION 07 9513

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### SECTION 08 1113 HOLLOW METAL DOORS AND FRAMES

# PART 1 GENERAL

# 1.01 SECTION INCLUDES

- A. Non-fire-rated hollow metal doors and frames.
- B. Hollow metal frames for wood doors.
- C. Fire-rated hollow metal doors and frames.
- D. Thermally insulated hollow metal doors with frames.

# 1.02 RELATED REQUIREMENTS

- A. Section 08 7100 Door Hardware.
- B. Section <u>08 8000 Glazing</u>: Glass for doors and borrowed lites.
- C. Section 09 9113 Exterior Painting: Field painting.
- D. Section 09 9123 Interior Painting: Field painting.

# 1.03 REFERENCE STANDARDS

- A. ADA Standards Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. ANSI/SDI A250.4 Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2011.
- C. ANSI/SDI A250.8 Specifications for Standard Steel Doors and Frames (SDI-100); 2017.
- D. ANSI/SDI A250.10 Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2011.
- E. ASTM A653/A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.
- F. ASTM A1008/A1008M Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2020.
- G. ASTM A1011/A1011M Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2018a.
- H. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials; 2021.
- I. BHMA A156.115 American National Standard for Hardware Preparation in Steel Doors and Steel Frames; 2016.
- J. ICC A117.1 Accessible and Usable Buildings and Facilities; 2017.
- K. ITS (DIR) Directory of Listed Products; current edition.
- L. NAAMM HMMA 830 Hardware Selection for Hollow Metal Doors and Frames; 2002.
- M. NAAMM HMMA 831 Hardware Locations for Hollow Metal Doors and Frames; 2011.
- N. NAAMM HMMA 840 Guide Specifications For Receipt, Storage and Installation of Hollow Metal Doors and Frames; 2007.
- O. NFPA 80 Standard for Fire Doors and Other Opening Protectives; 2019.
- P. NFPA 105 Standard for Smoke Door Assemblies and Other Opening Protectives; 2019.
- Q. NFPA 252 Standard Methods of Fire Tests of Door Assemblies; 2017.
- R. UL (DIR) Online Certifications Directory; Current Edition.
- S. UL 10C Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

T. UL 1784 - Standard for Air Leakage Tests of Door Assemblies; Current Edition, Including All Revisions.

# 1.04 SUBMITTALS

- A. See Section **01 3000 Administrative Requirements** for submittal procedures.
- B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes<< <u>; and one</u> <u>copy of referenced standards/guidelines;</u> or None N/A>>.
- C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.
- D. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.

#### 1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Provide hollow metal doors and frames from SDI Certified manufacturer: https://steeldoor.org/sdi-certified/#sle.
- B. Maintain at project site copies of reference standards relating to installation of products specified.

#### 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
- B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

# PART 2 PRODUCTS

### 2.01 MANUFACTURERS

- A. Hollow Metal Doors and Frames:
  - 1. Ceco Door, an Assa Abloy Group company<< ; \_\_\_\_\_; or None N/A>>: www.assaabloydss.com/#sle.
  - 2. Curries, an Assa Abloy Group company<< ; \_\_\_\_\_; or None N/A>>: www.assaabloydss.com/#sle.
  - Mesker, dormakaba Group<< ; FDJ Series Drywall Frames; ; F Series Masonry Frames; ; N Series Doors; ; Windstorm Series, Hurricane Doors and Frames; ; Embossed Panel Doors; ; Steel Stiffened ST Doors; ; \_\_\_\_; or None - N/A>>: www.meskeropeningsgroup.com/#sle.
  - 4. Republic Doors, an Allegion brand<< ; \_\_\_\_; or None N/A>>: www.republicdoor.com/#sle.
  - 5. Steelcraft, an Allegion brand<< ; \_\_\_\_; or None N/A>>: www.allegion.com/#sle.
  - 6. Substitutions: << <u>See Section 01 6000 Product Requirements;</u> Not permitted; or >>.

# 2.02 PERFORMANCE REQUIREMENTS

- A. Requirements for Hollow Metal Doors and Frames:
  - 1. Steel Sheet: Comply with one or more of the following requirements; galvannealed steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
  - 2. Accessibility: Comply with ICC A117.1 and ADA Standards.
  - 3. << <u>Exterior</u>; \_\_\_\_\_; or None N/A>>Door Top Closures: Flush end closure channel, with top and door faces aligned.
  - 4. Door Edge Profile: << <u>Manufacturers standard for application indicated</u>; Beveled, both sides; Hinged edge square, and lock edge beveled; or \_\_\_\_>>.

- 5. Typical Door Face Sheets: << <u>Flush.;</u> Flush with inlays; Flush with texture.; Flush with wood grain.; Embossed.; Embossed with texture.; Embossed with wood grain.; \_\_\_\_\_\_.; or None N/A>><< Refer to Door Schedule for additional information.; \_\_\_\_\_\_.; or <u>None N/A</u>>>
- Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. << <u>Style: Manufacturer's standard.</u>; Style: Flush.; Style: Overlap.; Style: Security.; Style: \_\_\_\_\_.; or None - N/A>>
- 7. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
- 8. Zinc Coating for Typical Interior and/or Exterior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvannealed) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.
  - a. Based on SDI Standards: Provide at least A40/ZF120 (galvannealed) when necessary, coating not required for typical interior door applications, and at least A60/ZF180 (galvannealed) for corrosive locations.
- B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

# 2.03 HOLLOW METAL DOORS

- A. Door Finish: << Factory primed and field finished; Factory finished; or \_\_\_\_>>.
- B. << Type \_\_\_\_,; \_\_\_\_,; or <u>None N/A</u>>>Exterior Doors: Thermally insulated. << Provide firerated door construction as indicated for door Type \_\_\_\_, Fire-Rated Doors and the following exterior door requirements.; or <u>None - N/A</u>>>
  - 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
    - a. Level << 1 Standard-duty; <u>2 Heavy-duty</u>; 3 Extra Heavy-duty; 4 Maximumduty; or \_\_\_\_>>.
    - Physical Performance << Level C, 250,000 cycles; <u>Level B, 500,000 cycles</u>; Level A, 1,000,000 cycles; or \_\_\_\_>; in accordance with ANSI/SDI A250.4.
    - c. Model << <u>1 Full Flush;</u> 2 Seamless; 3 Stile and Rail; or \_\_\_\_>>.
    - d. Door Face Metal Thickness: << 20 gauge, 0.032 inch; <u>18 gauge, 0.042 inch</u>; <u>16 gauge, 0.053 inch</u>; <u>14 gauge, 0.067 inch</u>; or <u>gauge, inch</u>>>, minimum.
    - e. Zinc Coating: << <u>A60/ZF180;</u> or A \_\_/ZF \_\_>> galvannealed coating; ASTM A653/A653M.
  - Door Core Material: << <u>Manufacturers standard core material/construction and in</u> <u>compliance with requirements;</u> Polystyrene, 1 lbs/cu ft minimum density; Polyurethane, 1.8 lbs/cu ft minimum density; Polyisocyanurate, 2 lbs/cu ft minimum density; Vertical steel stiffeners with fiberglass batts; or \_\_\_\_>>.
    - a. Foam Plastic Insulation: Manufacturer's standard board insulation with maximum flame spread index (FSI) of 75, and maximum smoke developed index (SDI) of 450 in accordance with ASTM E84, and completely enclosed within interior of door.
  - 3. Door Thickness: << 1-3/8 inches; <u>1-3/4 inches;</u> or <u>inches>></u>, nominal.
  - 4. Weatherstripping: << <u>Refer to Section 08 7100</u>; Integral, recessed into door edge or frame; or \_\_\_\_\_>>.
  - 5. Door Finish: << Factory primed and field finished; Factory finished; or \_\_\_\_>>.
- C. << Type \_\_\_\_\_;; \_\_\_\_\_; or <u>None N/A</u>>>Interior Doors, Non-Fire-Rated:
  - 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
    - a. Level << 1 Standard-duty; <u>2 Heavy-duty</u>; 3 Extra Heavy-duty; 4 Maximumduty; or \_\_\_\_>>.

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- b. Physical Performance << Level C, 250,000 cycles; <u>Level B, 500,000 cycles;</u> Level A, 1,000,000 cycles; or \_\_\_\_>; in accordance with ANSI/SDI A250.4.
- c. Model << 1 Full Flush; 2 Seamless; 3 Stile and Rail; or \_\_\_\_>>.
- d. Door Face Metal Thickness: << 20 gauge, 0.032 inch; <u>18 gauge, 0.042 inch</u>; <u>16 gauge, 0.053 inch</u>; <u>14 gauge, 0.067 inch</u>; or <u>gauge, inch>></u>, minimum.
- e. Zinc Coating: << <u>A60/ZF180;</u> or A \_\_\_/ZF \_\_\_>> galvannealed coating; ASTM A653/A653M.
- Door Core Material: << <u>Manufacturers standard core material/construction and in</u> <u>compliance with requirements</u>; Kraftpaper honeycomb; Vertical steel stiffeners; or >>.
- 3. Door Thickness: << 1-3/8 inches; <u>1-3/4 inches;</u> or \_\_\_\_\_ inches>>, nominal.
- 4. Door Finish: << Factory primed and field finished; Factory finished; or \_\_\_\_>>.
- D. << Type \_\_\_\_\_; \_\_\_\_\_; or None N/A>>Fire-Rated Doors:
  - 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
    - a. Level << 1 Standard-duty; <u>2 Heavy-duty</u>; 3 Extra Heavy-duty; 4 Maximumduty; or \_\_\_\_>>.
    - b. Physical Performance << Level C, 250,000 cycles; <u>Level B 500 000 cycles</u>; Level A, 1,000,000 cycles; or \_\_\_\_>; in accordance with ANSI/SDI A250.4.
    - c. Model << <u>1 Full Flush;</u> 2 Seamless; 3 Stile and Rail; or \_\_\_\_>>.
    - d. Door Face Metal Thickness: << <u>20 gauge, 0.032 inch</u>; 18 gauge, 0.042 inch; 16 gauge, 0.053 inch; 14 gauge, 0.067 inch; or <u>gauge</u>, <u>inch</u>>>, minimum.
    - e. Zinc Coating: << <u>A60/ZF180;</u> or A \_\_ /ZF \_\_\_> galvannealed coating; ASTM A653/A653M.
  - Fire Rating: << <u>As indicated on Door Schedule</u>; As indicated on drawings; 3 hours; 1-1/2 hours; 1 hour; 3/4 hour; 20 minutes; or \_\_\_\_\_>>, tested in accordance with << <u>UL 10C and NFPA 252 ("positive pressure fire tests")</u>; UL 10B ("neutral or negative pressure fire tests"); or \_\_\_\_\_>>.
  - Provide units listed and labeled by << <u>UL (DIR)</u>; <u>ITS (DIR)</u>; or \_\_\_\_>>.
    Attach fire rating label to each fire rated unit.
  - Smoke and Draft Control Doors<< <u>(Indicated with letter "S" on Drawings and/or Door</u> <u>Schedule</u>); (\_\_\_\_\_); or None - N/A>>: Self-closing or automatic closing doors in accordance with NFPA 80 and NFPA 105, with fire-resistance-rated wall construction rated the same or greater than the fire-rated doors, and the following;
    - Maximum Air Leakage: << <u>3.0 cfm/sq ft</u>; or \_\_\_\_ cfm/sq ft>> of door opening at << <u>0.10 inch w.g.</u>; or \_\_\_\_ inch w.g>> pressure, when tested in accordance with UL 1784 at both ambient and elevated temperatures.
    - b. Gasketing: << <u>Provide gasketing or edge sealing as necessary to achieve</u> <u>leakage limit;</u> or \_\_\_\_\_>>.
    - c. Label: Include the "S" label on fire-rating label of door.
  - Door Core Material: << <u>Manufacturers standard core material/construction in</u> <u>compliance with requirements</u>; Mineral board; Vertical steel stiffeners; or \_\_\_\_>.
  - 6. Door Thickness: << 1-3/8 inches; <u>1-3/4 inches;</u> or \_\_\_\_ inches>>, nominal.
  - 7. Door Finish: << Factory primed and field finished; Factory finished; or \_\_\_\_>>.

#### 2.04 HOLLOW METAL FRAMES

- A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.
- B. Frame Finish: << <u>Factory primed and field finished</u>; Same as hollow metal door; Factory finished; or \_\_\_\_\_>>.
- C. Exterior Door Frames: << Knock-down type; <u>Face welded type</u>; Full profile/continuously welded type; or \_\_\_\_\_>>.
  - 1. Frame Metal Thickness: << <u>18 gauge, 0.042 inch</u>; <u>16 gauge, 0.053 inch</u>; <u>14 gauge, 0.067 inch</u>; <u>12 gauge, 0.093 inch</u>; <u>or \_\_\_\_ gauge, \_\_\_\_ inch</u>>>, minimum.

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- 2. Weatherstripping: << Integral, recessed into frame edge; <u>Separate, see Section 08</u> <u>7100;</u> or \_\_\_\_>>.
- D. Interior Door Frames, Non-Fire Rated: << Knock-down type; Slip-on type; Slip-on type at gypsum board walls, and knock-down type at masonry walls; Face welded type; <u>Full</u> profile/continuously welded type; or \_\_\_\_>>.
  - 1. Frame Metal Thickness: << <u>18 gauge, 0.042 inch</u>; 16 gauge, 0.053 inch; 14 gauge, 0.067 inch; 12 gauge, 0.093 inch; or <u>gauge</u>, inch>>, minimum.
- E. Door Frames, Fire-Rated: << Knock-down type; Slip-on type; Slip-on type at gypsum board walls, and knock-down type at masonry walls; <u>Face welded type</u>; Full profile/continuously welded type; or \_\_\_\_>>.
  - 1. Fire Rating: Same as door, labeled.
  - Terminated Stops: Provide at << <u>interior doors</u>; or \_\_\_\_>; closed end stop terminated << <u>6 inch</u>; or \_\_\_\_\_ inch>>, maximum, above floor at << <u>45 degree</u>; 90 degree; or \_\_\_\_\_> angle.
  - 3. Frame Metal Thickness: << <u>18 gauge, 0.042 inch</u>; 16 gauge, 0.053 inch; 14 gauge, 0.067 inch; 12 gauge, 0.093 inch; or <u>gauge</u>, <u>inch>></u>, minimum.
- F. Exterior Four-Sided Frame: Face welded type
  - 1. Frame Metal Thickness: 18 gauge, 0.042 inch, minimum.
- G. Frames for Wood Doors: Comply with frame requirements in accordance with corresponding door.
- H. Frames Wider than << <u>48 inches</u>; or \_\_\_\_ inches>>: Reinforce with steel channel fitted tightly into frame head, flush with top.

# 2.05 FINISHES

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10<< <u>, door manufacturer's</u> <u>standard</u>; , air dried; , baked on; , zinc molybdate type; , \_\_\_\_\_; or None - N/A>>.

# 2.06 ACCESSORIES

- A. Door Window Frames: Door window frames with glazing securely fastened within door opening.
  - 1. Size: << 12 inch wide by 12 inch high; \_\_\_\_ inch wide by \_\_\_\_ inch high; <u>As</u> indicated on drawings; or \_\_\_\_>>.
  - Frame Material: << <u>18 gauge, 0.0478 inch</u>; or <u>gauge, inch</u>>>, << <u>galvanized</u> <u>steel</u>; stainless steel; or <u>>><<</u>, and wrapped in wood veneer; , with finish to match door; , <u>;</u> or <u>None N/A</u>>>.
  - 3. Glazing: << <u>1/4 inch</u>; 5/16 inch; 3/8 inch; or \_\_\_\_ inch>> thick, << <u>tempered glass</u>; or \_\_\_\_\_>>, in compliance with requirements of authorities having jurisdiction.
- C. Removable Stops: << Formed sheet steel; Rolled steel bar; or \_\_\_\_>>,<< shape as indicated on drawings,; \_\_\_\_\_,; or <u>None N/A</u>>> << butted; mitered; <u>mitered or butted;</u> or \_\_\_\_>> corners<< ; prepared for countersink style tamper proof screws; ; \_\_\_\_; or None N/A>>.
- D. Astragals for Double Doors: << <u>Specified in Section 08 7100.</u>; Specified in Section .; \_\_\_\_\_; or None N/A>>
- E. Silencers: Resilient << <u>rubber</u>; vinyl; rubber or vinyl; or \_\_\_\_>>, << <u>fitted into drilled</u> <u>hole</u>; stick-on type; or \_\_\_\_\_>>; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.
- F. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

# PART 3 EXECUTION

# 3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Verify that finished walls are in plane to ensure proper door alignment.

### 3.02 PREPARATION

A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

#### 3.03 INSTALLATION

- A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.
- B. Install fire rated units in accordance with NFPA 80.
- C. Coordinate frame anchor placement with wall construction.
- D. Install door hardware as specified in Section **08 7100**.
- E. Comply with glazing installation requirements of Section 08 8000.
- F. Coordinate installation of electrical connections to electrical hardware items.

# 3.04 TOLERANCES

A. Maximum Diagonal Distortion: << <u>1/16 inch</u>; 1/8 inch; or \_\_\_\_ inch>> measured with straight edge, corner to corner.

# 3.05 ADJUSTING

- A. Adjust for smooth and balanced door movement.
- 3.06 SCHEDULE<< SEE DRAWINGS; \_\_\_\_\_; OR NONE N/A>>
  - Refer to Door and Frame Schedule << <u>on the drawings</u>; appended to this section; appended to Section \_\_\_\_\_; or \_\_\_\_>>.

# END OF SECTION 08 1113

### SECTION 08 1213 HOLLOW METAL FRAMES

# PART 1 GENERAL

# 1.01 SECTION INCLUDES

- A. Non-fire-rated hollow metal frames for non-hollow metal doors.
- B. Fire-rated hollow metal frames for non-hollow metal doors.
- C. << <u>Interior</u>; Interior and exterior; or Exterior>> glazed borrowed lite frames.

# 1.02 RELATED REQUIREMENTS

- A. Section 08 1416 Flush Wood Doors: Non-hollow metal door for hollow metal frames.
- B. Section <u>08 7100 Door Hardware</u>: << <u>Hardware</u>; <u>silencers</u>; <u>weatherstripping</u>; and \_\_\_\_\_>>.
- C. Section <u>08 8000 Glazing</u>: Glazed borrowed lites.
- D. Section 09 9123 Interior Painting: Field painting.

# 1.03 REFERENCE STANDARDS

- A. AAMA/WDMA/CSA 101/I.S.2/A440 North American Fenestration Standard/Specification for Windows, Doors, and Skylights; 2017.
- B. ADA Standards Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- C. ANSI/SDI A250.4 Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2011.
- D. ANSI/SDI A250.8 Specifications for Standard Steel Doors and Frames (SDI-100); 2017.
- E. ASTM A653/A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.
- F. ASTM A1008/A1008M Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2020.
- G. ASTM A1011/A1011M Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2018a.
- H. ICC A117.1 Accessible and Usable Buildings and Facilities; 2017.
- I. ITS (DIR) Directory of Listed Products; current edition.
- J. NAAMM HMMA 831 Hardware Locations for Hollow Metal Doors and Frames; 2011.
- K. NFPA 80 Standard for Fire Doors and Other Opening Protectives; 2019.
- L. NFPA 105 Standard for Smoke Door Assemblies and Other Opening Protectives; 2019.
- M. NFPA 252 Standard Methods of Fire Tests of Door Assemblies; 2017.
- N. SDI 117 Manufacturing Tolerances for Standard Steel Doors and Frames; 2013.
- O. UL (DIR) Online Certifications Directory; Current Edition.
- P. UL 10B Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.
- Q. UL 10C Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

# 1.04 SUBMITTALS

- A. See Section <u>01 3000 Administrative Requirements</u> for submittal procedures.
- B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes<< <u>; and one copy of referenced grade standard</u>; or None N/A>>.

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- C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and identifying location of different finishes, if any.
- D. Samples: Submit << <u>one sample</u>; two samples; or <u>samples</u>>> of frame metal, << <u>2 by 2</u> <u>inches</u>; or <u>by</u> inches>>, showing factory finishes, colors, and surface textures.
- E. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.
- F. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.
- G. Installer's Qualification Statement.

#### 1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than << <u>three</u>; or \_\_\_\_>> years of<< <u>documented</u>; \_\_\_\_; or None N/A>> experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least << <u>three;</u> or \_\_\_\_>> years of<< <u>documented;</u> \_; or None N/A>> experience<< and approved by manufacturer; or <u>None N/A</u>>>.

#### 1.06 DELIVERY, STORAGE, AND HANDLING

# PART 2 PRODUCTS

#### 2.01 MANUFACTURERS

- A. Hollow Metal Frames<< <u>with Integral Casings</u>; or None N/A>>:
  - 1. Ceco Door, an Assa Abloy Group company<< ; \_\_\_\_\_; or None N/A>>: www.assaabloydss.com/#sle.
  - 2. Fleming Door Products, an Assa Abloy Group company<< ; \_\_\_\_\_; or None N/A>>: www.assaabloydss.com/#sle.
  - 3. Republic Doors, an Allegion brand<< ; \_\_\_\_; or None N/A>>: www.republicdoor.com/#sle.
- B. Hollow Metal Frames with Applied Casings, Prefinished:
  - 1. Substitutions: << See Section 01 6000 Product Requirements; or Not permitted>>.

# 2.02 PERFORMANCE REQUIREMENTS

- A. Hollow Metal Frames: AAMA/WDMA/CSA 101/I.S.2/A440 requirements for specific frame type:
  1. Performance Class (PC): << <u>AW</u>; R; LC; CW; or \_\_\_\_>>.
- B. Refer to Door and Frame Schedule << <u>on drawings</u>; <u>appended to this section</u>; <u>appended to Section</u>; <u>or</u> \_\_\_\_\_>> for frame sizes, fire ratings, sound ratings, finishing, door hardware to be installed, and other variations, if any.
- C. Steel Sheet: Comply with one or more of the following requirements; galvannealed steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
- D. Accessibility: Comply with ICC A117.1 and ADA Standards.
- E. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. << <u>Style: Manufacturers standard.</u>; Style: Flush.; Style: Overlap.; Style: Security.; Style: \_\_\_\_\_.; or None - N/A>>

# 2.03 HOLLOW METAL DOOR FRAMES WITH INTEGRAL CASINGS

- A. Frame Finish: << Factory finished; Factory primed and field finished; or \_\_\_\_>>.
- B. << <u>Type</u>,; \_\_\_\_,; or None N/A>>Exterior Door Frames: << Knock-down type; Face welded type; <u>Full profile/continuously welded type</u>; As required for fire-rated frame; or \_\_\_\_>>. << Provide fire-rated door frame construction as indicated for door frame Type \_\_\_, Fire-Rated Door Frames, and the following exterior door frame

### requirements.; or None - N/A>>

- 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
  - Level << 1 Standard-duty; 2 Heavy-duty; 3 Extra Heavy-duty; 4 Maximuma. duty: or >>.
  - Physical Performance << Level C, 250,000 cycles; Level B, 500,000 cycles; b. Level A, 1,000,000 cycles; or \_\_\_\_>; in accordance with ANSI/SDI A250.4.
  - Frame Metal Thickness: << 18 gauge, 0.042 inch; <u>16 gauge, 0.053 inch</u>; 14 C. gauge, 0.067 inch; or \_\_\_\_ gauge, \_\_\_ inch>>, minimum. Weatherstripping: << Integral, recessed into door edge or frame; <u>See Section 08</u>
- 2. <u>7100;</u> or \_\_\_\_>>.
- ; \_\_\_\_\_, ; or None N/A>>Interior Door Frames. Non-Fire Rated: << Knock-C. << Type down type; Slip-on type; Slip-on type at gypsum board walls, and knock-down type at masonry walls; Face welded type; Full profile/continuously welded type; or \_\_\_\_>>. 1.
  - Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
    - a. Level << 1 Standard-duty; 2 Heavy-duty; 3 Extra Heavy-duty; 4 Maximumduty; or >>.
    - b. Physical Performance << Level C, 250,000 cycles; Level B, 500,000 cycles; Level A, 1,000,000 cycles; or \_\_\_\_>; in accordance with ANSI/SDI A250.4.
    - c. Frame Metal Thickness: << 18 gauge, 0.042 inch; 16 gauge, 0.053 inch; 14 gauge, 0.067 inch; or \_\_\_\_ gauge, \_\_\_ inch>>, minimum.
- , ; or None N/A>>Fire-Rated Door Frames: << Knock-down type; D. << Type Slip-on type; Slip-on type at gypsum board walls, and knock-down type at masonry walls; Face welded type; Full profile/continuously welded type; or >>.
  - Based on SDI Standards: ANSI/SDI A250.8 (SDI-100). 1.
    - a. Level << 1 Standard-duty; 2 Heavy-duty; 3 Extra Heavy-duty; 4 Maximumduty; or >>.
    - b. Physical Performance << Level C, 250,000 cycles; Level B, 500,000 cycles; Level A, 1,000,000 cycles; or \_\_\_\_>; in accordance with ANSI/SDI A250.4.
    - Frame Metal Thickness: << 18 gauge, 0.042 inch; 16 gauge, 0.053 inch; 14 C. gauge, 0.067 inch; or \_\_\_\_ gauge, \_\_\_\_ inch>>, minimum.
  - 2 Fire Rating: << As indicated on Door and Frame Schedule; As indicated on drawings; 3 hours; 1-1/2 hours; 1 hour; 3/4 hour; or \_\_\_\_>>, tested in accordance with << UL 10C or NFPA 252 ("positive pressure fire tests"); UL 10B ("neutral or negative pressure fire tests"); or >>.
  - Provide units listed and labeled by << ITS (DIR); UL (DIR); or \_\_\_\_>>. 3.
    - a. Attach fire rating label to each fire rated unit.

# 2.04 HOLLOW METAL DOOR FRAMES WITH APPLIED CASINGS

- A. Frame Type: Knockdown, slip-on drywall frames; separate jambs and head with separate snap-on casings both sides; factory-applied finish on exposed surfaces.
  - Frame Material: Cold-rolled steel complying with ASTM A1008/A1008M. 1.
  - Casing Material: << Formed steel; Extruded aluminum; Solid polyvinylchloride; 2. None, for wood casing by others; or \_\_\_\_>>.
  - 3. Casing Profile: << Square corner; Shaped; As indicated; or >>.
  - 4. Finish: Factory-applied baked enamel finish, or electrostatically applied water-based paint.
    - a. Color: << <u>As selected from manufacturer's full line;</u> or \_\_\_\_\_>>.

#### SECTION 08 1416 FLUSH WOOD DOORS

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

 Flush wood doors; flush<< and flush glazed; \_, full-glazed, and half-glazed; or None -N/A>> configuration; << <u>fire-rated</u>; <u>non-rated</u>; <u>acoustical</u>; <u>special function</u>; and >>.

### 1.02 RELATED REQUIREMENTS

- A. Section 06 2000 Finish Carpentry: Wood door frames.
- B. Section 08 1113 Hollow Metal Doors and Frames.
- C. Section <u>08 7100 Door Hardware</u>.
- D. Section 08 8000 Glazing.
- E. Section **09 2116 Gypsum Board Assemblies**: Bullet-resistant sheathing and wallboard for bullet-resistant partitions and walls.

#### 1.03 REFERENCE STANDARDS

- A. ASTM C1048 Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.
- B. AWI/AWMAC/WI (AWS) Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).
- C. AWMAC/WI (NAAWS) North American Architectural Woodwork Standards, U.S. Version 3.1; 2017, with Errata (2019).
- D. NFPA 80 Standard for Fire Doors and Other Opening Protectives; 2019.
- E. UL 10C Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.
- F. UL 1784 Standard for Air Leakage Tests of Door Assemblies; Current Edition, Including All Revisions.
- G. WDMA I.S. 1A Interior Architectural Wood Flush Doors; 2013.

# 1.04 SUBMITTALS

- A. See Section **<u>01 3000 Administrative Requirements</u>** for submittal procedures.
- B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.
- C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.
  - Provide information as required by << <u>AWI/AWMAC/WI (AWS)</u>; <u>AWMAC/WI (NAAWS)</u>; or \_\_\_\_>>.
- D. Samples: Submit << two; or \_\_\_\_\_>> samples of door veneer, <u>12 by 12 inches</u> in size illustrating << <u>wood grain, stain color, and sheen</u>; plastic laminate color; plastic laminate pattern and color; or \_\_\_\_\_>>.
- E. Certificate: Submit labels and certificates required by quality assurance and quality control programs.
- F. Manufacturer's Installation Instructions: Indicate special installation instructions.
- G. Warranty, executed in Owner's name.

# 1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with not less than << <u>three</u>; or \_\_\_\_>> years of<< <u>documented</u>; \_\_\_\_\_; or

#### **None - N/A>>** experience.

- 1. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.
- B. Woodwork Quality Assurance Program:
  - Provide labels indicating that the installed work complies with << <u>AWI/AWMAC/WI</u> (<u>AWS</u>); <u>AWMAC/WI (NAAWS</u>); or \_\_\_\_\_>> requirements for grade or grades specified.
  - 2. Provide designated labels on shop drawings as required by quality assurance program.
  - 3. Provide designated labels on installed products as required by quality assurance program.
  - 4. Submit documentation upon completion of installation that verifies this work is in compliance with specified requirements.

# 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Package, deliver and store doors in accordance with specified quality standard.
- B. Accept doors on site in manufacturer's packaging, and inspect for damage.
- C. Protect doors with resilient packaging<< <u>sealed with heat shrunk plastic;</u> ; or None - N/A>>; do not store in damp or wet areas or areas where sunlight might bleach veneer; seal top and bottom edges<< <u>with tinted sealer;</u> ; or None - N/A>> if stored more than one week, and break seal on site to permit ventilation.

# 1.07 WARRANTY

- A. See Section <u>01 7800 Closeout Submittals</u> for additional warranty requirements.
- B. Interior Doors: Provide manufacturer's warranty for << <u>the life of the installation</u>; 2 years; or \_\_\_\_\_>>.
- C. Include coverage for << <u>delamination of veneer</u>; <u>warping beyond specified installation</u> <u>tolerances</u>; <u>defective materials</u>; <u>telegraphing core construction</u>; and \_\_\_\_\_>>.

### PART 2 PRODUCTS

# 2.01 MANUFACTURERS

- A. Wood Veneer Faced Doors:
  - 1. VT Industries, Inc<< ; \_\_\_\_; or None N/A>>: www.vtindustries.com/#sle.
  - 2. Substitutions: << See Section 01 6000 Product Requirements; or Not permitted>>.

# 2.02 DOORS << AND PANELS; NONE - N/A; OR \_\_\_\_>>

- A. Doors:<< <u>See drawings for locations and additional requirements.;</u> \_\_\_\_\_.; or None N/A>>
  - Quality Standard: << <u>Custom Grade</u>; Premium Grade; Grade as indicated on drawings; or \_\_\_\_\_>>, << Standard Duty; <u>Heavy Duty</u>; Extra Heavy Duty; or \_\_\_\_\_>> performance, in accordance with << <u>AWI/AWMAC/WI (AWS)</u>; <u>AWMAC/WI</u> (NAAWS); or \_\_\_\_\_>>, unless noted otherwise.
  - Wood Veneer Faced Doors: << 5-ply; <u>7-ply</u>; 5-ply or 7-ply; or \_\_\_\_>> unless otherwise indicated.
- B. Interior Doors: << <u>1-3/4 inches</u>; 1-3/8 inches; 2-1/4 inches; or \_\_\_\_\_ inches>> thick unless otherwise indicated; flush construction.
  - Provide solid core doors at each location<< , except provide hollow core doors at \_\_\_\_; , \_\_\_\_; or <u>None N/A</u>>>.
  - Fire Rated Doors: Tested to << <u>ratings indicated on drawings</u>; 20 minutes; 60 minutes; 90 minutes; or \_\_\_\_>> in accordance with << ICC (IBC) Positive Pressure; UL 10C Positive Pressure; {\rs\#1} or 16 CFR 1201 Negative (Neutral) Pressure; or \_\_\_\_\_>>; << <u>Underwriters Laboratories Inc (UL)</u>; Intertek/Warnock Hersey (WHI); or \_\_\_\_>> labeled<< <u>without any visible seals when door is closed</u>; \_\_\_\_; or None N/A>>.
  - Smoke and Draft Control Doors<< (Indicated as "S" on Drawings); \_\_\_\_; or None - N/A>>: In addition to required fire rating, provide door assemblies tested in accordance with UL 1784 with maximum air leakage of << <u>3.0 cfm per sq ft</u>; or \_\_\_\_ cfm per sq

ft>> of door opening at << <u>0.10 inch wg</u>; or \_\_\_\_\_ inch wg>> pressure at both ambient and elevated temperatures for "S" label<< <u>; if necessary, provide additional gasketing</u> <u>or edge sealing</u>; ; no additional gasketing or edge sealing allowed; ; \_\_\_\_; or None - N/A>>.

4. << <u>Wood;</u> or \_\_\_\_>> veneer facing << <u>with factory;</u> for field; or \_\_\_\_>> transparent finish<< <u>as indicated on drawings;</u> \_\_\_\_; or None - N/A>>.

### 2.03 DOOR AND PANEL CORES

- A. Non-Rated Solid Core and 20 Minute Rated Doors: Type << <u>particleboard core (PC)</u>; staved lumber core (SLC); structural composite lumber core (SCLC); framed non-bonded particleboard core (FPC); framed non-bonded staved lumber core (FSLC); framed non-bonded structural composite lumber core (FSCLC); or \_\_\_\_>>, plies and faces as indicated.
- B. Fire-Rated Doors: Mineral core type, with fire resistant composite core (FD), plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.

#### 2.04 DOOR FACINGS

A. Veneer Facing for Transparent Finish: << <u>Species as specified above</u>; Red oak; White oak; Natural birch; White birch; Red birch; Cherry; Honduras mahogany; African mahogany; Walnut; Ash; or \_\_\_\_>>, << <u>HPVA Grade A</u>; HPVA Grade AA; veneer grade in accordance with quality standard indicated; or \_\_\_\_>>, << <u>plain sliced (flat cut)</u>; quarter cut; rift cut (only red and white oak); comb grain (only red and white oak); or \_\_\_\_>>, with << <u>book match</u>; slip match; random match (mismatched); plank match; or \_\_\_\_>> between leaves of veneer, << <u>running match</u>; balance match; center balance match; or \_\_\_\_>> of spliced veneer leaves assembled on door or panel face<< ; unless otherwise indicated; ; \_\_\_\_\_; or <u>None - N/A</u>>>.

# 2.05 DOOR CONSTRUCTION

- A. Fabricate doors in accordance with door quality standard specified.
- B. Cores Constructed with stiles and rails:
  - 1. Provide solid blocks at << <u>lock edge</u>; top of door for closer; and \_\_\_\_>> for hardware reinforcement.
  - 2. Provide solid blocking for other throughbolted hardware.
- C. Glazed Openings: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.
- D. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
- E. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
- F. Provide edge clearances in accordance with the quality standard specified.

# 2.06 FINISHES - WOOD VENEER DOORS

- - 1. Transparent:
    - a. << <u>System 1, Lacquer, Nitrocellulose</u>; System 2, Lacquer, Precatalyzed; System - 3, Lacquer, Postcatalyzed; System - 4, Latex Acrylic, Water-based; System - 5, Varnish, Conversion; System - 6, Oil, Synthetic Penetrating (transparent only); System - 7, Vinyl, Catalyzed; System - 8, Acrylic Cross Linking, Water-based; System - 9, UV Curable, Acrylated Epoxy, Polyester or Urethane; System - 10, UV Curable, Water-based; System - 11, Polyurethane, Catalyzed; System - 12, Polyurethane, Water-based; System - 13, Polyester, Catalyzed; or \_\_\_\_\_>>.

- b. Stain: As selected by Architect.
- c. Sheen: << <u>Flat;</u> Satin; Semigloss; Gloss; or \_\_\_\_>>.
- B. Finish work in accordance with WDMA I.S. 1A for grade specified and as follows:
  - 1. Transparent:
    - a. << <u>System TR-2, Catalyzed Lacquer</u>; System TR-4, Conversion Varnish; System - TR-6, Catalyzed Polyurethane; System - TR-8, UV Cured Acrylated Polyester/Urethane; Manufacturers standard, in compliance with performance duty level indicated; or \_\_\_\_>>.
    - b. Stain: As selected by Architect.
    - c. Sheen: << Flat; Satin; Semigloss; Gloss; or \_\_\_\_>>.
- C. Factory finish doors in accordance with << <u>approved sample</u>; sample to be provided; or \_\_\_\_\_>>.
- D. Seal door top edge with << <u>color</u>; or \_\_\_\_>> sealer to match door facing.

# 2.07 ACCESSORIES

- A. Hollow Metal Door Frames: See Section <u>08 1113</u>.
- B. Glazed Openings:
  - 1. Heat-Strengthened and Fully Tempered Glass: ASTM C1048.
  - 2. Glazing: Single vision units, << <u>1/4 inch</u>; or \_\_\_\_ inch>> thick glass.
  - 3. Tint: << <u>Clear;</u> Frosted; Gray; or \_\_\_\_>>.
- C. Door Window Frames: Door window frames with glazing securely fastened within door opening.
  - 1. Size: << 12 inches wide by 12 inches high; \_\_\_\_ inches wide by \_\_\_\_ inches high; <u>As</u> indicated on drawings; or \_\_\_\_>>.
  - Frame Material: << <u>18 gauge</u>, <u>0.0478 inch</u>; or <u>gauge</u>, <u>inch>></u>, << <u>galvanized</u> <u>steel</u>; stainless steel; or <u>>><<</u>, and wrapped in wood veneer; , with finish to match door; , <u>;</u> or <u>None N/A</u>>>.
  - 3. Glazing: << <u>1/4 inch</u>; 5/16 inch; 3/8 inch; or \_\_\_\_ inch>> thick, << <u>tempered glass</u>; or \_\_\_\_\_>>, in compliance with requirements of authorities having jurisdiction.
- D. Glazing Stops: << <u>Wood, of same species as door facing</u>; Wood with metal clips for rated doors; Rolled steel channel shape; Rolled steel \_\_\_\_\_\_ shape; Aluminum channel shape; Aluminum \_\_\_\_\_\_ shape; or \_\_\_\_>>, << butted; <u>mitered</u>; or \_\_\_\_\_>> corners; prepared for countersink style<< <u>tamper proof</u>; \_\_\_\_\_; or None N/A>> screws.
- E. Door Hardware: See Section 08 7100.
  - 1. Dropdown acoustic hardware shall be mortised into bottom of door panels. Surface mounting is prohibited.

# PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

#### 3.02 INSTALLATION

- A. Install doors in accordance with manufacturer's instructions and specified quality standard.
  - Install fire-rated doors in accordance with << <u>NFPA 80</u>; ITS (DIR); UL (DIR); and \_\_\_\_\_\_
    requirements.
- B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.
- C. Use machine tools to cut or drill for hardware.

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Design Development Phase	00 1410 - 4	This wood Doors

- D. Coordinate installation of doors with installation of frames and hardware.
- E. Coordinate installation of glazing.

# 3.03 TOLERANCES

- A. Comply with specified quality standard for fit and clearance tolerances.
- B. Comply with specified quality standard for telegraphing, warp, and squareness.

### 3.04 ADJUSTING

- A. Adjust doors for smooth and balanced door movement.
- B. Adjust closers for full closure.

# 3.05 SCHEDULE<< - SEE DRAWINGS; \_\_\_\_; OR <u>NONE - N/A</u>>>

A. See Door and Frame Schedule appended to << <u>this section</u>; <u>Section</u>; ; or \_\_\_\_\_; or \_\_\_\_\_

# END OF SECTION 08 1416

#### SECTION 08 3100 ACCESS DOORS AND PANELS

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Wall- and ceiling-mounted access units.
- B. Floor-mounted access door and frame units, << <u>interior</u>; and <u>exterior</u>>>.

#### 1.02 RELATED REQUIREMENTS

- A. Section <u>08 7100 Door Hardware</u>: Mortise cylinder and core hardware.
- B. Section 09 9113 Exterior Painting: Field paint finish.
- C. Section 09 9123 Interior Painting: Field paint finish.

#### 1.03 REFERENCE STANDARDS

- A. ADA Standards Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. ASTM A240/A240M Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; 2020a.
- C. ASTM A500/A500M Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2021.
- D. UL (FRD) Fire Resistance Directory; Current Edition.

# 1.04 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements for submittal procedures.
- B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.
- C. Shop Drawings: Indicate exact position of each access door and/or panel unit.
- D. Manufacturer's Installation Instructions: Indicate << <u>installation requirements;</u> rough-in dimensions; and \_\_\_\_\_>>.
- E. Manufacturer's qualification statement.
- F. Project Record Documents: Record actual locations of each access unit.

#### 1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum << <u>three</u>; or \_\_\_\_\_>> years<< <u>documented</u>; \_\_\_\_; or None N/A>> experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least << <u>three</u>; or \_\_\_\_\_>> years<< <u>documented</u>; \_\_\_\_; or None N/A>> experience<< and approved by manufacturer; \_\_\_\_; or <u>None N/A</u>>>.

# PART 2 PRODUCTS

# 2.01 ACCESS DOORS AND PANELS ASSEMBLIES

- A. Wall-Mounted Units<< with Return Air Grille; or <u>None N/A</u>>>:
  - 1. Panel Material: << Steel; Steel, hot-dipped zinc or zinc-aluminum-alloy coated; Stainless steel; Stainless steel, Type 304; Aluminum; <u>Aluminum extrusions with</u> <u>gypsum board inlay;</u> or \_\_\_\_>>.
  - 2. Size: As required to suit access application
  - 3. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
  - Wall Mounting Criteria: Provide surface-mounted << <u>face frame and door surface flush</u> <u>with frame surface</u>; frame concealed by door, with pantograph hinges; or \_\_\_\_\_>.

- 5. Gypsum Board Mounting Criteria: Provide drywall bead frame with door surface << <u>flush</u> <u>with wall surface</u>; recessed for infill with wall finish; or \_\_\_\_>>.
- B. Wall-Mounted Units in Wet Areas:
  - 1. Location: << As indicated on drawings; or Where required to access valves, cleanouts or other building componants>>.
  - Panel Material: << <u>Steel, hot-dipped zinc, or zinc-aluminum-alloy coated;</u> Stainless steel; Stainless steel, Type 304; Aluminum; or \_\_\_\_\_>>.
  - 3. Size: << <u>12 by 12 inches;</u> or <u>by</u> inches>>.
  - 4. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
  - 5. Wall Mounting Criteria: Provide surface-mounted << <u>face frame and door surface flush</u> <u>with frame surface;</u> frame concealed by door with pantograph hinges; or \_\_\_\_>>.
  - 6. Gypsum Board Mounting Criteria: Provide drywall bead frame with door surface << <u>flush</u> <u>with wall surface</u>; recessed for infill with wall finish; or \_\_\_\_>>.
- C. Ceiling-Mounted Units<< with Return Air Grille; or <u>None N/A</u>>>:
  - 1. Location: << As indicated on drawings; or Where required to access valves, cleanouts or other componants>>.
  - 2. Panel Material: << Steel; Steel, hot-dipped zinc, or zinc-aluminum-alloy coated; Stainless steel; Stainless steel, Type 304; Aluminum; <u>Aluminum extrusion with</u> gypsum board inlay; or \_\_\_\_>>.
  - 3. Size Lay-In Grid Ceilings: To match module of ceiling grid.
  - 4. Size Other Ceilings: << <u>12 by 12 inches;</u> <u>by inches; <u>by inches;</u> <u>by inches; <u>by inches;</u> <u>by inches; by inches; <u></u></u></u></u>
  - 5. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.

# 2.02 << WALL-; CEILING-; OR WALL- AND CEILING->>MOUNTED ACCESS UNITS

- A. << Wall-; Ceiling-; or <u>Wall- and Ceiling-</u>>>Mounted Units: Factory-fabricated door and frame, fully assembled units with corner joints welded, filled and ground flush; square and without rack or warp; coordinate requirements with type of installation assembly being used for each unit.
  - Style: << Exposed frame with door surface flush with frame surface; Frame concealed by door panel; Recessed door panel for infill with wall/ceiling finish; or \_\_\_\_\_>>.
    - a. Gypsum Board Mounting Criteria: Use drywall bead type frame.
  - Door Style: << <u>Single thickness with rolled or turned in edges</u>; Double-skinned hollow panel; or \_\_\_\_\_>>.
  - 3. Frames: << <u>16 gauge, 0.0598 inch;</u> or <u>gauge, inch>></u>, minimum thickness.
  - 4. Single Steel Sheet Door Panels: << <u>1/16 inch;</u> or \_\_\_\_\_ inch>>, minimum thickness.
  - 5. Steel Finish: Primed.
  - 6. Hardware:
    - a. Hinges for Non-Fire-Rated Units: **<< Concealed, constant force closure spring** type; <u>Continuous piano hinge;</u> Concealed, hinged-arm guide at top and bottom of panel; Heavy duty butt hinges; or \_\_\_>>.
    - b. Latch/Lock: Tamperproof tool-operated cam latch.
    - c. Gasketing: Extruded neoprene, around perimeter of door panel.

# PART 3 EXECUTION

# 3.01 EXAMINATION

A. Verify that rough openings are correctly sized and located.

# 3.02 PREPARATION

- A. Clean surfaces thoroughly prior to proceeding with this work.
- B. Prepare surfaces using methods recommended by manufacturer for applicable substrates in accordance with project conditions.

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Design Development Phase	08 5100 - 2	Access Doors and Fallers

# 3.03 INSTALLATION

- A. Install units in accordance with manufacturer's instructions.
- B. Install frames plumb and level in openings, and secure units rigidly in place.
- C. Position units to provide convenient access to concealed equipment when necessary.

# END OF SECTION 08 3100

#### SECTION 08 3223 SLIDING AND FOLDING GLAZED WALLS AND DOORS

# PART 1 GENERAL

# 1.01 SECTION INCLUDES

A. Glazed aluminum sliding<< None - N/A; or <u>and pivoting</u>>> wall panel systems, top supported.

# 1.02 RELATED REQUIREMENTS

- A. Section <u>06 1000 Rough Carpentry</u>: Rough opening framing.
- B. Section <u>07 2100 Thermal Insulation</u>: Fibrous stuffing insulation at frame perimeter.
- C. Section <u>07 2500 Weather Barriers</u>: Sealing door frame to water-resistive barrier installed on adjacent construction.
- D. Section **07 9200 Joint Sealants**: Sealing joints between door frames and adjacent construction.
- E. Section 08 7100 Door Hardware: Additional hardware.
- F. Section <u>08 8000 Glazing</u>: Glass and glazing accessories.

# 1.03 REFERENCE STANDARDS

- A. AAMA 609 & 610 Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document); 2015.
- B. AAMA 611 Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).
- C. ASTM D1187/D1187M Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal; 1997 (Reapproved 2018).
- D. ASTM E90 Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).
- E. ASTM E413 Classification for Rating Sound Insulation; 2016.

# 1.04 SUBMITTALS

- A. See Section <u>01 3000 Administrative Requirements</u> for submittal procedures.
- B. Product Data: Provide information on dimensions, frame and sill construction, glazing, and hardware.
- C. Shop Drawings: Indicate opening dimensions, elevations of different types, and framed opening tolerances.
- D. Manufacturer's Installation Instructions: Include complete preparation, installation, and cleaning requirements.
- E. Installer's qualification statement.
- F. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

# 1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with not less than << <u>three</u>; or \_\_\_\_\_>> years of<< documented; \_\_\_\_\_; or <u>None N/A</u>>> experience.
- B. Installer Qualifications: Company specializing in installation of products of type specified, with not less than << <u>three</u>; or \_\_\_\_\_>> years of<< documented; \_\_\_\_\_; or <u>None N/A</u>>> experience<< and approved by manufacturer; or <u>None N/A</u>>>.

# 1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to project site and store in manufacturer's protective cartons until openings are ready for installation.

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Design Development Phase	08 3223 - 1	and Doors

B. Protect finished surfaces with wrapping paper or strippable coating during installation. Do not use adhesive papers or sprayed coatings that bond to substrate when exposed to sunlight or weather.

# 1.07 WARRANTY

- A. See Section 01 7800 Closeout Submittals for additional warranty requirements.
- B. Provide << <u>five</u>; or \_\_\_\_>> year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.

# PART 2 PRODUCTS

# 2.01 MANUFACTURERS

- A. Glazed Aluminum << Sliding; Sliding and Pivoting; Bi-Folding; or \_\_\_\_>> Wall Systems:
  1. Modernfold, a DORMA Group Company; Acousti-Clear.
  - Substitutions: << See Section 01 6000 Product Requirements; or Not permitted>>.

#### 2.02 PERFORMANCE REQUIREMENTS

- A. Acoustical Performance: Provide glass partitions and door assemblies tested by qualified testing agency, calculated in accordance with ASTM E413, tested in accordance with ASTM E90, and rated for not less than Sound Transmission Class (STC) indicated.
  - 1. Partition STC Rating: **<< 35; 45; or 51>>**, minimum, for framed partitions.

#### 2.03 SLIDING AND FOLDING GLAZED DOORS AND WALLS

- A. Glazed Aluminum << Sliding; <u>Sliding and Pivoting</u>; Bi-Folding; or \_\_\_\_\_>> Wall Panel Systems: Extruded aluminum sliding and fixed wall panel frames, factory fabricated; complete with<< sill,; \_\_\_\_\_\_; or <u>None - N/A</u>>> support and anchorage devices.
  - 1. Configuration: As shown on drawings.
  - Support System: << <u>Top hung</u>; Floor mounted; Top hung or floor mounted; or \_\_\_\_\_>>.
  - 3. Panel Rail Depth: << <u>1-1/4 inch</u>; <u>1-5/8 inch</u>; <u>1-7/8 inch</u>; <u>2-5/16 inch</u>; <u>2-1/2 inch</u>; <u>2-3/4 inch</u>; <u>3 inch</u>; <u>4 inch</u>; <u>— inch</u>; or Manufacturer's standard>>.
  - 4. Top Rail Height: << <u>3-5/8 inch</u>; 4-1/8 inch; 4-7/8 inch; 5-7/16 inch; 5-13/16 inch; or \_\_\_\_\_inch>><< <u>. square edge</u>; , tapered edge; , contoured face; or , \_\_\_\_\_>>.
  - 5. Bottom Rail Height: << <u>3-5/8 inch</u>; <u>3-15/16 inch</u>; <u>4-7/8 inch</u>; <u>5-1/16 inch</u>; <u>6 inch</u>; <u>10 inch</u>; or \_\_\_\_\_ inch>><< <u>, square edge</u>; , tapered edge; , contoured face; or , \_\_\_\_\_>>.
  - Panel Weight: << 330 lbs; 300 lbs; 264 lbs; 155 lbs; <u>10 lbs per sq ft; or \_\_\_ lbs>></u>, maximum.
  - 7. Aluminum Frames: Factory finished; << <u>manufacturer's standard;</u> or \_\_\_\_\_>> corner construction<<; thermally broken; ; non-thermally broken; or None N/A>>.
  - 8. Drainage: Provide drainage to exterior for moisture entering joints and glazing spaces and for condensation occurring within frame construction.
  - 9. Glass Stops: Same material and color as frame.
  - 10. Aluminum Frame Finish: << <u>Anodized coating in accordance with AAMA 611;</u> Powder coating in accordance with AAMA 2604; PVDF coating in accordance with AAMA 2605; As scheduled; or \_\_\_\_>>.
    - a. Sheen: << Standard gloss; <u>Matte;</u> or \_\_\_\_>>.
    - Exterior Color: << Dark bronze anodized; Clear anodized; Wood grain powder coat; As scheduled; <u>As selected from manufacturer's full range of colors;</u> or \_\_\_\_\_
    - c. Interior Color: << Dark bronze anodized; Clear anodized; Wood grain powder coat; As scheduled; <u>As selected from manufacturer's full range of colors;</u> or \_\_\_\_\_>>
- B. Glazing: << Single; <u>Double</u>; Triple; or \_\_\_\_>> glazed<< <u>, clear</u>; <u>, grey tinted</u>; <u>, bronze tinted</u>; <u>, heat mirror</u>; <u>, \_\_\_\_</u>; or None N/A>><< , Low-E coated; <u>, tempered</u>; or None -

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N/A>><< , argon filled; , krypton filled; , manufacturer's standard fill; , \_\_\_\_; or <u>None</u> -<u>N/A</u>>>, fully tempered, with glass thickness << <u>1/4 inch</u>; <u>3/8 inch</u>; <u>1/2 inch</u>; <u>15/16 inch</u>; <u>1</u> inch; <u>1-1/2 inches</u>; <u>1-15/16 inches</u>; \_\_\_\_ inch; or as required by authorities having jurisdiction for performance requirements indicated>>.

- C. Sliding Wall Panel Hardware: Manufacturer's standard hardware including carriages with sealed ball bearing rollers, and top or bottom tracks.
  - 1. Door Hardware: << Pull handle; <u>Back to back pull handle</u>; or \_\_\_\_\_>><<, satin stainless steel finish; , to match fittings finish; , \_\_\_\_; or <u>None - N/A</u>>>.
  - 2. Locking Mechanisms: Minimum two-point deadbolt locking of each panel; manufacturer's standard type.
  - 3. Exposed Hardware Finish: << Manufacturer's standard; Stainless steel; Brushed satin; Black titanium; As scheduled; <u>As selected from manufacturer's standard line;</u> or \_\_\_\_>>.

# 2.04 FACTORY ASSEMBLY

- A. Factory assemble sliding/folding operable panel frames as single unit, including head, jambs, and bottom sections; provide concealed fasteners.
  - 1. Sizes: Allow for tolerances of rough framed openings, clearances, and shims at perimeter of assemblies.
  - 2. Joints and Corners: Flush, hairline and waterproof, accurately fitted and secured; prepared to receive anchors; fasteners and attachments concealed from view; reinforced as required for imposed loads.
  - 3. Glazing: << <u>Factory installed;</u> Field installed; or \_\_\_\_>>.

# 2.05 ACCESSORIES

- A. Anchors: Hot-dipped galvanized or stainless steel in accordance with project and manufacturer's installation requirements.
- B. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M, Type I.

# PART 3 EXECUTION

# 3.01 EXAMINATION

A. Verify that openings are ready to receive work and opening dimensions and clearances are as indicated on << <u>approved shop drawings</u>; drawings; or \_\_\_\_\_>>.

# 3.02 PREPARATION

A. Prepare opening to permit correct installation of door unit in coordination with air and vapor seal.

# 3.03 INSTALLATION

- A. Install assemblies in accordance with << <u>manufacturer's instructions;</u> or \_\_\_\_\_>>.
- B. Attach frame and shims to perimeter opening to accommodate construction tolerances and other irregularities.
- C. Use anchorage devices to securely fasten assembly to adjacent construction without distortion or imposed stresses.

# 3.04 TOLERANCES

- A. Maintain dimensional tolerances and alignment with adjacent work.
- B. Maximum Variation from Plumb: << <u>1/16 inch</u>; or \_\_\_\_\_ inch>>.
- C. Maximum Variation from Level: << <u>1/16 inch;</u> or \_\_\_\_\_ inch>>.
- D. Longitudinal or Diagonal Warp: Plus or minus << <u>1/8 inch;</u> or <u>inch>></u> from <u>10 feet</u> straight edge.

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# 3.05 ADJUSTING

A. Adjust hardware for smooth operation.

# 3.06 CLEANING

- A. Remove protective material from factory finished surfaces.
- B. Remove labels and visible markings.
- C. Wash surfaces by method recommended and acceptable to sealant and window manufacturer; rinse and wipe surfaces clean.
- D. Upon completion of installation, thoroughly clean door aluminum surfaces in accordance with AAMA 609 & 610.

# 3.07 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

# END OF SECTION 08 3223

KPB PN: 22047.01	08 2222 4	Sliding and Folding Glazed Walls
Design Development Phase	00 3223 - 4	and Doors

### SECTION 08 3313 COILING COUNTER DOORS

# PART 1 GENERAL

### 1.01 SECTION INCLUDES

- A. Non-fire-rated coiling counter doors and operating hardware.
- B. Fire-rated coiling counter doors and operating hardware.
- C. Electric motor operation; wiring from electric circuit disconnect to operator to control station.

#### 1.02 RELATED REQUIREMENTS

- A. Section 06 1000 Rough Carpentry: Rough openings.
- B. Section 07 9200 Joint Sealants: Sealing joints between frames and adjacent construction.
- C. Section 08 7100 Door Hardware: Cylinder cores and keys.
- D. Section <u>09 2116 Gypsum Board Assemblies</u>: Rough openings.
- E. Section <u>09 9123 Interior Painting</u>: Field paint finish.
- F. Section <u>26 0533.13 Conduit for Electrical Systems</u>: Conduit from electric circuit to operator and from operator to control station.
- G. Section 26 0533.13 Conduit for Electrical Systems: Conduit from fire alarm system.
- H. Section <u>26 0583 Wiring Connections</u>: Power to disconnect.
- I. Section <u>28 4600 Fire Detection and Alarm</u>: Fire alarm interconnection.

#### 1.03 REFERENCE STANDARDS

- A. ASTM A36/A36M Standard Specification for Carbon Structural Steel; 2014.
- B. ASTM A123/A123M Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- C. ASTM A653/A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.
- D. ASTM B221 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2020.
- E. ITS (DIR) Directory of Listed Products; current edition.
- F. NEMA MG 1 Motors and Generators; 2018.
- G. NFPA 80 Standard for Fire Doors and Other Opening Protectives; 2019.
- H. UL (DIR) Online Certifications Directory; Current Edition.

# 1.04 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements for submittal procedures.
- B. Product Data: Submit manufacturer's standard literature showing materials and details of construction and finish. << Include data on electrical operation.; or None N/A>>
- C. Shop Drawings: Indicate rough and actual opening dimensions, anchorage methods, hardware locations, and installation details.
- D. Samples: << <u>Two;</u> or <u>>></u> slats, << <u>4 inches long;</u> or <u>inches long>></u>, illustrating shape, color, and finish texture.
- E. Manufacturer's Installation Instructions: Indicate installation sequence and installation, adjustment, and alignment procedures.
- F. Installer's qualification statement.
- G. Specimen warranty.

- H. Operation and Maintenance Data: Indicate modes of operation, lubrication requirements and frequency, and periodic adjustments required.
- I. Project Record Documents: Include as-built electrical diagrams for electrical operation and connection to fire alarm system.

# 1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of type specified and with at least << <u>three</u>; or \_\_\_\_\_>> years<< <u>documented</u>; \_\_\_\_\_; or None N/A>> experience<< and approved by manufacturer; or <u>None N/A</u>>>.
- B. Products Requiring Electrical Connection: Listed and classified by << <u>ITS (DIR)</u>; <u>UL (DIR)</u>; <u>testing firm acceptable to authorities having jurisdiction</u>; or \_\_\_\_\_>> as suitable for the purpose specified in this section and indicated on the drawings.

# 1.06 WARRANTY

- A. See Section **<u>01 7800 Closeout Submittals</u>** for additional warranty requirements.
- B. Manufacturer Warranty: Provide **<< 2-year; lifetime; or 5 year>>** manufacturer warranty for counterbalance shaft assembly. Complete forms in Owner's name and register with manufacturer.

# PART 2 PRODUCTS

# 2.01 MANUFACTURERS

- A. Coiling Counter Doors:
  - Alpine Overhead Doors, Inc<< <u>; Counter Shutter Rolling Shutters</u>; ; Counter Vision -See-Through Counter Shutters; ; \_\_\_\_; or None - N/A>>: www.alpinedoors.com/#sle.
  - C.H.I. Overhead Doors<< <u>; Model 6522 (steel)</u>; ; Model 6544 (aluminum); ; Model 6566 (stainless); ; \_\_\_\_\_; or None N/A>>: www.chiohd.com/#sle.
  - 3. Wayne-Dalton, a Division of Overhead Door Corporation<< <u>; Security Shutter Model</u> <u>523;</u> ; <u>; or None N/A>>: www.wayne-dalton.com/#sle</u>.
  - 4. Substitutions: << <u>See Section 01 6000 Product Requirements</u>; or Not permitted>>.
- B. Coiling Counter Fire Doors:
  - 1. Alpine Overhead Doors, Inc<< <u>; Auto Fire-Shut Metal Fire Shutters</u>; ; Fire-Shut Coiling Fire Shutters; ; \_\_\_\_\_; or None N/A>>: www.alpinedoors.com/#sle.
  - C.H.I. Overhead Doors<< <u>; Model 7522 (steel)</u>; ; Model 7566 (stainless); ; \_\_\_\_; or None - N/A>>: www.chiohd.com/#sle.
  - Wayne-Dalton, a Division of Overhead Door Corporation<< <u>; Fire Counter Door Model</u> <u>540</u>; ; Fire Counter Door - Model 550; ; \_\_\_\_; or None - N/A>>: www.waynedalton.com/#sle.
  - 4. Substitutions: << See Section 01 6000 Product Requirements; or Not permitted>>.

# 2.02 COILING COUNTER DOORS

- A. Coiling Counter Metal Doors, Non-Fire-Rated: << Galvanized steel; Stainless steel; <u>Aluminum;</u> or \_\_\_\_\_>> slat curtain.
  - 1. Mounting: << <u>Between jambs, within prepared opening;</u> Exterior face mounted; Interior face mounted; As indicated on drawings; or \_\_\_\_>>.
  - 2. Provide integral frame and sill of same material and finish.
  - 3. Nominal Slat Size: << <u>1-1/4 inches;</u> 2 inches; or \_\_\_\_\_ inches>> wide.
  - 4. Slat Profile: << <u>Flat;</u> Curved; or \_\_\_\_\_>><< <u>, perforated;</u> or None N/A>>.
  - 5. Finish, Aluminum: Anodized.
  - 6. Guides: Formed track; same material and finish unless otherwise indicated.
- B. Coiling Counter Metal Doors, Fire-Rated: << <u>Galvanized steel</u>; Stainless steel; or \_\_\_\_\_\_>> slat curtain.

- 1. Mounting: << <u>Between jambs, within prepared opening;</u> Exterior face mounted; Interior face mounted; As indicated on drawings; or \_\_\_\_>.
- 2. Provide integral frame and sill of same material and finish.
- 3. Fire Rating: << <u>3/4 hour;</u> 1 hour; 1-1/2 hours; 2 hours; 3 hours; As indicated on drawings; <u>hours;</u> or <u>>>;</u> comply with NFPA 80.
  - a. Provide product listed and labeled by << <u>ITS (DIR)</u>; <u>UL (DIR)</u>; or \_\_\_\_>> as suitable for the purpose specified and indicated.
- 4. Nominal Slat Size: << 1-1/4 inches; 2 inches; or \_\_\_\_\_ inches>> wide.
- 5. Slat Profile: << <u>Flat;</u> Curved; or \_\_\_\_>>.
- 6. Finish, Galvanized Steel: **<< No additional finish; Factory primed;** <u>Factory baked</u> <u>enamel; Factory powder coated; or \_\_\_\_>>.</u>
- 7. Guides: Formed track; same material and finish unless otherwise indicated.
- 9. Coiling Door Release Mechanism: << <u>Fusible link;</u> Fire alarm system; or \_\_\_\_>> activated with automatically governed closing speed.
- 10. Manual << hand chain lift; hand crank lift; push up; or \_\_\_\_\_>> operation.

# 2.03 COMPONENTS

- A. Metal Curtain Construction: Interlocking, single-thickness slats.
  - 1. Slat Ends: << <u>Alternate slats</u>; or Each slat>> fitted with end locks to act as wearing surface in guides and to prevent lateral movement.
  - Curtain Bottom: Fitted with << angles; tube; or \_\_\_\_\_>> to provide reinforcement and positive contact in closed position << <u>None - N/A</u>; ; neoprene astragal along bottom edge; ; vinyl astragal along bottom edge; or ; \_\_\_\_\_ along bottom edge>>.
  - 3. Steel Slats: ASTM A653/A653M galvanized steel sheet, with minimum << G60/Z180; <u>G90/Z275</u>; or \_\_\_\_>> coating; minimum thickness << 22 gauge, 0.03 inch; 20 gauge, 0.04 inch; 18 gauge, 0.05 inch; <u>16 gauge, 0.06 inch</u>; or \_\_\_ gauge, \_\_\_ inch>>.
  - Aluminum Slats: ASTM B221 (ASTM B221M)<< <u>, aluminum alloy Type 6063;</u> , aluminum alloy Type \_\_\_\_; or None - N/A>>; minimum thickness << <u>0.05 inch;</u> None - N/A; or None - N/A>>.
- B. Guide Construction: Continuous, of profile to retain door in place, with mounting brackets of same metal.
  - 1. Aluminum Guides: Extruded aluminum channel, with wool pile runners along inside.
- C. Hood Enclosure: Internally reinforced to maintain rigidity and shape.
- D. Lock Hardware:
- E. Roller Shaft Counterbalance: Steel pipe and << <u>torsion</u>; or None N/A>> steel spring system, capable of producing torque sufficient to ensure smooth operation of curtain from any position and capable of holding position at mid-travel; with adjustable spring tension; requiring << <u>25 lb</u>; or \_\_\_\_ lb>> nominal force to operate.

# 2.04 ELECTRIC OPERATION

- A. Operator, Controls, Actuators, and Safeties: Listed and classified by << <u>ITS (DIR)</u>; <u>UL (DIR)</u>; <u>testing agency acceptable to authorities having jurisdiction (AHJ)</u>; or \_\_\_\_\_> as suitable for purpose specified and indicated.
  - 1. Provide interlock switches on motor operated units.
- B. Electric Operators:
  - 1. Mounting: << <u>Side mounted;</u> Center mounted; or \_\_\_\_>>.
  - 2. Motor Enclosure: NEMA MG 1.
  - Motor Rating: << <u>As recommended by manufacturer</u>; 1/3 hp; 1/2 hp; 3/4 hp; or <u>hp>></u>; continuous duty.
  - 4. Motor Voltage: << Manufacturer's standard; <u>110-120 VAC, single phase, 60 Hz;</u> 220-240 VAC, 3 phase, 60 Hz; 440-480 VAC, 3 phase, 60 Hz; or \_\_\_\_>>.

- 5. Opening Speed: << <u>6 inches per second</u>; 12 inches per second; or \_\_\_\_\_ inches per second>>.
- 6. Manual override in case of power failure.
- C. Control Station: Standard three button (OPEN-STOP-CLOSE) << <u>momentary</u>; constant pressure; or \_\_\_\_>> control for each electrical operator.
  - 1. Controls: << 24 VAC; 24 VDC; 115 VAC; or \_\_\_\_>> circuit.
  - 2. << <u>Surface mounted;</u> Recessed; or \_\_\_\_>>.
- D. Safety Edge: Located at bottom of curtain, full width, << <u>electro-mechanical</u>; pneumatic; or \_\_\_\_\_>> sensitized type, wired to << <u>stop</u>; or reverse>> operator upon striking object, hollow << <u>neoprene</u>; rubber; or \_\_\_\_\_>> covered.

# PART 3 EXECUTION

# 3.01 EXAMINATION

- A. Verify that adjacent construction is suitable for door installation.
- B. Verify that door opening is plumb, header is level, and dimensions are correct.
- C. Notify Architect of any unacceptable conditions or varying dimensions.
- D. Commencement of installation indicates acceptance of substrate and door opening conditions.

#### 3.02 INSTALLATION

- A. Install units in accordance with manufacturer's instructions.
- B. Install fire-rated doors in accordance with NFPA 80.
- C. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.
- D. Securely and rigidly brace components suspended from structure. << <u>Secure guides to</u> <u>structural members only.</u>; or None N/A>>
- E. Fit and align assembly including hardware; level and plumb, to provide smooth operation.
- F. Coordinate installation of electrical service with Section 26 0583.
- G. Complete wiring from disconnect to unit components.
- H. Complete wiring from fire alarm system .

#### 3.03 TOLERANCES

- A. Maintain dimensional tolerances and alignment with adjacent work.
- B. Maximum Variation From Plumb: << <u>1/16 inch;</u> or \_\_\_\_ inch>>.
- C. Maximum Variation From Level: << <u>1/16 inch</u>; or \_\_\_\_ inch>>.
- D. Longitudinal or Diagonal Warp: Plus or minus << <u>1/8 inch per 10 ft</u>; or \_\_\_\_\_ inch per 10 ft>> straight edge.

# 3.04 ADJUSTING

A. Adjust operating assemblies for smooth and noiseless operation.

# 3.05 CLEANING

- A. Clean installed components.
- B. Remove labels and visible markings.

# END OF SECTION 08 3313

### SECTION 08 3323 OVERHEAD COILING DOORS

# PART 1 GENERAL

# 1.01 SECTION INCLUDES

- A. Exterior coiling doors.
- B. Interior non-fire-rated coiling doors.
- C. Electric operators and control stations.
- D. Wiring from electric circuit disconnect to operators and control stations.

# 1.02 RELATED REQUIREMENTS

- A. Section <u>07 9200 Joint Sealants</u>: Sealing joints between frames and adjacent construction.
- B. Section 08 3313 Coiling Counter Doors
- C. Section 08 7100 Door Hardware: Cylinder cores and keys.
- D. Section 09 9113 Exterior Painting: Field paint finish.
- E. Section 09 9123 Interior Painting: Field paint finish.
- F. Section <u>26 0533.13 Conduit for Electrical Systems</u>: Conduit from electric circuit to operator and from operator to control station.
- G. Section 26 0583 Wiring Connections: Power to disconnect.

# 1.03 REFERENCE STANDARDS

- A. ASTM A36/A36M Standard Specification for Carbon Structural Steel; 2014.
- B. ASTM A123/A123M Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- C. ASTM A653/A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.
- D. ASTM B221 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2020.
- E. ASTM B221M Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.
- F. ITS (DIR) Directory of Listed Products; current edition.
- G. NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.
- H. NEMA ICS 2 Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2000, with Errata (2008).
- I. UL (DIR) Online Certifications Directory; Current Edition.
- J. UL 325 Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems; Current Edition, Including All Revisions.

# 1.04 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements for submittal procedures.
- B. Product Data: Provide << general construction; electrical equipment; component connections and details; and \_\_\_\_>>.
- C. Shop Drawings: Indicate pertinent dimensioning, anchorage methods, hardware locations, and installation details.
- D. Samples: << <u>Two;</u> or \_\_\_\_>> slats, <u>\_\_\_\_by\_\_\_inches</u> in size illustrating shape, color and finish texture.
- E. Manufacturer's Installation Instructions: Indicate installation sequence and procedures, adjustment and alignment procedures<< <u>, and</u> \_\_\_\_\_; or None N/A>>.

- F. Manufacturer's qualification statement.
- G. Installer's qualification statement.
- H. Maintenance Data: Indicate << <u>lubrication requirements and frequency; periodic</u> <u>adjustments required; and</u>\_\_\_\_>>.
- I. Specimen warranty.

#### 1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum << <u>three</u>; or \_\_\_\_\_>> years of<< <u>documented</u>; or None N/A>> experience.
- B. Installer Qualifications: Company specializing in performing work of type specified and with at least << <u>three</u>; or \_\_\_\_\_>> years<< <u>documented</u>; \_\_\_\_\_; or None N/A>> experience<< and approved by manufacturer; or <u>None N/A</u>>>.
- C. Products Requiring Electrical Connection: Listed and classified by << <u>ITS (DIR)</u>; <u>UL (DIR)</u>; <u>testing firm acceptable to authorities having jurisdiction</u>; or \_\_\_\_\_>> as suitable for purpose specified and indicated.

#### 1.06 WARRANTY

- A. See Section <u>01 7800 Closeout Submittals</u> for additional warranty requirements.
- B. Manufacturer Warranty: Provide **<< 2-year; lifetime; or five year>>** manufacturer warranty for roller shaft counterbalance assembly. Complete forms in Owner's name and register with manufacturer.

#### PART 2 PRODUCTS

#### 2.01 MANUFACTURERS

- A. Overhead Coiling Metal Doors:
  - 1. Cornell Iron Works, Inc<< ; \_\_\_\_; or None N/A>>: www.cornelliron.com/#sle.
  - Overhead Door Corporation</ ; Model 600 Coil-Away Rolling Service Door; ; Model 610 Rolling Service Door; ; Model 611 Coil-Away Rolling Service Door; ; Model 620 Stormtite Rolling Service Door; ; Model 621 Rapidlite Stormtite Rolling Service Door; ; Model 625 Stormtite Insulated Rolling Service Door; ; Model 626 RapidSlat Stormtite Insulated Rolling Service Door; ; Model 770 Rolling Sheet Door; ; Model 780 Rolling Sheet Door; ; Model 790 Wind Load Rolling Sheet Door; ; \_\_\_\_; or None - N/A>>: www.overheaddoor.com/#sle.
  - 3. Raynor Garage Doors<< <u>; DuraCoil, Model</u> \_; ; \_\_; or None N/A>>: www.raynor.com/#sle.
  - 4. Substitutions: << <u>See Section 01 6000 Product Requirements</u>; or Not permitted>>.

# 2.02 COILING DOORS

- A. Exterior Coiling Doors<< <u>Type</u> ; or None N/A>>: << Steel; Stainless steel; <u>Aluminum</u>; or \_\_\_\_\_>> slat curtain.
  - 1. Capable of withstanding positive and negative wind loads of << <u>20 psf;</u> or \_\_\_\_ psf>> without undue deflection or damage to components.
  - 2. Single Thickness Slats: Manufacturer's standard.
    - a. Vision Lites: Single pane glazed.
      - 1) Size: As indicated in drawings.
  - Sandwich Slats: Manufacturer's standard, with core of << <u>foamed-in-place</u> <u>polyurethane</u>; or \_\_\_\_>> insulation; minimum << <u>R-value of 4.88</u>; R-value of 8.1; or <u>R-value of \_\_</u>>>.
    - a. Vision Lites: Dual pane glazed.
      - 1) Size: As indicated in drawings.
  - 4. Nominal Slat Size: << <u>2 inches</u>; 3 inches; or \_\_\_\_\_ inches>> wide by required length.
  - 5. Finish: Anodized, << \_\_\_\_\_ color; or <u>color as selected</u>>>.

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- 6. Guide, Angles: << <u>Galvanized steel</u>; Primed steel; Stainless steel; or \_\_\_\_>>.
- 7. Hood Enclosure: << <u>Manufacturer's standard;</u> As indicated on drawings; or \_\_\_\_\_>; << <u>primed steel;</u> galvanized steel; aluminum; or \_\_\_\_\_>>.
- 8. Electric operation.
- 9. Mounting: << As indicated on drawings; Face mounted; Surface mounted; <u>Within</u> <u>framed opening; or \_\_\_\_>></u>.
- 10. Locking Devices: << Slide bolt on inside; <u>Chain lock keeper on inside</u>; Lock and latch handle on outside; or \_\_\_\_>>.
- B. Interior Non-Fire-Rated Coiling Doors<< <u>Type</u> \_\_; or None N/A>>: << <u>Steel</u>; Stainless steel; Aluminum; or \_\_\_\_\_>> slat curtain.
  - 1. Single Thickness Slats: Manufacturer's standard.
    - a. Vision Lites: Single pane glazed.
      - Material: Manufacturer's standard << <u>polycarbonate sheet with proprietary</u> <u>abrasion resistant surfaces</u>; polycarbonate sheet with proprietary abrasion and UV resistant surfaces; acrylic sheet with manufacturer's standard abrasion resistant surfaces; acrylic sheet with manufacturer's standard abrasion and UV resistant surfaces; or \_\_\_\_>>.
      - 2) Size: As indicated in drawings.
      - Spacing: << <u>Manufacturer's standard for door width</u>; As indicated on drawings; or \_\_\_\_\_>>.
  - 2. Nominal Slat Size: << 2 inches; 3 inches; or \_\_\_\_\_ inches>> wide by required length.
  - 3. Finish: << <u>No. 4 Brushed;</u> or \_\_\_\_>>.

# 2.03 MATERIALS

- A. Metal Curtain Construction: << <u>Interlocking</u>; Hinged; or \_\_\_\_\_>> slats.
  - 1. Curtain Bottom for Slat Curtains: Fitted with << <u>angles</u>; or \_\_\_\_\_>> to provide reinforcement and positive contact in closed position.
  - Weatherstripping for Exterior Doors: Moisture and rot proof, resilient type, located at << jamb edges; bottom of curtain; where curtain enters hood enclosure; and >> of << all doors; exterior doors; doors indicated; or >>.
  - 3. Steel Slats: Minimum thickness, <u>gauge</u>, <u>inch</u>; ASTM A653/A653M galvanized steel sheet.
  - << <u>Single Wall</u>; Double-Wall; or \_\_\_\_>> Aluminum Slats: Minimum thickness; << <u>manufacturer's standard for door size and application</u>; or \_\_\_\_ inch>>, made from ASTM B221 (ASTM B221M)<< <u>, aluminum alloy Type 6063</u>; <u>, \_\_\_\_</u>; or None N/A>>.
- B. Guide Construction: Continuous, of profile to retain door in place<< <u>with snap-on trim;</u> ; or None - N/A>>, mounting brackets of same metal.
- C. Guides Angle: ASTM A36/A36M metal angles, size << <u>as indicated</u>; as required for wind loading; or \_\_\_\_\_>>.
  - 1. Hot-dip galvanized in compliance with ASTM A123/A123M.
- D. Hood Enclosure and Trim: Internally reinforced to maintain rigidity and shape.

# 2.04 ELECTRIC OPERATION

- Operator, Controls, Actuators, and Safeties: Comply with UL 325; provide products listed by << <u>ITS (DIR)</u>; <u>UL (DIR)</u>; <u>testing agency acceptable to authorities having jurisdiction</u>; or \_\_\_\_\_>.
  - 1. Provide interlock switches on motor operated units.
- B. Electric Operators:
  - 1. Mounting: << <u>Side mounted;</u> Center mounted; or \_\_\_\_>>.
  - 2. Motor Enclosure:
  - 3. Motor Rating: << <u>1/3 HP;</u> 1/2 HP; 3/4 HP; 1 HP; 2 HP; or \_\_\_\_\_ HP>>; continuous duty.
  - 4. Motor Voltage: << <u>120;</u> or \_\_\_>> volts, << <u>single;</u> three; or \_\_\_\_>> phase, 60 Hz.

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- 5. Motor Controller: NEMA ICS 2, full voltage, reversing magnetic motor starter.
- 6. Controller Enclosure: NEMA 250, << <u>Type 4</u>; Type 4X; or Type \_\_\_>>.
- Opening Speed: << 6 inches per second; <u>12 inches per second</u>; <u>24 inches per second</u>; <u>48 inches per second</u>; <u>60 inches per second</u>; <u>100 inches per second</u>; or <u>\_\_\_\_\_inches per second</u>>>.
- 8. Brake: << <u>Manufacturer's standard;</u> Adjustable friction clutch; or \_\_\_\_>> type, activated by motor controller.
- 9. Manual override in case of power failure.
- 10. See Section <u>26 0583</u> for electrical connections.
- C. Control Station: Provide standard << <u>three button</u>; key-operated; or \_\_\_\_\_>>, 'Open-Close-Stop' << <u>momentary-contact</u>; or continuous-constant>> control device for each operator complying with UL 325.
  - 1. << <u>24;</u> or \_\_\_\_> volt circuit.
  - << <u>Surface</u>; Recess; or \_\_\_\_>> mounted, at << <u>interior door jamb</u>; exterior location as indicated on drawings; or \_\_\_\_\_>>.
  - 3. Entrapment Protection Devices: Provide sensing devices and safety mechanisms complying with UL 325.
    - a. Primary Device: Provide << <u>electric sensing edge</u>; <u>wireless sensing</u>; <u>NEMA 1</u> <u>photo eye sensors</u>; <u>NEMA 4X photo eye sensors</u>; or \_\_\_\_>> as required with momentary-contact control device.
- D. Safety Edge: Located at bottom of coiling door, full width, << <u>electro-mechanical;</u> pneumatic; or \_\_\_\_\_>> sensitized type, wired to stop and reverse door direction upon striking object, hollow << <u>neoprene</u>; rubber; or \_\_\_\_\_>> covered.

# PART 3 EXECUTION

# 3.01 EXAMINATION

- A. Verify that adjacent construction is suitable for door installation.
- B. Verify that electrical services have been installed and are accessible.
- C. Verify that door opening is plumb, header is level, and dimensions are correct.
- D. Notify Architect of any unacceptable conditions or varying dimensions.
- E. Commencement of installation indicates acceptance of substrate and door opening conditions.

# 3.02 INSTALLATION

- A. Install units in accordance with manufacturer's instructions.
- B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.
- C. Securely and rigidly brace components suspended from structure.<< <u>Secure guides to</u> <u>structural members only.;</u> .; or None N/A>>
- D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.
- E. Coordinate installation of electrical service with Section 26 0583.
- F. Complete wiring from disconnect to unit components.
- G. Install enclosure and perimeter trim.

# 3.03 TOLERANCES

- A. Maintain dimensional tolerances and alignment with adjacent work.
- B. Maximum Variation From Plumb: << <u>1/16 inch;</u> or \_\_\_\_\_ inch>>.
- C. Maximum Variation From Level: << <u>1/16 inch</u>; or \_\_\_\_ inch>>.
- D. Longitudinal or Diagonal Warp: Plus or minus << <u>1/8 inch per 10 feet</u>; or \_\_\_\_ inch per 10 feet>> straight edge.

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# 3.04 ADJUSTING

A. Adjust operating assemblies for smooth and noiseless operation.

# END OF SECTION 08 3323

### SECTION 08 3500 SIDE-FOLDING GRILLES – OPEN DESIGN

### PART 1 GENERAL

### 1.01 SUMMARY

- A. Section Includes: Aluminum, manually operated, side-folding grilles.
- B. Related Sections:
  - 1. 05 50 00 Metal Fabrications. Structural support for track.
  - 2. 06 10 00 Rough Carpentry. Structural support for track.
  - 3. 08 31 00 Access Doors and Panels. Access doors.
  - 4. 08 70 00 Hardware. Masterkeyed cylinders.

# 1. Cookson

C. Alternates:

# 1.02 SUBMITTALS

- A. Reference Section 01 33 00 Submittal Procedures; submit the following items:
  - 1. Product Data.
  - 2. Shop Drawings: Include special conditions not detailed in Product Data. Show interface with adjacent work.
  - 3. Quality Assurance/Control Submittals:
    - a. Provide proof of manufacturer and installer qualifications see 1.3 below.
    - b. Provide manufacturer's installation instructions.
  - 4. Closeout Submittals:
    - a. Operation and Maintenance Manual.
    - b. Certificate stating that installed materials comply with this specification.

# 1.03 QUALITY ASSURANCE

- A. Qualifications:
  - 1. Manufacturer Qualifications: Minimum of five years experience in producing side-folding grilles of the type specified.
  - 2. Installer Qualifications: Manufacturer's approval.

# 1.04 DELIVERY STORAGE AND HANDLING

- A. Reference Section 01 66 00 Product Storage and Handling Requirements.
- B. Follow manufacturer's instructions.

# 1.05 DESIGN / PERFORMANCE REQUIREMENTS

- A. Stacking:
  - 1. Minimum stacking shall be 1.05 inches/linear foot (87.5 mm/meter) of opening plus 3.5 inches (89 mm) for each locking member.
  - 2. Grille support must be designed to carry the weight of a fully stacked door at any point along its length. Support is to carry the total weight / the total stacking and is express as lbs. per linear ft.
- B. Lintel Deflection: Accommodate deflection of lintel to prevent damage to components, deterioration of seals, or movement between door frame and perimeter framing.
- C. Thermal Movement: Design sections to permit thermal expansion and contraction of components to match perimeter opening construction.

#### 1.06 WARRANTY

- A. Standard Warranty: Two years from date of shipment against defects in material and workmanship.
- B. Maintenance: Submit for owner's consideration and acceptance of a maintenance service agreement for installed products.

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# PART 2 PRODUCTS

# 2.01 MANUFACTURER

- A. Manufacturer: Cornell 24 Elmwood Avenue, Mountain Top, PA 18707. Telephone: (800) 233-8366.
- B. Model: ESG32 GlideGard
- C. Substitutions: Reference Section 01 25 13 Product Substitution Procedures.

# 2.02 MATERIALS

- A. Curtain:
  - 1. Vertical Tubes: 5/16 inch (8 mm) diameter, 6063 T5 aluminum alloy, 3.5 inches (89 mm) on center.
  - 2. Tube Spacers: 7/16 inch (11 mm) outside diameter aluminum tubes to maintain horizontal chain spacing.
  - 3. Horizontal Bars: Aluminum bars, 6 inches x 3/4 inch (152 mm x 19 mm), Bars to be vertically spaced at 6 inches (152 mm) o.c. in a straight pattern.
  - 4. Hinge Panels: 2 inch (51 mm) high continuous interlocking aluminum panels at the top and bottom of the closure.
  - 5. Leading End Member: 1 5/16 x 2 3/8 x 1/8 inch (33 x 60 x 3 mm) thick extruded aluminum tube with recess for attaching curtain sections.
    - a. Provide concealed masterkeyable, cylinder operated hook-bolt #7 member with lock operable from public side of curtain; thumbturn cylinder lock operable from tenant side of curtain that engages a full height wall channel. Provide rubber bumper at the edge of the locking member.
  - 6. Intermediate Member(s): 1 5/16 x 2 3/8 x 1/8 inch (33 x 60 x 3 mm) thick extruded aluminum tube with recess for attaching curtain sections.
    - a. Provide concealed masterkeyable, cylinder operated, bottom ratcheted rod #3 member with lock operable from both sides of curtain. Supply dustproof floor sockets for all drop bolts. Provide rubber bumper at the edge of the locking member.
  - 7. Trailing End Member: 1 5/16 x 2 3/8 x 1/8 inch (33 x 60 x 3 mm) thick extruded aluminum tube with recess for attaching curtain sections.
    - a. Provide #8 fixed end member.
    - b. Provide self locking #6 floating end member with an attached full height protection plate and self locking into a steel V-stop mounted to the floor or counter inside the storage pocket.
- B. Trolleys: 1 1/8 inch (29 mm) diameter nylon tired ball bearing wheels; two wheel assembly at each hanger; three wheel assembly at all vertical members.
- C. Track: 1.3 x 1.8 inch (33 x 46 mm) thick extruded aluminum section with continuous recess for splice tongues and pins.
  - 1. Provide 15 degree curve track section(s) with a 14 inch radius.
- D. Finishes: Clear anodized.

# 2.03 ACCESSORIES

- A. Pocket Door:
  - 1. Door
    - a. Material: A36 HR steel
    - b. Thickness: USS 12-gauge
    - c. Finish: Phosphate treatment followed by a light gray baked-on polyester powder coat; minimum 2.5 mils (0.065 mm) cured film thickness.
    - d. Finish: Phosphate treatment followed by a baked-on polyester powder coat, color as selected from manufacturer's standard color range, minimum 2.5 mils (0.065 mm) cured film thickness; ASTM-D-3363 pencil hardness: H or better.
    - e. Size: Rough opening minus 13/16" (20.6 mm)

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- 2. Frame
  - a. Material: A36 HR steel
  - b. Thickness: USS 12-gauge steel
  - c. Finish: Phosphate treatment followed by a light gray baked-on polyester powder coat; minimum 2.5 mils (0.065 mm) cured film thickness.
  - d. Finish: Phosphate treatment followed by a baked-on polyester powder coat, color as selected from manufacturer's standard color range, minimum 32 colors minimum 2.5 mils (0.065 mm) cured film thickness; ASTM-D-3363 pencil hardness: H or better.
  - e. Size: Overlaps opening 2" (50.8 mm) with a 5/8" (15.9 mm) projection off wall
- 3. Hinges: 3" (76.2 mm) non-mortise type
- 4. Lock: 1" (25.4 mm) security mortise cylinder
- B. Emergency Egress Door
  - 1. Fall away man-door egress operable by means of thumb-turn. Door not to be used as a regular means of egress.
- C. Fixed Panel: Static grille curtain with frame assembly to fill adjacent space(s) around coiling grille.
  - 1. Finish and pattern to match coiling grille.

# 2.04 FABRICATION

- A. Fabricate with every fourth vertical rod as a hanger rod. Provide tube spacers at each hanger rod to maintain chain spacing.
- B. Hinge Panels: Continuous rows between top two and bottom two chain sets.
- C. Intermediate Members: Spacing not to exceed 13 feet (3.05 M) on center and located at each curve.
- D. Bi-Parting Grilles: Attach strike channel to appropriate curtain section.

# 2.05 OPERATION

A. Manual push-pull.

# PART 3 EXECUTION

# 3.01 EXAMINATION

- A. Examine header substrates upon which side-folding grilles will be installed and verify conditions are in accordance with approved shop drawings. Header, floor or sill to be level across entire grille opening.
- B. Commencement of work by installer is acceptance of substrate.

#### 3.02 INSTALLATION

- A. General: Install side-folding grille with necessary hardware, anchors, inserts, hangers and supports.
- B. Follow manufacturer's installation instructions.

#### 3.03 ADJUSTING

A. Following completion of installation, including related work by others, lubricate, test, and adjust side-folding grilles for ease of operation.

# 3.04 CLEANING

- A. Clean surfaces soiled by work as recommended by manufacturer.
- B. Remove surplus materials and debris from the site.

#### 3.05 **DEMONSTRATION**

- A. Demonstrate proper operation to Owner's Representative.
- B. Instruct Owner's Representative in maintenance procedures.

# END OF SECTION 08 3500

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Design Development Phase	08 3500 - 3	OPEN DESIGN
### SECTION 08 4313 ALUMINUM-FRAMED STOREFRONTS

### PART 1 GENERAL

### 1.01 SECTION INCLUDES

- A. Aluminum-framed storefront, with vision glass.
- B. Aluminum doors<< and frames; \_\_\_\_; or None N/A>>.
- C. Weatherstripping.

### 1.02 RELATED REQUIREMENTS

- A. Section 05 5000 Metal Fabrications: Steel attachment devices.
- B. Section **07 2500 Weather Barriers**: Sealing framing to water-resistive barrier installed on adjacent construction.
- C. Section 07 9200 Joint Sealants: Sealing joints between frames and adjacent construction.
- D. Section 08 4413 Glazed Aluminum Curtain Walls.
- E. Section **<u>08 7100 Door Hardware</u>**: Hardware items other than specified in this section.
- F. Section **08 8000 Glazing**: Glass and glazing accessories.

### 1.03 REFERENCE STANDARDS

- A. AAMA CW-10 Care and Handling of Architectural Aluminum From Shop to Site; 2015.
- B. AAMA 611 Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).
- C. AAMA 612 Voluntary Specification, Performance Requirements, and Test Procedures for Combined Coatings of Anodic Oxide and Transparent Organic Coatings on Architectural Aluminum; 2017a.
- D. ASTM B221 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2020.
- E. ASTM B221M Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.
- F. ASTM E283/E283M Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.
- G. ASTM E330/E330M Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.

### **1.04 ADMINISTRATIVE REQUIREMENTS**

A. Coordinate with installation of other components that comprise the exterior enclosure.

### 1.05 SUBMITTALS

- A. See Section **01 3000 Administrative Requirements** for submittal procedures.
- B. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.
- C. Samples: Submit << <u>two;</u> or \_\_\_\_>> samples \_\_\_\_\_ <u>inches</u> in size illustrating finished aluminum surface, glass<< <u>, infill panels;</u> , \_\_\_\_; or None N/A>>, glazing materials.
- D. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.
- E. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.
- F. Installer's Qualification Statement.

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G. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

### 1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least << <u>three</u>; or \_\_\_\_>> years of<< documented; \_\_\_\_; or <u>None - N/A</u>>> experience.
- B. Installer Qualifications: Company specializing in performing work of type specified and with at least << <u>three</u>; or \_\_\_\_\_> years of<< <u>documented</u>; \_\_\_\_; or None N/A>> experience<< and approved by manufacturer; \_\_\_\_; or <u>None N/A</u>>>.

# 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Handle products of this section in accordance with AAMA CW-10.
- B. Protect finished aluminum surfaces with << <u>wrapping</u>; strippable coating; or \_\_\_\_>>. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

### 1.08 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than << <u>40 degrees F</u>; or <u>\_\_\_\_\_</u> degrees F>>. Maintain this minimum temperature during and << <u>48</u>; or <u>\_\_\_\_</u>>> hours after installation.

### 1.09 WARRANTY

- A. See Section <u>01 7800 Closeout Submittals</u> for additional warranty requirements.
- B. Provide << <u>five</u>; or \_\_\_\_>> year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.

### PART 2 PRODUCTS

### 2.01 MANUFACTURERS

- A. << Other Acceptable ; or <u>None N/A</u>>>Aluminum-Framed Storefronts Manufacturers:
  - 1. Kawneer North America<< ; \_\_\_\_\_; or None N/A>>: www.kawneer.com/#sle.

2. Substitutions: << <u>See Section 01 6000 - Product Requirements</u>; or Not permitted>>.

### 2.02 BASIS OF DESIGN -- FRAMING FOR INSULATING GLAZING

- A. Front-Set Style, Thermally-Broken:
  - 1. Basis of Design: Kawneer, 451-T.
  - Vertical Mullion Dimensions: << <u>2 inches wide by 4-1/2 inches deep;</u> or \_\_\_\_>>.
- B. Front-Set Style, Not Thermally-Broken:
  - 1. Basis of Design: **Kawneer, 451**.
  - 2. Vertical Mullion Dimensions: << 2 inches wide by 4-1/2 inches deep; or \_\_\_\_>>.
- C. Substitutions: << See Section 01 6000 Product Requirements; or Not permitted>>.
  - 1. For any product not identified as "Basis of Design", submit information as specified for substitutions.

### 2.03 BASIS OF DESIGN -- FRAMING FOR MONOLITHIC GLAZING

### 2.04 BASIS OF DESIGN -- SWINGING DOORS

A. Medium Stile, Insulating Glazing, << Not Thermally-Broken; or <u>Thermally-Broken</u>>>:
 1. Basis of Design: Kawneer.

# 2.05 ALUMINUM-FRAMED STOREFRONT

A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.

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- 1. Finish: << Class I natural anodized; Class II natural anodized; Class I color anodized; Class II color anodized; Natural anodized with organic seal; <u>Color</u> <u>anodized with organic seal</u>; Pigmented organic coatings; High performance organic coatings; High performance silicone-modified polyester (SMP) organic coating; Superior performing organic coatings; or \_\_\_\_\_>>.
  - a. Factory finish all surfaces that will be exposed in completed assemblies.
- 2. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
- 3. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
- 4. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
- Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of << <u>170 degrees F</u>; or <u>degrees F</u>>> over a << <u>12</u>; or <u>>></u> hour period without causing detrimental effect to system components, anchorages, and other building elements.
- 6. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
- 7. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
- B. Performance Requirements
  - Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads << <u>1.5 times</u>; or \_\_\_\_\_>> the design wind loads and << <u>10 second</u>; or >> duration of maximum load.
    - a. Member Deflection: Limit member deflection to << <u>flexure limit of glass;</u> 1/175; or \_\_\_\_\_\_> in any direction, with full recovery of glazing materials.
  - Air Leakage: << <u>0.06 cfm/sq ft</u>; or <u>cfm/sq ft>></u> maximum leakage of storefront wall area when tested in accordance with ASTM E283/E283M at << <u>1.57 psf</u>; 6.27 psf; or <u>psf>></u> pressure difference.

### 2.06 COMPONENTS

- A. Aluminum Framing Members: Tubular aluminum sections<< , thermally broken with interior section insulated from exterior; None - N/A; or \_\_\_\_\_>>, drainage holes and internal weep drainage system.
  - 1. Framing members for interior applications need not be thermally broken.
  - 2. Glazing Stops: << <u>Flush;</u> Applied; or \_\_\_\_\_>>.
- B. Glazing: See Section 08 8000.
- C. Swing Doors: << <u>Glazed aluminum;</u> Flush aluminum; or \_\_\_\_\_>>.
  - 1. Thickness: << <u>1-3/4 inches;</u> 2 inches; or \_\_\_\_\_ inches>>.
  - 2. Top Rail: << <u>4 inches;</u> or \_\_\_\_\_ inches>> wide.
  - 3. Vertical Stiles: << <u>4-1/2 inches;</u> or \_\_\_\_\_ inches>> wide.
  - 4. Bottom Rail: << 10 inches; 6 inches; or \_\_\_\_\_ inches>> wide.
  - 5. Glazing Stops: << <u>Square</u>; Beveled; or \_\_\_\_>>.
  - 6. Finish: Same as storefront.

### 2.07 MATERIALS

- A. Extruded Aluminum: ASTM B221 (ASTM B221M).
- B. Fasteners: << <u>Stainless;</u> Galvanized; or \_\_\_\_>> steel.
- C. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

### 2.08 FINISHES

- A. Class I Natural Anodized Finish: AAMA 611<< <u>AA-M12C22A41</u>; \_\_\_\_; or None N/A>> Clear anodic coating not less than <u>0.7 mils</u> thick.
- B. Color Anodized Finish with Organic Seal: AAMA 612 Electrolytically deposited colored anodic coating with non-aqueous electro-deposited organic seal; not less **0.7 mils**.

### 2.09 HARDWARE

- A. For each door, include << <u>weatherstripping</u>; <u>sill sweep strip</u>; <u>threshold</u>; and \_\_\_\_>>.
- B. Other Door Hardware: See Section 08 7100.
- C. Weatherstripping: << <u>Wool;</u> or \_\_\_\_>> pile, continuous<< <u>and replaceable;</u> None N/A; or \_\_\_\_\_>>; provide on << <u>all doors;</u> all exterior doors; or \_\_\_\_\_>>.
- D. Sill Sweep Strips: Resilient seal type,<< <u>retracting.</u>; None N/A; or \_\_\_\_>> of << <u>neoprene</u>; or \_\_\_\_>>; provide on << <u>all doors</u>; all exterior doors; or \_\_\_\_>>.
- E. Threshold: Extruded aluminum, one piece per door opening, << <u>ribbed;</u> non-slip; or \_\_\_\_\_>> surface; provide on << <u>all doors;</u> all exterior doors; or \_\_\_\_\_>>.

### PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify dimensions, tolerances, and method of attachment with other work.
- B. Verify that storefront wall openings and adjoining water-resistive and/or air barrier seal materials are ready to receive work of this section.

#### 3.02 INSTALLATION

- A. Install wall system in accordance with manufacturer's instructions.
- B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- C. Provide alignment attachments and shims to permanently fasten system to building structure.
- D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances<< <u>, aligning with adjacent work;</u> <u>, \_\_\_\_;</u> or None N/A>>.
- E. Provide thermal isolation where components penetrate or disrupt building insulation.
- F. Install << <u>sill</u>; and \_\_\_\_\_>> flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.
- G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.
- H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- I. Set thresholds in bed of sealant and secure.
- J. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

#### 3.03 TOLERANCES

- A. Maximum Variation from Plumb: << <u>0.06 inch per 3 feet</u>; or \_\_\_\_\_ inch per 3 feet>> noncumulative or << <u>0.06 inch per 10 feet</u>; or \_\_\_\_\_ inch per 10 feet>>, whichever is less.
- B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: << <u>1/32 inch</u>; or \_\_\_\_\_ inch>>.

### 3.04 FIELD QUALITY CONTROL

- A. See Section 01 4000 Quality Requirements for general testing and inspection requirements.
- B. Repair or replace storefront components that have failed designated field testing, and retest to verify performance complies with specified requirements.

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# 3.05 ADJUSTING

A. Adjust operating hardware<< and sash; ; or None - N/A>> for smooth operation.

# 3.06 CLEANING

- A. Remove protective material from pre-finished aluminum surfaces.
- B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths, and take care to remove dirt from corners and to wipe surfaces clean.

# 3.07 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

# END OF SECTION 08 4313

### SECTION 08 4413 GLAZED ALUMINUM CURTAIN WALLS

### PART 1 GENERAL

# 1.01 SECTION INCLUDES

- B. Firestopping between curtain wall and edge of floor slab.

# 1.02 RELATED REQUIREMENTS

- A. Section <u>03 3000 Cast-in-Place Concrete</u>: Weld plates embedded in concrete for attachment of anchors.
- B. Section 05 1200 Structural Steel Framing: Steel attachment members.
- C. Section 05 5000 Metal Fabrications: Steel attachment devices.
- D. Section **07 2500 Weather Barriers**: Sealing framing to water-resistive barrier installed on adjacent construction.
- E. Section <u>07 8400 Firestopping</u>: Firestop at system junction with structure.
- F. Section 07 9200 Joint Sealants: Sealing joints between frames and adjacent construction.
- G. Section 08 4313 Aluminum-Framed Storefronts: Entrance framing and doors.
- H. Section 08 8000 Glazing.
- I. Section <u>09 2116 Gypsum Board Assemblies</u>: Metal stud<< <u>and gypsum board</u>; or None N/A>> wall at interior of curtain wall.
- J. Section <u>09 9123 Interior Painting</u>: Field painting of << <u>interior surface of infill panels</u>; and \_\_\_\_\_\_>>.
- K. Section <u>**12 2400 Window Shades</u>**: Attachments to framing members.</u>

# 1.03 REFERENCE STANDARDS

- A. AAMA CW-10 Care and Handling of Architectural Aluminum From Shop to Site; 2015.
- B. AAMA 501.4 Recommended Static Test Method for Evaluating Curtain Wall and Storefront Systems Subjected to Seismic and Wind Induced Interstory Drifts; 2018.
- C. AAMA 611 Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).
- D. AAMA 1503 Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; 2009.
- E. ASCE 7 Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
- F. ASTM A36/A36M Standard Specification for Carbon Structural Steel; 2014.
- G. ASTM A123/A123M Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- H. ASTM B209/B209M Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021.
- I. ASTM B221 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2020.
- J. ASTM B221M Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.
- K. ASTM C661 Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer; 2015.
- L. ASTM C793 Standard Test Method for Effects of Laboratory Accelerated Weathering on Elastomeric Joint Sealants; 2005 (Reapproved 2017).

- M. ASTM C794 Standard Test Method for Adhesion-In-Peel of Elastomeric Joint Sealants; 2018.
- N. ASTM C920 Standard Specification for Elastomeric Joint Sealants; 2018.
- O. ASTM C1087 Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems; 2016.
- P. ASTM C1135 Standard Test Method for Determining Tensile Adhesion Properties of Structural Sealants; 2015.
- Q. ASTM C1184 Standard Specification for Structural Silicone Sealants; 2018, with Editorial Revision.
- R. ASTM C1249 Standard Guide for Secondary Seal for Sealed Insulating Glass Units for Structural Sealant Glazing Applications; 2018.
- S. ASTM C1401 Standard Guide for Structural Sealant Glazing; 2014.
- T. ASTM E283/E283M Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.
- U. ASTM E330/E330M Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.
- V. SSPC-Paint 20 Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).

# 1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate with installation of other components that comprise the exterior enclosure.
- B. Preinstallation Meeting: Conduct a preinstallation meeting << <u>one week;</u> or \_\_\_\_>> before starting work of this section; require attendance by all affected installers.

# 1.05 SUBMITTALS

- A. See Section **<u>01 3000 Administrative Requirements</u>** for submittal procedures.
- B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, internal drainage details, glazing<< , \_\_\_\_; or <u>None - N/A</u>>>, and infill.
- C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work, expansion and contraction joint location and details, and field welding required.
- D. Shop Drawings: Provide details of proposed structural sealant glazing (SSG) and weather sealant joints indicating dimensions, materials, bite, thicknesses, profile, and support framing.
- E. Samples: Submit << <u>two;</u> or \_\_\_\_\_>> samples <u>16 by 16 inches</u> in size illustrating finished aluminum surface, glazing,<< <u>infill panels</u>,; \_\_\_\_\_,; or None N/A>> and glazing materials.
- F. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.
- G. Design Data: Provide framing member structural and physical characteristics and engineering calculations, and identify dimensional limitations; include load calculations at points of attachment to building structure.
- H. Structural Sealant Glazing (SSG): Submit product data and calculations showing compliance with performance requirements.
- I. Test Reports: Submit results of full-size mock-up testing. << <u>Reports of tests previously</u> <u>performed on the same design are acceptable.</u>; or None - N/A>>
- J. Designer's Qualification Statement.
- K. Manufacturer's Qualification Statement.

- L. Installer's Qualification Statement.
- M. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

# 1.06 QUALITY ASSURANCE

- A. Designer Qualifications: Design curtain wall and its structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed at the State in which the Project is located.
- B. Verify that each component is appropriate for use in structural sealant glazing (SSG) application in regards to at least the following properties; size, shape, dimensions, material, self-life, storage conditions, and color.
- C. Installer Qualifications: Company specializing in performing work of type specified and with at least << <u>three</u>; or \_\_\_\_\_>> years of<< <u>documented</u>; \_\_\_\_; or None N/A>> experience<< and approved by manufacturer; or <u>None N/A</u>>>.

### 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Handle products of this section in accordance with AAMA CW-10.
- B. Protect finished aluminum surfaces with << <u>wrapping</u>; or strippable coating>>. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

### 1.08 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than << <u>40 degrees F</u>; or <u>\_\_\_\_\_</u> degrees F>>. Maintain this minimum temperature during and << <u>48</u>; or <u>\_\_\_\_</u>>> hours after installation.

#### 1.09 WARRANTY

- A. See Section **<u>01 7800 Closeout Submittals</u>** for additional warranty requirements.
- B. Provide << <u>five</u>; or \_\_\_\_>> year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.

# PART 2 PRODUCTS

### 2.01 MANUFACTURERS

- A. << Other Acceptable ; or <u>None N/A</u>>>Glazed Aluminum Curtain Walls Manufacturers:
  - 1. Kinslo Glass Wall: https://kinsloglasswall.com/
  - 2. Oldcastle Building Envelope<< ; \_\_\_\_; or None N/A>>: www.oldcastlebe.com/#sle.
  - 3. Substitutions: << See Section 01 6000 Product Requirements; or Not permitted>>.

### 2.02 CURTAIN WALL

- A. Aluminum-Framed Curtain Wall: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
  - 1. Outside triple-glazed, with pressure plate and mullion cover<< , where indicated on drawings; , \_\_\_\_; or <u>None N/A</u>>>.
  - Fabrication Method: << Either shop/factory or field fabricated system; Shop/factory unitized system; Field fabricated stick system; Shop/factory unit and mullion system; or \_\_\_\_\_>>.
  - 3. Glazing Method: << Either shop/factory or field glazed system; Shop/factory glazed system; Field glazed system; or \_\_\_\_>>.
  - 4. Perimeter and Horizontal Mullion Dimensions: 2 inches wide by 6 3/4 inches deep.
  - 5. Vertical Mullions: Silicone butt glazed
  - 6. Finish: << <u>Class I natural anodized;</u> Class II natural anodized; Class I color anodized; Class II color anodized; Natural anodized with organic seal; Color anodized with organic seal; Pigmented organic coatings; High performance

# organic coatings; High performance silicone-modified polyester (SMP) organic coatings; Superior performing organic coatings; or \_\_\_\_\_>>.

- a. Factory finish surfaces that will be exposed in completed assemblies.
- b. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
- 7. Provide flush joints and corners, weathersealed, accurately fitted and secured; prepared to receive anchors; fasteners and attachments concealed from view; reinforced as required for imposed loads.
- 8. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
- 9. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
- 10. Maintain continuous air barrier and/or vapor retarder seal throughout assembly, primarily in line with<< <u>inside</u>; <u>infill panel</u>; <u>infill</u>
- B. Structural Performance Requirements: Design and size components to withstand the following load requirements without damage or permanent set.
  - Design Wind Loads: Comply with << <u>the following:</u>; the applicable code.; the requirements of \_\_\_\_\_ code.; the requirements of ASCE 7; or \_\_\_\_\_.>>
    - a. Positive & Negative Design Wind Load: See Structural drawings (S006)
    - Measure performance by testing in accordance with ASTM E330/E330M, using test loads equal to << <u>1.5 times</u>; or \_\_\_\_>> the design wind loads and << <u>10 second</u>; or \_\_\_\_>> duration of maximum pressure.
    - c. Member Deflection: For spans less than << <u>13 feet 6 inches</u>; or \_\_\_\_\_ feet>>, limit member deflection to << <u>flexure limit of glass</u>; 1/175; or \_\_\_\_\_>> in any direction, and maximum of << <u>1/175 of span</u>; or \_\_\_\_\_>> or << <u>3/4 inch</u>; or inch>>, whichever is less and with full recovery of glazing materials.
    - d. Member Deflection: For spans over << <u>13 feet 6 inches</u>; or \_\_\_\_\_ feet>> and less than << <u>40 feet</u>; or \_\_\_\_\_ feet>>, limit member deflection to << <u>flexure limit of</u> glass; 1/175; or \_\_\_\_\_ >> in any direction, and maximum of << 1/175 of span; <u>1/240 of span plus 1/4 inch</u>; or \_\_\_\_\_ >>, with full recovery of glazing materials.

  - Interstory Differential Lateral Movement: Meeting pass/fail criteria of AAMA 501.4<< <u>for</u> <u>Use Group I, Standard Occupancy;</u> for Use Group II, High Occupancy Assembly; for Use Group III, Essential Facilities; \_\_\_\_; or None - N/A>>, when tested at design displacement of << <u>0.010</u>; 0.020; or \_\_\_\_>> times greater adjacent story height, maximum, and 1.5 times design displacement<< <u>, through three complete</u> <u>cycles</u>; , \_\_\_\_; or None - N/A>>.
  - 4. Movement: Accommodate the following movement without damage to components or deterioration of seals:
    - a. Expansion and contraction caused by << <u>180 degrees F</u>; or <u>degrees F>></u> surface temperature.
    - Expansion and contraction caused by cycling temperature range of << <u>170 degrees</u>
      <u>F</u>; or <u>degrees</u> F>> over a << <u>12</u>; or <u>>></u> hour period.
    - c. Movement of curtain wall relative to perimeter framing.
    - d. Deflection of structural support framing<< <u>, under permanent and dynamic loads</u>; or None N/A>>.
  - Structural Sealant Glazing (SSG) System: For individual glass lites, design framing members to not exceed a deflection normal to the wall of L/175 between supports with <u>3/4</u> <u>inch</u> maximum, and a deflection parallel to the wall of L/360 with <u>1/8 inch</u> maximum, whichever is less.

- C. Water Penetration Resistance on Manufactured Assembly: No uncontrolled water on indoor face when tested as follows:
  - 1. Test Pressure Differential: << <u>10 psf;</u> 15 psf; 20 psf; or \_\_\_\_ psf>>.
- D. Air Leakage: << <u>0.06 cfm/sq ft</u>; or <u>cfm/sq ft>></u> maximum leakage of wall area when tested in accordance with ASTM E283/E283M at << <u>6.27 psf</u>; or <u>psf>></u> pressure difference across assembly.
- E. Thermal Performance Requirements:
  - 1. Condensation Resistance Factor of Framing: << <u>50</u>; 60; 70; or \_\_\_>, minimum, measured in accordance with AAMA 1503.

### 2.03 COMPONENTS

- A. Aluminum Framing Members: Tubular aluminum sections<< <u>, thermally broken with interior</u> <u>section insulated from exterior</u>; <u>, \_\_\_\_</u>; or None N/A>>, drainage holes and internal weep drainage system.
- B. Glazing: See Section 08 8000.
- C. Infill Panels: Insulated, << <u>aluminum;</u> steel; or \_\_\_\_\_>> sheet face and back, with edges formed to fit glazing channel << <u>and sealed;</u> or <u>unsealed to permit air movement>></u>.
  - 1. Face Sheet: **<u>0.032 inch</u>** thick.
  - 2. Core: << <u>Glass fiber</u>; Rigid polystyrene; Rigid polyurethane; or \_\_\_\_\_>> insulation core with <u>R-value of depth of mullion (R=12 min)</u>.
  - 3. Back Sheet: **<u>0.032 inch</u>** thick.
- D. Sun Screens: Shop fabricated, shop finished, extruded aluminum outriggers.
  - 1. Outrigger Shape: << <u>Straight;</u> Bullnose; Curved; Wedge; or \_\_\_\_\_>>.
  - 2. Design Criteria: Design and fabricate to resist the same loads as curtain wall system as well as the following loads without failure, damage, or permanent deflection:
    - a. Snow: \_\_\_\_**psf**; minimum.
    - b. Live: \_\_\_\_**psf**; minimum.
    - c. Thermal Movement: Plus/minus << <u>1/8 inch;</u> or \_\_\_ inch>>, maximum.
  - 3. Sizes: As indicated on drawings.
  - 4. Shop fabricate to the greatest extent possible; disassemble if necessary for shipping.
  - 5. Products:
    - a. Terracotta, Agrob Buchtal: KeraShape.
    - b. Substitutions: << <u>See Section</u> 01 6000 <u>Product Requirements</u>; or Not permitted>>.

### 2.04 MATERIALS

- A. Extruded Aluminum: ASTM B221 (ASTM B221M).
- B. Sheet Aluminum: ASTM B209/B209M.
- C. Structural Steel Sections including those inside long-span vertical mullions: ASTM A36/A36M; galvanized in accordance with requirements of ASTM A123/A123M.
- D. Structural Supporting Anchors: See Section 05 1200.
- E. Structural Supporting Anchors Attached to Structural Steel: Design for << <u>bolted</u>; or welded>> attachment.
- F. Structural Supporting Anchors Attached to Reinforced Concrete Members: Design for welded attachment to weld plates embedded in concrete.
- G. Fasteners: << <u>Stainless</u>; or Galvanized>> steel; type as required or recommended by curtain wall manufacturer.
- H. Exposed Flashings: Aluminum sheet, << <u>20 gauge, 0.032 inch</u>; or <u>gauge, inch</u>>> minimum thickness; finish to match framing members.

- I. Concealed Flashings: Sheet aluminum, << <u>26 gauge, 0.017 inch;</u> or <u>gauge, inch>></u> minimum thickness.
- J. Firestopping: See Section 07 8400.
- K. Structural Sealant Glazing (SSG) Adhesive: Neutral curing, silicone sealant formulated for SSG applications in compliance with ASTM C1184 and structural glazing industry guidelines, ASTM C1401.
  - SSG adhesive in compliance with ASTM C920; << <u>Type S Single-component</u>; Type M - Multicomponent; or \_\_\_\_\_>>, Grade NS, << <u>Class 50</u>; Class 25; or Class \_\_\_>>, Use NT, G, and A.
  - 2. Ultimate Tensile Strength: Minimum of <u>**50 psi**</u> as determined by test method ASTM C1135 under the following conditions.
    - a. Exposure to air temperatures of <u>190 degrees F</u> and <u>minus 20 degrees F</u>.
    - b. Water immersion for seven (7) days, minimum.
    - c. Exposure to weathering for 5,000 hours, minimum.
  - 3. Sealant Design Tensile Strength: **<u>20 psi</u>**, maximum.
  - 4. Hardness: 20 to 60 with Type A-2 durometer in compliance with test method ASTM C661.
  - 5. Color: << <u>Black;</u> Gray; or \_\_\_\_>>.
  - 6. SSG sealant tested for compatibility with glazing accessories in compliance with ASTM C1087, tested for accelerated weathering in compliance with ASTM C793, and in compliance with insulating glass secondary sealant design standards of ASTM C1249.
- L. Weatherseal Sealant: Silicone, with adhesion in compliance with ASTM C794; << <u>compatible</u> <u>with glazing accessories</u>; compatible with structural sealant glazing (SSG) adhesive; type recommended by structural sealant glazing (SSG) adhesive manufacturer; or \_\_\_\_>>.
- M. Sill Flashing Sealant: Elastomeric, silicone or polyurethane, and compatible with flashing material.
- N. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.
- O. Beauty Caps: 2" at system perimeter and horizontal mullions as indicated in the drawings.
- P. Glazing Accessories: See Section 08 8000.
- Q. Touch-Up Primer for Galvanized Steel Surfaces: << <u>SSPC-Paint 20, zinc rich;</u> or \_\_\_\_\_>>.

### 2.05 FINISHES

- A. Class I Natural Anodized Finish: AAMA 611<< <u>AA-M12C22A41</u>; or None N/A>> Clear anodic coating not less than <u>0.7 mils</u> thick.
- B. Color: To be selected by Architect from manufacturer's << standard; <u>full</u>; custom; or \_\_\_\_\_>> range.
- C. Touch-Up Materials: As recommended by coating manufacturer for field application.

### PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify dimensions, tolerances, and method of attachment with other related work.
- B. Verify that curtain wall openings and adjoining water-resistive and air barrier seal materials are ready to receive work of this section.
- C. Verify that anchorage devices have been properly installed and located.

# 3.02 INSTALLATION

- A. Install curtain wall system in accordance with manufacturer's instructions.
- B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

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Design Development Phase	08 44 13 - 0	Giazeu Aluminum Curtain Walls

- C. Provide alignment attachments and shims to permanently fasten system to building structure.
- D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances<< <u>, aligning with adjacent work;</u> , \_\_\_\_; or None N/A>>.
- E. Provide thermal isolation where components penetrate or disrupt building insulation.
- F. Install << <u>sill</u>; head; eave edge; and \_\_\_\_\_>> flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.
- G. << <u>Install</u>; Coordinate installation of; or \_\_\_\_\_>> firestopping at each floor slab edge.
- H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- I. Structural Sealant Glazing (SSG) Adhesive: Install structural sealant glazing adhesive and weatherseal sealant in accordance with manufacturer's instructions.
- J. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

### 3.03 TOLERANCES

- A. Maximum Variation from Plumb: << <u>0.06 inches every 3 ft;</u> or \_\_\_\_\_ inches every 3 ft>> noncumulative or << <u>0.5 inches per 100 ft;</u> or \_\_\_\_\_ inches per 100 ft>>, whichever is less.
- B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: << <u>1/32 inch</u>; or \_\_\_\_\_ inch>>.
- C. Sealant Space Between Curtain Wall Mullions and Adjacent Construction: Maximum of << <u>3/4</u> <u>inch;</u> or \_\_\_\_\_ inch>> and minimum of << <u>1/4 inch;</u> or \_\_\_\_\_ inch>>.

### 3.04 FIELD QUALITY CONTROL

- A. See Section **<u>01 4000 Quality Requirements</u>** for general testing and inspection requirements.
- B. Repair or replace curtain wall components that have failed designated field testing, and retest to verify performance complies with specified requirements.

# 3.05 CLEANING

- A. Remove protective material from pre-finished aluminum surfaces.
- B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths, take care to remove dirt from corners, and wipe surfaces clean.

### 3.06 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

### END OF SECTION 08 4413

#### SECTION 08 5113 ALUMINUM WINDOWS

### PART 1 GENERAL

### 1.01 SECTION INCLUDES

- A. Extruded aluminum windows with << <u>fixed sash</u>; operating sash; infill panels; and \_\_\_\_\_>>.
- B. << <u>Factory glazing</u>; Site glazing; or \_\_\_\_\_>>.

#### 1.02 RELATED REQUIREMENTS

- A. Section **07 2500 Weather Barriers**: Sealing frame to water-resistive barrier installed on adjacent construction.
- B. Section <u>07 9200 Joint Sealants</u>: Sealing joints between window frames and adjacent construction.

### **1.03 REFERENCE STANDARDS**

- A. AAMA/WDMA/CSA 101/I.S.2/A440 North American Fenestration Standard/Specification for Windows, Doors, and Skylights; 2017.
- B. AAMA CW-10 Care and Handling of Architectural Aluminum From Shop to Site; 2015.
- C. AAMA 611 Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).
- D. ASTM E283/E283M Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.
- E. ASTM E331 Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2016).

#### **1.04 ADMINISTRATIVE REQUIREMENTS**

A. Preinstallation Meeting: Convene << <u>one week</u>; or \_\_\_\_>> before starting work of this section.

#### 1.05 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements for submittal procedures.
- B. Product Data: Include << <u>component dimensions</u>; <u>information on glass and glazing</u>; <u>internal drainage details</u>; descriptions of hardware and accessories; and \_\_\_\_\_>>.
- C. Shop Drawings: Indicate opening dimensions<< <u>, elevations of different types</u>; , \_\_\_\_; or None N/A>>, framed opening tolerances, anchorage locations<< <u>, \_\_\_\_; or None N/A>></u>, and installation requirements.
- D. Samples:
  - 1. Sashes: << <u>Two;</u> or \_\_\_\_>> samples, << <u>12 by 12 inch;</u> or \_\_\_\_by\_\_\_ inch>> in size illustrating typical corner construction, accessories, and finishes.
- E. Grade Substantiation: Prior to submitting shop drawings or starting fabrication, submit one of the following showing compliance with specified grade:
  - 1. Evidence of AAMA Certification.
  - 2. Evidence of WDMA Certification.
  - 3. Evidence of CSA Certification.
  - 4. Test report(s) by independent testing agency itemizing compliance<< <u>and acceptable to</u> <u>authorities having jurisdiction;</u> ; or None N/A>>.
- F. Test Reports: Prior to submitting shop drawings or starting fabrication, submit test report(s) by independent testing agency showing compliance with performance requirements in excess of those prescribed by specified grade.
- G. Manufacturer's Installation Instructions: Include complete preparation, installation, and cleaning requirements.

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- H. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.
- I. Installer's qualification statement.
- J. Specimen warranty.

# 1.06 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of type specified and with at least << <u>three</u>; or \_\_\_\_\_>> years of<< documented; \_\_\_\_\_; or <u>None - N/A</u>>> experience<< and approved by manufacturer; \_\_\_\_\_; or <u>None - N/A</u>>>.

### 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of AAMA CW-10.
- B. Protect finished surfaces with wrapping paper or strippable coating during installation. Do not use adhesive papers or sprayed coatings that bond to substrate when exposed to sunlight or weather.

### **1.08 FIELD CONDITIONS**

- A. Do not install sealants when ambient temperature is less than << <u>40 degrees F</u>; or <u>degrees F>></u>.
- B. Maintain this minimum temperature during and << 24; or \_\_>> hours after installation of sealants.

# 1.09 WARRANTY

- A. See Section <u>01 7800 Closeout Submittals</u> for additional warranty requirements.
- B. Correct defective work within a << <u>five</u>; or \_\_\_\_>> year period after Date of Substantial Completion.
- C. Manufacturer Warranty: Provide << <u>5-year</u>; or \_\_\_\_>> manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units. Complete forms in Owner's name and register with manufacturer.

### PART 2 PRODUCTS

#### 2.01 MANUFACTURERS

- A. Basis of Design: Kawneer 8225TL.
- B. << <u>Other Acceptable ;</u> or None N/A>>Aluminum Windows Manufacturers:
  - 1. Substitutions: << See Section 01 6000 Product Requirements; or Not permitted>>.

### 2.02 ALUMINUM WINDOWS

- A. Aluminum Windows: Extruded aluminum frame and sash, factory fabricated, factory finished, with operating hardware, related flashings, and anchorage and attachment devices.
  - Frame Depth: << 3-1/2 inch; 2-1/4 inch; 2-1/2 inch; 3-7/8 inch; 4 inch; or \_\_\_\_\_ inch>>.
  - 2. Provide factory-glazed units.
  - 3. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors; fasteners and attachments concealed from view; reinforced as required for operating hardware and imposed loads.
  - 4. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
  - 5. Movement: Accommodate movement between window and perimeter framing and deflection of lintel, without damage to components or deterioration of seals.
  - 6. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
- B. Fixed, Non-Operable Type:

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- 1. Construction: << Thermally broken; Non-thermally broken; or \_\_\_\_\_>>.
- 2. Glazing: << Single; <u>Double</u>; Triple; or \_\_\_\_>>; << <u>clear</u>; bronze tinted; gray tinted; or \_\_\_\_\_>>; << reflective; low-e; <u>transparent</u>; or \_\_\_\_\_>>.
- 3. Exterior Finish: << <u>Class I natural anodized;</u> Class II natural anodized; Class I color anodized; Class II color anodized; Natural anodized with organic seal; Color anodized with organic seal; Pigmented organic coatings; High performance organic coatings; High performance silicone-modified polyester (SMP) organic coatings; Superior performing organic coatings; or \_\_\_\_>>.

### 2.03 PERFORMANCE REQUIREMENTS

- A. Grade: AAMA/WDMA/CSA 101/I.S.2/A440 requirements for specific window type:
  1. Performance Class (PC): << R; LC; <u>CW</u>; AW; or \_\_\_\_>>.
- B. Design Pressure (DP): In accordance with << applicable codes; ASCE 7; or \_\_\_\_>>.
- C. Water Leakage: No uncontrolled leakage on interior face when tested in accordance with ASTM E331 at differential pressure of << <u>12.11 psf</u>; **9.19 psf**; or \_\_\_\_\_ psf>>.
- D. Air Leakage: << <u>0.1 cfm/sq ft</u>; or <u>cfm/sq ft>></u> maximum leakage per unit area of outside window frame dimension when tested at << <u>1.57 psf</u>; or <u>psf>></u> pressure difference in accordance with ASTM E283/E283M.
- E. Overall Thermal Transmittance (U-value): << <u>0.35;</u> or \_\_\_>>, maximum, including glazing, measured on window sizes required for this project.

### 2.04 MATERIALS

### 2.05 FINISHES

A. Class I Natural Anodized Finish: AAMA 611<< <u>AA-M12C22A41;</u> \_\_\_\_; or None - N/A>>, clear anodic coating not less than <u>0.7 mil</u> thick.

### PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify that wall openings and adjoining water-resistive barrier materials are ready to receive aluminum windows; see Section **07 2500**.

# 3.02 PRIME WINDOW INSTALLATION

- A. Install windows in accordance with manufacturer's instructions.
- B. Attach window frame and shims to perimeter opening to accommodate construction tolerances and other irregularities.
- C. Align window plumb and level, free of warp or twist. Maintain dimensional tolerances and alignment with adjacent work.
- D. Install sill<< and sill end angles; ; or None N/A>>.
- E. Set sill members and sill flashing in continuous bead of sealant.
- F. Provide thermal isolation where components penetrate or disrupt building insulation. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

### 3.03 TOLERANCES

A. Maximum Variation from Level or Plumb: << <u>1/16 inches every 3 ft;</u> or \_\_\_\_\_ inches every 3 ft>> non-cumulative or << <u>1/8 inches per 10 ft;</u> or \_\_\_\_\_ inches per 10 ft>>, whichever is less.

#### 3.04 FIELD QUALITY CONTROL

A. See Section <u>01 4000 - Quality Requirements</u> for independent field testing and inspection requirements, and requirements for monitoring quality of specified product installations.

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Design Development Phase	08 51 13 - 3	Aluminum Windows

# 3.05 CLEANING

- A. Remove protective material from factory finished aluminum surfaces.
- B. Wash surfaces by method recommended and acceptable to window manufacturer; rinse and wipe surfaces clean.
- C. Remove excess glazing sealant by moderate use of mineral spirits or other solvent acceptable to sealant and window manufacturer.

# END OF SECTION 08 5113

### SECTION 08 5659 SERVICE AND TELLER WINDOW UNITS

### PART 1 GENERAL

# **1.01 SECTION INCLUDES**

- A. Service and teller window units.
- B. Service and teller window units with pass-through device.

# 1.02 RELATED REQUIREMENTS

A. Section <u>07 9200 - Joint Sealants</u>: Sealing joints between frames and adjacent construction.

# 1.03 REFERENCE STANDARDS

- A. AAMA 611 Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).
- B. ASTM A123/A123M Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- C. ASTM B221 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2020.
- D. ASTM B221M Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.

# 1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate work with adjacent materials specified in other sections and as indicated on drawings and approved shop drawings.

# 1.05 SUBMITTALS

- A. See Section **<u>01 3000 Administrative Requirements</u>** for submittal procedures.
- B. Shop Drawings: Indicate configuration, sizes, rough-in, mounting, anchors and fasteners, and installation clearances.
- C. Samples for Selection of Finishes:
  - 1. Color Anodized Finishes: Frame member sections showing range of color to be expected in finished work.
- D. Manufacturer Qualification Statement.
- E. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

### 1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with at least << <u>ten</u>; <u>three</u>; or \_\_\_>> years<< <u>documented</u>; \_\_\_\_; <u>or None -</u> N/A>> experience, and with ability to provide test reports showing that their standard manufactured products meet the specified requirements.

# 1.07 WARRANTY

- A. See Section 01 7800 Closeout Submittals for additional warranty requirements.
- B. Provide manufacturer's warranty agreeing to repair or replace units and their components that fail in materials or workmanship within << two years; <u>five years</u>; or <u>years</u>>> from Date of Substantial Completion.

# PART 2 PRODUCTS

### 2.01 MANUFACTURERS

- A. Service and Teller Window Units:
  - 1. Quikserv Corp<< ; \_\_\_\_\_; or None N/A>>: www.quikserv.com/#sle.

KPB PN: 22047.01	09 5650 1	Service and Teller Window Unite
Design Development Phase	08 3039 - 1	Service and Teller Window Offics

# 2.02 SERVICE AND TELLER WINDOW UNITS

- A. Location: Built within **<< exterior**; <u>interior</u>; and \_\_\_\_\_>> wall, as indicated on drawings.
- B. Type of Use: << As indicated on drawings; Drive-through; Walk-up; or \_\_\_\_>>.
- C. Window Type: << Fixed; Sliding, single horizontal; Sliding, double horizontal, centerparting; Vertical lift up; Vertical pull down; or Slider>>.
  - 1. Operation: << Automatic; Self-closing; Manual; or \_\_\_\_>>.
  - 2. Mounting: << Flush with wall surface; Projected from wall surface; or \_\_\_\_>>.
  - 3. Window Size: << As indicated on drawings; <u>24 inch wide by 36 inch high</u>; <u>24 inch wide by 48 inch high</u>; <u>30 inch wide by 36 inch high</u>; <u>36 inch wide by 36 inch high</u>; <u>39 inch wide by 45 inch high</u>; <u>39 inch wide by 54 inch high</u>; <u>47-1/2 inch wide by 36 inch high</u>; <u>47-5/8 inch wide by 56-1/2 inch high</u>; <u>50 inch wide by 38 inch high</u>; <u>50 inch wide by 54 inch high</u>; <u>53-1/2 inch wide by 56-1/2 inch high</u>; <u>53-1/2 inch wide by 56-1/4 inch high</u>; or \_\_\_\_ inch wide by \_\_\_\_ inch high>>.
  - 4. Material: << <u>Aluminum;</u> Stainless steel; or \_\_\_\_>>.
    - a. Finish: << <u>Clear anodized;</u> Color anodized, dark bronze; Color anodized, black; Color anodized, \_\_\_\_; Pigmented coating, manufacturer's standard type; or \_\_\_\_>.
- D. Glazing: << <u>Single (monolithic);</u> Single (monolithic), 1/4 inch thick; Single (monolithic), \_\_\_\_\_inch thick; Insulating glass; Insulating glass, 1 inch overall depth; Insulating glass, \_\_\_\_\_overall depth; or \_\_\_\_\_>>, << <u>clear</u>; tinted; low-e coating; or \_\_\_\_\_>>.
  - 1. << Tempered; Laminated; Polycarbonate; or \_\_\_\_> safety glazing.
- E. Products:
  - 1. Quikserv Corp; << <u>T1-2436S Ticket Window with speak-thru;</u> T1-3036 Ticket Window; T1-3636 Ticket Window; or \_\_\_\_>> and built-in deal tray: www.quikserv.com/#sle.
  - 2. Substitutions: << See Section 01 6000 Product Requirements; or Not permitted>>.

### 2.03 ASSEMBLY COMPONENTS

- A. Windows: Factory-fabricated, finished, and glazed, with extruded aluminum frame and glazing stops; complete with hardware and anchors.
  - 1. Provide window units that are re-glazable from the secure side without dismantling the non-secure side of framing.
  - 2. Rigidly fit and secure joints and corners with internal reinforcement. Make joints and connections flush, hairline, and weatherproof. Fully weld corners.
  - 3. Horizontal Sliding Windows: Top-hung operable sash; with thumb-turn release<< and drop down security bar; \_\_\_\_; or None N/A>>.

### 2.04 MATERIALS

- A. Aluminum Extrusions: Minimum << <u>1/8 inch;</u> or \_\_\_\_\_ inch>> thick frame and sash material complying with ASTM B221 and ASTM B221M.
- B. Concealed Steel Items: Galvanized in accordance with ASTM A123/A123M to thickness Grade 85, **2.0 ounces per square foot**.
- C. Monolithic Glass: Fully tempered float glass; minimum << <u>1/4 inch</u>; or \_\_\_\_ inch>> thickness.
- D. Sealant for Setting Sills and Sill Flashing: Non-curing butyl type.

#### 2.05 FINISHES

A. Class I Natural Anodized Finish: AAMA 611<< <u>AA-M12C22A41</u>; or None - N/A>> Clear anodic coating not less than <u>0.7 mils</u> thick.

### PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify that window openings are ready for installation of windows.

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- B. Verify that correct embedded anchors are in place and in proper location; repair or replace anchors as required to achieve satisfactory installation.
- C. Notify Architect if conditions are not suitable for installation of units; do not proceed until conditions are satisfactory.

# 3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install units in correct orientation (inside/outside or secure/non-secure).
- C. Anchor units securely in manner so as to achieve performance specified.

# 3.03 ADJUSTING

A. Adjust operating components for smooth operation while also maintaining a secure, weathertight enclosure and a tight fit at the contact points; lubricate operating hardware.

# 3.04 CLEANING

- A. Remove protective material from factory finished surfaces.
- B. Clean exposed surfaces promptly after installation without damaging finishes.

# 3.05 PROTECTION

A. Provide temporary protection to ensure that service and teller windows are without damage upon Date of Substantial Completion.

# END OF SECTION 08 5659

### SECTION 08 7000 DOOR HARDWARE

### PART 1 GENERAL

### 1.01 SECTION INCLUDES

- A. Hardware for wood, aluminum, and hollow metal doors.
  - 1. Hardware for fire-rated doors.
  - 2. Electrically operated and controlled hardware.
  - 3. Thresholds.
  - 4. Weatherstripping and gasketing.
  - 5. RELATED REQUIREMENTS
    - a. Section 08 1113 Hollow Metal Doors and Frames.
      - 1) Section 08 1116 Aluminum Doors and Frames.
      - 2) Section 08 1416 Flush Wood Doors.
      - 3) Section 08 4413 Glazed Aluminum Curtain Walls: Door hardware, except cylinders.
      - 4) Section 28 1000 Access Control: Electronic access control devices.
  - 6. REFERENCE STANDARDS
    - a. ADA Standards Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
      - 1) BHMA (CPD) Certified Products Directory; Current Edition.
      - 2) BHMA A156.1 American National Standard for Butts and Hinges; 2016.
      - 3) BHMA A156.2 American National Standard for Bored and Preassembled Locks & Latches; 2017.
      - 4) BHMA A156.3 American National Standard for Exit Devices; 2014.
      - 5) BHMA A156.4 American National Standard for Door Controls Closers; 2013.
      - 6) BHMA A156.6 American National Standard for Architectural Door Trim; 2015.
      - 7) BHMA A156.13 American National Standard for Mortise Locks & Latches Series 1000; 2017.
      - 8) BHMA A156.16 American National Standard for Auxiliary Hardware; 2018.
      - 9) BHMA A156.17 American National Standard for Self Closing Hinges & Pivots; 2014.
      - 10) BHMA A156.21 American National Standard for Thresholds; 2014.
      - 11) BHMA A156.22 American National Standard for Door Gasketing and Edge Seal Systems Sponsor; 2017.
      - 12) BHMA A156.23 American National Standard for Electromagnetic Locks; 2017.
      - 13) BHMA A156.31 American National Standard for Electric Strikes and Frame Mounted Actuators; 2013.
      - 14) BHMA A156.115 American National Standard for Hardware Preparation in Steel Doors and Steel Frames; 2016.
      - 15) BHMA A156.115W American National Standard for Hardware Preparation in Wood Doors with Wood or Steel Frames; 2006.
      - 16) ICC A117.1 Accessible and Usable Buildings and Facilities; 2017.
      - 17) ITS (DIR) Directory of Listed Products; current edition.
      - 18) NFPA 70 National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
      - 19) NFPA 80 Standard for Fire Doors and Other Opening Protectives; 2019.
      - 20) NFPA 252 Standard Methods of Fire Tests of Door Assemblies; 2017.
      - 21) UL (DIR) Online Certifications Directory; Current Edition.
      - 22) UL 10C Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.
  - 7. ADMINISTRATIVE REQUIREMENTS

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Design Development Phase	08 7000 - 1	DOORTIANDWARE

- a. Coordinate the manufacture, fabrication, and installation of products that door hardware is installed on.
  - 1) Furnish templates for door and frame preparation to manufacturers and fabricators of products requiring internal reinforcement for door hardware.
- 8. SUBMITTALS
  - a. See Section 01 3000 Administrative Requirements for submittal procedures.
    - 1) Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project, and includes construction details, material descriptions, finishes, and dimensions and profiles of individual components.
  - b. Shop Drawings Door Hardware Schedule: Submit detailed listing that includes each item of hardware to be installed on each door. Use door numbering scheme as included in Contract Documents.
    - 1) Prepared by or under supervision of Architectural Hardware Consultant (AHC).
    - 2) Provide complete description for each door listed.
    - 3) Provide manufacturer name, product names, and catalog numbers; include functions, types, styles, sizes and finishes of each item.
    - 4) Shop Drawings Electrified Door Hardware: Submit diagrams for power, signal, and control wiring for electrified door hardware that include details of interface with building safety and security systems. Provide elevations and diagrams for each electrified door opening as follows:
      - (a) Prepared by or under supervision of Architectural Hardware Consultant (AHC) and Electrified Hardware Consultant (EHC).
      - (b) Elevations: Submit front and back elevations of each door opening showing electrified devices with connections installed and an operations narrative describing how opening operates from either side at any given time.
      - (c) Diagrams: Submit point-to-point wiring diagram that shows each device in door opening system with related colored wire connections to each device.
    - 5) Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.
    - 6) Warranty: Submit manufacturer's warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- 9. QUALITY ASSURANCE
  - a. Standards for Fire-Rated Doors: Maintain one copy of each referenced standard on site, for use by Architect and Contractor.
- 10. DELIVERY, STORAGE, AND HANDLING
  - a. Package hardware items individually; label and identify each package with door opening code to match door hardware schedule.
- 11. WARRANTY
  - a. See Section 01 7800 Closeout Submittals for additional warranty requirements.
    - 1) Warranty against defects in material and workmanship for period indicated, from Date of Substantial Completion.
      - (a) Closers: Five years, minimum.
      - (b) Exit Devices: Three years, minimum.
      - (c) Locksets and Cylinders: Three years, minimum.
      - (d) Other Hardware: Two years, minimum.

### PART 2 PRODUCTS

#### 2.01 DESIGN AND PERFORMANCE CRITERIA

- A. Provide specified door hardware as required to make doors fully functional, compliant with applicable codes, and secure to extent indicated.
  - 1. Provide individual items of single type, of same model, and by same manufacturer.
  - 2. Provide door hardware products that comply with the following requirements:
    - a. Applicable provisions of federal, state, and local codes.

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- b. Accessibility: ADA Standards and ICC A117.1.
- c. Fire-Rated Doors: NFPA 80, listed and labeled by qualified testing agency for fire protection ratings indicated, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.
- d. Hardware on Fire-Rated Doors: Listed and classified by UL (DIR), ITS (DIR), testing firm acceptable to authorities having jurisdiction, or as suitable for application indicated.
- e. Listed and certified compliant with specified standards by BHMA (CPD).
- f. Hardware Preparation for Steel Doors and Steel Frames: BHMA A156.115.
- g. Hardware Preparation for Wood Doors with Wood or Steel Frames: BHMA A156.115W.
- h. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified.
  - Electrically Operated and/or Controlled Hardware: Provide necessary power supplies, power transfer hinges, relays, and interfaces as required for proper operation; provide wiring between hardware and control components and to building power connection in compliance with NFPA 70.
    - (a) See Section 28 1000 for additional access control system requirements.
  - 2) Fasteners:
    - (a) Provide fasteners of proper type, size, quantity, and finish that comply with commercially recognized standards for proposed applications.
      - (1) Aluminum fasteners are not permitted.
      - (2) Provide phillips flat-head screws with heads finished to match door surface hardware unless otherwise indicated.
      - (3) Fire-Rated Applications: Comply with NFPA 80.
      - (4) Provide wood or machine screws for hinges mortised to doors or frames, strike plates to frames, and closers to doors and frames.
      - (5) Provide steel through bolts for attachment of surface mounted closers, hinges, or exit devices to door panels unless proper door blocking is provided.
- 3. HINGES
  - a. Hinges: Comply with BHMA A156.1, Grade 1.
    - 1) Provide hinges on every swinging door.
    - 2) Provide following quantity of butt hinges for each door:
- 4. PIVOTS
  - a. Center-Hung and Offset Pivots: Comply with BHMA A156.4.
    - 1) Self-Closing Pivots: Comply with BHMA A156.17.
- 5. EXIT DEVICES
  - a. Exit Devices: Comply with BHMA A156.3, Grade 1.
    - 1) Lever design to match lockset trim.
    - 2) Provide cylinder with cylinder dogging or locking trim.
    - 3) Provide exit devices properly sized for door width and height.
    - 4) Provide strike as recommended by manufacturer for application indicated.
    - 5) Provide UL (DIR) listed exit device assemblies for fire-rated doors and panic device assemblies for non-fire-rated doors.
- 6. ELECTRIC STRIKES
  - a. Electric Strikes: Comply with BHMA A156.31, Grade 1.
    - 1) Provide UL (DIR) listed burglary-resistant electric strike; style to suit locks.
    - 2) Provide non-handed 24 VDC electric strike suitable for door frame material and scheduled lock configuration.
- 7. ELECTROMAGNETIC LOCKS
  - a. Electromagnetic Locks: Comply with BHMA A156.23, Grade 1.
    - 1) Holding Force: 600 lbs, minimum.
    - 2) Voltage: 12 VDC, and provide power supplies by same manufacturer as locks.

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- 3) Mounting: Surface mounted to door and frame on secure side, with fasteners, brackets, and spacer bars as required for application.
- B. LOCK CYLINDERS
  - Lock Cylinders: Provide key access on outside of each lock, unless otherwise indicated.
    a. Provide cams and/or tailpieces as required for locking devices.
  - 2. CYLINDRICAL LOCKS
    - a. Cylindrical Locks (Bored): Comply with BHMA A156.2, Grade 1, 4000 Series.
      - 1) Bored Hole: 2-1/8 inch diameter.
      - 2) Latchbolt Throw: 1/2 inch, minimum.
      - 3) Backset: 2-3/4 inch unless otherwise indicated.
      - 4) Strikes: Provide manufacturer's standard strike for each latchset or lockset with strike box and curved lip extending to protect frame in compliance with indicated requirements.
        - (a) Finish: To match lock or latch.
- C. MORTISE LOCKS
  - 1. Mortise Locks: Comply with BHMA A156.13, Grade 1, Security, 1000 Series.
    - a. Latchbolt Throw: 3/4 inch, minimum.
    - b. Deadbolt Throw: 1 inch, minimum.
    - c. Backset: 2-3/4 inch unless otherwise indicated.
    - d. Strikes: Provide manufacturer's standard strike for each latchset or lockset with strike box and curved lip extending to protect frame in compliance with indicated requirements.
      - 1) Finish: To match lock or latch.
- D. DOOR PULLS AND PUSH PLATES
  - 1. Door Pulls and Push Plates: Comply with BHMA A156.6.
    - a. Pull Type: Straight, unless otherwise indicated.
    - b. Push Plate Type: Flat, with square corners, unless otherwise indicated.
      - 1) Edges: Beveled, unless otherwise indicated.
        - (a) Material: Aluminum, unless otherwise indicated.
  - 2. COORDINATORS
    - a. Coordinators: Provide on doors having closers and self-latching or automatic flush bolts to ensure that inactive door leaf closes before active door leaf.
      - 1) Type: Bar, unless otherwise indicated.
      - 2) Material: Aluminum, unless otherwise indicated.
      - 3) Ensure that coordination of other door hardware affected by placement of coordinators and carry bar is applied properly for completely operable installation.

### E. CLOSERS

- 1. Manufacturers; Concealed Overhead:
  - a. Closers: Comply with BHMA A156.4, Grade 1.
    - 1) Type: Surface mounted to door.
    - 2) Provide door closer on each exterior door.
- 2. PROTECTION PLATES
  - a. Protection Plates: Comply with BHMA A156.6.
    - 1) Edges: Beveled, on four sides unless otherwise indicated.
    - 2) Fasteners: Countersunk screw fasteners.
- 3. ARMOR PLATES
  - a. Armor Plates: Provide on bottom half of push side of doors that require protection from objects moving through openings that may damage door surface.
    - 1) Size: 34 inch high by 1-1/2 inch less door width (LDW) on pull side and 2 inch LDW on push side of door.
- F. KICK PLATES

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- 1. Kick Plates: Provide along bottom edge of push side of every door with closer, except aluminum storefront and glass entry doors, unless otherwise indicated.
  - a. Size: 8 inch high by 2 inch less door width (LDW) on push side of door.
- G. DOOR HOLDERS
  - 1. Door Holders: Comply with BHMA A156.16, Grade 1.
    - a. Type: Lever, or kick down stop, with rubber bumper at bottom end.
    - b. Material: Aluminum.
- H. WALL STOPS
  - 1. Wall Stops: Comply with BHMA A156.16, Grade 1 and Resilient Material Retention Test as described in this standard.
    - a. Type: Bumper, concave, wall stop.
    - b. Material: Aluminum housing with rubber insert.
- I. ASTRAGALS
  - 1. Astragals: Comply with BHMA A156.22.
    - a. Type: Split, two parts, and with sealing gasket.
    - b. Material: Aluminum, with neoprene weatherstripping.
    - c. Provide non-corroding fasteners at exterior locations.
  - 2. THRESHOLDS
    - a. Thresholds: Comply with BHMA A156.21.
      - 1) Provide threshold at each exterior door, unless otherwise indicated.
      - 2) Type: Flat surface.
      - 3) Material: Aluminum.
      - 4) Threshold Surface: Fluted horizontal grooves across full width.
      - 5) Field cut threshold to profile of frame and width of door sill for tight fit.
      - 6) Provide non-corroding fasteners at exterior locations.
  - 3. WEATHERSTRIPPING AND GASKETING
    - a. Weatherstripping and Gasketing: Comply with BHMA A156.22.
    - 1) Head and Jamb Type: Adjustable.
      - 2) Door Sweep Type: Encased in retainer.
      - 3) Material: Aluminum, with brush weatherstripping.
  - 4. COAT HOOKS
    - a. Coat Hooks: Provide on room side of door, screw fastened.
      - 1) Material: Brass.
- J. SILENCERS
  - 1. Silencers: Provide at equal locations on door frame to mute sound of door's impact upon closing.
    - a. Single Door: Provide three on strike jamb of frame.
    - b. Pair of Doors: Provide two on head of frame, one for each door at latch side.
    - c. Material: Rubber, gray color.
  - 2. EXIT MOTION SENSOR
    - a. Exit Motion Sensor: Interior passive infrared detection device to initiate door release of exit door magnetic lock.
      - 1) Power: 12 VDC.
      - 2) Provide adjustable detector face to allow for precise pattern configurations, and easy pattern adjustment.
      - 3) Provide relay that operates before transistor to prevent false alarms.
      - 4) Operating Temperature: 32 to 110 degrees F.
  - 3. POWER SUPPLY
    - a. Power Supply: Hard wired, with multiple zones providing eight (8) breakers for each output panel with individual control switches and LED's; UL (DIR) Class 2 listed.
      - 1) Power: 24 VAC, 10 Amp; with 120 VAC power supply.
      - 2) Operating Temperature: 32 to 110 degrees F.

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3) Provide with emergency release terminals that release devices upon activation of fire alarm system.

# 2.02 FINISHES PART 3 EXECUTION

- A. INSTALLATION
  - 1. Install hardware in accordance with manufacturer's instructions and applicable codes.
    - a. Install hardware on fire-rated doors and frames in accordance with applicable codes and NFPA 80.
    - b. Use templates provided by hardware item manufacturer.
    - c. Door Hardware Mounting Heights: Distance from finished floor to center line of hardware item. As indicated in following list; unless noted otherwise in Door Hardware Schedule or on drawings.
    - d. Set exterior door thresholds with full-width bead of elastomeric sealant at each point of contact with floor providing a continuous weather seal; anchor thresholds with stainless steel countersunk screws.
  - 2. FIELD QUALITY CONTROL
    - a. Perform field inspection and testing under provisions of Section 01 4000 Quality Requirements.
  - 3. ADJUSTING
    - a. Adjust work under provisions of Section 01 7000 Execution and Closeout Requirements.
      - 1) Adjust hardware for smooth operation.
      - 2) Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.
  - 4. CLEANING
    - a. Clean finished hardware in accordance with manufacturer's written instructions after final adjustments have been made.
      - 1) Clean adjacent surfaces soiled by hardware installation.
      - 2) Replace items that cannot be cleaned to manufacturer's level of finish quality at no additional cost.
  - 5. PROTECTION
    - a. Protect finished Work under provisions of Section 01 7000 Execution and Closeout Requirements.
      - 1) Do not permit adjacent work to damage hardware or finish.

### END OF SECTION 08 7000

### SECTION 08 7113 POWER DOOR OPERATORS

### PART 1 GENERAL

### 1.01 SECTION INCLUDES

- A. Operators for swinging doors.
- B. Controllers, actuators, and safety devices.
- C. Maintenance.

### 1.02 RELATED REQUIREMENTS

- A. Section 08 4313 Aluminum-Framed Storefronts.
- B. Section 08 4413 Glazed Aluminum Curtain Walls.
- C. Section 08 7100 Door Hardware: Balance of door hardware.
- D. Section 26 0583 Wiring Connections.
- E. Section <u>28 1000 Access Control</u>: Connection to access control system; access control devices used as actuators.
- F. Section 28 4600 Fire Detection and Alarm: Connection to fire alarm system.

### **1.03 REFERENCE STANDARDS**

- A. AAMA 611 Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).
- B. ADA Standards Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- C. BHMA A156.10 American National Standard for Power Operated Pedestrian Doors; 2017.
- D. BHMA A156.19 American National Standard for Power Assist and Low Energy Power Operated Doors; 2013.
- E. ITS (DIR) Directory of Listed Products; current edition.
- F. NFPA 70 National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. NFPA 101 Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. UL (DIR) Online Certifications Directory; Current Edition.
- I. UL 325 Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems; Current Edition, Including All Revisions.

### **1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination: Coordinate power door operators with balance of door hardware and electrical work required for each affected door opening.
  - 1. Templates: Check other sections' shop drawings to confirm that adequate provisions are in place for locating and installing power door operators.
  - 2. Electrical System Roughing-in: Coordinate layout and installation of power door operators with connections to power supplies, remote activation devices, and electric door latching hardware.

#### 1.05 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements for submittal procedures.
- B. Shop Drawings:
  - 1. Indicate layout and dimensions; head, jamb, and sill conditions; elevations; components, anchorage, recesses, materials, and finishes, electrical characteristics and connection requirements.
  - 2. Identify installation tolerances required, assembly conditions, routing of service lines and conduit, and locations of operating components and boxes.

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- C. Product Data: Provide data on system components, sizes, features, and finishes.
- D. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention, and manufacturer's hardware and component templates.
- E. Manufacturer's qualification statement.
- F. Installer's qualification statement.
- G. Project Record Documents: Record actual locations of concealed equipment, services, and conduit.
- H. Maintenance Data: Include manufacturer's parts list and maintenance instructions for each type of hardware and operating component.
- I. Specimen warranty.

# 1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than << <u>three</u>; or \_\_\_\_\_>> years of<< <u>documented</u>; or None N/A>> experience<< <u>, and a member of AAADM</u>; or None N/A>>.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least << <u>three</u>; or \_\_\_\_\_>> years<< <u>documented</u>; \_\_\_\_; or None N/A>> experience<< and approved by manufacturer; or None N/A>>.

### 1.07 WARRANTY

- A. See Section 01 7800 Closeout Submittals for additional warranty requirements.
- B. Manufacturer Warranty: Provide **<< 2-year; or Five year>>** manufacturer warranty for components of power door operators. Complete forms in Owner's name and register with manufacturer.

# PART 2 PRODUCTS

### 2.01 MANUFACTURERS

- A. Operators for Swinging Doors:
  - 1. ASSA ABLOY Entrance Solutions<< <u>; Besam SW200i;</u> ; Besam SW200i IG; ; Besam SW100; ; Besam PowerSwing; ; \_\_\_\_; or None N/A>>: www.besam-usa.com/#sle.
  - DORMA USA, Inc<< <u>; ED100;</u> ; ED250; ; ED400; ; ED700; ; ED900; ; \_\_\_\_\_; or None - N/A>>: www.dorma.com/#sle.
  - 3. LCN, an Allegion brand<< ; \_\_\_\_\_; or None N/A>>: www.allegion.com/us/#sle.
  - Stanley Access Technologies<< <u>; Magic Access LE (Low Energy)</u>; ; Magic Force LE (Low Energy); ; Magic Force FE (Full Energy); ; <u>; ror None N/A>>:</u> www.stanleyaccess.com/#sle.

### 2.02 POWER DOOR OPERATORS - GENERAL

- A. Electrically Operated or Controlled Hardware: Provide necessary power supplies, relays, and interfaces as required for proper operation; provide wiring between control components and to building power connection in compliance with NFPA 70.
- B. Comply with << <u>ADA Standards</u>; applicable local building codes; or \_\_\_\_>> for egress requirements.
- C. Comply with NFPA 101 and requirements of authorities having jurisdiction; provide units selected for actual door weight and for << <u>light</u>; heavy; and \_\_\_\_>> pedestrian traffic unless otherwise indicated.

### 2.03 OPERATORS FOR SWINGING DOORS

- A. Door Operator<< <u>, Type</u> ; for ; ; or None N/A>>: << Electromechanical; <u>Hydraulic;</u> Pneumatic/Hydraulic; Pneumatic; or \_\_\_\_>>.
  - 1. Applications: Include operators for << <u>single;</u> <u>double;</u> and \_\_\_\_> doors.
  - 2. Hydraulic Operators: <u>hp</u> minimum, self-contained, electrically driven.

- 3. Speed Control: << <u>Variable</u>; Constant; or \_\_\_\_>><< <u>, field-adjustable</u>; , \_\_\_\_; or None N/A>> opening and closing cycles.
- 4. Functionality: << <u>Full-power</u>; Low-energy power; Power-assist; or \_\_\_\_>> open, << <u>spring close</u>; power boost; power close; or \_\_\_\_>> operation.
  - a. Full-Power Operators: Comply with BHMA A156.10; safeties required.
    - Comply with UL 325; acceptable evidence of compliance includes << <u>UL (DIR)</u>; or <u>ITS (DIR)</u>>> listing<< <u>or test report by testing agency acceptable to</u> <u>authorities having jurisdiction</u>; \_\_\_\_\_; or None - N/A>>.
    - Force Required to Set Door in Motion When Unpowered: << <u>30 lbf;</u> or \_\_\_\_\_
      lbf>>, maximum, measured at << <u>1 inch;</u> or \_\_\_\_\_ inch>> from the latch edge of the door at any point in the closing cycle.
  - b. Low-Energy Power Operators: Comply with BHMA A156.19; operator activated by pushing or pulling the door or by manual actuator, not a sensor; safeties not required.
  - c. Power-Assist Operators: Comply with BHMA A156.19; operator activated by pushing or pulling the door, not by separate actuator or sensor; safeties not required.
- 5. Mounting: << <u>Surface mounted overhead</u>; Cncealed overhead; Concealed in floor; Recessed in threshold; or \_\_\_\_\_>>.
- 6. Power Supply Units: Self-contained, electrically operated, and << <u>independent of door</u> <u>operator</u>; integrated with door operator; or \_\_\_\_>>.
- 7. Actuators: Manufacturer's standard.

### 2.04 CONTROLLERS, ACTUATORS, AND SAFETY DEVICES

- A. Controllers: Manufacturer's standard for products specified.
- B. Actuators: Manufacturer's standard for products specified<< <u>and as specified below;</u> and as indicated on drawings.; or None N/A>>.
  - 1. Comply with BHMA A156.10 for actuator and safety types and zones.
  - 2. << <u>Proximity Detector</u>; Motion Sensor; or \_\_\_\_>> Actuator/Safety: << <u>Microwave</u>; Passive infrared; or \_\_\_\_\_>>; distance of control sensitivity adjustable.
- C. Safety Devices: Manufacturer's standard units recommended for project applications and conditions.

### 2.05 FINISHES

- A. Aluminum Finishes: Manufacturer's standard.
  - Class I Natural Anodized Finish: Clear anodic coating; AAMA 611<< <u>AA-M12C22A41;</u>

; or None - N/A>>, minimum dry film thickness (DFT) of 0.7 mil, 0.0007 inch.

# PART 3 EXECUTION

1

### 3.01 EXAMINATION

- A. Verify installation conditions including, but not limited to the following: opening sizes, floor conditions, plumb and level mounting surfaces.
- B. Verify that electric power is available, in the correct location, and of the correct characteristics.

### 3.02 INSTALLATION

A. Install equipment in accordance with manufacturer's instructions.

### 3.03 ADJUSTING

A. Adjust door equipment for correct function and smooth operation.

### 3.04 CLEANING

A. Remove temporary protection, clean exposed surfaces.

# 3.05 CLOSEOUT ACTIVITIES

A. Demonstrate to Owner's representative equipment operation, operating components, adjustment features, and lubrication requirements.

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# 3.06 MAINTENANCE

- A. See Section <u>01 7000 Execution and Closeout Requirements</u> for additional requirements relating to maintenance service.
- B. Provide service and maintenance of operating equipment for one year from Date of Substantial Completion, at no extra charge to Owner.

# END OF SECTION 08 7113

#### SECTION 08 8000 GLAZING

### PART 1 GENERAL

### 1.01 SECTION INCLUDES

- A. Insulating glass units.
- B. Glazing units<< , \_\_\_\_; or <u>None N/A</u>>>.
- C. Plastic films.
- D. Glazing compounds.
- E. Decorative glazing.

### 1.02 RELATED REQUIREMENTS

- A. Section <u>08 1113 Hollow Metal Doors and Frames</u>: Glazed << <u>lites in doors</u>; <u>borrowed</u> <u>lites</u>; and \_\_\_\_\_>>.
- B. Section <u>08 1416 Flush Wood Doors</u>: Glazed lites in doors.
- C. Section 08 3200 Sliding Glass Doors: Glazing provided by door manufacturer.
- D. Section **08 4313 Aluminum-Framed Storefronts**: Glazing provided as part of storefront assembly.
- E. Section **08 4413 Glazed Aluminum Curtain Walls**: Glazing provided as part of wall assembly.
- F. Section 08 5113 Aluminum Windows: Glazing provided by window manufacturer.
- G. Section 08 5659 Service and Teller Window Units: Glazing provided as part of assembly.
- H. Section <u>08 8300 Mirrors</u>.
- I. Section 08 8813 Fire-Rated Glazing.

### 1.03 REFERENCE STANDARDS

- A. 16 CFR 1201 Safety Standard for Architectural Glazing Materials; Current Edition.
- B. ANSI Z97.1 American National Standard for Safety Glazing Materials Used in Buildings -Safety Performance Specifications and Methods of Test; 2015.
- C. ASTM C864 Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2015).
- D. ASTM C1036 Standard Specification for Flat Glass; 2016.
- E. ASTM C1048 Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.
- F. ASTM C1172 Standard Specification for Laminated Architectural Flat Glass; 2014.
- G. ASTM C1376 Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass; 2021.
- H. ASTM E90 Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).
- I. ASTM E413 Classification for Rating Sound Insulation; 2016.
- J. ASTM E1300 Standard Practice for Determining Load Resistance of Glass in Buildings; 2016.
- K. ASTM E2190 Standard Specification for Insulating Glass Unit Performance and Evaluation; 2010.
- L. GANA (GM) GANA Glazing Manual; 2008.
- M. GANA (SM) GANA Sealant Manual; 2008.
- N. GANA (LGRM) Laminated Glazing Reference Manual; 2009.

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- O. IGMA TM-3000 North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use; 1990 (2016).
- P. NFRC 100 Procedure for Determining Fenestration Product U-factors; 2017.
- Q. NFRC 200 Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence; 2014, with Errata (2017).
- R. NFRC 300 Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems; 2017.

### 1.04 SUBMITTALS

- A. See Section **<u>01 3000 Administrative Requirements</u>** for submittal procedures.
- B. Product Data on << <u>Insulating Glass Unit</u>; <u>Glazing Unit</u>; <u>Plastic Sheet Glazing Unit</u>; <u>Plastic Film</u>; and \_\_\_\_\_>> Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.
- C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.
- D. Samples: Submit << two; or \_\_\_\_>> samples <u>12" by 12" inch in size</u><< of glass units; of glass and plastic units; of glass and plastic units; showing coloration; of glass and plastic units, showing coloration and design; of glass units, showing coloration; of glass units, showing coloration and design; of glass units, showing design; of glass units, showing design; of plastic units, showing design; of plastic units, showing coloration and design; of plastic units, showing coloration; of plastic units, showing coloration and design; of plastic units, showing coloration; of plastic units, showing coloration and design; of plastic units, showing coloration; of plastic units, showing coloration and design; of plastic units, showing coloration; of plastic units, showing coloration and design; of plastic units, showing coloration; of plastic units, showing coloration and design; of plastic units; or None N/A>>.
- E. Certificate: Certify that << products of this section; or \_\_\_\_>> meet or exceed << specified requirements; or \_\_\_\_>>.
- F. Installer's qualification statement.
- G. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

#### 1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with << <u>GANA (GM)</u>; <u>GANA (SM)</u>; <u>GANA (LGRM)</u>; <u>IGMA</u> <u>TM-3000</u>; and \_\_\_\_\_>> for << <u>glazing installation methods</u>; or \_\_\_\_\_>>. << <u>Maintain</u> <u>one copy on site.</u>; <u>Maintain</u> <u>copies on site.</u>; or <u>None - N/A>></u>
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least << <u>three</u>; or \_\_\_\_\_>> years<< documented; \_\_\_\_\_; or <u>None N/A</u>>> experience<< and approved by manufacturer; \_\_\_\_\_; or <u>None N/A</u>>>.

#### 1.06 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than << <u>40 degrees F</u>; or <u>degrees F>></u>.

#### 1.07 WARRANTY

- A. See Section 01 7800 Closeout Submittals for additional warranty requirements.
- B. Insulating Glass Units: Provide a << <u>five (5)</u>; ten (10); or \_\_\_\_>> year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.
- C. Heat Soaked Tempered Glass: Provide a << <u>five (5)</u>; ten (10); or \_\_\_\_>> year manufacturer warranty to include coverage for spontaneous breakage of fully tempered glass caused by nickel sulfide (NiS) inclusions.

# PART 2 PRODUCTS

### 2.01 MANUFACTURERS

- A. Glass Fabricators:
  - 1. Guardian.
  - 2. Pilkington
  - 3. MCGRORY GLASS
  - 4. Substitutions: << See Section 01 6000 Product Requirements; or Not permitted>>.
- B. Float Glass Manufacturers:
  - 1. Vitro Architectural Glass (formerly PPG Glass)<< ; \_\_\_\_\_; or None N/A>>: www.vitroglazings.com/#sle.
  - 2. Substitutions: << See Section 01 6000 Product Requirements; or Not permitted>>.
- C. Laminated Glass Manufacturers:
- D. Mirrored Glass Manufacturers:
- E. Radiation Shielding Glass Manufacturers:
- F. Plastic Films Manufacturers:
  - 1. 3M Window Film<< ; \_\_\_\_; or None N/A>>:
    - solutions.3m.com/wps/portal/3M/en\_US/Window\_Film/Solutions/#sle.
  - 2. Substitutions: << See Section 01 6000 Product Requirements; or Not permitted>>.

### 2.02 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

- A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
  - 1. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
  - 2. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
  - 3. Glass thicknesses listed are minimum.
- B. Weather-Resistive Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure water-resistive barrier, vapor retarder, and/or air barrier.
  - 1. In conjunction with weather barrier related materials described in other sections, as follows:
- C. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:
  - 1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
  - 2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
  - 3. Solar Optical Properties: Comply with NFRC 300 test method.

### 2.03 GLASS MATERIALS

- A. Float Glass: Provide float glass based glazing unless otherwise indicated.
  - 1. Annealed Type: ASTM C1036, Type I Transparent Flat, Class 1 Clear, << <u>Quality -</u> <u>Q3</u>; Quality Q4; or \_\_\_\_\_>>.
  - 2. Kind HS Heat-Strengthened Type: Complies with ASTM C1048.
  - 3. Kind FT Fully Tempered Type: Complies with ASTM C1048.
  - 4. Fully Tempered Safety Glass: Complies with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.
  - Heat-Soak Testing (HST): Provide HST of fully tempered glass used on << <u>canopy;</u> <u>point-supported; spider wall; high-risk; sloping overhead; horizontal overhead;</u> <u>free-standing glass protective barrier; other demanding; or</u> >> applications of

project, to reduce risks of spontaneous breakage due to nickel sulfide (NiS) induced fractures in accordance with industry established testing requirements.

- B. Laminated Glass: Float glass laminated in accordance with ASTM C1172.
  - Laminated Safety Glass: Complies with ANSI Z97.1 << <u>Class B</u>; or Class A>> or 16 CFR 1201 - << <u>Category I</u>; or Category II>> impact test requirements.

### 2.04 INSULATING GLASS UNITS

- A. Manufacturers:
  - 1. Glass: Any of the manufacturers specified for float glass.
  - Vitro Architectural Glass (formerly PPG Glass)<< ; Solarban 72; or None N/A>>: www.vitroglazings.com/#sle.
  - Substitutions: << <u>See Section 01 6000 Product Requirements</u>; Not permitted; or \_\_\_\_\_\_\_\_
- B. Insulating Glass Units: Types as indicated.
  - 1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
  - Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
  - 3. Metal-Edge Spacers: << <u>Aluminum</u>; Stainless steel; or \_\_\_\_\_>>, << <u>bent and</u> soldered; bent and spot welded; mitered and spigoted; or \_\_\_\_\_>> corners.
  - Spacer Color: << <u>Black</u>; White; Gray; Dark gray; Light Gray; Champagne; Bronze; Aluminum; or \_\_\_\_>>.
  - 5. Edge Seal:
    - a. Color: << <u>Black;</u> Gray; or \_\_\_\_>>.
  - 6. Purge interpane space with dry air, hermetically sealed.
- C. << Type IG-1 ; Type \_\_\_\_\_ ; \_\_\_\_\_; or <u>None N/A</u>>>Insulating Glass Units: Vision glass, double glazed.
  - 1. Applications: << Exterior glazing unless otherwise indicated; or Insulated Hollow Metal System(s)>>.
  - 2. Space between lites filled with << <u>air;</u> argon; krypton; or \_\_\_\_>>.
  - 3. Outboard Lite: << Annealed float glass; Heat-strengthened float glass; <u>Fully</u> <u>tempered float glass;</u> Laminated; Anti-reflective glass; or \_\_\_\_\_>>, << <u>1/4 inch;</u> or \_\_\_\_\_inch>> thick<< , minimum; <u>None - N/A;</u> or , \_\_\_\_>>.
    - a. Tint: << Clear; Green; Blue; Gray; Bronze; or Clear>>.
  - 4. Metal edge spacer.
  - 5. Inboard Lite: << Annealed; Heat-strengthened; Fully tempered; Laminated; Antireflective glass; or \_\_\_\_\_>> float glass, << <u>1/4 inch;</u> or \_\_\_\_\_ inch>> thick<< , minimum; <u>None - N/A;</u> or , \_\_\_\_>>.
    - a. Tint: << <u>Clear;</u> Green; Blue; Gray; Bronze; or \_\_\_\_>>.
    - b. Coating: Low-E (passive type), on #3 surface.
- D. << Type IG-2 ; Type \_\_\_\_\_ ; IGL-1; or None N/A>>Insulating Glass Units: Vision glass, triple glazed.
  - 1. Applications: << Exterior glazing as indicated on drawings; <u>Exterior glazing unless</u> <u>otherwise indicated</u>; or \_\_\_\_>>.
  - 2. Space between lites filled with << <u>air;</u> argon; krypton; or \_\_\_\_>>.
  - 3. Outboard Lite: << Annealed float glass; Heat-strengthened float glass; Fully tempered float glass; Laminated; Anti-reflective glass; or \_\_\_\_>>, << <u>1/4 inch</u>; or \_\_\_\_ inch>> thick<<, minimum; <u>None - N/A</u>; or , \_\_\_\_>>.
    - a. Tint: << Clear; Green; Blue; Gray; Bronze; or >>.
    - b. Coating: Solarban 72 on #2 surface.
    - c. Coating: Self-cleaning type, Pilkington Activ on #1 surface.
  - 4. Middle Lite: << Annealed; Heat-strengthened; Fully tempered; Laminated; or \_\_\_\_\_\_\_\_>> float glass, << <u>1/4 inch</u>; or \_\_\_\_\_ inch>> thick<< , minimum; <u>None N/A</u>;

- or , \_\_\_\_>>.
- a. Tint: << Clear; or \_\_\_\_>>.
- Inboard Lite: << Annealed; Heat-strengthened; Fully tempered; Laminated; Anti-5. reflective glass; or \_\_\_\_\_>> float glass, << 1/4 inch; or \_\_\_\_\_ inch>> thick<< , minimum; None - N/A; or , \_\_\_\_>>. a. Tint: << Clear; Green; Blue; Gray; Bronze; or >>.
- [IGL-1A] Insulating Glass Units: Horizontal Frit, triple glazed. E.
  - Applications: Exterior glazing where indicated on drawings. 1.
  - Space between lites filled with air. 2.
  - Outboard lite: Fully tempered. 1/4 inch thick. 3.
    - a. Tint: Clear.
    - b. Coating: Solarban 72 on #2 surface.
    - c. Coating: Self-cleaning type, Pilkington Activ on #1 surface.
  - Middle Lite: Fully tempered, 1/4 inch thick. 4. a. Tint: Clear.
  - 5. Inboard Lite: Fully tempered, 1/4 inch thick.
    - a. Tint: Clear.
    - b. Coating: 30% white ceramic frit horizontal lines on #5 surface
- [IGL-2] Insulating Glass Units: Opaque Spandrel glass, triple glazed. F.
  - Applications: Exterior spandrel glazing. 1.
  - Space between lites filled with air. 2.
  - Outboard Lite: Fully tempered, 1/4 inch thick 3.
    - a. Tint: Clear.
    - b. Coating: Solarban 72 on #2 surface.
    - c. Coating: Self-cleaning type, Pilkington Activ on #1 surface.
  - Middle Lite: Fully tempered, 1/4 inch thick. 4.
  - a. Tint: Clear.
  - Inboard Lite: Fully tempered, 1/4 inch thick. 5.
    - a. Tint: Clear.
    - b. Opacifier: Ceramic frit on #5 surface.
      - 1) Opaci-coat 300.
      - 2) Color: 2-3868 vine leaf.
- G. [GLX] Decorative Interior Glazing: Varia
  - Applications: Interior 1.
    - a. Glazing: Safety.
    - b. Gauge: 3/4 inch.
    - c. Color: To be selected from manufacturer full range.
    - d. Mounting hardware: 3Form top support 200.25.

#### 2.05 GLAZING UNITS

- << Type G-2 -; Type -; -; or None N/A>>Monolithic Interior Vision Glazing: Α. 1. Applications: << As scheduled; Interior glazing unless otherwise indicated; or
  - >>. 2. Glass Type: << Annealed; Heat-strengthened; Fully tempered; Laminated; or >> float glass.
  - Tint: << Clear; Ultra-Clear; Green; Blue; Gray; Bronze; or >>. 3.
  - Thickness: << <u>1/4 inch;</u> or \_\_\_\_\_ inch>>, nominal. 4.
- B. << Type G-3 ; Type \_\_\_\_ ; \_\_\_\_ ; or <u>None N/A</u>>>Monolithic Safety Glazing: Non-firerated.
  - 1. Applications:
    - a. Glazed lites in doors, except fire doors.
    - b. Glazed sidelights to doors, except in fire-rated walls and partitions.

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- c. Other locations required by applicable federal, state, and local codes and regulations.
- d. Other locations indicated on drawings.
- Glass Type: << <u>Fully tempered</u>; Impact resistant; Laminated safety; or \_\_\_\_>> safety glass as specified.
- 3. Tint: << <u>Clear;</u> Ultra-Clear; Green; Blue; Gray; Bronze; or \_\_\_\_>>.
- 4. Thickness: << <u>1/4 inch;</u> or \_\_\_\_\_ inch>>, nominal.
- C. << <u>Type G-6 -</u>; Type \_\_\_\_ -; \_\_\_\_ -; or None N/A>>Security Glazing: Laminated glass<<, 2-Ply; <u>.3-Ply</u>; , multi-ply; , \_\_\_\_; or None N/A>>.
  - 1. Applications: Locations as indicated on drawings.
  - 2. Tint: << Clear; Gray; Obscure; or \_\_\_\_>.
  - 3. Thickness: << 1/2 inch; \_\_\_\_\_ inch; or As required to meet performance criteria>>.
  - Outer Lite: << <u>Annealed glass</u>; Tempered glass; Heat-strengthened glass; or \_\_\_\_\_\_\_
  - 5. Interlayer: << Ionoplast; Safety resin; <u>Polyvinyl butyral (PVB)</u>; Ethylene vinyl acetate (EVA); or \_\_\_\_\_>>, thickness as required to meet performance criteria.
  - Middle Lite: << <u>Annealed glass</u>; Tempered glass; Heat-strengthened glass; or \_\_\_\_\_\_\_
  - Interlayer, Inboard Side : << Ionoplast; Safety resin; <u>Polyvinyl butyral (PVB);</u> Ethylene vinyl acetate (EVA); or \_\_\_\_\_>>, thickness as required to meet performance criteria.
  - Inside Lite: << <u>Annealed glass;</u> Tempered glass; Heat-strengthened glass; or \_\_\_\_\_\_\_
- D. << <u>Type G-16 -</u>; Type \_\_\_\_\_ ; <u>\_\_\_\_\_</u> ; or None N/A>>Radiation Shielding Glazing: Transparent lead-bearing glass for gamma and/or X-ray protection.
  - 1. Applications: Vision panels located in lead-lined partitions and other locations indicated on drawings.
- E. << <u>Type G-17 -</u>; Type \_\_\_\_\_-; \_\_\_\_\_-; or None N/A>>Sound Control Glazing: Laminated << monolithic; <u>double insulating</u>; or \_\_\_\_\_>> glass.
- F. << <u>Type M-1 -</u>; Type \_\_\_\_\_-; or None N/A>>Transparent One-Way Mirror: Mirror quality float glass with pyrolytic (hard coat) type coating located on high light level surface of glass; ASTM C1376.
  - 1. Applications: Locations as indicated on drawings.
  - 2. Thickness: << <u>1/4 inch;</u> or \_\_\_\_\_ inch>>.
  - 3. Glass Tint: << <u>Grey;</u> or \_\_\_\_>>.
  - Glass Type: << <u>Annealed</u>; Fully tempered; Laminated annealed; Insulating glass unit; or \_\_\_\_\_>>.

# 2.06 PLASTIC FILMS

- A. << Type F-2 ; Type \_\_\_\_ ; VF2 \_\_; or None N/A>>Safety and Security Plastic Film: << <u>Polyester</u>; or \_\_\_\_>> type.
  - 1. Locations: See drawings.
  - 2. Color: << <u>Clear;</u> Neutral; or \_\_\_\_>>.
  - 3. Thickness Without Liner: << 0.002 inch; 0.004 inch; 0.008 inch; or \_\_\_\_ inch>>.
- B. << Type F-4 ; Type \_\_\_\_ ; \_\_\_\_ ; or <u>None N/A</u>>>Decorative Plastic Film: << <u>Polyester</u>; Vinyl; Polyvinyl Butyral (PVB); or \_\_\_\_>> type.
  - 1. Application: Locations as indicated on drawings.
  - Color: << <u>Acid Etch;</u> Frost; Glacier; Mist; Silver; Diamond White; Brilliant Black; Sand White; or \_\_\_\_\_>>.

# 2.07 LAMINATED GLASS INTERLAYERS

- A. << <u>Type LGI-1 -</u>; Type \_\_\_\_-; \_\_\_\_-; or None N/A>>Polyvinyl Butyral (PVB) Interlayer for Laminated Glazing:
  - Functionality: Post-breakage << <u>safety</u>; <u>security</u>; <u>hurricane resistance</u>; and >>.
  - 2. Applications:
  - 3. Color: << <u>Clear;</u> or \_\_\_\_>>.
  - Thickness: << <u>As required for indicated performance of laminated glass application;</u> 0.015 inch, 15 mils, nominal; 0.030 inch, 30 mils, nominal; 0.090 inch, 90 mils, nominal; or \_\_\_\_ inch, \_\_\_ mils, nominal>>.

### 2.08 GLASS COATINGS

A. Self-Cleaning Photocatalytic Glass Coating: Transparent visible light activated coating that improves air quality and maintaining clean glass that also breaks down VOC's, odors, and airborne pollutants; ISO-tested.

### 2.09 GLAZING COMPOUNDS

A. << <u>Type GC-1 -</u>; Type \_\_\_\_-; \_\_\_\_-; or None - N/A>>Glazing Putty: Polymer modified latex<< <u>recommended by manufacturer for outdoor use</u>; \_\_\_\_\_; or None - N/A>>, knife grade consistency; << <u>gray</u>; or \_\_\_\_>> color.

# 2.10 ACCESSORIES

- A. Setting Blocks: << EPDM; <u>Silicone</u>; Neoprene; Thermoplastic; or \_\_\_\_>>, with << <u>80</u> <u>to 90</u>; or \_\_\_\_to \_\_\_>> Shore A durometer hardness<< ; ASTM C864 Option I; <u>ASTM</u> <u>C864 Option II</u>; <u>; \_\_\_\_\_</u>; or None - N/A>>. Length of <u>0.1 inch for each square foot</u> of glazing or minimum <u>4 inch</u> by width of glazing rabbet space minus <u>1/16 inch</u> by height to suit glazing method and pane weight and area.
- C. Glazing Tape: Closed cell polyvinyl chloride (PVC) foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume of 2 percent, designed for compression of 25 percent to effect an air barrier and vapor retarder seal; <u>x</u> inch size.
- D. Glazing << <u>Splines</u>; Gaskets; or \_\_\_\_>>: Resilient << polyvinyl chloride; <u>silicone</u>; or \_\_\_\_\_> extruded shape to suit glazing channel retaining slot<< ; ASTM C864 Option I; ; \_\_\_\_\_; or None N/A>>; color << <u>black</u>; as selected; or \_\_\_\_\_>.

### 2.11 SOURCE QUALITY CONTROL

A. See Section <u>01 4000 - Quality Requirements</u> for additional requirements.

### PART 3 EXECUTION

### 3.01 VERIFICATION OF CONDITIONS

- A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.
- B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

### 3.02 PREPARATION

A. Clean contact surfaces with appropriate solvent and wipe dry << immediately before glazing; within maximum of 24 hours before glazing; or \_\_\_\_\_>>. Remove coatings that are not tightly bonded to substrates.

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- B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

# 3.03 INSTALLATION, GENERAL

A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.

# 3.04 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)

- A. Application Exterior and/or Interior Glazed: Set glazing infills from either the exterior or the interior of the building.
- B. Place setting blocks at << <u>1/4</u>; 1/3; or \_\_\_\_\_>> points with edge block no more than << <u>6</u> <u>inch</u>; or \_\_\_\_\_ inch>> from corners.
- C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.
- D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

#### 3.05 FIELD QUALITY CONTROL

A. Monitor and report installation procedures and unacceptable conditions.

#### 3.06 CLEANING

- A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.
- B. Remove non-permanent labels immediately after glazing installation is complete.
- C. Clean glass and adjacent surfaces after sealants are fully cured.
- D. Clean glass on both exposed surfaces << <u>not more than 4 days</u>; not more than <u>days</u>; or <u>sor</u> <u></u>

#### 3.07 PROTECTION

- A. After installation, mark pane with an 'X' by using removable plastic tape or paste<< <u>; do not</u> <u>mark heat absorbing or reflective glass units;</u> , <u>; or None N/A>></u>.
- B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

#### SECTION 08 8300 MIRRORS

#### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Glass mirrors.
  - 1. Annealed float glass.
  - 2. Tempered safety glass.

#### 1.02 RELATED REQUIREMENTS

A. Section 10 2800 - Toilet, Bath, and Laundry Accessories: Metal mirror frames.

#### 1.03 REFERENCE STANDARDS

- A. ASTM B221 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2020.
- B. ASTM B221M Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.
- C. ASTM C1036 Standard Specification for Flat Glass; 2016.
- D. ASTM C1048 Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.

# 1.04 SUBMITTALS

- A. See Section <u>01 3000 Administrative Requirements</u>, for submittal procedures.
- B. Product Data on Mirror Types: Submit structural, physical and environmental characteristics, size limitations, special handling and installation requirements.
- C. Product Data on Glazing Compounds: Submit chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.
- D. Samples: Submit << <u>two;</u> or \_\_\_\_>> samples, \_\_\_\_\_ inch in size, illustrating mirrors << <u>design; edging; coloration;</u> and \_\_\_\_>>.
- E. Manufacturer's Certificate: Certify that mirrors, meets or exceeds << <u>specified requirements</u>; or \_\_\_\_\_>>.
- F. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

#### 1.05 QUALITY ASSURANCE

A. Fabricate, store, transport, receive, install, and clean mirrors in accordance with manufacturer's recommendations.

#### 1.06 WARRANTY

- A. See Section 01 7800 Closeout Submittals, for additional warranty requirements.
- B. Provide << <u>five</u>; or \_\_\_\_>> year manufacturer warranty for reflective coating on mirrors and replacement of same.

# PART 2 PRODUCTS

# 2.01 MANUFACTURERS

- A. Mirrors:
  - 1. Binswanger Mirror/ACI Distribution<< ; \_\_\_\_; or None N/A>>: www.binswangerglass.com/#sle.
  - Trulite Glass and Aluminum Solutions<<; \_\_\_\_; or None N/A>>: www.trulite.com/#sle.
  - Walker Glass Company Ltd<< <u>; Walker Glass Mirrors</u>; <u>;</u> <u>;</u> or None N/A>>: www.walkerglass.com/#sle.

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4. Substitutions: << <u>See Section 01 6000 - Product Requirements;</u> Not permitted; or \_\_\_\_\_>>.

# 2.02 MATERIALS

- A. Mirror Design Criteria: Select materials and/or provide supports as required to limit mirror material deflection to << <u>1/200</u>; or \_\_\_\_>>, or to the flexure limit of glass, with full recovery of glazing materials, whichever is less.
- B. Mirror Glass<< ; Type \_\_\_\_; ; \_\_\_; or <u>None N/A</u>>>: Clear, << annealed float glass; ASTM C1036; <u>tempered safety glass</u>; <u>ASTM C1048</u>; or \_\_\_\_>>, with copper and silver coatings, and protective overcoating.
  - 1. Thickness: << 3/32 inch; 1/8 inch; 3/16 inch; <u>1/4 inch;</u> inch; or As indicated on drawings>>.
  - 2. Edges: << <u>Arrised;</u> Beveled; Square and lapped; or \_\_\_\_>>.
  - 3. Size: As indicated on drawings.
- C. Tinted Mirror Glass<< ; Type \_\_\_; ; \_\_\_; or None N/A>>: Tinted, << annealed float glass; ASTM C1036; or \_\_\_\_>.
  - 1. Thickness: << 1/4 inch; \_\_\_\_ inch; or As indicated on drawings>>.

#### 2.03 ACCESSORIES

- A. Setting Blocks: << <u>Neoprene</u>; EPDM; Silicone; or \_\_\_\_>>, << <u>80 to 90</u>; or \_\_\_>> Shore A durometer hardness.
- B. Glazing Tape: Preformed << <u>butyl</u>; or \_\_\_\_\_>> compound << with integral resilient tube spacing device; \_\_\_\_\_; or <u>None N/A</u>>>; << <u>10 to 15</u>; or \_\_\_\_>> Shore A durometer hardness; on release paper.
- C. Mirror Attachment Accessories: << <u>Stainless steel clips;</u> Stainless steel J-profile channels; Plastic rosettes; or \_\_\_\_>>.
- D. Mirror Adhesive: Silicone pre-polymer based, chemically compatible with mirror coating and wall substrate.
- E. U-Shape Frame: Aluminum extrusion, << <u>dimensions as detailed on drawings;</u> 1/2 inch by 1/2 inch by 3/8 inch deep; or \_\_\_\_\_ inch by \_\_\_\_ inch deep>>.
  - 1. Material: Comply with ASTM B221 (ASTM B221M), << <u>6005-T6</u>; 6063-T6; or \_\_\_\_> alloy and temper.
  - 2. Finish: << Mill finish; <u>Anodized, clear</u>; Anodized, \_\_\_\_; Baked enamel, \_\_\_; or \_\_\_>>.

# PART 3 EXECUTION

# 3.01 PREPARATION

A. Clean contact surfaces with solvent and wipe dry.

#### 3.02 INSTALLATION

- A. Install mirrors in accordance with manufacturer's recommendations.
- B. Set mirrors plumb and level, and free of optical distortion.
- C. Set mirrors with edge clearance free of surrounding construction including countertops or backsplashes.

#### 3.03 CLEANING

- A. Remove wet glazing materials from finish surfaces.
- B. Remove labels after work is complete.
- C. Clean mirrors and adjacent surfaces.

#### SECTION 08 9100 LOUVERS

#### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

A. Louvers, frames, and accessories.

#### 1.02 RELATED REQUIREMENTS

- A. Section **07 2500 Weather Barriers**: Sealing frames to water-resistive barrier installed on adjacent construction.
- B. Section <u>07 9200 Joint Sealants</u>: Sealing joints between frames and adjacent construction.
- C. Section <u>23 3100 HVAC Ducts and Casings</u>: Ductwork attachment to louvers<< , and blankoff panels; , and installation of blank-off panels; , \_\_\_\_\_; or <u>None - N/A</u>>>.
- D. Section <u>23 3700 Air Outlets and Inlets</u>: << <u>Louvered penthouse</u>; or Operating louvers>>.

#### 1.03 REFERENCE STANDARDS

- A. AAMA 2604 Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2017a.
- B. AMCA 511 Certified Ratings Program Product Rating Manual for Air Control Devices; 2021, with Editorial Revision (2022).
- C. ASTM A653/A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.
- D. ASTM B221 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2020.
- E. ASTM B221M Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.

# 1.04 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements for submittal procedures.
- B. Product Data: Provide data describing design characteristics, maximum recommended air velocity, design free area, materials and finishes.
- C. Shop Drawings: Indicate louver layout plan and elevations, opening and clearance dimensions, and tolerances; head, jamb and sill details; blade configuration, screens, blank-off areas required, and frames.
- D. Samples: Submit << two; or \_\_\_\_>> samples << 2 by 2 inches; or \_\_\_ by \_\_\_ inches>> in size illustrating finish and color of exterior<< and interior; \_\_\_\_; or None N/A>> surfaces.
- E. Test Reports: Independent agency reports showing compliance with specified performance criteria.
- F. Manufacturer's Certificate: Certify that << products; or \_\_\_\_\_>> meet or exceed << specified requirements; or \_\_\_\_\_>>.
- G. Maintenance Data: Include lubrication schedules, adjustment requirements<< and \_\_\_\_\_; or <u>None N/A</u>>>.

#### 1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with minimum << <u>three</u>; or \_\_\_\_\_>> years of<< <u>documented</u>; \_\_\_\_\_; or None - N/A>> experience.

#### 1.06 WARRANTY

- A. See Section 01 7800 Closeout Submittals for additional warranty requirements.
- B. Provide << <u>five</u>; or \_\_\_\_\_>> year manufacturer's warranty against distortion, metal degradation, and connection failures of louver components.
  - 1. Finish: Include<< <u>twenty</u>; ten; \_\_\_\_; or None N/A>> year coverage against degradation of exterior finish.

#### PART 2 PRODUCTS

#### 2.01 MANUFACTURERS

- A. Louvers:
  - 1. Airolite Company, LLC<< ; \_\_\_\_; or None N/A>>: www.airolite.com/#sle.
  - Ruskin Company<< ; Acoustical Louvers; ; Sightproof Louvers; ; Stationary Louvers; ; Specialty-Shape Louvers; ; Louvers; ; Hurricane and Wind-Driven Rain Louvers; ; Glazing Louvers; ; Extreme Performance Louvers and Grilles; ; \_\_\_\_; or None - N/A>>: www.ruskin.com/#sle.

# 2.02 LOUVERS

- A. Louvers: Factory fabricated and assembled, complete with frame, mullions, and accessories<< ; AMCA Certified in accordance with AMCA 511; ; \_\_\_\_; or None N/A>>.
- B. << \_\_\_\_; or None N/A>>Louvers<< <u>, Type</u> \_\_; at \_\_; , \_\_; or None N/A>>: << <u>Aluminum</u>; Steel; or \_\_\_\_>> outer frames, << <u>louver end frames only, non-thermally</u> <u>broken</u>; louver perimeter frame, non-thermally broken; louver perimeter frame, thermally broken; or \_\_\_\_>>, << <u>air</u>; smoke; or \_\_\_>> ventilator with overlapping louvers.
  - 1. Frame: \_\_\_\_\_inch deep, \_\_\_\_\_inch wide, extruded aluminum.
  - 2. Frame Size: << <u>As indicated on drawings;</u> or <u>inch wide by</u> <u>inch high>></u>.
- C. << <u>Stationary</u>; \_\_\_\_\_; or None N/A>>Louvers<<, <u>Type</u> \_; at \_\_\_; , \_\_\_; or None N/A>>: << <u>Horizontal</u>; Vertical; or \_\_\_\_>> blade, << extruded aluminum; <u>formed galvanized steel sheet</u>; or \_\_\_\_>> construction<<, <u>with intermediate mullions</u> <u>matching frame</u>; , with concealed intermediate mullions; , \_\_\_\_; or None N/A>>.
  - 1. Blades: << <u>Straight</u>; Drainable; Airfoil-shaped; Inverted V; Inverted Y; Sightproof with drainable edge design; or \_\_\_\_\_>>.
  - Frame: << <u>4 inches deep</u>; <u>6 inches deep</u>; <u>inches deep</u>; <u>Depth as indicated on drawings</u>; or \_\_\_\_>>, << <u>channel profile</u>; or \_\_\_\_>>; corner joints << <u>mitered and</u>; None N/A; or \_\_\_\_>><< <u>, with continuous recessed caulking channel each side</u>; None N/A; or \_\_\_\_>>.
  - 3. Steel Thickness, Galvanized: Frame << <u>16 gauge, 0.0598 inch</u>; or <u>gauge, gauge, inch>></u> minimum base metal; blades << <u>16 gauge, 0.0598 inch</u>; or <u>gauge, gauge, metal</u>; inch>> minimum base metal.
  - Steel Finish: << Pigmented organic coating; High performance organic coating; High performance silicone-modified polyester (SMP) organic coating; <u>Superior</u> <u>performing organic coating</u>; Primed; or \_\_\_\_>, finished after fabrication.

#### 2.03 MATERIALS

- A. Extruded Aluminum: ASTM B221 (ASTM B221M)<< , <u>alloy</u>, <u>temper</u>; or None N/A>>.
- B. Steel Sheet: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with << <u>G90/Z275;</u> G60/Z180; or \_\_\_\_>> coating.

#### 2.04 FINISHES

A. High Performance Organic Coatings: AAMA 2604; multiple coats, thermally cured fluoropolymer system.

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# 2.05 ACCESSORIES

- A. Blank-Off Panels: Same material as louver, painted black on exterior side; provide where duct connected to louver is smaller than louver frame, sealing off louver area outside duct.
- B. Bird Screen: Interwoven wire mesh of << <u>steel</u>; aluminum; or \_\_\_\_\_>>, << <u>14 gauge</u>, <u>0.0641 inch</u>; or \_\_\_ gauge, \_\_\_ inch>> diameter wire, << <u>1/2 inch</u>; or \_\_\_ inch>> open weave, << <u>diagonal</u>; square; or \_\_\_\_>> design.
- C. Insect Screen: << <u>18 x 16;</u> or \_\_\_\_>> size << <u>aluminum;</u> steel; or \_\_\_\_>> mesh.
- D. Fasteners and Anchors: << <u>Galvanized;</u> Stainless; or \_\_\_\_> steel.
- E. Sealant for Setting Sills and Sill Flashing: Non-curing butyl type.

# PART 3 EXECUTION

#### 3.01 EXAMINATION

A. Verify that prepared openings<< <u>and flashings</u>; \_\_\_\_; or None - N/A>> are ready to receive this work and opening dimensions are as << <u>indicated on shop drawings</u>; instructed by the louver manufacturer; or \_\_\_\_>>.

#### 3.02 INSTALLATION

- A. Install louver assembly in accordance with manufacturer's instructions.
- B. Install louvers level and plumb.
- C. << Install flashings and align; <u>Align</u>; or \_\_\_\_>> louver assembly to ensure moisture shed from flashings and diversion of moisture to exterior.
- D. Secure louver frames in openings with << <u>concealed</u>; exposed; or \_\_\_\_\_>> fasteners.

#### 3.03 ADJUSTING

A. Adjust operable louvers for freedom of movement of control mechanism. Lubricate operating joints.

#### 3.04 CLEANING

A. Strip protective finish coverings.

#### SECTION 09 0561 COMMON WORK RESULTS FOR FLOORING PREPARATION

# PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. This section applies to floors identified in Contract Documents that are receiving the following types of floor coverings:
  - 1. Resilient tile and sheet.
  - 2. Carpet tile.
  - 3. Thin-set ceramic tile and stone tile.
- B. Removal of existing floor coverings.
- C. Preparation of << <u>new and existing</u>; new; or existing>> concrete floor slabs for installation of floor coverings.
- D. Testing of concrete floor slabs for moisture and alkalinity (pH).
- E. Remediation of concrete floor slabs due to unsatisfactory moisture or alkalinity (pH) conditions.
  - 1. Contractor shall perform all specified remediation of concrete floor slabs. If such remediation is indicated by testing agency's report and is due to a condition not under Contractor's control or could not have been predicted by examination prior to entering into the contract, a contract modification will be issued.

#### 1.02 RELATED REQUIREMENTS

- A. Section <u>01 2300 Alternates</u>: Bid pricing for remediation treatments if required.
- B. Section <u>03 3000 Cast-in-Place Concrete</u>: Moisture emission reducing curing and sealing compound for slabs to receive adhered flooring, to prevent moisture content-related flooring failures; to remain in place, not to be removed.

# 1.03 PRICE AND PAYMENT PROCEDURES

A. Alternates : See Section <u>01 2300 - Alternates</u>.

#### 1.04 REFERENCE STANDARDS

- A. ASTM F1869 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2016a.
- B. ASTM F2170 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.
- C. RFCI (RWP) Recommended Work Practices for Removal of Resilient Floor Coverings; 2011.

# 1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordinate scheduling of cleaning and testing, so that preliminary cleaning has been completed for at least 24 hours prior to testing.

# 1.06 SUBMITTALS

- A. Visual Observation Report: For existing floor coverings to be removed.
- B. Floor Covering and Adhesive Manufacturers' Product Literature: For each specific combination of substrate, floor covering, and adhesive to be used; showing:
  - 1. Moisture and alkalinity (pH) limits and test methods.
  - 2. Manufacturer's required bond/compatibility test procedure.
- C. Testing Agency's Report:
  - 1. Description of areas tested; include floor plans and photographs if helpful.
  - 2. Summary of conditions encountered.
  - 3. Moisture and alkalinity (pH) test reports.
  - 4. Copies of specified test methods.
  - 5. Recommendations for remediation of unsatisfactory surfaces.
  - 6. Submit report directly to Owner.

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- Submit report not more than << <u>two business days</u>; or \_\_\_\_>> after conclusion of testing.
- D. Floor Moisture Testing Technician Certificate: International Concrete Repair Institute (ICRI) Concrete Slab Moisture Testing Technician- Grade I certificate.

#### 1.07 QUALITY ASSURANCE

- A. Moisture and alkalinity (pH) testing will be performed by an independent testing agency employed and paid by Owner.
- B. Testing Agency Qualifications: Independent testing agency experienced in the types of testing specified.
  - 1. Submit evidence of experience consisting of at least 3 test reports of the type required, with project Owner's project contact information.
- C. Contractor's Responsibility Relating to Independent Agency Testing:
  - 1. Provide access for and cooperate with testing agency.
  - 2. Confirm date of start of testing at least << <u>10 days</u>; or \_\_\_\_\_>> prior to actual start.
  - 3. Allow at least << <u>4 business days</u>; or \_\_\_\_>> on site for testing agency activities.
  - 4. Achieve and maintain specified ambient conditions.
  - 5. Notify Owner when specified ambient conditions have been achieved and when testing will start.
- D. Floor Moisture Testing Technician Qualifications: International Concrete Repair Institute (ICRI) Concrete Slab Moisture Testing Technician Certification- Grade I.

#### 1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, handle, and protect products in accordance with manufacturer's instructions and recommendations.
- B. Deliver materials in manufacturer's packaging; include installation instructions.
- C. Keep materials from freezing.

#### **1.09 FIELD CONDITIONS**

- A. Maintain ambient temperature in spaces where concrete testing is being performed, and for at least << <u>48 hours</u>; or \_\_\_\_\_>> prior to testing, at not less than << <u>65 degrees F</u>; or \_\_\_\_\_ degrees F>> or more than << <u>85 degrees F</u>; or \_\_\_\_\_ degrees F>>.
- B. Maintain relative humidity in spaces where concrete testing is being performed, and for at least << <u>48 hours</u>; or \_\_\_\_\_>> prior to testing, at not less than << <u>40 percent</u>; or \_\_\_\_\_>> and not more than << <u>60 percent</u>; or \_\_\_\_\_>>.

# PART 2 PRODUCTS

# 2.01 MATERIALS

#### PART 3 EXECUTION

# 3.01 CONCRETE SLAB PREPARATION

- A. Perform following operations in the order indicated:
  - 1. Existing concrete slabs (on-grade and elevated) with existing floor coverings:
    - a. Visual observation of existing floor covering, for adhesion, water damage, alkaline deposits, and other defects.
    - b. Removal of existing floor covering.
  - 2. Preliminary cleaning.
  - Moisture vapor emission tests; << <u>3 tests</u>; or \_\_\_\_\_>> in the first << <u>1000 square feet</u>; or \_\_\_\_\_\_>> in each additional << <u>1000</u> square feet; or \_\_\_\_\_\_>> in each additional << <u>1000</u> square feet; or \_\_\_\_\_\_square feet>>, unless otherwise indicated or required by flooring manufacturer.
  - 4. Internal relative humidity tests; in same locations as moisture vapor emission tests, unless otherwise indicated.

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- 5. Alkalinity (pH) tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
- 6. Specified remediation, if required.
- 7. Patching, smoothing, and leveling, as required.
- 8. Other preparation specified.
- 9. Adhesive bond and compatibility test.
- 10. Protection.
- B. Remediations:
  - 1. Active Water Leaks or Continuing Moisture Migration to Surface of Slab: Correct this condition before doing any other remediation; re-test after correction.
  - 2. Excessive Moisture Emission or Relative Humidity: If an adhesive that is resistant to the level of moisture present is available and acceptable to flooring manufacturer, use that adhesive for installation of the flooring; if not, apply remedial floor coating or remedial sheet membrane over entire suspect floor area.
  - 3. Excessive Alkalinity (pH): If remedial floor coating is necessary to address excessive moisture, no additional remediation is required; if not, if an adhesive that is resistant to the level present is available and acceptable to the flooring manufacturer, use that adhesive for installation of the flooring; otherwise, apply a skim coat of specified patching compound over entire suspect floor area.

# 3.02 REMOVAL OF EXISTING FLOOR COVERINGS

- A. Comply with local, State, and federal regulations and recommendations of RFCI Recommended Work Practices for Removal of Resilient Floor Coverings, as applicable to floor covering being removed.
- B. Dispose of removed materials in accordance with local, State, and federal regulations and as specified.

# 3.03 PRELIMINARY CLEANING

- A. Clean floors of dust, solvents, paint, wax, oil, grease, asphalt, residual adhesive, adhesive removers, film-forming curing compounds, sealing compounds, alkaline salts, excessive laitance, mold, mildew, and other materials that might prevent adhesive bond.
- B. Do not use solvents or other chemicals for cleaning.

# 3.04 MOISTURE VAPOR EMISSION TESTING

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.
- C. Test in accordance with ASTM F1869 and as follows.
- D. Plastic sheet test and mat bond test may not be substituted for the specified ASTM test method, as those methods do not quantify the moisture content sufficiently.
- E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if test values exceed << <u>3 pounds per 1000 square feet</u>; or \_\_\_\_\_> per 24 hours.
- F. Report: Report the information required by the test method.

# 3.05 INTERNAL RELATIVE HUMIDITY TESTING

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.
- C. Test in accordance with ASTM F2170 Procedure A and as follows.

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- D. Testing with electrical impedance or resistance apparatus may not be substituted for the specified ASTM test method, as the values determined are not comparable to the ASTM test values and do not quantify the moisture content sufficiently.
- E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if any test value exceeds 75 percent relative humidity.
- F. Report: Report the information required by the test method.

# 3.06 ALKALINITY TESTING

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if alkalinity (pH) test value is over 10.

# 3.07 PREPARATION

- A. See individual floor covering section(s) for additional requirements.
- B. Comply with requirements and recommendations of floor covering manufacturer.
- C. Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, and other irregularities with patching compound.
- D. Do not fill expansion joints, isolation joints, or other moving joints.

# 3.08 ADHESIVE BOND AND COMPATIBILITY TESTING

A. Comply with requirements and recommendations of floor covering manufacturer.

#### SECTION 09 2116 GYPSUM BOARD ASSEMBLIES

# PART 1 GENERAL

# 1.01 SECTION INCLUDES

- A. Performance criteria for gypsum board assemblies.
- B. Metal stud wall framing.
- C. Metal channel ceiling framing.
- D. Acoustic insulation.
- E. Gypsum sheathing.
- F. Cementitious backing board.
- G. Gypsum wallboard.
- H. Joint treatment and accessories.
- I. Plenum space sound control.
- J. Textured finish system.
- K. Bullet resistant sheathing and wallboard.

# 1.02 RELATED REQUIREMENTS

- A. Section <u>06 1000 Rough Carpentry</u>: Wood blocking product and execution requirements.
- B. Section 07 2100 Thermal Insulation: Acoustic insulation.
- C. Section 07 2500 Weather Barriers: Water-resistive barrier over sheathing.
- D. Section **07 9200 Joint Sealants**: Sealing acoustical gaps in construction other than gypsum board or plaster work.
- E. Section 09 2216 Non-Structural Metal Framing.
- F. Section <u>09 3000 Tiling</u>: Tile backing board.

# 1.03 REFERENCE STANDARDS

- A. ASHRAE Std 62.1 Ventilation for Acceptable Indoor Air Quality; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- B. ASTM A653/A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.
- C. ASTM C475/C475M Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2017.
- D. ASTM C645 Standard Specification for Nonstructural Steel Framing Members; 2018.
- E. ASTM C665 Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2017.
- F. ASTM C754 Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.
- G. ASTM C840 Standard Specification for Application and Finishing of Gypsum Board; 2020.
- H. ASTM C1047 Standard Specification for Accessories For Gypsum Wallboard and Gypsum Veneer Base; 2019.
- I. ASTM C1177/C1177M Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2017.
- J. ASTM C1280 Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing; 2018.

- K. ASTM C1288 Standard Specification for Discrete Non-Asbestos Fiber-Cement Interior Substrate Sheets; 2017.
- L. ASTM C1396/C1396M Standard Specification for Gypsum Board; 2017.
- M. ASTM C1629/C1629M Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels; 2019.
- N. ASTM C1658/C1658M Standard Specification for Glass Mat Gypsum Panels; 2019, with Ediorial Revision (2020).
- O. ASTM D3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2016.
- P. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials; 2021.
- Q. ASTM E90 Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).
- R. ASTM E413 Classification for Rating Sound Insulation; 2016.
- S. GA-216 Application and Finishing of Gypsum Panel Products; 2016.
- T. UL (FRD) Fire Resistance Directory; Current Edition.

# 1.04 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on << <u>metal framing</u>; <u>gypsum board</u>; <u>glass mat faced gypsum board</u>; <u>accessories</u>; <u>joint finishing system</u>; and \_\_\_\_\_>>.
- C. Samples: Submit << <u>two</u>; or \_\_\_\_\_>> samples of gypsum board finished with proposed texture application, << <u>12 by 12 inches</u>; or \_\_\_\_ inches square>> in size, illustrating finish color and texture.

# 1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing gypsum board installation and finishing<< <u>, with minimum</u> 3 <u>years of experience</u>; <u>, with minimum \_\_\_\_</u> years of documented experience; \_\_\_\_\_\_; or None - N/A>>.

# PART 2 PRODUCTS

# 2.01 GYPSUM BOARD ASSEMBLIES

- A. Provide completed assemblies complying with ASTM C840 and GA-216.
- B. Interior Partitions<< <u>, Indicated as Acoustic</u>; <u>, Indicated as Sound-Rated</u>; <u>, \_\_\_\_\_</u>; or None N/A>>: Provide completed assemblies with the following characteristics:
  - Acoustic Attenuation: << <u>STC of 45-49</u>; STC of 50-54; STC of 55-59; STC of \_\_\_; STC as indicated; or \_\_\_\_>> calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.
- C. Shaft Walls at HVAC Shafts: Provide completed assemblies with the following characteristics:
  - Air Pressure Within Shaft: << Intermittent; <u>Sustained</u>; or \_\_\_\_>> loads of << <u>5</u> <u>Ibf/sq ft</u>; 7.5 lbf/sq ft; 10 lbf/sq ft; 15 lbf/sq ft; or \_\_\_ lbf/sq ft>> with maximum midspan deflection of << <u>L/240</u>; L/360; or \_\_\_\_>>.
  - 2. Acoustic Attenuation: STC of << <u>35-39</u>; **40-44**; **45-49**; **50-54**; or \_\_\_\_>> calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.
- D. Fire-Resistance-Rated Assemblies: Provide completed assemblies << with the following characteristics:; <u>complying with applicable code.</u>; or \_\_\_\_\_>>
  - 1. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL (FRD).

# 2.02 METAL FRAMING MATERIALS

A. Manufacturers - Metal Framing, Connectors, and Accessories:

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- ClarkDietrich<<; ; ; or None N/A>>: www.clarkdietrich.com/#sle. 1.
- Substitutions: << See Section 01 6000 Product Requirements; or Not permitted>>. 2.
- B. Non-structural Steel Framing for Application of Gypsum Board: See Section 09 2216.
- C. Non-structural Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of << L/120 at 5 psf; L/120 at 7.5 psf; L/120 at 10 psf; L/240 at 5 psf; L/240 at 7.5 psf; L/240 at 10 psf; L/360 at 5 psf; L/360 at 7.5 psf; L/360 at 10 psf; or >>.
  - 1. Studs: C-shaped<< with flat faces; with knurled or embossed faces; with ribbed webs, and flanges with rolled edge stiffeners; with \_\_\_\_; or None - N/A>>.
  - Paired Studs for Sound-Rated Assemblies: Engineered single-piece assemblies 2. comprised of paired studs coupled by sound isolators, designed to replace conventional side-by-side, parallel, double-wall partition framing. a. Widths: As indicated on drawings.
  - Runners: U shaped, sized to match studs. 3.
  - 4. Ceiling Channels: << C-shaped; T-shaped; or >>.
  - 5. Sill Plate Isolation Pads: Acoustical separation between sole plate and subfloor.
- D. Shaft Wall Studs and Accessories: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754<< and specified performance requirements; \_; or None - N/A>>.
  - 1. Products:
    - a. Same manufacturer as other framing materials.
- E. Partition Head To Structure Connections: Provide track fastened to structure with legs of sufficient length to accommodate deflection, for friction fit of studs cut short<< and fastened as indicated on drawings; and screwed to secondary deflection channel set inside but unattached to top track; and braced with continuous bridging both sides; \_\_\_\_\_; or None - N/A>>.
- F. Deflection and Firestop Track: Intumescent strip factory-applied to track flanges expands when exposed to heat or flames to provide a perimeter joint seal.
- G. Non-structural Framing Accessories:
  - Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required. 1.
  - 2. Partial Height Wall Framing Support: Provides stud reinforcement and anchored connection to floor.
  - Framing Connectors: ASTM A653/A653M G90 galvanized steel clips; secures cold rolled 3. channel to wall studs for lateral bracing.
- H. Grid Suspension Systems: Steel grid system of main tees and support bars connected to structure using hanging wire.
  - Products: 1.
    - a. USG Corporation<< <u>; Drywall Suspension System</u>; ; \_\_\_\_; or None N/A>>: www.usg.com/#sle.

# 2.03 BOARD MATERIALS

- A. Manufacturers - Gypsum-Based Board:
  - American Gypsum Company<< ; \_\_\_\_; or None N/A>>: 1. www.americangypsum.com/#sle.
  - CertainTeed Corporation<< ; \_\_\_\_; or None N/A>>: www.certainteed.com/#sle. Georgia-Pacific Gypsum<< ; \_\_\_\_; or None N/A>>: www.gpgypsum.com/#sle. 2.
  - 3.
  - National Gypsum Company<< ; \_\_\_\_; or None N/A>>: www.nationalgypsum.com/#sle. 4.
  - USG Corporation<< ; \_\_\_\_; or None N/A>>: www.usg.com/#sle. 5.
  - 6. Substitutions: << See Section 01 6000 - Product Requirements; or Not permitted>>.
- B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.

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Design Development Phase	092110-3	Gypsull Board Assemblies

- 1. Application: Use for << <u>vertical surfaces;</u> <u>ceilings;</u> and \_\_\_\_>>, unless otherwise indicated.
- 2. Glass mat faced gypsum panels, as defined in ASTM C1658/C1658M, suitable for paint finish, of the same core type and thickness may be substituted for paper-faced board.
- 3. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
- 4. Thickness:
  - a. Vertical Surfaces: << 1/2 inch; <u>5/8 inch</u>; <u>3/4 inch</u>; or \_\_\_\_\_ inch>>.
  - b. Ceilings: << 1/2 inch; <u>5/8 inch; or</u> \_\_\_\_\_ inch>>.
  - c. Multi-Layer Assemblies: Thicknesses as indicated on drawings.
- 5. Paper-Faced Products:
  - a. American Gypsum Company; FireBloc Type X Gypsum Wallboard: www.americangypsum.com/#sle.
  - b. CertainTeed Corporation; Type X Drywall: www.certainteed.com/#sle.
  - c. Continental Building Products; Firecheck Type X: www.continental-bp.com/#sle.
  - d. Georgia-Pacific Gypsum; ToughRock Fireguard X: www.gpgypsum.com/#sle.
  - e. Substitutions: << <u>See Section 01 6000 Product Requirements;</u> or Not permitted>>.
- 6. Mold Resistant Paper Faced Products:
  - a. American Gypsum Company; M-Bloc Type X: www.americangypsum.com/#sle.
  - b. CertainTeed Corporation; M2Tech 5/8" Type X Moisture & Mold Resistant Drywall: www.certainteed.com/#sle.
  - c. Georgia-Pacific Gypsum; ToughRock Fireguard X Mold-Guard: www.gpgypsum.com/#sle.
- 7. Glass Mat Faced Products:
  - a. National Gypsum Company; Gold Bond eXP Interior Extreme Gypsum Panel: www.nationalgypsum.com/#sle.
  - b. Substitutions: << <u>See Section 01 6000 Product Requirements</u>; or Not permitted>>.
- C. Impact Resistant Wallboard:
  - 1. Application: << High-traffic areas indicated; or Loading/Staging (Room 110)>>.
  - 2. Surface Abrasion: << Level 3; or \_\_\_\_>>, minimum, when tested in accordance with ASTM C1629/C1629M.
  - 3. Hard Body Impact: << Level 2; Level 3; or \_\_\_\_>>, minimum, when tested in accordance with ASTM C1629/C1629M.
  - 4. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
  - 5. Type: Fire-resistance-rated Type X, UL or WH listed.
  - 6. Thickness: << <u>5/8 inch;</u> or \_\_\_\_ inch>>.
  - 7. Edges: Tapered.
  - 8. Paper-Faced Products:
    - a. American Gypsum Company; M-Bloc IR Type X: www.americangypsum.com/#sle.
    - b. CertainTeed Corporation; Extreme Impact Resistant Drywall with M2Tech: www.certainteed.com/#sle.
    - c. National Gypsum Company; Gold Bond Hi-Impact XP Gypsum Board: www.nationalgypsum.com/#sle.
    - d. USG Corporation; USG Sheetrock Brand Mold Tough VHI Firecode X Panels: www.usg.com/#sle.
- D. Backing Board For Wet Areas: << <u>One of the following products:</u>; None N/A; or >>
  - 1. Application: Surfaces behind tile in wet areas including << tub and shower surrounds; shower ceilings; and \_\_\_\_\_>>.
  - 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.

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- 3. ASTM Cement-Based Board: Non-gypsum-based, cementitious board complying with ASTM C1288.
  - a. Thickness: << 1/2 inch; or inch>>.
- E. Ceiling Board: Special sag resistant gypsum ceiling board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
  - 1. Application: << <u>Ceilings;</u> or \_\_\_\_\_>>, unless otherwise indicated.
  - 2. Thickness: << <u>1/2 inch;</u> or \_\_\_\_ inch>>.
  - 3. Edges: << Tapered; or >>.
  - 4. Products:
    - a. CertainTeed Corporation; 1/2" Easi-Lite: www.certainteed.com/#sle.
    - b. Substitutions: << See Section 01 6000 Product Requirements; or Not permitted>>.
- F. Exterior Sheathing Board: Sizes to minimize joints in place; ends square cut.
  - 1. Application: << Exterior sheathing; or \_\_\_\_\_>>, unless otherwise indicated.
  - Glass Mat Faced Sheathing: Glass mat faced gypsum substrate as defined in ASTM 2. C1177/C1177M.
  - 3. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
  - 4.
  - Core Type: << Regular; <u>Type X</u>; or \_\_\_\_>>. Type X Thickness: << <u>5/8 inch</u>; or \_\_\_\_ inch>>. 5.
  - Edges: << <u>Square;</u> or \_\_\_\_\_>>. 6.
  - Glass Mat Faced Products: 7.
    - a. American Gypsum Company; M-Glass Exterior Sheathing Type X: www.americangypsum.com/#sle.
    - b. CertainTeed Corporation; GlasRoc Type X Exterior Sheathing: www.certainteed.com/#sle.
    - c. Georgia-Pacific Gypsum; DensGlass Fireguard Sheathing: www.gpgypsum.com/#sle.
    - d. National Gypsum Company; Gold Bond eXP Sheathing: www.nationalgypsum.com/#sle.
    - e. USG Corporation; USG Securock Brand Ultralight Glass-Mat Sheathing Firecode X: www.usg.com/#sle.
    - Substitutions: << See Section 01 6000 Product Requirements; or Not f. permitted>>.
- G. Exterior Soffit Board: Exterior gypsum soffit board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
  - Application: << Ceilings and soffits in protected exterior areas; or \_\_\_\_\_>>, 1. unless otherwise indicated.
  - Types: **<< Regular;** <u>Type X</u>; Type C; and \_\_\_\_>>, in locations indicated. 2.
  - Type X Thickness: << <u>5/8 inch;</u> or \_\_\_\_ inch>>. 3.
  - Edges: << Tapered; or \_\_\_\_>>. 4.
  - Products: 5.
    - a. American Gypsum Company; Exterior Soffit Gypsum Wallboard Type X: www.americangypsum.com/#sle.
    - b. Georgia-Pacific Gypsum; ToughRock Fireguard C Soffit Board: www.gpgypsum.com/#sle.
    - Substitutions: << See Section 01 6000 Product Requirements; or Not C. permitted>>.
- H. Shaftwall and Coreboard: Type X; << 1 inch; or inch>> thick by << 24 inches; or inches>> wide, << beveled; square; tongue-and-groove; or >> long edges, ends square cut.
  - Paper-Faced Type: Gypsum shaftliner board or gypsum coreboard as defined ASTM 1. C1396/C1396M; water-resistant faces.

- 2. Paper-Faced Products:
  - a. American Gypsum Company; M-Bloc Shaft Liner: www.americangypsum.com/#sle.
  - b. CertainTeed Corporation; M2Tech Type X Shaftliner: www.certainteed.com/#sle.
  - c. Georgia-Pacific Gypsum; ToughRock Shaftliner: www.gpgypsum.com/#sle.
  - d. National Gypsum Company; Gold Bond Fire-Shield Shaftliner XP: www.nationalgypsum.com/#sle.
  - e. Substitutions: << <u>See Section 01 6000 Product Requirements;</u> or Not permitted>>.

# 2.04 PLENUM SPACE SOUND CONTROL

- A. Manufacturers:
  - AcoustiGuard WILREP LTD<< <u>; Privacy Board and Return-Air Silencers</u>; ;
    <u>; or None N/A>></u>: www.acoustiguard.com/#sle.
  - 2. Substitutions: << See Section 01 6000 Product Requirements; or Not permitted>>.
- B. Description: Acoustical extension wall board for noise control within ceiling plenums above wall partitions.
- C. General Requirements:
  - 1. Airstream surfaces installed in return air plenum to comply with requirements in ASHRAE Std 62.1.

# 2.05 GYPSUM BOARD ACCESSORIES

- A. Acoustic Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced. Thickness: << <u>3 1/2 inch</u>; 1 inch; 1-1/2 inch; or 2 inch>>.
- B. Sound Isolation Tape: Elastomeric foam tape for sound decoupling.
  - Surface Burning Characteristics: Provide assemblies with flame spread index of << <u>75 or</u> <u>less</u>; or \_\_\_\_\_>> and smoke developed index of << <u>450 or less</u>; or \_\_\_\_\_>>, when tested in accordance with ASTM E84.
  - 2. Tape Thickness: << <u>1/4 inch;</u> or \_\_\_\_\_ inch>>.
  - 3. Products:
    - a. Armacell LLC<< <u>; ArmaComfort MTD;</u> ; \_\_\_\_\_; or None N/A>>: www.armacell.us/#sle.
    - b. Substitutions: << <u>See Section 01 6000 Product Requirements</u>; Not permitted; or \_\_\_\_\_>>.
- C. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.
  - 1. Products:
    - a. Franklin International, Inc; Titebond GREENchoice Professional Acoustical Smoke and Sound Sealant: www.titebond.com/#sle.
    - b. Liquid Nails, a brand of PPG Architectural Coatings<< ; \_\_\_\_\_; or None N/A>>: www.liquidnails.com/#sle.
    - c. Specified Technologies Inc<< <u>; Smoke N Sound Acoustical Sealant</u>; <u>; Smoke N Sound Acoustical Spray</u>; <u>; \_\_\_\_</u>; or None N/A>>: www.stifirestop.com/#sle.
    - d. Substitutions: << <u>See Section 01 6000 Product Requirements;</u> or Not permitted>>.
- D. (CG2) << <u>Beads</u>; <u>Joint Accessories</u>; and <u>Other Trim>></u>: ASTM C1047, << rigid plastic; <u>galvanized steel</u>; rolled zinc; or \_\_\_\_\_>>, unless noted otherwise.
  - Corner Beads: Embedded, for << <u>90 degree outside corners;</u> and \_\_\_\_>>. a. Products:

# 1) Fry Reglet, DWCT-375.

- 2. Architectural Reveal Beads (RV1):
  - a. Reveal Depth: << 1/4 inch; 1/2 inch; 5/8 inch; or \_\_\_\_\_ inch>>.
  - b. Reveal Width: << 1/4 inch; 1/2 inch; 5/8 inch; 3/4 inch; 1 inch; 2 inch; or <u>3/8</u> inch>>.

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c. Products:

# 1) Fry Reglet, DRM 625-375.

- 3. Expansion Joints:
  - a. Type: V-shaped metal with factory-installed protective tape.
- 4. Art Hanging and Display System: Systemic Art.
  - a. Moderna 251# Picture Rail, WM685M with handing rods, two per unit.
  - b. Color: White.
  - c. Finish: Powder coat.
  - d. Location(s): TH Exam Rooms.
- E. Joint Materials: ASTM C475/C475M<< and as recommended by gypsum board manufacturer for project conditions; ; or None N/A>>.
  - Paper Tape: <u>2 inch</u> wide, creased paper tape for joints and corners<< , except as otherwise indicated; <u>None N/A</u>; or \_\_\_\_>>.
  - 2. Joint Compound: Setting type, field-mixed.
- F. Abuse Resistant Finishes:
  - 1. Acrylic, water-based, non-textured, high build, tintable primer and surfacer.

# PART 3 EXECUTION

# 3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

# 3.02 SHAFT WALL INSTALLATION

- A. Shaft Wall Framing: Install in accordance with << <u>manufacturer's installation instructions</u>; GA-600 requirements; or \_\_\_\_\_>>.
  - 1. Fasten runners to structure with short leg to finished side, using appropriate power-driven fasteners at not more than <u>24 inches</u> on center.
  - 2. Install studs at spacing required to meet performance requirements.
- B. Shaft Wall Liner: Cut panels to accurate dimensions and install sequentially between special friction studs.
  - 1. Seal perimeter of shaft wall and penetrations with acoustical sealant.

# 3.03 FRAMING INSTALLATION

- A. Metal Framing: Install in accordance with ASTM C754<< <u>and manufacturer's instructions</u>; None - N/A; or \_\_\_\_\_>>.
- B. Suspended Ceilings and Soffits: Space framing and furring members << <u>as indicated</u>; at 12 inches on center; at 16 inches on center; at 24 inches on center; at \_\_\_\_ inches on center; as permitted by standard; or \_\_\_\_\_>>.
  - 1. Level << ceiling; and soffit>> system to a tolerance of << 1/1200; 1/600; or \_\_\_\_>>.
  - 2. Laterally brace entire suspension system.
- C. Studs: Space studs << as indicated; at 12 inches on center; <u>at 16 inches on center</u>; at 24 inches on center; at \_\_\_\_ inches on center; at \_\_\_\_ inches on center; as permitted by standard; as scheduled; or \_\_\_\_\_>>.
  - Extend partition framing << to structure where indicated and to ceiling in other locations; to structure in all locations; to ceiling in all locations; or \_\_\_\_>>.
  - Partitions Terminating at Ceiling: Attach ceiling runner securely to << <u>ceiling track in</u> <u>accordance with manufacturer's instructions</u>; to ceiling framing in accordance with details; or \_\_\_\_\_>>.
  - 3. Partitions Terminating at Structure: Attach extended leg top runner to structure, maintain clearance between top of studs and structure, and brace both flanges of studs with continuous bridging.
- D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.

- E. Resilient Sound Isolation Clips: Install resilient sound isolation clips, and where applicable, associated furring sections and channels, << <u>in accordance with clip manufacturer's written</u> <u>instructions;</u> as indicated on the drawings; or \_\_\_\_\_>>.
- F. Blocking: Install << <u>wood blocking</u>; mechanically fastened steel sheet blocking; mechanically fastened steel channel blocking; or \_\_\_\_\_> for support of:
  - 1. Framed openings.
  - 2. Wall-mounted cabinets.
  - 3. Plumbing fixtures.
  - 4. Toilet partitions.
  - 5. Toilet accessories.
  - 6. Wall-mounted door hardware.

# 3.04 ACOUSTIC ACCESSORIES INSTALLATION

- A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
- B. Sound Isolation Tape: Apply to vertical studs and top and bottom tracks/runners in accordance with manufacturer's instructions.
- C. Acoustic Sealant: Install << in accordance with manufacturer's instructions.; as follows:; or \_\_\_\_>>
  - 1. Place << <u>one bead</u>; two beads; or \_\_\_\_>> continuously on substrate before installation of perimeter framing members.
  - 2. Place continuous bead at perimeter of each layer of gypsum board.
  - Seal around all penetrations by << <u>conduit</u>; <u>pipe</u>; <u>ducts</u>; <u>rough-in boxes</u>; and \_\_\_\_\_\_\_>, except where firestopping is provided.
- D. Acoustical Shielding: Install in accordance with manufacturer's instructions for application << <u>between studs and gypsum board</u>; over gypsum board; or \_\_\_\_\_>>.

# 3.05 BOARD INSTALLATION

- A. Comply with << <u>ASTM C840</u>; <u>GA-216</u>; <u>manufacturer's instructions</u>; and \_\_\_\_>>. << <u>Install to minimize butt end joints, especially in highly visible locations.</u>; None N/A; or \_\_\_\_>>
- B. Single-Layer Nonrated: Install gypsum board << in most economical direction; perpendicular to framing; parallel to framing; or \_\_\_\_\_>>, with ends and edges occurring over firm bearing.
- C. Double-Layer, Nonrated: Use gypsum board for first layer, placed << perpendicular; parallel; or \_\_\_\_\_>> to framing or furring members, with ends and edges occurring over firm bearing.<< Use glass mat faced gypsum board at exterior walls and at other locations as indicated.; \_\_\_\_\_; or <u>None N/A</u>>> Place second layer << <u>perpendicular</u>; parallel; or \_\_\_\_\_>> to framing or furring members. Offset joints of second layer from joints of first layer.
- D. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.
- E. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with waterresistant sealant.
- F. Exterior Sheathing: Comply with ASTM C1280. Install sheathing << horizontally; vertically; or \_\_\_\_\_>, with edges butted tight and ends occurring over firm bearing.
  - 1. Seal joints, cut edges, and holes with water-resistant sealant.
- G. Exterior Soffits: Install exterior soffit board perpendicular to framing, with staggered end joints over framing members or other solid backing.
  - 1. Seal joints, cut edges, and holes with water-resistant sealant.
- H. Installation on Metal Framing: Use screws for attachment of gypsum board<< except face layer of nonrated double-layer assemblies, which may be installed by means of adhesive

#### lamination; \_\_\_\_; or None - N/A>>.

#### 3.06 INSTALLATION OF TRIM AND ACCESSORIES

- A. Control Joints: Place control joints consistent with lines of building spaces and << <u>as</u> <u>indicated.</u>; as directed.; as follows:; or \_\_\_\_>>
  - Not more than <u>30 feet</u> apart on walls<< <u>and ceilings;</u> ; or None N/A>> over <u>50 feet</u> long.
  - 2. At exterior soffits, not more than <u>**30 feet**</u> apart in both directions.
- B. Corner Beads: Install at external corners, using longest practical lengths.
- C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials<< and as indicated; \_\_\_\_\_; or None N/A>>.
- D. Decorative Trim: Install at locations shown on drawings and in accordance with manufacturer's instructions.

# 3.07 JOINT TREATMENT

- A. Glass Mat Faced Gypsum Board and Exterior Glass Mat Faced Sheathing: Use fiberglass joint tape<< <u>, embed and</u>; , \_\_\_\_\_ and; or None N/A>> finish with setting type joint compound.
- B. Paper Faced Gypsum Board: Use << <u>paper</u>; fiberglass; or \_\_\_\_\_>> joint tape, embed with << <u>drying type</u>; setting type; or \_\_\_\_\_\_>> joint compound and finish with << <u>drying type</u>; setting type; or \_\_\_\_\_\_>> joint compound.
- C. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
  - 1. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish and other areas specifically indicated.
  - 2. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
  - 3. Level 1: **<< Wall;** <u>Fire-resistance-rated wall;</u> or <u>\_\_\_\_</u>>> areas above finished ceilings, whether or not accessible in the completed construction.
- D. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
  - Feather coats of joint compound so that camber is maximum << <u>1/32 inch</u>; or \_\_\_\_\_ inch>>.
- E. << <u>Where Level 5 finish is indicated, spray;</u> Spray; or \_\_\_\_\_>> apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

# 3.08 TEXTURE FINISH

A. Apply finish texture coating by means of << <u>spraying apparatus</u>; trowel; roller; brush; or \_\_\_\_\_\_\_>> in accordance with manufacturer's instructions<< <u>and to match approved</u>

sample; None - N/A; or \_\_\_\_>>.

#### 3.09 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: << <u>1/8 inch in 10</u> <u>feet;</u> or \_\_\_\_\_ inch in 10 feet>> in any direction.

#### SECTION 09 2216 NON-STRUCTURAL METAL FRAMING

# PART 1 GENERAL

#### **1.01 SECTION INCLUDES**

- A. Metal << <u>partition</u>; <u>ceiling</u>; and <u>soffit</u>>> framing.
- B. Framing accessories.

#### 1.02 RELATED REQUIREMENTS

- A. Section <u>05 4000 Cold-Formed Metal Framing</u>: Requirements for << <u>structural, load-</u> <u>bearing, metal stud framing</u>; <u>exterior wall stud framing</u>; and \_\_\_\_\_>>.
- C. Section 05 5000 Metal Fabrications: Metal fabrications attached to stud framing.
- D. Section <u>06 1000 Rough Carpentry</u>: Wood blocking within stud framing.
- E. Section 07 2100 Thermal Insulation: << Acoustic insulation; Insulation; or \_\_\_\_>>.
- F. Section 07 8400 Firestopping: Sealing top-of-wall assemblies at fire-resistance-rated walls.
- G. Section <u>07 9200 Joint Sealants</u>: Sealing acoustical gaps in construction other than gypsum board or plaster work.
- H. Section 08 3100 Access Doors and Panels.
- I. Section **09 2116 Gypsum Board Assemblies**: Metal studs for gypsum board partition framing.

#### 1.03 REFERENCE STANDARDS

- A. AISI S100 North American Specification for the Design of Cold-Formed Steel Structural Members; 2016, with Supplement (2018).
- B. ASTM A36/A36M Standard Specification for Carbon Structural Steel; 2014.
- C. ASTM A653/A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.
- D. ASTM A1003/A1003M Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members; 2015.
- E. ASTM C645 Standard Specification for Nonstructural Steel Framing Members; 2018.
- F. ASTM C665 Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2017.
- G. ASTM C754 Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.
- H. ASTM C1002 Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2020.
- I. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials; 2021.

#### 1.04 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements for submittal procedures.
- B. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

#### 1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum << <u>five</u>; three; or \_\_\_\_\_>> years<< documented; or <u>None - N/A</u>>> experience<< and approved by manufacturer; or <u>None - N/A</u>>>.

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# PART 2 PRODUCTS

# 2.01 MANUFACTURERS

- A. Metal Framing, Connectors, and Accessories:
  - Clarkdietrich<<; \_\_\_\_\_; or None N/A>>: www.clarkdietrich.com/#sle. 1.
  - SCAFCO Corporation<<; \_\_\_\_\_; or None N/A>>: www.scafco.com/#sle. Steel Construction Systems<<; \_\_\_\_\_; or None N/A>>: 2
  - 3. www.steelconsvstems.com/#sle.
  - Substitutions: << See Section 01 6000 Product Requirements; or Not permitted>>. 4.

# 2.02 FRAMING MATERIALS

- A. Fire-Resistance-Rated Assemblies: Comply with << applicable; or >> code and << as indicated on drawings.; as follows:; or .>>
- Β. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of << L/120 at 5 psf; L/120 at 7.5 psf; L/120 at 10 psf; L/240 at 5 psf; L/240 at 7.5 psf; L/240 at 10 psf; L/360 at 5 psf; L/360 at 7.5 psf; L/360 at 10 psf; or >>.
  - 1. Studs: C shaped<< with flat faces; with knurled or embossed faces; with ribbed webs, and flanges with rolled edge stiffeners; with \_\_\_\_\_; or None - N/A>>.
  - Paired Studs for Sound-Rated Assemblies: Engineered single-piece assemblies 2. comprised of paired studs coupled by sound isolators, designed to replace conventional side-by-side, parallel, double-wall partition framing. a. Widths: As indicated on drawings.
    - Runners: U shaped, sized to match studs.
  - 3. 4. Ceiling Channels: C shaped.
- C. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws, and anti-friction bushings, preventing rotation of studs while maintaining structural performance of partition.
  - Structural Performance: Maintain lateral load resistance and vertical movement capacity 1. required by applicable code, when evaluated in accordance with AISI S100.
  - 2. Material: ASTM A653/A653M steel sheet. SS Grade 50, with G60/Z180 hot-dipped galvanized coating.
  - 3. Provide components UL-listed for use in UL-listed fire-resistance-rated head of partition ioint systems << indicated on drawings: specified in this section: specified in Section 07 8400; of fire rating and movement required; or \_\_\_\_>>.
- D. Preformed Top Track Firestop Seal:
  - Provide components UL-listed for use in UL-listed fire-resistance-rated head of partition 1. joint systems << indicated on drawings; specified in this section; specified in Section 078400; of fire rating and movement required; or \_\_\_\_>>.
  - 2. Products:
    - a. Hilti, Inc; Top Track Seal CFS TTS: www.us.hilti.com/#sle.
    - b. Substitutions: << See Section 01 6000 Product Requirements; or Not permitted>>.
- E. Non-Loadbearing Framing Accessories:
  - Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required. 1.
  - Partial Height Wall Framing Support: Provides stud reinforcement and anchored 2. connection to floor.
    - a. Materials: ASTM A36/A36M formed sheet steel support member with factory-welded ASTM A1003/A1003M steel plate base.
  - 3. N/A>>.
  - 4. Fasteners: ASTM C1002 self-piercing tapping screws.

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- 5. Anchorage Devices: << <u>Powder actuated</u>; Drilled expansion bolts; Screws with sleeves; or \_\_\_\_\_>>.
- 6. Acoustic Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced. << Thickness: \_\_\_\_\_ inch ( \_\_\_\_\_ mm).; or None N/A>>
- 7. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.
- F. Sound Isolation Tape: Elastomeric foam tape for sound decoupling.
  - Surface Burning Characteristics: Provide assemblies with flame spread index of << <u>75 or</u> <u>less</u>; or \_\_\_\_\_>> and smoke developed index of << <u>450 or less</u>; or \_\_\_\_\_>>, when tested in accordance with ASTM E84.
  - 2. Tape Thickness: << <u>1/4 inch</u>; or \_\_\_\_\_ inch>>.

# PART 3 EXECUTION

# 3.01 INSTALLATION OF STUD FRAMING

- A. Extend partition framing << to structure where indicated and to ceiling in other locations; to structure in all locations; to ceiling in all locations; or \_\_\_\_>>.
- B. Partitions Terminating at Ceiling: Attach ceiling runner securely to << <u>ceiling track in</u> <u>accordance with manufacturer's instructions</u>; to ceiling framing in accordance with details; or \_\_\_\_\_>>.
- C. Partitions Terminating at Structure: Attach extended leg top runner to structure, maintain clearance between top of studs and structure, and brace both flanges of studs as indicated.
- D. Align and secure top and bottom runners at << <u>24 inches</u>; or \_\_\_\_\_ inches>> on center.
- E. At partitions indicated with an acoustic rating:
  - 1. Place << <u>one bead</u>; two beads; or \_\_\_\_>> of acoustic sealant between runners and substrate << <u>, studs and adjacent construction</u>; or None N/A>>.
  - 2. Sound Isolation Tape: Apply to vertical studs and top and bottom tracks/runners in accordance with manufacturer's instructions.
- F. Fit runners under and above openings; secure intermediate studs to same spacing as wall studs.
- G. Install studs vertically at spacing indicated << on drawings; in schedule; or \_\_\_\_>>.
- H. Align stud web openings horizontally.
- I. Secure studs to tracks using << <u>crimping</u>; clip and tie; fastener; or \_\_\_\_>> method. Do not weld.
- J. Stud splicing is not permissible.
- K. Fabricate corners using a minimum of three studs.
- L. Install double studs at wall openings, door and window jambs, not more than <u>2 inches</u> from each side of openings.
- N. Coordinate installation of bucks, anchors, and blocking with electrical, mechanical, and other work to be placed within or behind stud framing.
- O. Blocking: Use << wood blocking; or steel channels>> secured to studs. Provide blocking for support of << plumbing fixtures; toilet partitions; wall cabinets; toilet accessories; hardware; opening frames; and \_\_\_\_\_>>.
- P. Sound Isolation Clips: Mechanically attach to framing or structure with fasteners recommended by clip manufacturer. Install at spacing indicated on drawings.

# 3.02 CEILING AND SOFFIT << FRAMING; AND FURRING>>

A. Comply with requirements of ASTM C754.

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- B. Install furring after work above ceiling or soffit is complete. Coordinate the location of hangers with other work.
- C. Install furring independent of walls, columns, and above-ceiling work.
- D. Securely anchor hangers to structural members or embed them in structural slab. Space hangers as required to limit deflection to criteria indicated. << <u>Use rigid hangers at exterior</u> <u>soffits.</u>; or None N/A>>
- E. Space main carrying channels at maximum << <u>72 inch</u>; or \_\_\_\_\_ inch>> on center, and not more than << <u>6 inches</u>; or \_\_\_\_\_ inches>> from wall surfaces. Lap splice securely.
- F. Securely fix carrying channels to hangers to prevent turning or twisting and to transmit full load to hangers.
- G. Place furring channels perpendicular to carrying channels, not more than << <u>2 inches</u>; or \_\_\_\_\_ inches>> from perimeter walls, and rigidly secure. Lap splices securely.
- H. Reinforce openings in suspension system that interrupt main carrying channels or furring channels with lateral channel bracing. Extend bracing minimum << <u>24 inches</u>; or \_\_\_\_\_ inches>> past each opening.
- I. Laterally brace suspension system.

# 3.03 TOLERANCES

- A. Maximum Variation From True Position: << <u>1/8 inch in 10 feet;</u> or \_\_\_\_\_>>.
- B. Maximum Variation From Plumb: << <u>1/8 inch in 10 feet</u>; or \_\_\_\_\_>>.

#### SECTION 09 3000 TILING

#### PART 1 GENERAL

# 1.01 SECTION INCLUDES

- A. Tile for floor applications.
- B. Tile for wall applications.
- C. Cementitious backer board as tile substrate.
- D. Ceramic accessories.
- E. Ceramic trim.
- F. Non-ceramic trim.

#### **1.02 RELATED REQUIREMENTS**

- A. Section <u>07 9200 Joint Sealants</u>: Sealing joints between tile work and adjacent construction and fixtures.
- B. Section <u>09 0561 Common Work Results for Flooring Preparation</u>: Concrete slab moisture and alkalinity << <u>testing</u>; <u>remediation procedures</u>; and \_\_\_\_>>.

#### 1.03 REFERENCE STANDARDS

- A. ANSI A108.1a American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar; 2017.
- B. ANSI A108.1b American National Standard Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar; 2017.
- C. ANSI A108.1c Specifications for Contractors Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Bed with Dry-Set or Latex-Portland Cement; 1999 (Reaffirmed 2016).
- D. ANSI A108.2 American National Standard General Requirements: Materials, Environmental and Workmanship; 2019.
- E. ANSI A108.4 American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile-Setting Epoxy Adhesive; 2009 (Revised).
- F. ANSI A108.5 American National Standard Specifications for Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).
- G. ANSI A108.6 American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy; 1999 (Reaffirmed 2010).
- H. ANSI A108.8 American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout; 1999 (Reaffirmed 2010).
- I. ANSI A108.9 American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout; 1999 (Reaffirmed 2010).
- J. ANSI A108.10 American National Standard Specifications for Installation of Grout in Tilework; 2017.
- K. ANSI A108.11 American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2018.
- L. ANSI A108.12 American National Standard for Installation of Ceramic Tile with EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).
- M. ANSI A108.13 American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone; 2005 (Reaffirmed 2016).

- N. ANSI A108.19 American National Standard Specifications for Interior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs by the Thin-Bed Method Bonded with Modified Dry-Set Cement Mortar or Improved Modified Dry-Set Cement Mortar; 2020.
- O. ANSI A108.20 American National Standard Specifications for Exterior Installation of Vertical and Overhead Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs by the Thin-Bed Method Bonded with Improved Modified Dry-Set Cement Mortar; 2020.
- P. ANSI A118.6 American National Standard Specifications for Standard Cement Grouts for Tile Installation; 2010 (Reaffirmed 2016).
- Q. ANSI A118.9 American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 1999 (Reaffirmed 2016).
- R. ANSI A118.10 American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes For Thin-Set Ceramic Tile And Dimension Stone Installation; 2014.
- S. ANSI A118.12 American National Standard Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation; 2014.
- T. TCNA (HB) Handbook for Ceramic, Glass, and Stone Tile Installation; 2019.

#### 1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting << <u>one week</u>; or \_\_\_\_>> before starting work of this section; require attendance by affected installers.

#### 1.05 SUBMITTALS

- A. See Section **<u>01 3000 Administrative Requirements</u>** for submittal procedures.
- B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.
- C. Shop Drawings: Indicate << <u>tile layout</u>; <u>patterns</u>; <u>color arrangement</u>; <u>perimeter</u> <u>conditions</u>; <u>junctions with dissimilar materials</u>; <u>control and expansion joints</u>; thresholds; ceramic accessories; setting details; and \_\_\_\_\_>>.
- D. Samples: Mount tile and apply grout on << <u>two</u>; or \_\_\_\_>> plywood panels, minimum << <u>18</u> <u>by 18 inches</u>; or \_\_\_by\_\_\_ inches>> in size illustrating pattern, color variations, and grout joint size variations.
- E. Installer's Qualification Statement:
  - 1. Submit documentation of National Tile Contractors Association (NTCA) or Tile Contractors' Association of America (TCAA) accreditation.
- F. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section <u>01 6000 Product Requirements</u>, for additional provisions.
  - 2. Extra Tile: << <u>10 square feet;</u> or <u>square feet>></u> of each size, color, and surface finish combination.

# 1.06 QUALITY ASSURANCE

- A. Installer Qualifications:
  - Company specializing in performing tile installation, with minimum of << <u>five;</u> or \_\_>> years of documented experience.

# 1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

#### **1.08 FIELD CONDITIONS**

- A. Do not install solvent-based products in an unventilated environment.
- B. Maintain ambient and substrate temperature above << <u>50 degrees F</u>; or <u>degrees F</u>; or <u></u>

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#### materials.

# PART 2 PRODUCTS

#### 2.01 TILE

- A. Manufacturers: << All products by the same manufacturer.; <u>All products of each type by</u> <u>the same manufacturer.</u>; \_\_\_\_\_.; or None - N/A>>
  - 1. Substitutions: << <u>See Section 01 6000 Product Requirements;</u> or Not permitted>>.
- B. Products: As indicated in drawings.

#### 2.02 TRIM AND ACCESSORIES

- A. Ceramic Accessories: << <u>Glazed;</u> Unglazed; or \_\_\_\_\_>> finish, << <u>same color and</u> \_\_\_\_\_\_\_\_>; same manufacturer as tile.
- B. Pre-Formed Accessories To Be Covered with Tile: High density expanded polystyrene with ANSI A118.10 waterproofing finish or membrane.
- C. << <u>Ceramic</u>; or None N/A>> Trim: Matching << <u>bullnose</u>; surface bullnose; double bullnose; cove base; <u>cove</u>; window sill or step nosing; and \_\_\_\_\_\_>> ceramic shapes in << sizes indicated; <u>sizes coordinated with field tile</u>; or \_\_\_\_\_\_>>.
  - 1. Applications:
    - a. Open Edges: Bullnose.
    - b. Inside Corners: << <u>Jointed;</u> Coved; or \_\_\_\_>>.
  - 2. Manufacturers: Same as for tile.
- D. << <u>Non-Ceramic</u>; \_\_\_\_; or None N/A>> Trim: << Satin brass anodized extruded aluminum; Satin natural anodized extruded aluminum; Solid brass; <u>Brushed stainless</u> <u>steel</u>; Integrally colored extruded PVC; or \_\_\_\_>, style, << to suit application; as indicated on drawings; or Jolly>>.
  - 1. Applications:
    - a. Top trim on T3 tile base.
  - 2. Manufacturers:
    - a. Schluter-Systems: www.schluter.com/#sle.
    - b. Substitutions: << <u>See Section 01 6000 Product Requirements</u>; or Not permitted>>.

# 2.03 SETTING MATERIALS

A. Provide setting and grout materials from same manufacturer.

# 2.04 GROUTS

- A. Provide setting and grout materials from same manufacturer.
- B. Standard Grout: ANSI A118.6 standard cement grout.
  - 1. Applications: Use this type of grout where indicated << <u>and where no other type of</u> <u>grout is indicated;</u> ; or None N/A>>.
  - 2. Use sanded grout for joints <u>1/8 inch</u> wide and larger; use unsanded grout for joints less than <u>1/8 inch</u> wide.
  - 3. Color: << As indicated on drawings; As indicated; or (GR1), Pearl Grey 19>>.
  - 4. Color: (GR2), Silver 27.
  - 5. Color: (GR3), Selected from manufacturer full range.
  - 6. Products:
    - a. Mapei, Keraflex.
    - b. Substitutions: << <u>See Section</u> <u>01 6000 Product Requirements</u>; or Not permitted>>.

# 2.05 MAINTENANCE MATERIALS

A. Grout Sealer: Liquid-applied, moisture and stain protection for existing or new Portland cement grout.

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- Composition: Water-based << <u>colorless silicone</u>; pigmented urethane acrylic; or \_\_\_\_\_>.
- 2. Products:
  - a. Merkrete, by Parex USA, Inc<< <u>; Merkrete Revive;</u> ; \_\_\_\_\_; or None N/A>>: www.merkrete.com/#sle.
  - b. Substitutions: << <u>See Section 01 6000 Product Requirements</u>; or Not permitted>>.

#### 2.06 ACCESSORY MATERIALS

- A. Concrete Floor Slab Crack Isolation Membrane: Material complying with ANSI A118.12; not intended as waterproofing.
  - 1. Crack Resistance: No failure at << 1/16 inch; <u>1/8 inch</u>; <u>3/8 inch</u>; or \_\_\_\_\_ inch>> gap, minimum.
  - 2. Fluid or Trowel Applied Type:
    - a. Thickness: << 20 mils; 40 mils; or \_\_\_\_ mils>>, maximum.
  - 3. Peel-and-Stick Sheet Type:
    - a. Thickness: << 20 mils; 40 mils; or \_\_\_\_ mils>>, maximum.
- B. Waterproofing Membrane<< <u>at Floors</u>; <u>; or None N/A>></u>: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.
- C. Backer Board: Cementitious type complying with ANSI A118.9; high density, glass fiber reinforced, << 7/16 inch; 1/2 inch; <u>5/8 inch</u>; or \_\_\_\_\_ inch>> thick; <u>2 inch</u> wide coated glass fiber tape for joints and corners.

# PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.
- C. Verify that subfloor surfaces are dust free and free of substances that could impair bonding of setting materials to subfloor surfaces.
- D. Cementitious Subfloor Surfaces: Verify that substrates are ready for tiling installation by testing for moisture and alkalinity (pH).
  - 1. Test in accordance with Section **09 0561**.
  - 2. Obtain instructions if test results are not within limits recommended by tiling material manufacturer and setting material manufacturer.

#### 3.02 PREPARATION

- A. Protect surrounding work from damage.
- B. Vacuum clean surfaces << and damp clean; and \_\_\_\_; or None N/A>>.
- C. Seal substrate surface cracks with filler. << <u>Level existing substrate surfaces to acceptable</u> <u>flatness tolerances.</u>; or None - N/A>>
- D. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.

# 3.03 INSTALLATION - GENERAL

- A. Install << <u>tile</u>; <u>thresholds</u>; <u>stair treads</u>; and \_\_\_\_\_>> and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.20, manufacturer's instructions, and TCNA (HB) recommendations.
- B. << <u>Lay tile to pattern indicated;</u> Request tile pattern; or \_\_\_\_\_>>. Do not interrupt tile pattern through openings.

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- C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners<< <u>and</u> <u>bases</u>; or None N/A>> neatly. << <u>Align floor joints.</u>; Align floor and base joints.; Align floor, base, and wall joints.; Align floor and wall joints.; Align wall joints.; <u>Align wall joints.</u>; or None N/A>>
- D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.
- E. Form internal angles << <u>square</u>; coved; or \_\_\_\_>> and external angles << <u>bullnosed</u>; square; or \_\_\_\_>>.
- F. Install ceramic accessories rigidly in prepared openings.
- G. Install non-ceramic trim in accordance with manufacturer's instructions.
- H. Sound tile after setting. Replace hollow sounding units.
- I. Keep control and expansion joints free of mortar, grout, and adhesive.
- J. Prior to grouting, allow installation to completely cure; minimum of << <u>48</u>; or \_\_\_\_> hours.
- K. Grout tile joints unless otherwise indicated. << <u>Use standard grout unless otherwise</u> indicated.; \_\_\_\_\_.; or None N/A>>
- L. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

#### 3.04 INSTALLATION - FLOORS - THIN-SET METHODS

A. Over<< <u>interior</u>; or None - N/A>> concrete substrates, install in accordance with TCNA (HB) Method << <u>F113, dry-set or latex-Portland cement bond coat</u>; F116, organic adhesive; or \_\_\_\_\_\_>, with standard grout<< <u>, unless otherwise indicated</u>; or None - N/A>>.

# 3.05 INSTALLATION - WALL TILE

- A. Over cementitious backer units on studs, install in accordance with TCNA (HB) Method W244<<, using membrane at toilet rooms; , using membrane at toilet rooms and kitchens; , using membrane at toilet rooms, kitchens, locker rooms, and \_\_\_\_\_; , using membrane at toilet rooms, kitchens, and \_\_\_\_\_; , using membrane at toilet rooms, kitchens, and \_\_\_\_\_; , using membrane at toilet rooms, kitchens, and \_\_\_\_\_; , using membrane at toilet rooms, and \_\_\_\_\_; , using membrane at toilet rooms and \_\_\_\_\_; , using membrane at kitchens; , using membrane at kitchens and locker rooms; , using membrane at locker rooms and \_\_\_\_\_; , using membrane at locker rooms and \_\_\_\_\_\_; , using membrane at locker rooms and \_\_\_\_\_\_\_; , using membrane at locker rooms and \_\_\_\_\_\_\_; , using membrane at \_\_\_
- B. Over << <u>interior</u>; or None N/A>> concrete and masonry install in accordance with TCNA (HB) Method << <u>W202, thin-set with dry-set or latex-Portland cement bond coat</u>; W211, bonded mortar bed without membrane; or \_\_\_\_\_>>.

#### 3.06 CLEANING

A. Clean tile and grout surfaces.

# 3.07 PROTECTION

A. Do not permit traffic over finished floor surface for << <u>4</u>; or \_\_\_\_>> days after installation.

# SECTION 09 5100 ACOUSTICAL CEILINGS

# PART 1 GENERAL

# 1.01 SECTION INCLUDES

- A. Suspended metal grid ceiling system.
- B. Suspended plastic grid ceiling system.
- C. Acoustical units.

# 1.02 RELATED REQUIREMENTS

- A. Section <u>05 3100 Steel Decking</u>: Placement of special anchors or inserts for suspension system.
- B. Section **<u>21 1300 Fire-Suppression Sprinkler Systems</u>**: Sprinkler heads in ceiling system.
- C. Section 23 3700 Air Outlets and Inlets: Air diffusion devices in ceiling.
- D. Section 26 5000 Lighting
- E. Section 27 5116 Public Address Systems: Speakers in ceiling system.
- F. Section <u>28 4600 Fire Detection and Alarm</u>: Fire alarm components in ceiling system.

# 1.03 REFERENCE STANDARDS

- A. ASCE 7 Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
- B. ASTM C635/C635M Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2017.
- C. ASTM C636/C636M Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2013.
- D. ASTM E580/E580M Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2020.

# 1.04 ADMINISTRATIVE REQUIREMENTS

- A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
- B. Do not install acoustical units until after interior wet work is dry.

# 1.05 SUBMITTALS

- A. See Section <u>01 3000 Administrative Requirements</u> for submittal procedures.
- B. Product Data: Provide data on << <u>suspension system components</u>; <u>acoustical units</u>; and \_\_\_\_\_>>.
- C. Reflected ceiling plan for each floor indicating:
  - 1. For each ceiling, proposed two adjacent 'fixed' edges.
  - 2. For each ceiling area or cloud exceeding 1,000 square feet in areas, proposed location of compression struts shown graphically.
  - 3. For each ceiling area or cloud exceeding 2,500 square feet in area, proposed location of seismic joints diving it into areas less than 2,500 sf shown graphically.
- D. Samples: Submit << <u>two;</u> or \_\_\_\_>> full size samples illustrating material and finish of acoustical units.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section <u>01 6000 Product Requirements</u>, for additional provisions.
  - 2. Extra Acoustical Units: << Quantity equal to 5 percent of total installed; Quantity equal to \_\_\_\_\_percent of total installed; or \_\_\_\_\_>>.

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Design Development Phase	09 5100 - 1	Acoustical Cellings

# 1.06 FIELD CONDITIONS

A. Maintain uniform temperature of minimum << <u>60 degrees F</u>; or <u>degrees F>></u>, and maximum humidity of << <u>40</u>; or <u>>></u> percent prior to, during, and after acoustical unit installation.

# PART 2 PRODUCTS

# 2.01 MANUFACTURERS

A. See Drawings

# 2.02 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Ceiling systems designed to withstand the effects of earthquake motions determined according to ASCE 7-16 for Seismic Design Category << C; D, E, or F; or D>> and complying with the following:
  - 1. Local authorities having jurisdiction.

# 2.03 ACOUSTICAL UNITS

A. See drawings.

# 2.04 SUSPENSION SYSTEM(S)

- A. See drawings.
- B. Metal Suspension Systems General: Complying with ASTM C635/C635M; die cut and interlocking components, with << <u>perimeter moldings</u>; <u>hold down clips</u>; <u>stabilizer bars</u>; <u>clips</u>; <u>splices</u>; and \_\_\_\_\_>> as required.

# 2.05 ACCESSORIES

- A. Support Channels and Hangers: << <u>Galvanized</u>; or Primed>> steel; size and type to suit application<< <u>, seismic requirements</u>,; or None N/A>> and ceiling system flatness requirement specified.
- B. Hanger Wire: << <u>12 gauge, 0.08 inch;</u> or <u>gauge, inch>></u> galvanized steel wire.
- C. Seismic Clips: Manufacturer's standard clips for seismic conditions and to suit application.
- D. Perimeter Moldings: << <u>Same metal and finish as grid</u>; Aluminum; or \_\_\_\_>>.
  1. Size: As required for installation conditions<< <u>and specified Seismic Design Category</u>; and \_\_\_\_; or None - N/A>>.
  - 2. Angle Molding: L-shaped, for mounting at same elevation as face of grid.

# PART 3 EXECUTION

# 3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that layout of hangers will not interfere with other work.

# 3.02 PREPARATION

- A. Install after major above-ceiling work is complete.
- B. Coordinate the location of hangers with other work.

# 3.03 INSTALLATION - SUSPENSION SYSTEM

- Install suspension system in accordance with << <u>ASTM C636/C636M</u>; <u>ASTM E580/E580M</u>; and <u>manufacturer's instructions</u>>> and as supplemented in this section.
- B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of << <u>1:360</u>; 1:240; or \_\_\_\_>>.
- C. Locate system on room axis according to reflected plan.
- D. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
  - 1. Use longest practical lengths.

- E. Seismic Suspension System, Seismic Design Categories D, E, F: Hang suspension system with grid ends attached to the perimeter molding on two adjacent walls; on opposite walls, maintain a <u>3/4 inch</u> clearance between grid ends and wall.
- F. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers<< <u>and related carrying channels</u>; or None - N/A>> to span the extra distance.
- G. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- H. Support fixture loads using supplementary hangers located within << <u>6 inches</u>; or \_\_\_\_\_ inches>> of each corner, or support components independently.
- I. Vertical wire hangers shall be 12-gauge @ 4'-0" o.c. (max) and be 1 in 6 to plumb.
- J. Perimeter vertical hangers shall be provided within 8" of walls.
- K. Provide ASCE 7-16 seismic clips at EACH PERIMETER TEE.
  - 1. Two adjacent ceiling edges shall be "fixed" with two screws through the clip and perimeter angle and one through the tee through the clip hole.
  - 2. Opposing two ceiling edges shall be "loose" with two screws through the clip and perimeter angle and one through the tee through the clip slot.
- L. For contiguous ceilings that exceed 2,500 sf in area, provide expansion joint to reduce ceiling into contiguous ceilings under 2,500 sf.
- M. Do not eccentrically load system or induce rotation of runners.

#### 3.04 INSTALLATION - ACOUSTICAL UNITS

- A. Install acoustical units in accordance with manufacturer's instructions.
- B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- C. Fit border trim neatly against abutting surfaces.
- D. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
- E. Cutting Acoustical Units:1. Make field cut edges of same profile as factory edges.
- F. Where << <u>round obstructions</u>; bullnose concrete block corners; and \_\_\_\_>> occur, provide preformed closures to match perimeter molding.
- G. Install safety clips on wood veneer panels <u>2 inches</u> from outside edge of panel and at <u>24</u> <u>inches</u> on center.
  - 1. Use wire ties to attach safety clips.

# 3.05 COORDINATION OF WORK BY OTHER TRADES

- A. Sprinkler heads shall be provided in center of ceiling panels with flexible hose fittings.
- B. Cable tray and electrical conduit shall be independently supported and not connected to the acoustical ceiling system.
- C. Pendant-hung light fixtures shall be supported from structure above with 9-gauge wire or approved alternate.

#### 3.06 TOLERANCES

- A. Maximum Variation from Flat and Level Surface: << <u>1/8 inch in 10 feet</u>; or \_\_\_\_\_ inch in 10 feet>>.
- B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: << <u>2</u>; or \_\_\_\_\_\_>> degrees.

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Design Development Phase	095100-3	Acoustical Cellings

#### SECTION 09 5426 SUSPENDED WOOD CEILINGS

# PART 1 GENERAL

# **1.01 SECTION INCLUDES**

- A. Linear wood planks.
- B. Metal suspension system.

# 1.02 RELATED REQUIREMENTS

A. Section <u>09 5100 - Acoustical Ceilings</u>: Metal suspension systems.

# 1.03 REFERENCE STANDARDS

- A. ASTM C635/C635M Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2017.
- B. ASTM C636/C636M Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2013.
- C. ASTM E580/E580M Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2020.
- D. CISCA (WC) Wood Ceilings Technical Guidelines; 2009.

# 1.04 SUBMITTALS

- A. See Section **01 3000 Administrative Requirements** for submittal procedures.
- B. Shop Drawings: Indicate << grid layout and related dimensioning; attachment of wood ceiling components to grid; accessory attachments; junctions with other ceiling finishes; mechanical and electrical items installed in the ceiling; and \_\_\_\_\_>>.
- C. Product Data: Provide data on << <u>wood ceiling components;</u> <u>suspension system</u> <u>components;</u> and \_\_\_\_>>.
- D. Samples: Submit << <u>two</u>; or \_\_\_\_>><< <u>full size</u>; \_\_\_\_ by \_\_\_\_ inch; or \_\_\_\_>> samples illustrating material and finish of wood ceiling components.
- E. Samples: Submit << <u>two;</u> or \_\_\_\_>> samples each, <u>12 inches</u> long, of suspension system << <u>main runner;</u> <u>cross runner;</u> <u>perimeter molding;</u> and \_\_\_\_\_>>.
- F. Manufacturer's Installation Instructions: Indicate << <u>special procedures;</u> <u>perimeter</u> <u>conditions requiring special attention;</u> and <u>\_\_\_\_\_>></u>.

# 1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with at least << <u>three</u>; or \_\_\_\_\_>> years<< <u>documented</u>; or None - N/A>> experience.

# 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver wood ceiling components to project site in original, unopened packages.
- B. Store in fully enclosed space, flat, level and off the floor.

#### 1.07 FIELD CONDITIONS

- A. Do not install suspended wood ceiling system until wet construction work is complete and permanent heat and air conditioning is installed and operating.
- B. Maintain room temperature between << <u>60 degrees F</u>; or <u>degrees F</u> and << <u>75</u> <u>degrees F</u>; or <u>degrees F</u> and relative humidity between << <u>35 to 55 percent</u>; or <u>to percent</u> before, during, and after installation.

# PART 2 PRODUCTS

# 2.01 MANUFACTURERS

A. See Drawings.

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# 2.02 SUSPENDED WOOD CEILING SYSTEM

- A. See Drawings.
- B. Metal Suspension System:
  - General: Comply with ASTM C635/C635M; die cut and interlocking components, with << perimeter moldings; hold down clips; stabilizer bars; clips; splices; and \_\_\_\_\_>> as required.
  - Support Channels and Hangers: << <u>Galvanized</u>; or \_\_\_\_\_>> steel; size and type to suit application<< <u>, seismic requirements</u>,; or None N/A>> and ceiling system flatness requirement.
- C. Accessories: Manufacturer's standard accessories for installation method indicated, << <u>seismic requirements; above-ceiling accessibility;</u> and \_\_\_\_>.

# PART 3 EXECUTION

# 3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Do not install ceiling until after interior wet work is dry.

# 3.02 PREPARATION

- A. Layout wood ceiling components in pattern according to reflected ceiling plan and as shown on shop drawings.
- B. Acclimate wood ceiling materials by removing from packaging in installation area a minimum of << <u>48 hours;</u> 72 hours; or \_\_\_\_>> prior to installation.

# 3.03 INSTALLATION

- A. General: Install suspended wood ceiling system in accordance with CISCA (WC).
- B. Suspension System:
  - 1. Install suspension system in accordance with << <u>ASTM C636/C636M</u>; <u>ASTM</u> <u>E580/E580M</u>; and <u>manufacturer's instructions</u>>> and as supplemented in this section.
  - Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of << <u>1:360</u>; <u>1:240</u>; or \_\_\_\_>.
  - 3. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
  - Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers<< <u>and related carrying channels</u>; or None - N/A>> to span the extra distance.
  - 5. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
  - 6. Do not eccentrically load system or induce rotation of runners.
- C. Wood Ceiling:
  - 1. Install wood ceilings in accordance with manufacturer's instructions.
  - 2. Fit wood components in place, free from damaged edges or other defects detrimental to appearance and function.
  - 3. Install components in uniform plane, and free from twist, warp, and dents.
  - 4. Cut to fit irregular grid and perimeter edge trim.
  - 5. Make field cut edges of same profile as factory edges, seal and finish according to manufacturer.
  - 6. Install << <u>clips;</u> <u>stabilizer bars;</u> <u>other attachments;</u> and \_\_\_\_>> as indicated to secure wood ceiling components tight to the grid system.

# 3.04 TOLERANCES

Maximum Variation from Flat and Level Surface: << <u>1/8 inch in 10 feet</u>; or \_\_\_\_\_ inch in 10 feet>>.

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# 3.05 CLEANING

A. Clean and touch up minor finish damage. Remove and replace components that cannot be successfully cleaned and repaired.

#### SECTION 09 6429 WOOD STRIP AND PLANK FLOORING

#### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

A. Wood **<< strip; and <u>plank</u>>>** flooring, nailed.

#### 1.02 RELATED REQUIREMENTS

- A. Section <u>03 3000 Cast-in-Place Concrete</u>: Concrete subfloor surface.
- B. Section <u>06 1000 Rough Carpentry</u>: Wood<< <u>overlay</u>; or None N/A>> subfloor surface.
- C. Section 09 9123 Interior Painting: Painted surface finish on wood flooring.

# 1.03 REFERENCE STANDARDS

- A. ASTM D3676 Standard Specification for Rubber Cellular Cushion Used for Carpet or Rug Underlay; 2018.
- B. ASTM E492 Standard Test Method for Laboratory Measurement of Impact Sound Transmission Through Floor-Ceiling Assemblies Using the Tapping Machine; 2009, with Editorial Revision (2016).
- C. NWFA (IG) Installation Guidelines; Current Edition.
- D. NWFA/NOFMA International Standards for Unfinished Wood Flooring; 2018.

# 1.04 SUBMITTALS

- A. See Section **<u>01 3000 Administrative Requirements</u>**, for submittal procedures.
- B. Product Data: Provide data for << <u>flooring</u>; floor finish materials; and \_\_\_\_>>.
- C. Shop Drawings: Indicate floor joint pattern and termination details.
- D. Manufacturer's Instructions: Indicate << <u>standard and special installation procedures;</u> perimeter conditions requiring special attention; and \_\_\_\_\_>>.
- E. Samples: Submit << <u>two;</u> or \_\_\_\_\_>> samples <u>12 by 12 inch</u> in size illustrating floor finish, color, and sheen.
- F. Maintenance Data: Include << <u>maintenance procedures;</u> <u>recommended maintenance</u> <u>materials;</u> and \_\_\_\_>>.

#### 1.05 QUALITY ASSURANCE

- Perform work of this section in accordance with << MFMA (SPEC); NWFA (IG); <u>NWFA/NOFMA</u>; and \_\_\_\_>>.
- B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum << <u>three</u>; or \_\_\_\_>> years<< <u>documented</u>; or None N/A>> experience.
- C. Installer Qualifications: Company specializing in performing work of the type specified and with at least << <u>three</u>; or \_\_\_\_\_>> years of<< <u>documented</u>; \_\_\_\_; or None N/A>> experience<< and approved by manufacturer; or <u>None N/A</u>>>.

#### 1.06 FIELD CONDITIONS

- A. Do not install wood flooring until wet construction work is complete and ambient air at installation space has moisture content stabilized at maximum moisture content of 40 percent.
- B. Store materials in area of installation for minimum period of 24 hours prior to installation.
- C. Maintain minimum room temperature of <u>65 degrees F</u> for a period of two days prior to delivery of materials to installation space, during installation, and after installation.

# PART 2 PRODUCTS

# 2.01 MANUFACTURERS

#### A. See drawings.

#### 2.02 MATERIALS

A. See drawings.

#### 2.03 ACCESSORIES

- A. Sound Control Underlayment: Recycled rubber type complying with ASTM D3676.
  - 1. Thickness: << <u>1/8 inch;</u> 1/4 inch; 3/8 inch; 1/2 inch; or \_\_\_\_\_ inch>>, nominal.

# PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Verify existing conditions before starting this work.
- B. Verify that required floor-mounted utilities are in correct location.

#### 3.02 PREPARATION

- Prepare substrate to receive wood flooring in accordance with << <u>manufacturer's</u>; MFMA; <u>NWFA</u>; and \_\_\_\_>> instructions.
- B. Broom clean substrate.

# 3.03 INSTALLATION

- A. Sheathing Paper: Place over << <u>wood subfloor</u>; or sleepers>>; lap edges and ends <u>2</u> <u>inches</u>, staple in place.
- B. Underlayments: Install in accordance with underlayment manufacturer's instructions.
- C. Wood Flooring:
  - Install in accordance with << <u>manufacturer's</u>; <u>NWFA</u>; MFMA; and \_\_\_\_\_>> instructions;<< <u>predrill and</u>; or None - N/A>> blind nail to subfloor.
  - 2. Lay flooring << parallel to length of room areas; parallel to width of room areas; in patterns indicated on drawings; or \_\_\_\_>. Verify alignment as work progresses.
  - 3. Arrange flooring with << <u>end matched grain;</u> square ends; or \_\_\_\_>> set flush and tight.
  - 4. Terminate flooring at centerline of door openings where adjacent floor finish is dissimilar; provide divider strips and transition strips in accordance with flooring manufacturer's recommendations and as indicated.
  - 5. Install edge strips at unprotected or exposed edges, and where flooring terminates.
  - Secure edge strips << <u>before</u>; or after>> installation of flooring with stainless steel screws.
  - 7. Install flooring tight to floor access covers.
  - 8. Provide \_\_\_\_\_inch expansion space at fixed walls and other interruptions.

# 3.04 CLEANING

A. Clean and polish floor surfaces in accordance with floor finish manufacturer's instructions.

# 3.05 PROTECTION

- A. Prohibit traffic on floor finish for 48 hours after installation.
- B. Place protective coverings over finished floors; do not remove coverings until Date of Substantial Completion.
#### SECTION 09 6500 RESILIENT FLOORING

#### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Resilient sheet flooring.
- B. Static control resilient sheet flooring.
- C. Resilient base.
- D. Resilient stair accessories.
- E. Installation accessories.

#### 1.02 RELATED REQUIREMENTS

- A. Section <u>03 3000 Cast-in-Place Concrete</u>: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied resilient flooring.
- B. Section <u>09 0561 Common Work Results for Flooring Preparation</u>: Removal of existing floor coverings, cleaning, and preparation.
- C. Section <u>09 0561 Common Work Results for Flooring Preparation</u>: Concrete slab moisture and alkalinity << <u>testing</u>; <u>remediation procedures</u>; and \_\_\_\_>>.
- D. Section <u>26 0526 Grounding and Bonding for Electrical Systems</u>: Grounding and bonding of static control flooring to building grounding system.

#### 1.03 REFERENCE STANDARDS

## 1.04 SUBMITTALS

- A. See Section **<u>01 3000 Administrative Requirements</u>** for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- C. Shop Drawings: Indicate << <u>seaming plans;</u> <u>floor patterns;</u> layout of grounding strips and connections to the building grounding system; and \_\_\_\_\_>>.
- D. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.
- E. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.
- F. Installer's Qualification Statement.
- G. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section <u>01 6000 Product Requirements</u>, for additional provisions.
  - 2. Extra Flooring Material: <u>100 square feet</u> of each type and color.
  - 3. Extra Wall Base: 40 linear feet of each type and color.
  - 4. Extra Stair Materials: Quantity equivalent to << <u>5 percent</u>; or \_\_\_\_>> of each type and color.

### 1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in installing specified flooring with minimum << <u>three</u>; or \_\_\_\_\_>> years<< documented; \_\_\_\_\_; or <u>None N/A</u>>> experience<< and approved by flooring manufacturer; \_\_\_\_\_; or <u>None N/A</u>>>.
- B. Testing Agency Qualifications: Independent firm specializing in performing concrete slab moisture testing and inspections of the type specified in this section.

# 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.
- B. Store all materials off of the floor in an acclimatized, weather-tight space.
- C. Maintain temperature in storage area between << <u>55 degrees F</u>; or <u>degrees F</u>>> and << <u>90 degrees F</u>; or <u>degrees F</u>>>.
- D. Protect roll materials from damage by storing << <u>on end</u>; or \_\_\_\_\_>>.

### 1.07 FIELD CONDITIONS

A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of << <u>70 degrees F</u>; or <u>degrees F>></u> to achieve temperature stability. Thereafter, maintain conditions above << <u>55 degrees F</u>; or <u>degrees F>></u>.

### PART 2 PRODUCTS

#### 2.01 SHEET FLOORING

- A. See drawings.
- 2.02 TILE FLOORING
- A. See drawings.
- 2.03 STAIR COVERING
  - Α.

#### 2.04 RESILIENT BASE

A. See drawings.

#### 2.05 ACCESSORIES

- A. << <u>Primers</u>; <u>Adhesives</u>; <u>Seam Sealer</u>; and \_\_\_\_>>: Waterproof; types recommended by flooring manufacturer.
- B. Moldings, Transition and Edge Strips: << Same material as flooring; Metal; or \_\_\_\_\_>>.
- C. Filler for Coved Base: << <u>Plastic;</u> Wood; or \_\_\_\_\_>>.

### PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.
- B. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
  - 1. Test in accordance with Section 09 0561.
  - 2. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

#### 3.02 PREPARATION

- A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.
- B. Remove subfloor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with subfloor filler to achieve smooth, flat, hard surface.
- C. Prohibit traffic until filler is fully cured.
- D. Clean substrate.

### 3.03 INSTALLATION - GENERAL

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install in accordance with manufacturer's written instructions.

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- C. Adhesive-Applied Installation:
  - Place copper grounding strip in conductive adhesive and apply additional adhesive to top side of strip before installing static control flooring. Allow strip to extend beyond flooring in accordance with static control flooring manufacturer's instructions. Refer to Section <u>26</u> <u>0526</u> for grounding and bonding to building grounding system.
  - 2. Fit joints and butt seams tightly.
  - 3. Set flooring in place, press with heavy roller to attain full adhesion.
- D. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.
- E. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.
- F. At movable partitions, install flooring under partitions without interrupting floor pattern.

#### 3.04 INSTALLATION - SHEET FLOORING

- A. Lay flooring with joints and seams << in accordance with seaming plan; <u>parallel to longer</u> <u>room dimensions, to produce minimum number of seams</u>; or \_\_\_\_\_>>. Lay out seams to avoid widths less than 1/3 of roll width; match patterns at seams.
- B. Seams are prohibited in << <u>bathrooms</u>; kitchens; <u>toilet rooms</u>; custodial closets; and \_\_\_\_\_>>.

# 3.05 INSTALLATION - TILE FLOORING

- A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.
- B. Lay flooring with joints and seams << parallel; at 45 degrees; or \_\_\_\_>> to building lines to produce symmetrical pattern.

#### 3.06 INSTALLATION - RESILIENT BASE

- A. Fit joints tightly and make vertical. Maintain minimum dimension of << <u>18 inches</u>; or \_\_\_\_\_ inches>> between joints.
- B. Install base on solid backing. Bond tightly to wall and floor surfaces.
- C. Scribe and fit to door frames and other interruptions.

#### 3.07 INSTALLATION - STAIR COVERINGS

- A. Install stair coverings in one piece for full width<< <u>and depth</u>; \_\_\_\_; or None N/A>> of tread.
- B. Adhere over entire surface. Fit accurately and securely.

#### 3.08 CLEANING

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. << Clean, seal, and wax; Clean and seal; Clean and wax; <u>Clean;</u> or \_\_\_\_\_>> in accordance with manufacturer's written instructions.

#### 3.09 PROTECTION

A. Prohibit traffic on resilient flooring for 48 hours after installation.

#### SECTION 09 6566 RESILIENT ATHLETIC FLOORING

#### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

A. Rubber sheet flooring, adhesively installed.

#### 1.02 RELATED REQUIREMENTS

- A. Section <u>03 3000 Cast-in-Place Concrete</u>: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied flooring.
- B. Section **09 0561 Common Work Results for Flooring Preparation**: Removal of existing floor coverings, cleaning, and preparation.
- C. Section <u>09 0561 Common Work Results for Flooring Preparation</u>: Concrete slab moisture and alkalinity << <u>testing</u>; <u>remediation procedures</u>; and \_\_\_\_>>.
- D. Section 09 6500 Resilient Flooring.

#### 1.03 REFERENCE STANDARDS

- A. ASTM D412 Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2016, with Editorial Revision (2021).
- B. ASTM D2240 Standard Test Method for Rubber Property--Durometer Hardness; 2015, with Editorial Revision (2017).
- C. ASTM F710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2019, with Editorial Revision (2020).
- D. ASTM F2772 Standard Specification for Athletic Performance Properties of Indoor Sports Floor Systems; 2011 (Reapproved 2019).

#### 1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting << <u>one week</u>; or \_\_\_\_>> before starting work of this section; << require; request; or \_\_\_\_>> attendance by all affected installers; review preparation and installation procedures and coordination and scheduling necessary for related work.

### 1.05 SUBMITTALS

- A. See Section <u>01 3000 Administrative Requirements</u>, for submittal procedures.
- B. Product Data: Manufacturer's printed data sheets for products specified.
- C. Shop Drawings: Fabrication and installation details, and layout, colors, and widths of game lines and equipment locations.
- D. Verification Samples: Actual flooring material specified, not less than << <u>12 inch</u>; or <u>inch</u>>> square, mounted on solid backing.
  - 1. Include samples of game lines, illustrating colors selected.
- E. Test Reports: Submit test reports showing compliance with << DIN EN 14904; <u>ASTM F2772</u>; or \_\_\_\_>>.
- F. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.
- G. Manufacturer's Instructions: Indicate << <u>standard and special installation procedures;</u> perimeter conditions requiring special attention; and \_\_\_\_\_>>.
- H. << Installer's; Applicator's; Erector's; or \_\_\_\_>> qualification statement.
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section <u>01 6000 Product Requirements</u>, for additional provisions.

# 1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least << <u>three</u>; or \_\_\_\_>> years of<< <u>documented</u>; \_\_\_\_; or None N/A>> experience.
- B. << <u>Installer</u>; Applicator; Erector; or \_\_\_\_>> Qualifications: Company specializing in performing work of the type specified and with at least << <u>three</u>; or \_\_\_\_\_>> years of<< <u>documented</u>; \_\_\_\_\_; or None N/A>> experience<< and approved by manufacturer; or <u>None N/A</u>>>.

### 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to project site in unopened containers clearly labeled with manufacturer's name and identification of contents.
- B. Store materials in dry and clean location until needed for installation. During installation, handle in a manner that will prevent marring and soiling of finished surfaces.

### 1.08 FIELD CONDITIONS

A. Maintain temperature in spaces to receive adhesively installed resilient flooring within range of <u>70 to 95 degrees F</u> for not less than 48 hours before the beginning of installation and for not less than 48 hours after installation has been completed. Subsequently, do not allow temperature in installed spaces to drop below <u>50 degrees F</u> or to go above <u>100 degrees F</u>.

## PART 2 PRODUCTS

# 2.01 PREFORMED ATHLETIC FLOORING

A. See drawings.

# 2.02 ACCESSORIES

- A. Leveling Compound: Latex-modified cement formulation as recommended by flooring manufacturer for substrate conditions.
- B. Flooring Adhesive: Waterproof; types recommended by flooring manufacturer.

# PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Examine substrates for conditions detrimental to installation of athletic flooring. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of athletic flooring to substrate.
- C. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
  - 1. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

### 3.02 PREPARATION

A. Prepare floor substrates for installation of flooring in accordance with Section **09 0561**.

### 3.03 INSTALLATION

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install in accordance with manufacturer's written instructions<< and approved shop drawings; or <u>None - N/A</u>>>.
- C. Resilient Sheet Flooring:
  - 1. Unroll flooring and allow to relax before beginning installation.

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- 2. Mix adhesive thoroughly and apply to substrate with notched trowel. Roll flooring into fresh adhesive,<< <u>overlapping end seams and double cutting</u>.; or None N/A>> butting factory edges and compression fitting.
- 3. Roll entire flooring surface with steel roller to assure adhesion to substrate and eliminate air bubbles.
- 4. Immediately remove any adhesive from flooring surface, using chemical recommended by flooring manufacturer.
- 5. Weld seams using techniques and equipment recommended by manufacturer.
- 6. Lay out game lines using tape and taping machine approved by flooring manufacturer. Apply game line paint with roller, and allow to dry before removing tape.
- 7. Apply transparent top coat over flooring if recommended by manufacturer, to achieve a uniform finished appearance.

### 3.04 CLEANING

A. Clean flooring using methods recommended by manufacturer.

### 3.05 PROTECTION

A. Protect finished athletic flooring from construction traffic to ensure that it is without damage upon Date of Substantial Completion.

#### SECTION 09 6813 TILE CARPETING

#### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- Carpet tile, << <u>fully adhered</u>; loose laid with edges and control grid adhered; or \_\_\_\_\_\_>>.
- B. Removal of existing carpet tile.

#### 1.02 RELATED REQUIREMENTS

- A. Section <u>03 3000 Cast-in-Place Concrete</u>: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied flooring.
- B. Section <u>09 0561 Common Work Results for Flooring Preparation</u>: Removal of existing floor coverings, cleaning, and preparation.
- C. Section <u>09 0561 Common Work Results for Flooring Preparation</u>: Concrete slab moisture and alkalinity << <u>testing</u>; <u>remediation procedures</u>; and \_\_\_\_>>.

## 1.03 PRICE AND PAYMENT PROCEDURES

A. Section <u>01 2100 - Allowances</u>: Cash allowances affecting this section.

### 1.04 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical<< <u>and performance</u>; or None N/A>> characteristics; sizes, patterns, colors available, and method of installation.
- C. Shop Drawings: Indicate << <u>layout of joints</u>; direction of carpet pile; location of edge moldings; layout of flat wire system; and \_\_\_\_\_>>.
- D. Samples: Submit << <u>two</u>; or \_\_\_\_\_>> carpet tiles illustrating color<< <u>and pattern design</u>; or None N/A>> for each carpet color selected.
- E. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.
- F. Installer's Qualification Statement.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section <u>01 6000 Product Requirements</u>, for additional provisions.
  - 2. Extra Carpet Tiles: << Quantity equal to 5 percent of total installed; Quantity equal
    - to \_\_\_\_ percent of total installed; or \_\_\_\_\_>> of each color and pattern installed.

### 1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in installing carpet tile with minimum << <u>three</u>; or \_\_\_\_\_>> years<< <u>documented</u>; \_\_\_\_\_; or None - N/A>> experience<< <u>and</u> <u>approved by carpet tile manufacturer</u>; \_\_\_\_\_; or None - N/A>>.
- B. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

### 1.06 FIELD CONDITIONS

A. Store materials in area of installation for minimum period of 24 hours prior to installation.

### PART 2 PRODUCTS

# 2.01 MANUFACTURERS

### A. See drawings.

## 2.02 MATERIALS

A. See drawings.

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## 2.03 ACCESSORIES

- A. Edge Strips: << <u>Embossed aluminum</u>; Rubber; Vinyl; or \_\_\_\_\_>>, << \_\_\_\_ color; or <u>color as selected by Architect</u>>>.
- B. Stair Nosing: As specified in << Section 09 6500; or \_\_\_\_>>.
- C. Adhesives:
- D. Carpet Tile Adhesive: Recommended by carpet tile manufacturer<< ; releasable type; ; \_\_\_\_\_type; or None - N/A>>.

## PART 3 EXECUTION

# 3.01 EXAMINATION

- A. Verify that subfloor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.
- B. Cementitious Subfloor Surfaces: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH).
  - 1. Test in accordance with Section **<u>09 0561</u>**.
  - 2. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.

### 3.02 PREPARATION

- A. Remove existing carpet tile in remodel areas.
- B. Prepare floor substrates for installation of flooring in accordance with Section 09 0561.

### 3.03 INSTALLATION

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install carpet tile in accordance with manufacturer's instructions<< and CRI 104 (Commercial); and CRI 105 (Residential); and \_\_\_\_; or <u>None - N/A</u>>>.
- C. Blend carpet from different cartons to ensure minimal variation in color match.
- D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.
- E. Lay carpet tile in << square; or \_\_\_\_\_>> pattern, with pile direction << parallel; or alternating>> to next unit, set << parallel to building lines; aligned as indicated on shop drawings; or \_\_\_\_\_\_>>.
- F. Locate change of color or pattern between rooms under door centerline.
- G. Fully adhere carpet tile to substrate.
- H. Trim carpet tile neatly at walls and around interruptions.
- I. Complete installation of edge strips, concealing exposed edges.

### 3.04 CLEANING

- A. Remove excess adhesive without damage, from floor, base, and wall surfaces.
- B. Clean and vacuum carpet surfaces.

#### SECTION 09 6816 SHEET CARPETING

#### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Carpet, << stretched-in with cushion underlay; direct-glued; and \_\_\_\_>>.
- B. Removal of existing carpet.

#### 1.02 RELATED REQUIREMENTS

- A. Section 01 6116 Volatile Organic Compound (VOC) Content Restrictions.
- B. Section <u>01 7419 Construction Waste Management and Disposal</u>: Reclamation/Recycling of << <u>new carpet scrap</u>; <u>new cushion scrap</u>; <u>removed carpet</u>; <u>removed carpet cushion</u>; and \_\_\_\_\_>>.
- C. Section <u>09 0561 Common Work Results for Flooring Preparation</u>: Independent agency testing of concrete slabs, removal of existing floor coverings, cleaning, and preparation.
- D. Section <u>09 0561 Common Work Results for Flooring Preparation</u>: Concrete slab moisture and alkalinity << <u>testing</u>; <u>remediation procedures</u>; and \_\_\_\_>>.
- E. Section 09 6813 Tile Carpeting.
- F. Section <u>22 1006 Plumbing Piping Specialties</u>: Plumbing floor cover plate with recess for carpet.

# 1.03 REFERENCE STANDARDS

- A. ASTM D2859 Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials; 2016 (Reapproved 2021).
- B. CRI 104 Standard for Installation of Commercial Carpet; 2015.

### 1.04 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical<< <u>and performance</u>; \_\_\_\_; or None - N/A>> characteristics; sizes, patterns, colors available, and method of installation.
- C. Shop Drawings: Indicate seaming plan, method of joining seams, direction of carpet pile<< <u>and pattern</u>; or None - N/A>>, location of edge moldings and edge bindings<< <u>, layout of</u> <u>flat wire system</u>; <u>, \_\_\_\_\_</u>; or None - N/A>><< <u>, and \_\_\_\_\_</u>; or None - N/A>>.
- D. Samples: Submit << <u>two</u>; or \_\_\_\_\_>> samples <u>24 by 24 inch</u> in size illustrating color and pattern for each carpet<< <u>and cushion</u>; \_\_\_\_; or None N/A>> material specified.
- E. Accessory Samples: Submit << <u>two;</u> or \_\_\_\_>> <u>12 inch</u> long samples of << <u>edge strip;</u> base gripper; base cap; and \_\_\_\_\_>> for each color specified.
- F. Manufacturer's Installation Instructions: Indicate << <u>special procedures;</u> perimeter conditions requiring special attention; and \_\_\_\_\_>>.
- G. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.
- H. Manufacturer's Qualification Statement.
- I. Installer's Qualification Statement.
- J. Operation and Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.
- K. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 Product Requirements. for additional requirements.

## 1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet with minimum << <u>three;</u> or \_\_\_\_\_>> years<< <u>documented;</u> \_\_\_\_; or None N/A>> experience.

### **1.06 FIELD CONDITIONS**

- A. Store materials in area of installation for minimum period of 24 hours prior to installation.
- B. Maintain minimum <u>70 degrees F</u> ambient temperature << <u>24</u>; 72; or \_\_\_>> hours prior to, during and 24 hours after installation.
- C. Ventilate installation area during installation and for << <u>72</u>; or \_\_\_\_>> hours after installation.

# PART 2 PRODUCTS

# 2.01 MANUFACTURERS

A. See drawings.

### 2.02 CARPET

A. See drawings.

### 2.03 ACCESSORIES

- A. Subfloor Filler: Type recommended by carpet manufacturer.
- B. Adhesives:
  - Compatible with materials being adhered; maximum VOC content as specified in Section 01 6116.
- C. Seam Adhesive: Recommended by carpet manufacturer.
- D. Carpet Adhesive: Recommended by carpet manufacturer<< ; releasable type; ; \_\_\_\_\_\_ type; or <u>None N/A</u>>>.

### PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive carpet.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive carpet.
- C. Cementitious Subfloor Surfaces: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH).
  - 1. Test in accordance with Section 09 0561.
  - 2. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.
- D. Verify that required floor-mounted utilities are in correct location.

### 3.02 PREPARATION

A. Prepare floor substrates for installation of flooring in accordance with Section 09 0561.

### 3.03 INSTALLATION - GENERAL

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install carpet and cushion in accordance with manufacturer's instructions<< <u>and CRI 104</u> (<u>Commercial</u>); and CRI 105 (Residential); and <u>\_\_\_\_; or None N/A>>.</u>
- C. Verify carpet match before cutting to ensure minimal variation between dye lots.

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- D. Lay out carpet<< <u>and locate seams in accordance with shop drawings;</u> ; or None N/A>>.
  - 1. Locate seams in area of least traffic, out of areas of pivoting traffic, and parallel to main traffic.
  - 2. Do not locate seams perpendicular through door openings.
  - 3. Align run of pile in same direction as anticipated traffic and in same direction on adjacent pieces.
  - 4. Locate change of color or pattern between rooms under door centerline.
  - 5. Provide monolithic color, pattern, and texture match within any one area.
- E. Install carpet tight and flat on subfloor, well fastened at edges, with a uniform appearance.

# 3.04 DIRECT-GLUED CARPET

- A. Double cut carpet seams<< <u>, with accurate pattern match</u>; <u>, \_\_\_\_</u>; or None N/A>>. Make cuts straight, true, and unfrayed. << <u>Apply seam adhesive to cut edges of woven carpet</u> <u>immediately.</u>; <u>\_\_\_\_</u>.; or None N/A>>
- B. Apply contact adhesive to floor uniformly at rate recommended by manufacturer. After sufficient open time, press carpet into adhesive.
- C. Apply seam adhesive to the base of the edge glued down. Lay adjoining piece with seam straight, not overlapped or peaked, and free of gaps.
- D. Roll with appropriate roller for complete contact of adhesive to carpet backing.
- E. Trim carpet neatly at walls and around interruptions.

# 3.05 CLEANING

- A. See Section <u>01 7000 Execution and Closeout Requirements</u> for additional requirements.
- B. Remove excess adhesive from floor and wall surfaces without damage.
- C. Clean and vacuum carpet surfaces.

#### SECTION 09 7200 WALL COVERINGS

### PART 1 GENERAL

## 1.01 SECTION INCLUDES

- A. Surface preparation << <u>and prime painting;</u> or None N/A>>.
- B. Wall covering<< <u>and borders;</u> or None N/A>>.

## 1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

# 1.03 REFERENCE STANDARDS

- A. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials; 2021.
- B. ASTM F793/F793M Standard Classification of Wall Coverings by Use Characteristics; 2015.

# 1.04 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on wall covering<< <u>and adhesive;</u> or None N/A>>.
- C. Shop Drawings: Indicate wall elevations with seaming layout.
- D. Samples: Submit << <u>two;</u> or \_\_\_\_>> samples of wall covering, <u>16 by 16 inch</u> in size illustrating color, finish, and texture.
- E. Test Reports: Indicate verification of flame and smoke ratings, when tested by << <u>UL</u>; an agency approved by authority having jurisdiction; or \_\_\_\_\_>>.
- F. Manufacturer's Installation Instructions: Indicate << <u>special procedures;</u> perimeter conditions requiring special attention; and \_\_\_\_\_>>.
- G. Maintenance Data: Submit data on cleaning, touch-up, and repair of covered surfaces.
- H. Manufacturer's Qualification Statement.
- I. Installer's Qualification Statement.
- J. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  1. See Section <u>01 6000 Product Requirements</u>, for additional provisions.

### 1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum << <u>three</u>; or \_\_\_\_>> years of<< <u>documented</u>; \_\_\_\_; or None N/A>> experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least << <u>three</u>; or \_\_\_\_\_>> years of<< <u>documented</u>; \_\_\_\_; or None N/A>> experience<< and approved by manufacturer; \_\_\_\_; or <u>None N/A</u>>>.

### 1.06 MOCK-UP

- A. See Section <u>01 4000 Quality Requirements</u> for additional requirements.
- B. Provide panel, << <u>panel drops;</u> <u>feet; or</u> >> wide, full height, illustrating installed << <u>wall covering;</u> joint seaming technique; and \_\_\_\_\_>>.
- C. Locate << <u>where directed;</u> or \_\_\_\_\_>>.
- D. Mock-up << <u>may</u>; or may not>> remain as part of the Work.

### 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Inspect roll materials at arrival on site, to verify acceptability.
- B. Protect packaged adhesive from temperature cycling<< <u>and cold temperatures</u>; or None N/A>>.

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C. Do not store roll goods on end.

# PART 2 PRODUCTS

# 2.01 WALL COVERINGS

## SECTION 09 9113 EXTERIOR PAINTING

## PART 1 GENERAL

## 1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished << and unless otherwise indicated.; and unless otherwise indicated, including the following:; or .>>
- D. Do Not Paint or Finish the Following Items:
  - 1. Items factory-finished unless otherwise indicated; materials and products having factoryapplied primers are not considered factory finished.
  - 2. Items indicated to receive other finishes.
  - 3. Items indicated to remain unfinished.
  - 4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
  - 5. Floors, unless specifically indicated.
  - 6. Glass.
  - 7. Concealed pipes, ducts, and conduits.

# 1.02 RELATED REQUIREMENTS

- A. Section 01 6116 Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 05 5000 Metal Fabrications: Shop-primed items.
- C. Section <u>05 5100 Metal Stairs</u>: Shop-primed items.
- D. Section 09 9123 Interior Painting.
- E. Section 09 9300 Staining and Transparent Finishing. Wood substrates.

### **1.03 REFERENCE STANDARDS**

- A. MPI (APSM) Master Painters Institute Architectural Painting Specification Manual; Current Edition.
- B. SSPC-SP 1 Solvent Cleaning; 2015, with Editorial Revision (2016).

## 1.04 SUBMITTALS

- A. See Section <u>01 3000 Administrative Requirements</u>, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
  - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
  - 2. MPI product number (e.g. MPI #47).
  - 3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
- C. Samples: Submit << <u>three</u>; or \_\_\_\_\_>> paper "draw down" samples, << <u>8-1/2 by 11 inches</u>; or \_\_\_\_\_\_ inches>> in size, illustrating range of colors available for each finishing product specified.
  - 1. Where sheen is specified, submit samples in only that sheen.

## 1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of <u>45 degrees F</u> and a maximum of <u>90</u> <u>degrees F</u>, in ventilated area, and as required by manufacturer's instructions.

#### 1.06 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the paint product manufacturer's temperature ranges.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
- D. Minimum Application Temperatures for Latex Paints: <u>50 degrees F</u> for exterior; unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of << <u>80 ft candles</u>; or \_\_\_\_\_ ft candles>> measured mid-height at substrate surface.

#### PART 2 PRODUCTS

#### 2.01 MANUFACTURERS

- A. See drawings.
- B. Provide paints and finishes from the same manufacturer<< <u>to the greatest extent possible;</u> ; or None - N/A>>.
  - If a single manufacturer cannot provide specified products, minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for << <u>substitutions</u>; or submittals>>.
- C. Primer Sealers: Same manufacturer as top coats.
- D. Substitutions: << See Section 01 6000 Product Requirements; or Not permitted>>.

### 2.02 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready-mixed, unless required to be a field-catalyzed paint.
  - 1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
  - 2. Supply each paint material in quantity required to complete entire project's work from a single production run.
  - 3. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is described explicitly in manufacturer's product instructions.
- B. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.
- C. Colors: << To be selected from manufacturer's full range of available colors; <u>As</u> <u>indicated on drawings;</u> As indicated in Color Schedule; or \_\_\_\_\_>>.

#### 2.03 PAINT SYSTEMS - EXTERIOR

- A. << <u>Paint E-OP -</u>; \_\_\_\_; or None N/A>>Exterior Surfaces to be Painted, Unless Otherwise Indicated: Including << concrete; concrete masonry units; brick; fiber cement siding; primed wood; primed metal; and \_\_\_\_>>.
  - 1. << <u>Two top coats;</u> One top coat; or \_\_\_\_>> and one coat primer.
  - Top Coat(s): Exterior Latex<< ; MPI #10, 11, 15, 119, or 214; ; \_\_\_\_; or None N/A>>.
    - a. Products:

Β.

- 3. Top Coat(s): Exterior Alkyd Enamel<< : MPI #94 or 96; ; \_\_\_\_; or None N/A>>.
- << <u>Paint ME-OP-2L -;</u> \_\_\_\_\_\_; or None N/A>>Ferrous Metals, Primed, Latex, 2 Coat:
- 1. Touch-up with rust-inhibitive primer recommended by top coat manufacturer.
- 2. Semi-gloss: Two coats of latex enamel<< ; \_\_\_\_; or None N/A>>.

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#### 2.04 PRIMERS

A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.

# 2.05 ACCESSORY MATERIALS

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Patching Material: << <u>Latex;</u> or \_\_\_\_\_>> filler.
- C. Fastener Head Cover Material: << <u>Latex;</u> or \_\_\_\_\_>> filler.

### PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- B. Test shop-applied primer for compatibility with subsequent cover materials.

#### 3.02 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove<< <u>or mask</u>; or None N/A>> surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Ferrous Metal:
  - 1. Solvent clean according to SSPC-SP 1.
  - Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. << <u>Re-prime entire shop-primed item.</u>; or None - N/A>>

#### 3.03 APPLICATION

- A. Apply products in accordance with manufacturer's written instructions<< <u>and</u> <u>recommendations in "MPI Architectural Painting Specification Manual";</u> ; or None - N/A>>.
- B. Apply each coat to uniform appearance.
- C. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

#### 3.04 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

#### 3.05 PROTECTION

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

#### SECTION 09 9123 INTERIOR PAINTING

# PART 1 GENERAL

## **1.01 SECTION INCLUDES**

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished << <u>and unless</u> <u>otherwise indicated.</u>; and unless otherwise indicated, including the following:; or .>>
  - 1. Prime surfaces to receive wall coverings.
  - 2. Mechanical and Electrical:
    - a. << <u>In finished areas</u>; In all areas; or \_\_\_\_>>, paint << <u>insulated and exposed</u> <u>pipes</u>; <u>conduit</u>; <u>boxes</u>; <u>insulated and exposed ducts</u>; <u>hangers, brackets</u>, <u>collars and supports</u>; <u>mechanical equipment</u>; <u>electrical equipment</u>; and \_\_\_\_\_>>, unless otherwise indicated.
- D. Do Not Paint or Finish the Following Items:
  - 1. Items factory-finished unless otherwise indicated; materials and products having factoryapplied primers are not considered factory finished.
  - 2. Items indicated to receive other finishes.
  - 3. Items indicated to remain unfinished.
  - 4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
  - 5. Stainless steel, anodized aluminum, bronze, terne-coated stainless steel, and lead items.
  - 6. Floors, unless specifically indicated.
  - 7. Ceramic and other tiles.
  - 8. Glass.
  - 9. Concealed pipes, ducts, and conduits.

### 1.02 RELATED REQUIREMENTS

- A. Section <u>05 5000 Metal Fabrications</u>: Shop-primed items.
- B. Section 05 5100 Metal Stairs: Shop-primed items.
- C. Section 09 9300 Staining and Transparent Finishing: Wood substrates.

### 1.03 DEFINITIONS

A. Comply with ASTM D16 for interpretation of terms used in this section.

### 1.04 REFERENCE STANDARDS

- A. ASTM D16 Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2016.
- B. MPI (APSM) Master Painters Institute Architectural Painting Specification Manual; Current Edition.
- C. SSPC-SP 1 Solvent Cleaning; 2015, with Editorial Revision (2016).
- D. SSPC-SP 6 Commercial Blast Cleaning; 2007.

# 1.05 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
  - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g., "alkyd enamel").
  - 2. MPI product number (e.g., MPI #47).

- 3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
- 4. Manufacturer's installation instructions.
- C. Samples: Submit << three; or two>> paper "draw down" samples, << <u>8-1/2 by 11 inches;</u> or \_\_\_\_\_\_ inches>> in size, illustrating range of colors available for each finishing product specified.
  - 1. Where sheen is specified, submit samples in only that sheen.
  - 2. Where sheen is not specified, discuss sheen options with Architect before preparing samples, to eliminate sheens not required.
  - 3. Allow << <u>30 days;</u> or \_\_\_\_\_>> for approval process, after receipt of complete samples by Architect.
- D. Manufacturer's Instructions: Indicate << <u>special surface preparation procedures</u>; substrate conditions requiring special attention; and \_\_\_\_\_>>.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section <u>01 6000 Product Requirements</u>, for additional provisions.
  - Extra Paint and Finish Materials: << <u>1 gallon</u>; or <u>gallon</u> gallons>> of each << <u>color</u>; type; surface texture; and <u>>>;<< from the same product run</u>; ; or None N/A>> store where directed.
  - 3. Label each container with << <u>color</u>; type; texture; room locations; and \_\_\_\_\_>> in addition to the manufacturer's label.

#### 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of <u>45 degrees F</u> and a maximum of <u>90</u> <u>degrees F</u>, in ventilated area, and as required by manufacturer's instructions.

#### 1.07 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Provide lighting level of << <u>80 ft candles;</u> or \_\_\_\_\_ ft candles>> measured mid-height at substrate surface.

### PART 2 PRODUCTS

### 2.01 MANUFACTURERS

- A. See drawings.
- B. Provide paints and finishes from the same manufacturer<< <u>to the greatest extent possible;</u> ; or None - N/A>>.
  - 1. If a single manufacturer cannot provide specified products; minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for << <u>substitutions</u>; or submittals>>.
- C. Primer Sealers: Same manufacturer as top coats.
- D. Substitutions: << See Section 01 6000 Product Requirements; or Not permitted>>.

#### 2.02 PAINTS AND FINISHES - GENERAL

- A. See drawings.
- B. Paints and Finishes: Ready-mixed, unless intended to be a field-catalyzed paint.

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- 1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
- 2. Supply each paint material in quantity required to complete entire project's work from a single production run.
- 3. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- C. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

## 2.03 PAINT SYSTEMS - INTERIOR

- A. << <u>Paint I-OP -</u>; \_\_\_\_; or None N/A>>Interior Surfaces to be Painted, Unless Otherwise Indicated: Including << <u>gypsum board</u>; concrete; concrete masonry units; brick; wood; plaster; uncoated steel; <u>shop primed steel</u>; galvanized steel; aluminum; acoustical ceilings; and \_\_\_\_>>.
  - 1. << <u>Two top coats</u>; One top coat; or \_\_\_\_>> and one coat primer.
  - 2. Top Coat(s): High Performance Architectural Interior Latex<< ; MPI #138, 139, 140, or 141; ; 139; or None N/A>>.
    - a. Products:
      - 1) Sherwin-Williams Pre-Catalyzed Waterbased Epoxy, Eg-Shel. (MPI #139)
      - 2) Substitutions: << <u>Section 01 6000 Product Requirements;</u> or Not permitted>>.
  - 3. Top Coat Sheen:
    - a. Flat: MPI gloss level 1; use this sheen << at all locations; for ceilings and other overhead surfaces; at \_\_\_\_; for \_\_\_\_; or per schedule in Part 3.>>.
    - b. Eggshell: MPI gloss level 3; use this sheen << at all locations; at \_\_\_\_; for \_\_\_; or per schedule in Part 3>>.
    - c. Gloss: MPI gloss level 6; use this sheen << at all locations; at \_\_\_\_; for per schedule in Part 3.; or \_\_\_\_>>.
  - 4. Primer: << <u>As recommended by top coat manufacturer for specific substrate;</u> As specified under "PRIMERS" below; or \_\_\_\_>>.
- B. << <u>Paint I-OP-DF -</u>; \_\_\_\_\_; or None N/A>>Dry Fall: Metals; exposed structure and overhead-mounted services<< in utilitarian spaces; \_\_\_\_\_; or <u>None N/A</u>>>, including shop primed << <u>steel deck</u>; <u>structural steel</u>; <u>metal fabrications</u>; <u>galvanized ducts</u>; <u>galvanized conduit</u>; <u>galvanized piping</u>; and \_\_\_\_\_>>.
  - 1. Shop primer by others.
  - Top Coat: Latex Dry Fall<< <u>; MPI #118, 155, or 226</u>; <u>;</u> ; or None N/A>>.
     a. Products:
    - 1) Sherwin-Williams Waterborne Acrylic Dryfall, Eg-Shel. (MPI #155, 226)
    - Substitutions: << <u>Section 01 6000 Product Requirements</u>; or Not permitted>>.

### 2.04 PRIMERS

- A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.
  - Interior Latex Primer Sealer<< ; MPI #50; ; \_\_\_\_; or None N/A>>.
    - a. Products:
      - 1) As recommended by manufacturer for application.
  - Interior/Exterior Quick Dry Alkyd Primer for Metal<< <u>; MPI #76;</u> ; \_\_\_\_; or None N/A>>.
    - a. Products:
      - 1) As recommended by manufacturer for application..

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## 2.05 ACCESSORY MATERIALS

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Patching Material: << <u>Latex;</u> or \_\_\_\_\_>> filler.
- C. Fastener Head Cover Material: << <u>Latex;</u> or \_\_\_\_\_>> filler.

## PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- C. Test shop-applied primer for compatibility with subsequent cover materials.
- D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces is below the following maximums:
   1. Gypsum Wallboard: << 12; or \_\_\_\_> percent.

#### 3.02 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove<< <u>or mask;</u> or None N/A>> surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.
- F. Ferrous Metal:
  - 1. Solvent clean according to SSPC-SP 1.
  - Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. << <u>Re-prime entire shop-primed item.</u>; or None - N/A>>
  - Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and << <u>blast cleaning according to</u> <u>SSPC-SP 6</u> "Commercial Blast Cleaning"; or \_\_\_\_>>. Protect from corrosion until coated.

## 3.03 APPLICATION

- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- B. Apply products in accordance with manufacturer's written instructions<< <u>and</u> <u>recommendations in "MPI Architectural Painting Specification Manual"</u>; ; or None - N/A>>.
- C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- D. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
- E. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- F. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

# 3.04 FIELD QUALITY CONTROL

A. See Section <u>01 4000 - Quality Requirements</u>, for general requirements for field << <u>inspection</u>; and testing>>.

# 3.05 PROTECTION

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

# 3.06 SCHEDULE

- A. P1, Field: Snowbound SW 7004, Eggshell.
- B. P2, Accent: Silver Mist SW7621, Eggshell.
- C. P3, Steel Stairs: Elephant Ear SW 9168, Flat.
- D. P4, Interior Bracing: Snowbound SW 7004, Gloss.
- E. P5, Accent: Mega Greige SW7031, Eggshell.
- F. P6, Accent: Grecian Ivory SW 7541, Eggshell.
- G. P7, Accent: Koi Pond SW7727, Eggshell.

#### SECTION 09 9300 STAINING AND TRANSPARENT FINISHING

## PART 1 GENERAL

# 1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field and shop application of << stains; transparent finishes; and \_\_\_\_>>.

## 1.02 RELATED REQUIREMENTS

- A. Section 06 6200 Finish Carpentry
- B. Section **09 9123 Interior Painting**: Stains and transparent finishes for concrete substrates.
- C. Section 12 3200 Manufactured Wood Casework

# 1.03 REFERENCE STANDARDS

- A. 40 CFR 59, Subpart D National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.
- B. ASTM D4442 Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2020.
- C. MPI (APL) Master Painters Institute Approved Products List; Master Painters and Decorators Association; Current Edition.
- D. MPI (APSM) Master Painters Institute Architectural Painting Specification Manual; Current Edition.

# 1.04 SUBMITTALS

- A. Product Data: Provide complete list of products to be used, with the following information for each:
  - 1. Manufacturer's name, product name and/or catalog number, and general product category.
  - 2. MPI product number (e.g. MPI #33).
  - 3. Manufacturer's installation instructions.
  - 4. If proposal of substitutions is allowed under submittal procedures, explanation of substitutions proposed.
- B. Samples: Submit << two; or \_\_\_\_\_>> samples, illustrating selected colors and sheens for each system<< with specified coats cascaded; \_\_\_\_\_; or None N/A>>. Submit on << actual wood substrate to be finished; or \_\_\_\_\_\_>>, 12 by 12 inch in size.
- C. Maintenance Data: Submit << <u>data</u>; coating maintenance manual; or \_\_\_\_\_>> including << <u>finish schedule showing where each product/color/finish was used</u>; <u>product</u> <u>technical data sheets</u>; <u>safety data sheets (SDS)</u>; <u>care and cleaning instructions</u>; <u>touch-up procedures</u>; <u>color samples of each color and finish used</u>; and \_\_\_\_\_>>.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - Extra Stain and Transparent Finish Materials: << <u>1 gallon</u>; or <u>gallon</u> gallons>> of each
     << <u>color</u>; <u>type</u>; surface texture; and <u>>></u>;<< <u>from the same product run</u>;
     ; or None N/A>> store where directed.
  - 2. Label each container with << <u>color</u>; <u>type</u>; texture; room locations; and \_\_\_\_>> in addition to the manufacturer's label.

### 1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum << <u>three</u>; or \_\_\_\_\_>> years<< <u>documented</u>; \_\_\_\_; or None N/A>> experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified << <u>with minimum</u> 5 <u>years experience</u>; with minimum \_\_\_\_\_\_ years documented

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#### experience; and <u>approved by manufacturer>>.</u>

#### 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of stain or transparent finish, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

#### **1.07 FIELD CONDITIONS**

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by manufacturer of stains and transparent finishes.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Provide lighting level of << <u>80 ft candles</u>; or \_\_\_\_\_ ft candles>> measured mid-height at substrate surface.

#### PART 2 PRODUCTS

#### 2.01 MANUFACTURERS

- Provide finishes from the same manufacturer<< <u>to the greatest extent possible;</u> ;
   or None N/A>>.
  - 1. In the event that a single manufacturer cannot provide specified products, minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for << <u>substitutions</u>; or submittals>>.
- B. Transparent Finishes:
  - 1. Behr Process Corporation: www.behr.com/#sle.
  - 2. PPG Paints<< ; \_\_\_\_\_; or <u>None N/A</u>>>: www.ppgpaints.com/#sle.
  - 3. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
- C. Stains:
- D. Substitutions: << See Section 01 6000 Product Requirements; or Not permitted>>.

### 2.02 STAINS AND TRANSPARENT FINISHES - GENERAL

- A. Finishes:
  - 1. Provide finishes capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
  - 2. Supply each finish material in quantity required to complete entire project's work from a single production run.
  - 3. Do not reduce, thin, or dilute finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Volatile Organic Compound (VOC) Content: Comply with Section 01 6116.
- C. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.
- D. Colors: << To be selected from manufacturer's full range of available colors; <u>As</u> <u>indicated on drawings;</u> As indicated in Color Schedule; or \_\_\_\_\_>>.

### 2.03 INTERIOR STAIN AND TRANSPARENT FINISH SYSTEMS

- A. Finish on Wood<< Vertical Surfaces; Doors; Trim; Wall Paneling; \_\_\_; or None - N/A>>:
  - Top Coat(s): Clear Water-Based Varnish<< <u>; MPI #128, 129, or 130</u>; ; \_\_\_\_; or None N/A>>.
    - a. Products:
      - 1) Behr Fast Drying Water-Based Polyurethane [B8100].

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- 2) PPG Paints Deft Interior Polyurethane Water-Based Acrylic, DFT159, Satin. (MPI #128)
- Substitutions: << <u>Section 01 6000 Product Requirements</u>; or Not permitted>>.
- 2. Top Coat Sheen:
  - a. Semi-Gloss: MPI gloss level 5; use this sheen << <u>at all locations</u>; at \_\_\_\_; for \_\_\_\_; or \_\_\_\_>>.

## 2.04 ACCESSORY MATERIALS

- A. Accessory Materials: Cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of finished surfaces.
- B. Patching Material: << <u>Latex;</u> or \_\_\_\_\_>> filler.

# PART 3 EXECUTION

# 3.01 EXAMINATION

- A. Do not begin application of stains and finishes until substrates have been properly prepared.
- B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.
- D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:

#### 3.02 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or repair existing finishes that exhibit surface defects.
- D. Remove<< <u>or mask</u>; or None N/A>> surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- E. Seal surfaces that might cause bleed through or staining of topcoat.
- F. Wood Surfaces to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats. Prime concealed surfaces with gloss varnish reduced 25 percent with thinner.

### 3.03 APPLICATION

- A. Apply products in accordance with manufacturer's written instructions<< <u>and</u> <u>recommendations in "MPI Architectural Painting Specification Manual"</u>; \_\_\_\_; or None - N/A>>.
- B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- C. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
- D. Sand wood surfaces lightly between coats to achieve required finish.
- E. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- F. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

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# 3.04 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

# 3.05 PROTECTION

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

#### SECTION 09 9723 CONCRETE AND MASONRY COATINGS

### PART 1 GENERAL

#### **1.01 SECTION INCLUDES**

A. Moisture resistant smooth concrete and masonry coatings.

#### 1.02 RELATED REQUIREMENTS

- A. Section 01 6116 Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 03 3300 Cast in Place Concrete
- C. Section 09 9113 Exterior Painting.

#### 1.03 REFERENCE STANDARDS

- A. ASTM B117 Standard Practice for Operating Salt Spray (Fog) Apparatus; 2019.
- B. ASTM D1653 Standard Test Methods for Water Vapor Transmission of Organic Coating Films; 2013 (Reapproved 2021).
- C. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials; 2021.
- D. ASTM G153 Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials; 2013 (Reapproved 2021).
- E. SSPC-SP 13/NACE No.6 Surface Preparation of Concrete; 2018.
- F. SSPC-SP 3 Power Tool Cleaning; 2018.

#### 1.04 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data indicating coating materials<< <u>and</u> \_\_\_\_\_; or None N/A>>.
- C. Samples: Submit << <u>two</u>; or \_\_\_\_\_>> samples <u>12 by 12 inch</u> in size illustrating colors<< <u>available</u>; or None N/A>> for selection.
- D. Manufacturer's Installation Instructions: Indicate << <u>special procedures; perimeter</u> <u>conditions requiring special attention;</u> and <u>\_\_\_\_>></u>.
- E. Maintenance Data: Include << <u>cleaning procedures</u>; <u>repair and patching techniques</u>; and \_\_\_\_\_\_>>.

### 1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum << <u>three</u>; or \_\_\_\_\_>> years<< <u>documented</u>; or None - N/A>> experience.
- B. Applicator Qualifications: Company specializing in performing the work of this section << with minimum \_\_\_\_\_ years experience; with minimum 5 years documented experience; or approved by manufacturer>>.

#### **1.06 FIELD CONDITIONS**

- A. Do not install materials when temperature is below << <u>55 degrees F</u>; or <u>degrees F</u>; or <u>degrees F</u>; or <u>degrees F</u>.
- B. Maintain this temperature range, 24 hours before, during, and << <u>72</u>; or \_\_\_\_>> hours after installation of coating.
- C. Restrict traffic from area where coating is being applied or is curing.

#### 1.07 WARRANTY

A. See Section <u>01 7800 - Closeout Submittals</u>, for additional warranty requirements.

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# PART 2 PRODUCTS

#### 2.01 MANUFACTURERS

A. Concrete and Masonry Coatings:

## 2.02 CONCRETE AND MASONRY COATINGS

- A. Provide high-build, weather resistant coating systems that meet the following minimum performance criteria, unless more stringent criteria are specified:
  - 1. Salt Spray Resistance: Passes when tested according to ASTM B117 for 2000 hours.
  - Surface Burning Characteristics: Flame spread/Smoke developed index of << <u>0/0</u>; or \_/\_>>, maximum, when tested in accordance with ASTM E84.
  - 3. Accelerated Outdoor Exposure: Passes when tested according to ASTM G153 for 5,000 hours.

#### 2.03 MATERIALS

A. Coatings - General: Provide complete systems formulated and recommended by manufacturer for the applications indicated, in the thicknesses indicated.

#### PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that substrate surfaces are ready to receive work as instructed by the coating manufacturer. Obtain and follow manufacturer's instructions for examination and testing of substrates.

### 3.02 PREPARATION

- A. Clean surfaces of loose foreign matter.
- B. Remove substances that would bleed through finished coatings.
- C. Remove finish hardware, fixture covers, and accessories and store.
- D. Protect adjacent surfaces and materials not receiving coating from spatter and overspray; mask if necessary to provide adequate protection. Repair damage.

#### 3.03 PRIMING

A. Apply primer to << all; or \_\_\_\_\_>> surfaces, unless specifically not required by coating manufacturer. Apply in accordance with coating manufacturer's instructions.

#### 3.04 COATING APPLICATION

- A. Apply coatings in accordance with manufacturer's instructions, to thicknesses specified.
- B. Apply in uniform thickness coats, without runs, drips, pinholes, brush marks, or variations in color, texture, or finish. Finish edges, crevices, corners, and other changes in dimension with full coating thickness.

#### 3.05 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.
- B. Clean surfaces immediately of overspray, splatter, and excess material.
- C. After coating has cured, clean and replace finish hardware, fixtures, and fittings previously removed.

#### 3.06 PROTECTION

A. Protect finished work from damage.

#### SECTION 10 1100 VISUAL DISPLAY UNITS

#### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Letter Board Indoor Enclosed Bulletin board.
- B. Porcelain enamel steel markerboards.
- C. Glass markerboards.
- D. Tackboards.
- E. Tackable wall panels.

#### **1.02 RELATED REQUIREMENTS**

- A. Section <u>06 1000 Rough Carpentry</u>: Blocking and supports.
- B. Section 09 2116 Gypsum Board Assemblies: Concealed supports in metal stud walls.
- C. Section <u>09 9123 Interior Painting</u>: Finishing of wood frame<< <u>and marker rail</u>; and chalkrail; or None N/A>>.

#### 1.03 REFERENCE STANDARDS

- A. 16 CFR 1201 Safety Standard for Architectural Glazing Materials; Current Edition.
- B. ANSI Z97.1 American National Standard for Safety Glazing Materials Used in Buildings -Safety Performance Specifications and Methods of Test; 2015.
- C. ASTM C1172 Standard Specification for Laminated Architectural Flat Glass; 2014.

#### 1.04 SUBMITTALS

- A. See Section <u>01 3000 Administrative Requirements</u>, for submittal procedures.
- B. Product Data: Provide manufacturer's data on << <u>chalkboard</u>; <u>porcelain enamel steel</u> <u>markerboard</u>; <u>glass markerboard</u>; <u>tackboard</u>; <u>tackboard surface covering</u>; <u>trim</u>; <u>accessories</u>; and \_\_\_\_>>.
- C. Shop Drawings: Indicate wall elevations, dimensions, joint locations << <u>, special anchor</u> <u>details</u>; or None N/A>>.
- D. Samples: Color charts for selection of color and texture of << chalkboard; <u>porcelain enamel</u> <u>steel markerboard</u>; <u>glass markerboard</u>; <u>tackboard</u>; <u>tackboard surface covering</u>; <u>trim</u>; and \_\_\_\_>>.
- E. Manufacturer's printed installation instructions.
- F. Maintenance Data: Include data on regular cleaning, stain removal << , and \_\_\_\_; or None N/A>>.

#### 1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum << <u>three</u>; or \_\_\_\_\_>> years<< <u>documented</u>; or None - N/A>> experience.

#### 1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

### PART 2 PRODUCTS

#### 2.01 MANUFACTURERS

- A. Substitutions: << See Section 01 6000 Product Requirements; or Not permitted>>.
- 2.02 VISUAL DISPLAY UNITS
  - A. << <u>Magnetic</u>; Nonmagnetic; None N/A; or \_\_\_\_\_ >>Glass Markerboards: << <u>Back-</u> <u>coated glass</u>; Surface-coated glass; Noncoated glass; or \_\_\_\_>><< None - N/A; \_

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laminated to steel; or , \_\_\_\_>>.

- Glass: << Tempered, low iron; Laminated, low iron; or \_\_\_\_\_>>, << manufacturer's standard thickness; 1/4 inch thick; 1/2 inch thick; or \_\_\_\_ inch thick>>, << with bevel edges and radiused corners; with flat polish and square corners; with flat ground and square corners; with pencil polish and square corners; with pencil ground and square corners; or \_\_\_\_\_>><< None N/A; , laminated to steel backing sheet for use with magnets; or , \_\_\_\_>>. Coated or treated for use as << dry erase board; projection surface; or \_\_\_\_>>.
- 2. Steel Backing Sheet Thickness: << 24 gauge, 0.0239 inch; 28 gauge, 0.0149 inch; or \_\_\_\_\_gauge, \_\_\_\_ inch>>.
- 3. Size: As indicated on drawings.
- 4. Frame: << <u>No frame</u>; No frame, bottom support bar; Extruded aluminum; Solid wood; As indicated on drawings; or \_\_\_\_>><< <u>, with concealed fasteners</u>; or None N/A>>.
- 5. Mounting: << <u>Concealed Z clips;</u> Stainless steel standoffs; Anodized aluminum standoffs; or \_\_\_\_>>.
- 6. Accessories: Provide << <u>magnetic marker tray;</u> <u>magnetic marker holder;</u> <u>magnetic</u> <u>eraser;</u> <u>magnets;</u> and \_\_\_\_>>.
- 7. Manufacturers:
  - a. Substitutions: << <u>See Section 01 6000</u> <u>Product Requirements;</u> or Not permitted>>.
- B. Tackboards: << <u>Fine-grained, homogeneous natural cork;</u> Composition cork; Fabric laminated to cork; Fabric laminated to fiberboard; or \_\_\_\_>>.
  - 1. Cork Thickness: << <u>1/8 inch;</u> 1/4 inch; 7/32 inch; or \_\_\_\_ inch>>.
- C. Tackable Wall Panels: << <u>Fabric laminated to fiberboard</u>; or \_\_\_\_>; Factory-fabricated.
- D. << Combination Units; and <u>Units Made of More Than One Panel</u>>>: Factory-assembled << chalkboards; markerboards; <u>tackboards</u>; and \_\_\_\_>> in a single frame, of materials specified above.
  - 1. Configuration: << <u>As indicated on drawings;</u> or \_\_\_\_\_>>.

# 2.03 MATERIALS

- A. Float Glass: Provide float-glass-based glazing unless otherwise indicated.
- B. Laminated Glass: Float glass laminated in accordance with ASTM C1172.
  - Laminated Safety Glass: Comply with ANSI Z97.1 << <u>Class B</u>; or Class A>> or 16 CFR 1201 - << <u>Category I</u>; or Category II>> impact test requirements.

# 2.04 ACCESSORIES

- A. Temporary Protective Cover: Sheet polyethylene, << <u>8 mil;</u> or \_\_\_\_\_ mil>> thick.
- B. << <u>Marker</u>; Chalk; or \_\_\_\_\_>> Tray: Aluminum<<, <u>manufacturer's standard profile</u>; , manufacturer's standard extruded profile; , manufacturer's standard formed profile; , style as indicated on drawings; , \_\_\_\_\_; or None - N/A>><< <u>, one piece full length of</u> <u>markerboard</u>; , one piece full length of chalkboard; , \_\_\_\_\_; or None - N/A>><< <u>, molded</u> <u>ends</u>; , closed ends; , \_\_\_\_\_ ends; or None - N/A>>, << concealed fasteners; <u>manufacturer's standard fastening method</u>; or \_\_\_\_\_>>, << <u>same finish as frame</u>; or \_\_\_\_\_>>.
- C. Mounting Brackets: Concealed.

### PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that field measurements are as << <u>indicated</u>; <u>indicated on shop drawings</u>; instructed by the manufacturer; or \_\_\_\_\_>>.
- B. Verify that internal wall blocking is ready to receive work and positioning dimensions are as << <u>indicated on shop drawings</u>; instructed by the manufacturer; or \_\_\_\_\_>>.

### 3.02 PREPARATION

- A. Acclimatize tackable wall panels by removing from packaging in installation area not less than 24 hours before application.
- B. Remove switchplates, wall plates, and surface-mounted fixtures where tackable wall paneling is applied. Reinstall items on completion of installation.
- C. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

#### 3.03 INSTALLATION

- A. Install boards in accordance with manufacturer's instructions.
- B. Secure units level and plumb.
- C. Butt Joints: Install with tight hairline joints.
- D. Install tackable wall panels in accordance with manufacturer's recommendations on specified substrates with concealed attachments.

### 3.04 CLEANING

- A. Clean board surfaces in accordance with manufacturer's instructions.
- B. Cover with protective cover, taped to frame.
- C. Remove temporary protective cover at << <u>Date of Substantial Completion</u>; or \_\_\_\_\_>>.

#### SECTION 10 1200 DISPLAY CASES

#### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Recessed display cases.
- B. << <u>Surface-mounted;</u> Free-standing; or \_\_\_\_>> display cases.

#### 1.02 RELATED REQUIREMENTS

- A. Section <u>06 1000 Rough Carpentry</u>: Blocking and supports.
- B. Section **<u>09 2116 Gypsum Board Assemblies</u>**: Concealed supports in metal stud walls.
- C. Section 09 2216 Non-Structural Metal Framing: Concealed supports in metal stud walls.

#### 1.03 REFERENCE STANDARDS

- A. AAMA 611 Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).
- B. AAMA 2603 Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2017a.
- C. ASTM B221 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2020.
- D. ASTM B221M Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.
- E. ASTM C1048 Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.
- F. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials; 2021.

### 1.04 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements, for submittal procedures.
- B. Product Data: Submit complete printed data and installation details indicating products to be provided as specified.

1. Submit color charts for selection by the Architect.

- C. Shop Drawings: Submit complete installation details. Include dimensioned elevations.
- D. Samples: Submit samples of material and trim to illustrate finish, color, and texture.
- E. Manufacturer's Qualification Statement.
- F. Specimen Warranty.

### 1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least << <u>three</u>; or \_\_\_\_>> years of<< <u>documented</u>; \_\_\_\_; or None - N/A>> experience.

#### 1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver display cases and materials to the Project site with manufacturer's protective crate covering and do not open until ready for use.
- B. Protect display cases before, during, and after installation. In case of damage, immediately provide necessary repairs and replacements.

#### **1.07 FIELD CONDITIONS**

A. Field Measurements: Verify field measurements for recessed application for display cases before preparation of shop drawings and before fabrication to ensure proper installation.

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#### 1.08 WARRANTY

- A. See Section 01 7800 Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a << <u>five</u>; or \_\_\_\_>> year period after Date of Substantial Completion.

## PART 2 PRODUCTS

#### 2.01 DISPLAY CASES

- A. Manufacturers:
- B. Recessed Display Case: Factory-fabricated wood-framed display case with adjustable glass shelves, finished interior, and << wood; <u>aluminum</u>; or \_\_\_\_>> trim on face to cover edge of recessed opening.
- C. << <u>Surface-Mounted</u>; Free-Standing; or \_\_\_\_>> Display Case: Factory-fabricated << wood-framed; <u>aluminum-framed</u>; or \_\_\_\_>> display case with adjustable glass shelves, finished interior.

#### 2.02 COMPONENTS

- A. Wood Case Construction: << <u>3/4 inch</u>; or \_\_\_\_\_ inch>> 7-ply << <u>maple</u>; oak; cherry; walnut; or \_\_\_\_\_>> veneer plywood with manufacturer's << <u>standard</u>; custom; or \_\_\_\_\_>> stain.
- B. Aluminum Framed Case Construction: << <u>1-1/2 inch by 2 inch</u>; or \_\_\_\_\_ inch by \_\_\_\_\_ inch>> extruded aluminum tube frame with << <u>tempered glass</u>; <u>laminate-faced</u>; <u>stained</u> <u>veneer plywood</u>; and \_\_\_\_>> infill panels.
- C. Aluminum Case Construction: Aluminum side, bottom, and top panels fabricated from extruded aluminum shapes.
- D. Face Frame Trim for Recessed Installation: << <u>2 inch</u>; 3-1/2 inch; 4 inch; or \_\_\_\_\_\_ inch>><< <u>flat</u>; radiused; or \_\_\_\_\_\_>> face dimension extruded aluminum trim mitered with corner clips and mechanical fasteners.
- E. Glazed Sliding Doors:
- F. Glazed Hinged Doors:
- G. Glass Shelves:
- H. Shelf Standards and Brackets: Single-slotted channel standards for brackets adjustable in <u>1</u> <u>inch</u> increments along entire length of standard, drilled and countersunk for screws.
  - 1. Finish: << <u>Anochrome;</u> or \_\_\_\_>>.
- I. Cable Display Systems: Sizes and configurations indicated on drawings.
  - 1. Description:
    - a. << <u>Tensioned</u>; Suspended; or \_\_\_\_>> cable display system used to support << <u>shelving</u>; <u>panels</u>; <u>artwork</u>; and \_\_\_\_>> from << <u>walls</u>; <u>ceilings</u>; and \_\_\_\_>> with the following components:
      - 1) Wire Cable: 7x7 construction.

#### 2.03 MATERIALS

- A. Aluminum Extrusions for Framing and Trim: Alloy as recommended by manufacturer for construction and specified finish; nominal << <u>1/8 inch</u>; or \_\_\_\_ inch>> wall thickness.
- B. Aluminum Extrusions: ASTM B221 (ASTM B221M), << <u>6063</u>; or \_\_\_\_>> alloy, << <u>T5</u>; or \_\_\_\_>> temper.
- C. Heat-Strengthened and Fully Tempered Glass: ASTM C1048, Kind FT.

# PART 3 EXECUTION

# 3.01 PREPARATION

#### 3.02 INSTALLATION

- A. << <u>Install</u>; Apply; or Erect>> in accordance with << <u>manufacturer's instructions</u>; or \_\_\_\_\_\_\_\_
- B. Locate fastening devices to secure cases securely to back and sides of rough opening.
- C. Install recessed display cases plumb and level<< <u>in wall openings;</u> or None N/A>>, \_\_\_\_\_ inches from finished floor to << <u>inside bottom of display case;</u> or \_\_\_\_\_>>.
- D. Refer to drawings for display case mounting heights.

#### 3.03 ADJUSTING AND CLEANING

- A. Verify that all accessories are installed as detailed for each unit.
- B. At completion of work, clean glass surfaces, back panels and trim in accordance with manufacturer's recommendations leaving units ready for use.

#### SECTION 10 1400 SIGNAGE

## PART 1 GENERAL

## 1.01 SECTION INCLUDES

- A. Room and door signs.
- B. Interior directional and informational signs.
- C. Luminous egress path marking and other "glow-in-the-dark" signs.
- D. Emergency evacuation maps.
- E. Building identification signs.
- F. Plaque.

# 1.02 RELATED REQUIREMENTS

A. Section <u>26 5100 - Interior Lighting</u>: Exit signs required by code.

# 1.03 REFERENCE STANDARDS

- A. 36 CFR 1191 Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.
- B. ADA Standards Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- C. ICC A117.1 Accessible and Usable Buildings and Facilities; 2017.

# 1.04 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements, for submittal procedures.
- B. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
  - 1. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.
  - When content of signs is indicated to be determined later, request such information from Owner through Architect<< <u>at least 2 months prior to start of fabrication</u>; or >>; upon request, submit preliminary schedule.
  - 3. Submit for approval by Owner through Architect prior to fabrication.
- C. Samples: Submit << <u>two samples</u>; one sample; or \_\_\_\_\_>><< <u>of each type of sign</u>; \_\_\_\_\_; or None - N/A>>, of size similar to that required for project, illustrating sign style, font, and method of attachment.
- D. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.
- E. Verification Samples: Submit samples showing colors specified.
- F. Manufacturer's Installation Instructions: Include installation templates and attachment devices.

# 1.05 DELIVERY, STORAGE, AND HANDLING

- A. Package signs as required to prevent damage before installation.
- B. Store tape adhesive at normal room temperature.

# PART 2 PRODUCTS

### 2.01 MANUFACTURERS

- A. Flat Signs:
  - 1. Best Sign Systems, Inc<< ; \_\_\_\_; or None N/A>>: www.bestsigns.com/#sle.
  - 2. Cosco Industries (ADA signs)<< <u>; ADA Series 1</u>; ; ADA Series 2; ; ADA Elegance Series; ; ADA Insert Series; ; ADA Laminate Series; ; ADA Custom Series; ; ADA Photopolymer; ; \_\_\_\_\_; or None - N/A>>: www.coscoarchitecturalsigns.com/#sle.

- Mohawk Sign Systems, Inc<< ; \_\_\_\_; or None N/A>>: www.mohawksign.com/#sle. Seton Identification Products<< ; \_\_\_\_; or None N/A>>: www.seton.com/aec/#sle. 3.
- 4.
- 5. Substitutions: << See Section 01 6000 - Product Requirements; or Not permitted>>.
- B. Dimensional Letter Signs:
- C. Plaques:
- D. Photoluminescent Marking and Signage:
- E. Photoluminescent Exit Signs: 1. Substitutions: << See Section 01 6000 - Product Requirements; or Not permitted>>.

### 2.02 SIGNAGE APPLICATIONS

- A. Accessibility Compliance: Signs are required to comply with ADA Standards and ICC A117.1<< and applicable building codes; \_\_\_\_\_; or None - N/A>>, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.
- B. Interior Directional and Informational Signs:
  - Sign Type: Same as room and door signs. 1.
  - Sizes: As indicated on drawings. 2
- C. Luminous Egress Path Marking and Other "Glow-in-the-Dark" Signs: Photoluminescent media.
- D. Emergency Evacuation Maps:
  - Use clear plastic panel silk-screened on reverse, in brushed aluminum frame, screw-1. mounted.
- E. Recognition/Donor Panels: Engraved panel media; individual name signs attached with magnetic tape to fixed panel.
- F. **Building Identification Signs:**
- G. Other Dimensional Letter Signs: Wall-mounted.

### 2.03 SIGN TYPES

- A. Flat Signs: Signage media << without; in aluminum; in matching plastic; or >> frame.
  - Clear Cover: For customer produced sign media, provide clear cover of polycarbonate 1. plastic, glossy on back, non-glare on front.
- B. Schedule:
  - (A1): Room signage permanent signage. 1.
    - a. DEPARTMENT, room NAME, and NUMBER.
    - b. Level II braille with domed top.
    - c. Image: To be determined.
    - d. Mounting: Adhered to substrate with vinyl tape.
    - Dimensional numbers and letters: e.
      - Color: Match owner standard. 1)
      - 2) Depth: 1/32"
      - Font: Match owner standard. 3)
    - Finish: Matte. f.
    - Size: Match owner standard, approximately 8" wide x 6" high. q.
  - (A2): Room signage for designated rooms. 2.
    - a. DEPARTMENT, room NAME, and NUMBER.
    - b. Level II braille with domed top.
    - c. Paper insert graphic
    - Image to be determined. 1)
    - d. OCCUPIED/NOT OCCUPIED window.
    - Mounting: Adhered to substrate with vinyl tape. e.
    - Dimensional numbers and letters: f.

- 1) Color: Match owner standard.
- 2) Depth: 1/32".
- 3) Font: Match owner standard.
- g. Size: Match owner standard, approximately 8" wide x 6" high.
- 3. (A3): Room signage for Conference/Talking Rooms:
  - a. DEPARTMENT, room NAME, and NUMBER.
  - b. Level II braille with domed top.
  - c. Paper insert graphic
    - 1) Image to be determined.
  - d. OCCUPIED/NOT OCCUPIED window.
  - e. Mounting: Adhered to substrate with vinyl tape.
  - f. Dimensional numbers and letters:
    - 1) Color: Match owner standard.
    - 2) Depth: 1/32".
    - 3) Font: Match owner standard.
  - g. Size: Match owner standard, approximately 8" wide x 8" high.
- 4. (B1): Stair Outside Stairs, MECHANICAL, PLUMBING, and ELECTRICAL.
  - a. Room NUMBER & room NAME.
  - b. Stair pictogram.
  - c. Level II braille with domed top.
  - d. Dimensional numbers and letters:
    - 1) Color: Match owner standard.
      - 2) Depth: 1/32".
      - 3) Font: Match owner standard.
  - e. Size: 6" x 8".
- 5. (B2) Restrooms:
  - a. Room NUMBER and room NAME.
  - b. Level II braille with domed top.
  - c. ADA pictogram.
  - d. Dimensional numbers and letters:
    - 1) Color: Match owner standard.
    - 2) Depth: 1/32".
    - 3) Font: Match owner standard.
  - e. Size: 6" x 8".
  - f. Location: Adjacent to door on wall.
- 6. (B3)Restrooms/Stair:
  - a. Flag sign: room NAME
  - b. Pictogram.
  - c. Lettering: Match (B2)
  - (C): Stair Inside Stair.
  - a. Floor LEVEL, Stair NAME, ROOF ACCESS if applicable and EXIT DISCHARGE LEVEL.
  - b. Level II braille with domed top.
  - c. 1/4" Polycarbonate, clear.
  - d. Dimensional numbers and letters:
    - 1) Color: Match owner standard.
    - 2) Depth: 1/32"
  - e. Mounting: Adhered to substrate with vinyl tape.
  - f. Size: 1'-6" x 1'-0"
- 8. (D): Wayfinding:
  - a. FLOOR, department NAME, suite NUMBER and directional Arrows.
  - b. Resin panel.
  - c. Adhered to glass/gwb with vinyl tape.

7.
- d. Finish: Matte.
- e. Size: 18" x 24".
- f. Dimensional numbers and letters:
  - 1) Color: Match owner standard.
  - 2) Depth: 1/32".
  - 3) Font: Match owner standard.
- 9. (E): Exterior Building Signage:
  - a. Exterior sign, halo lit individual characters.
  - b. Dimensional aluminum letters and numbers.
  - c. SCF Stacked Logo.
  - d. Mounted on 2" standoffs to facade.
  - e. Color: From manufacturer full line.
  - f. Size: 11" high.
    - 1) Font: Match existing.
  - g. Location: As shown in architectural drawings.
- 10. (F): SCF Departments:
  - a. Halo lit, individual characters.
  - b. Dimensional aluminum letters and numbers.
  - c. Mounted on 3/4" standoffs.
  - d. Color: From manufacturer full line.
  - e. Location: Coordinate with Architect.
- 11. (G): Not used.
- 12. H: Pick up Numbering:
  - a. Dimensional numbers.
  - b. Mounted on 3/4" standoffs.
  - c. Model and Color: From manufacturer full line.
  - d. Height: 5" numbers.
  - e. Location: On each side of Pick up window wing walls.
- 13. Construction Related Signage:
  - a. C-Sign 1: "Excuse out mess".
  - b. Branded banner/sign.
- 14. Evacuation Maps:
  - a. Thermoplastic, 8" x 10".
  - b. Suitable to receive paper floor plan.
  - c. Adhered to substrate.

### 2.04 PLAQUES

# 2.05 DIMENSIONAL LETTERS

- A. Metal Letters:
  - 1. Metal: << Aluminum casting; Bronze casting; Aluminum sheet, flat; Bronze sheet, flat; Stainless steel sheet, flat; Stainless steel sheet, flat; Weathering steel sheet, flat; <u>Aluminum sheet, fabricated reverse channel;</u> Stainless steel sheet, fabricated reverse channel; or \_\_\_\_\_>>.
  - 2. Text and Typeface:
    - a. Character Font: << Helvetica, Arial, or other sans serif font; or Fact Variable Regular>>.
    - b. Character Case: << <u>Upper case only;</u> Lower case only; or Upper and lower case (title case)>>.

## 2.06 PHOTOLUMINESCENT MEDIA

A. Photoluminescent Stair Nosings: Factory fabricated aluminum extrusion with replaceable embedded photoluminescent and slip-resistant strip.

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## 2.07 ACCESSORIES

- A. Concealed Screws: Stainless steel, galvanized steel, chrome plated, or other non-corroding metal.
- B. Tape Adhesive: Double sided tape, permanent adhesive.

# PART 3 EXECUTION

## 3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

## 3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install neatly, with horizontal edges level.
- C. Locate signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.
- D. Protect from damage until Date of Substantial Completion; repair or replace damaged items.

#### SECTION 10 2113.17 PHENOLIC TOILET COMPARTMENTS

### PART 1 GENERAL

### 1.01 SECTION INCLUDES

- A. Phenolic toilet compartments.
- B. Urinal<< and vestibule; \_\_\_\_\_; or <u>None N/A</u>>> screens.

#### 1.02 RELATED REQUIREMENTS

- A. Section <u>06 1000 Rough Carpentry</u>: Blocking and supports.
- B. Section 10 2800 Toilet, Bath, and Laundry Accessories.

### 1.03 REFERENCE STANDARDS

- A. ASTM A666 Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.
- B. NFPA 286 Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2019.

#### 1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the work with placement of support framing and anchors in walls and ceilings.

### 1.05 SUBMITTALS

- A. See Section <u>01 3000 Administrative Requirements</u>, for submittal procedures.
- B. Product Data: Provide data on panel construction, hardware, and accessories.
- C. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of << <u>wall;</u> floor; and ceiling>> supports, door swings.
- D. Samples: Submit << <u>two;</u> or \_\_\_\_\_>> samples of partition panels, <u>6 x 6 inch</u> in size illustrating panel finish, color, and sheen.
- E. Manufacturer's Installation Instructions: Indicate << <u>special procedures;</u> perimeter conditions requiring special attention; and \_\_\_\_\_>>.

#### PART 2 PRODUCTS

#### 2.01 MANUFACTURERS

A. Phenolic Toilet Compartments:

#### 2.02 PHENOLIC TOILET COMPARTMENTS

A. Toilet Compartments: Factory fabricated doors, pilasters, and divider panels made of solid phenolic core panels with integral melamine finish, << <u>floor-mounted unbraced</u>; floormounted headrail-braced; floor-to-ceiling; ceiling-hung; wall-hung; or \_\_\_\_>>.

### 2.03 ACCESSORIES

- A. Pilaster Shoes: Formed << <u>ASTM A666 Type 304 stainless steel with No. 4 finish</u>; ASTM A666 Type 304 stainless steel with \_\_\_\_\_ finish; chromed steel with polished finish; chromed steel with satin finish; or \_\_\_\_\_>>, << <u>3 inch</u>; or \_\_\_\_ inch>> high, concealing << <u>floor</u>; ceiling; and \_\_\_\_\_>> fastenings.
- B. Head Rails: Hollow << <u>anodized aluminum</u>; chrome plated steel; stainless steel; or \_\_\_\_\_\_>>, << <u>1 inch by 1-1/2 inch</u>; or \_\_\_\_\_ inch by \_\_\_\_\_ inch>> size, with<< <u>anti-grip</u> profile and; \_\_\_\_\_ and; or None N/A>> cast socket wall brackets.
- C. Attachments, Screws, and Bolts: Stainless steel << , tamper proof type; or None N/A>>.
- D. Hardware: << <u>Polished stainless steel</u>; Satin stainless steel; Natural anodized aluminum; or \_\_\_\_\_>>:
  - 1. Pivot hinges, gravity type, adjustable for door close positioning; two per door.

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- 2. Door Latch: << <u>Slide type</u>; Thumbturn type; or \_\_\_\_\_>><< <u>with exterior</u> <u>emergency access feature</u>; with \_\_\_\_; or None N/A>>.
- 3. Door strike and keeper with rubber bumper; mounted on pilaster in alignment with door latch.
- 4. Coat hook with rubber bumper; one per compartment, mounted on << door; or panel>>.
- 5. Provide door pull for outswinging doors.

# PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that field measurements are as << <u>indicated</u>; <u>indicated</u> on shop drawings; or instructed by the manufacturer>>.
- B. Verify correct spacing of and between plumbing fixtures.
- C. Verify correct location of built-in framing, anchorage, and bracing.

### 3.02 INSTALLATION

- A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.
- B. Maintain << <u>3/8 inch to 1/2 inch; or \_\_\_\_\_ inch to \_\_\_\_\_ inch>> space between wall and panels and between wall and end pilasters.</u>
- C. Attach panel brackets securely to walls using anchor devices.
- D. Attach panels and pilasters to brackets. << <u>Locate head rail joints at pilaster center lines.</u>; or None - N/A>>

## 3.03 TOLERANCES

A. Maximum Variation From True Position: << <u>1/4 inch;</u> or \_\_\_\_\_ inch>>.

#### 3.04 ADJUSTING

- A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding <u>3/16</u> <u>inch</u>.
- B. Adjust hinges to position doors in << <u>partial opening</u>; full closed; or \_\_\_\_>> position when unlatched. Return out-swinging doors to closed position.
- C. Adjust adjacent components for consistency of line or plane.

### END OF SECTION 10 2113.17

#### SECTION 10 2123 CUBICLE CURTAINS AND TRACK

### PART 1 GENERAL

### 1.01 SECTION INCLUDES

- A. Suspended overhead curtain track and guides.
- B. Surface mounted overhead curtain track and guides.
- C. Cubicle curtains.

#### 1.02 RELATED REQUIREMENTS

- A. Section 06 1000 Rough Carpentry: Blocking and supports for track.
- B. Section 09 5100 Acoustical Ceilings: Suspended ceiling system to support track.

#### 1.03 REFERENCE STANDARDS

- A. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials; 2021.
- B. NFPA 701 Standard Methods of Fire Tests for Flame Propagation of Textiles and Films; 2019.

### 1.04 SUBMITTALS

- A. See Section <u>01 3000 Administrative Requirements</u>, for submittal procedures.
- B. Product Data: Provide data for curtain fabric characteristics<< <u>and</u> ; or None N/A>>.
- C. Shop Drawings: Indicate a reflected ceiling plan view of curtain track, hangers and suspension points, attachment details, schedule of curtain sizes.
- D. Samples: Submit << <u>12 by 12 inch</u>; or <u>by</u> inch>> sample patch of curtain cloth with representative top, bottom, and edge hem stitch detail, heading with reinforcement and carrier attachment to curtain header.
- E. Samples: Submit << <u>12 inch</u>; or \_\_\_\_\_ inch>> sample length of curtain track including typical splice, wall and ceiling hanger, and escutcheon.
- F. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention << , and \_\_\_\_\_; or <u>None N/A</u>>>.
- G. Maintenance Data: Include recommended cleaning methods and materials and stain removal methods.

### 1.05 MOCK-UP

- A. Locate << <u>where directed;</u> or \_\_\_\_>>.
- B. Mock-up << <u>may</u>; or may not>> remain as part of the Work.

#### 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Accept curtain materials on site and inspect for damage.
- B. Store curtain materials on site and deliver to Owner for installation when requested.

### PART 2 PRODUCTS

#### 2.01 MANUFACTURERS

A. Cubicle Track and Curtains:

### 2.02 TRACKS AND TRACK COMPONENTS

- A. Tracks: << <u>Extruded aluminum;</u> Formed steel; PVC with metal spline; or \_\_\_\_\_>> sections; one piece per track run.
  - 1. Profile: << <u>Channel;</u> I-beam; or \_\_\_\_>>.
  - 2. Mounting: << <u>Surface;</u> Suspended; or \_\_\_\_>>.
  - 3. Track << End Stop; Tees; Y's; Switches; and \_\_\_\_>>: To fit track section.

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- 4. Finish on Exposed Surfaces: << <u>Clear anodized;</u> anodized; White enamel; enamel; or \_\_\_\_>>.
- B. Curtain Carriers: Nylon << <u>rollers</u>; slider; or \_\_\_\_>>, size and type compatible with track; designed to eliminate bind when curtain is pulled; fitted to curtain to prevent accidental curtain removal.
- C. Installation Accessories: Types required for specified mounting method and substrate conditions.

## 2.03 CURTAINS

- A. Cubicle Curtains:
  - Flame spread index of << <u>25</u>; or \_\_\_\_>>, maximum; smoke developed index of << <u>450</u>; or \_\_\_\_>>, maximum; when tested in accordance with ASTM E84.
  - Inherently flame resistant or flameproofed; capable of passing << <u>NFPA 701</u>; or \_\_\_\_\_>> test.
  - Material: Close weave << <u>polyester</u>; cotton; nylon; recycled content and ecopolyester material; or \_\_\_\_\_>>; anti-bacterial, self deodorizing, sanitized, and preshrunk.
- B. Curtain Fabrication:
  - 1. Width of curtain to be << <u>10</u>; **15**; or \_\_\_\_>> percent wider than track length.
  - 2. Length of curtain to end << 10 inches; 12 inches; <u>15 inches</u>; or \_\_\_\_\_ inches>> above finished floor.
  - 3. Railroad fabric without vertical seams.

## PART 3 EXECUTION

## 3.01 EXAMINATION

- A. Verify that surfaces<< <u>and supports above ceiling</u>; or None N/A>> are ready to receive work of this Section.
- B. Verify that field measurements are as << <u>indicated</u>; indicated on shop drawings; or \_\_\_\_\_>>.

# 3.02 INSTALLATION

- A. Install curtain track to be secure, rigid, and true to ceiling line.
- B. << <u>Secure track to</u>; or Suspend track from>> ceiling system.
- C. Install end cap<< <u>and stop device</u>; or None N/A>>.
- D. Install curtains on carriers ensuring smooth operation.

# 3.03 SCHEDULES

- A. Patient Rooms: Cotton fabric type, open mesh tops, track suspended <u>6 inches</u> below ceiling.
- B. Treatment Rooms: Nylon type, track tight to ceiling.

#### SECTION 10 2239 FOLDING PANEL PARTITIONS

### PART 1 GENERAL

### 1.01 SECTION INCLUDES

- A. Top-supported folding panel partitions, horizontal opening.
- B. Top-supported operable panel partitions, vertical opening, electrical operation.

#### 1.02 RELATED REQUIREMENTS

- A. Section <u>06 1000 Rough Carpentry</u>: Wood blocking and track support shimming.
- B. Section 08 7100 Door Hardware: Lock cylinders for panels
- C. Section **09 9123 Interior Painting**: Field applied paint finish to panels.
- D. Section <u>26 0533.13 Conduit for Electrical Systems</u>: Empty conduit from partition motor controller to disconnect<< <u>and from motor controller to control buttons;</u> ; or None N/A>>.
- E. Section <u>26 0583 Wiring Connections</u>: Electrical characteristics and wiring connections; control buttons .

#### 1.03 REFERENCE STANDARDS

- A. ASTM B221 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2020.
- B. ASTM B221M Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.
- C. ASTM C1396/C1396M Standard Specification for Gypsum Board; 2017.
- D. ASTM E90 Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).
- E. ASTM E413 Classification for Rating Sound Insulation; 2016.
- F. ASTM E557 Standard Guide for Architectural Design and Installation Practices for Sound Isolation between Spaces Separated by Operable Partitions; 2012 (Reapproved 2020).
- G. ASTM F793/F793M Standard Classification of Wall Coverings by Use Characteristics; 2015.

### 1.04 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on << partition materials; operation; hardware and accessories; electric operating components; track switching components; colors and finishes available; and \_\_\_\_>>.
- C. Design Data: Design calculations, bearing seal and signature of structural engineer licensed to practice in the State in which the Project is located, showing loads at points of attachment to the building structure.
- D. Shop Drawings: Indicate << opening sizes; track layout; details of track and required supports; static and dynamic loads; location and details of pass door and frame; adjacent construction and finish trim; stacking depth; and \_\_\_\_>>.
- E. Samples for Selection: Submit << <u>two;</u> or \_\_\_\_>> samples of full manufacturer's color range for selection of colors.
- F. Samples for Review: Submit << two; or \_\_\_\_\_>> samples of surface finish, << 12 by 12 inches; or \_\_\_\_by\_\_\_ inches>> size, illustrating << quality; colors selected; texture; weight; and \_\_\_\_>>.
- G. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods. Describe cleaning materials detrimental to finish surfaces and hardware finish.

## 1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified this section with minimum << <u>three</u>; or \_\_\_\_\_>> years of<< <u>documented</u>; \_\_\_\_; or None N/A>> experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least << <u>three</u>; or \_\_\_\_\_>> years of<< <u>documented</u>; \_\_\_\_; or None N/A>> experience<< and approved by manufacturer; or <u>None N/A</u>>>.

### 1.06 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until installation.

## 1.07 WARRANTY

- A. See Section <u>01 7800 Closeout Submittals</u>, for additional warranty requirements.
- B. Correct defective Work within << <u>five;</u> or \_\_\_\_>> year period after Date of Substantial Completion.

## PART 2 PRODUCTS

## 2.01 MANUFACTURERS

- A. Folding Panel Partitions Horizontal Opening:
  - Modernfold, a DORMA Group Company<< : Acousti-Seal and Acousti-Clear; or None -N/A>>: www.modernfold.com/#sle.
  - 2. Substitutions: << See Section 01 6000 Product Requirements; or Not permitted>>.

## 2.02 FOLDING PANEL PARTITIONS - HORIZONTAL OPENING

- A. Folding Panel Partitions: << Center; <u>Side</u>; or \_\_\_\_\_>> opening; << <u>paired</u>; individual; or continuous hinged>> panels; << <u>side</u>; center; or \_\_\_\_>> stacking; << <u>manually</u> <u>operated</u>; or motor operated>>.
- B. Panel Construction:
  - Frame: << 14 gauge, 0.0747 inch; <u>16 gauge, 0.0598 inch</u>; <u>18 gauge, 0.0478 inch</u>; <u>gauge, \_\_\_\_\_\_\_inch</u>; or Manufacturer's standard>> thick formed sheet steel frame top, bottom, jambs, and intermediates; welded construction<< <u>, with acoustical</u> <u>insulation fill</u>; or None - N/A>>.
  - 2. Substrate: << <u>Gypsum board;</u> Plywood; Particle board; Medium-density fiberboard; or \_\_\_\_\_>>.
  - Panel Substrate Facing: << <u>Steel</u>; or Aluminum>> sheet, << 14 gauge, 0.0747 inch; 16 gauge, 0.0598 inch; 18 gauge, 0.0478 inch; 20 gauge, 0.0359 inch; 22 gauge, 0.0299 inch; <u>gauge</u>, <u>inch</u>; or <u>manufacturer's standard</u>>> thickness.
  - 4. Hinges: << <u>Continuous piano;</u> or \_\_\_\_\_>> type, <u>gauge, inch</u><< <u>stainless;</u> or \_\_\_\_\_>> steel.
  - 5. Panel Properties:
    - a. Thickness << <u>With;</u> or Without>> Finish: << 3 inches; <u>4 inches;</u> or \_\_\_\_\_ inches>>.
    - b. Width: << Standard width; <u>Equal widths</u>; Up to 48 inches (1219 mm); or Up to 58 1/2 inches (1486 mm)>>.
- C. Panel Finishes:
  - 1. Facing: << <u>Vinyl coated fabric</u>; Acoustical carpet; Plastic laminate; Wood veneer; Markerboard; Tackboard; Paint; or \_\_\_\_>>.
  - Exposed Metal Trim: << Clear anodized; <u>Custom powder coated paint finish</u>; or \_\_\_\_\_\_\_\_\_
- D. Panel Seals:
  - 1. Panel to Panel Seals: << <u>Grooved and gasketed astragals;</u> or \_\_\_\_>>, with continuous flexible ribbed vinyl seal fitted to panel edge construction; color to match panel finish.

- Acoustic Seals: Flexible acoustic seals at jambs,<< <u>meeting mullions.;</u>; or None - N/A>> ceilings,<< <u>retractable;</u>; or None - N/A>> floor<< <u>and ceiling;</u> or None - N/A>> seals<< <u>, and above track to structure acoustic seal;</u> , \_\_\_; or None - N/A>>.
- E. Suspension System:
  - Track: << Formed steel; Extruded aluminum; or \_\_\_\_>>; << 1-1/4 by 1-1/4 inch; 1-5/8 by 1-5/8 inch; or \_\_\_\_ by \_\_\_\_ inch>> size; thickness and profile designed to support loads<< , steel sub-channel and track connectors; or None - N/A>><< , and track switches; , \_\_\_\_; or None - N/A>>.
  - Carriers: << Nylon; Steel, ball bearing; or \_\_\_\_>> wheels on trolley carrier at top of every << second; or \_\_\_\_\_>> panel, sized to carry imposed loads, with threaded pendant bolt for vertical adjustment.
- F. Performance:
  - 1. Acoustic Performance:
    - a. Sound Transmission Class (STC): << <u>38 to 42</u>; 43 to 47; 48 to 52; 53 to 57; or \_\_\_\_\_\_\_\_>> calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90, on panel size of << <u>100 sq ft</u>; or \_\_\_\_\_ sq ft>>.
      b. Acoustia-Clear: STC. 51.
  - Installed partition system track capable of supporting imposed loads, with maximum deflection of << <u>1/360</u>; or \_\_\_\_>> of span.
- G. Accessories:
  - Ceiling Closure: << <u>White enameled ceiling closure</u>; Wood ceiling closure of \_\_\_\_\_\_species; or \_\_\_\_>>;<< <u>aluminum</u>; \_\_\_\_; or None - N/A>> jamb<< <u>and</u> <u>head</u>; \_\_\_\_; or None - N/A>> molding, fittings and attachments<< , and intermediate meeting posts; , \_\_\_\_; or <u>None - N/A</u>>>.

  - 3. Acoustic Sealant: As recommended by partition manufacturer.

### 2.03 OPERABLE PANEL PARTITIONS - VERTICAL OPENING

- A. Operable Panel Partition: Vertical opening; individual panels stacked in drive box above ceiling; motor operated.
- B. Panel Construction:
- C. Panel Finishes:
- D. Panel Seals:
  - 1. Panel to Panel Seals: Tongue and groove configuration, color to match panel finish.
- E. Suspension System:
  - 1. Guide Rails: Extruded aluminum; <u>6 inches</u> wide and <u>6 inches</u> deep.
  - 2. Guide Rollers: Sealed rollers with hardened steel ball bearings.
  - 3. Drive Box: Hardened steel construction.
    - a. Supports weight of panels in stacked position.
- F. Performance:
  - Installed partition system track capable of supporting imposed loads, with maximum deflection of << <u>1/360</u>; or \_\_\_\_>> of span.
- G. Operation:
  - 1. Electric Operator: 5 to 10 feet per minute vertical traveling speed.
    - a. Drive system includes drive shafts, couplers, torque limiter, key pressure actuation control station wired in series, dual drive emergency operation and all necessary equipment for electric operation.
    - b. Chain drive attaches to dual direction lead panel.
  - 2. Control Station: One standard keyed switch (RESET-OFF-ON) and one two-position (OPEN-CLOSE, constant pressure) type rocker switch; << <u>24</u>; or \_\_\_\_>> volt circuit; <<

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surface; recess; or \_\_\_\_>> mounted.

- a. Master key switch prepared for mortise lock cylinder.
- b. Key switches << <u>alike;</u> or \_\_\_\_>>.
- 3. Safety Features:
  - a. Load Arrestor: Stops free fall occurrence.
  - b. Entrapment Backup System: Automatically reverses downward movement when lead edge makes contact with obstruction within path of travel.
  - c. Limit Switches: Automatic type, at both extremes of travel, to prevent over-travel.
  - d. Emergency Release: Mechanism to disengage motor drive system and permit manual operation.
- 4. Electrical Requirements:

### 2.04 MATERIALS

- A. Aluminum Extrusions: ASTM B221 (ASTM B221M)<< <u>, 6063 alloy, T6 temper;</u> , <u>alloy,</u> <u>temper; or None N/A>>.</u>
- B. Standard Gypsum Board: ASTM C1396/C1396M, << <u>3/8 inch</u>; 1/2 inch; 5/8 inch; or \_\_\_\_\_\_ inch>> thick, maximum permissible length; ends square cut, << <u>square</u>; beveled; or \_\_\_\_\_\_>> edges.
- C. Vinyl Coated Fabric: << ASTM F793 Category IV; ASTM F793 Category V; <u>ASTM F793</u> <u>Category VI</u>; or \_\_\_\_\_>><< , <u>polyvinyl fluoride (PVC) finish for washability and</u> <u>improved flame retardance;</u> , \_\_\_\_; or None - N/A>><< ; \_\_\_\_ color; or <u>; color as</u> <u>selected by Architect from manufacturer's standard range</u>>>.
- D. Markerboard: Porcelain enamel on steel, laminated to core<< ; \_\_\_\_\_ color; ; color as selected; ; color(s) as indicated; or <u>None N/A</u>>>.
- F. Acoustic Insulation:
  - 1. Type: << Manufacturers standard; <u>As required for acoustic performance indicated;</u> ASTM C665 preformed mineral fiber, friction fit; or \_\_\_\_>>.
  - Thickness: << <u>As required for acoustic performance indicated</u>; 2-1/2 inch; 3-1/2 inch; or \_\_\_\_\_ inch>>.

### PART 3 EXECUTION

#### 3.01 EXAMINATION

- Verify that field measurements are as << <u>indicated</u>; indicated on shop drawings; required by the manufacturer; or \_\_\_\_\_>>.
- B. Verify track supports are laterally braced and will permit track to be level within << <u>1/4 inch</u>; or \_\_\_\_\_ inch>> of required position and parallel to the floor surface.

### 3.02 INSTALLATION

- A. Install partition in accordance with << <u>manufacturer's instructions</u>; <u>ASTM E557</u>; and \_\_\_\_\_\_\_
- B. Install electric operator, wiring, and controls. Locate control station(s) << <u>as indicated</u>; or \_\_\_\_\_\_>>.
- C. Fit and align partition assembly<< <u>and pocket doors;</u> ; or None N/A>> level and plumb.
- D. Install acoustic sealant to achieve required acoustic performance.
- E. Coordinate electrical connections.

## 3.03 ADJUSTING

- A. Adjust partition assembly to provide smooth operation from stacked to full open position. Do not over-compress acoustic seals.
- B. Visually inspect partition in full extended position for light leaks to identify a potential acoustical leak.
- C. Adjust partition assembly to achieve lightproof seal.

## 3.04 CLEANING

- A. Clean finish surfaces and partition accessories.
- B. Condition << <u>markerboard</u>; or \_\_\_\_>> surfaces in accordance with manufacturer's instructions.

## 3.05 CLOSEOUT ACTIVITIES

A. Demonstrate operation of partition and identify potential operational problems.

### SECTION 10 2600 WALL AND DOOR PROTECTION

### PART 1 GENERAL

### **1.01 SECTION INCLUDES**

- A. Corner guards.
- B. Protective wall covering.
- C. Door and frame protection.

#### 1.02 RELATED REQUIREMENTS

- A. Section 06 1000 Rough Carpentry: Blocking for wall and corner guard anchors.
- B. Section 08 7100 Door Hardware: Standard protection plates and trim.
- C. Section <u>09 2116 Gypsum Board Assemblies</u>: Placement of supports in stud wall construction.
- D. Section <u>09 2216 Non-Structural Metal Framing</u>: Placement of supports in stud wall construction.
- E. Section <u>09 7200 Wall Coverings</u>: Terminating wall covering at wall and door protection.

#### 1.03 REFERENCE STANDARDS

- A. ASTM D256 Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics; 2010 (Reapproved 2018).
- B. ASTM F476 Standard Test Methods for Security of Swinging Door Assemblies; 2014.

#### 1.04 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Include plans, elevation, sections, and attachment details.<< Show design and spacing of supports for protective corridor handrails, required to withstand structural loads.; or <u>None - N/A</u>>>
- C. Samples: Submit samples illustrating component design, configurations, joinery, color and finish.
  - 1. Submit << <u>two</u>; or \_\_\_\_\_>> samples of << <u>protective wall covering</u>; door surface protection; and \_\_\_\_\_>>, << <u>6 by 6 inches</u>; or \_\_\_\_\_ inches>> square.
  - Submit << two; or \_\_\_\_\_>> full-size samples of << door edge; door frame; door hardware; and \_\_\_\_\_>> protectors.
- D. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- E. Maintenance Data: Manufacturer's instructions for care and cleaning of each type of product. Include information about both recommended and potentially detrimental cleaning materials and methods.

#### 1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver wall and door protection items in original, undamaged protective packaging. Label items to designate installation locations.
- B. Protect work from UV light damage.
- C. Do not deliver products to project site until areas for storage and installation are fully enclosed, and interior temperature and humidity are in compliance with manufacturer's recommendations for each type of item.
- D. Store products in either horizontal or vertical position, in compliance with manufacturer's instructions.

## 1.06 WARRANTY

- A. See Section <u>01 7800 Closeout Submittals</u>, for additional warranty requirements.
- B. Correct defective Work within a << <u>one;</u> or \_\_\_\_>> year period after Date of Substantial Completion.
- C. Provide << <u>five;</u> or \_\_\_\_>> year manufacturer and installer warranty for metal crash rails.

## PART 2 PRODUCTS

## 2.01 MANUFACTURERS

- A. << Bumper Rails; Crash Rails; Protective Corridor Handrails; and Corner Guards>>:
  - Construction Specialties, Inc<<; Acrovyn Solid Color and Chameleon Crash Rails; ; Acrovyn Renaissance Real Wood and Metal Crash Rails; ; Heavy Duty Rubber Crash Rails; ; Acrovyn Solid Color and Chameleon Hand Rails; ; Acrovyn Renaissance Real Wood and Metal Hand Rails; ; Platform Handrails; ; Single Line Handrails; ; Acrovyn Solid Color and Chameleon Corner Guards; ; Acrovyn Renaissance Real Wood and Metal Corner Guards; ; Heavy Duty Corner Guards; ; Stainless Steel Corner Guards; or None - N/A>>: www.c-sgroup.com/#sle.
  - 2. Substitutions: << See Section 01 6000 Product Requirements; or Not permitted>>.
- B. (WP1, WP2) Rigid Sheet Wall Protection:
  - Construction Specialties, Inc<< <u>: Acrovyn High-Impact Wall Covering</u>; ; Acrovyn by Design Wall Covering; ; Acrovyn Saratoga Series Wall System; ; Acrovyn Wall Panels; ; \_\_\_\_\_; or None - N/A>>: 4000 www.c-sgroup.com/#sle.
  - 2. Substitutions: << See Section 01 6000 Product Requirements; or Not permitted>>.
- C. (FRP) Fiberglass Reinforced Panel:
  - 1. Marlite
- D. (WP3) Protective Wall Coverings:
  - 1. Koroseal
- E. Metal Door Frame Protection:
  - 1. Koroseal.
  - 2. Substitutions: << See Section 01 6000 Product Requirements; or Not permitted>>.

### 2.02 PERFORMANCE CRITERIA

A. Impact Strength: Unless otherwise noted, provide protection products and assemblies that have been successfully tested for compliance with applicable provisions of ASTM D256 and/or ASTM F476.

## 2.03 PRODUCT TYPES

- A. (CG1) Corner Guards Flush Mounted:
  - Material: Type << <u>304</u>; 430; or \_\_\_\_>> stainless steel, << <u>No. 4</u>; or \_\_\_\_>> finish, <u>20</u> gauge, \_\_inch thick.
  - 2. Width of Wings: << <u>2 inches;</u> 3 inches; or \_\_\_\_\_ inches>>.
  - 3. Corner: << <u>Square;</u> Radiused; or \_\_\_\_>>.
  - 4. Length: One piece, 96".
  - 5. Locations: Outside corners in Rooms 110, 113, 114, 115, 129, and 156.
- B. Corner Guards Surface Mounted:
  - 1. Width of Wings: << <u>2 inches</u>; 3 inches; or \_\_\_\_\_ inches>>.
  - 2. Corner: << Square; Radiused; or \_\_\_\_>>.

  - 4. Length: One piece.
- C. (WP1, WP2) Rigid Sheet Wall Protection:

- 1. Material: Fiber Reinforced Laminate (FRL): Thermofused melamine overlay, decorative paper and fire-rated phenolic paper with fiber reinforcing inner layers.
- 2. Thickness: << 0.075 inch; or 0.06 inch>>.
- 3. Panel Size: << <u>3 feet by 8 feet;</u> 3 feet by 10 feet; 4 feet by 8 feet; 4 feet by 10 feet; 5 feet by 8 feet; 5 feet by 10 feet; or \_\_\_\_\_ feet by \_\_\_\_\_ feet>>.
- 4. (WP1, WP2) Color and Pattern: << <u>As selected from manufacturer's standard</u> <u>finishes;</u> As indicated on drawings; As scheduled; or \_\_\_\_>>.
- 5. Texture: << As selected from manufacturer's standard textures; <u>As indicated on</u> <u>drawings;</u> As scheduled; or \_\_\_\_>>.
  - a. Texture Direction: << <u>Horizontal</u>; Vertical; or \_\_\_\_>>.
- 6. Accessories: Provide manufacturer's standard << <u>PVC</u>; aluminum; or \_\_\_\_>><< <u>color-matched</u>; contrasting; or \_\_\_\_>> trim and moldings.
  - a. Outside Corner Trim: << Flat; Round; or \_\_\_\_>>.
  - b. Division Bar: << <u>Flat;</u> Round; or \_\_\_\_>>.
- 7. Mounting: Adhesive.
- D. (WP3) Protective Wall Coverings:
  - 1. Color/Pattern: Urban, Linen URB-15.
- E. Doorway Protection:
  - 1. Frames Protection: Attached to jambs.
    - a. Material: Stainless steel.
    - b. Mounting: Mechanically fastened to push side exposed corner of door frame, using stainless steel, phillips pan head, self-tapping, sheet metal screws of size recommended by manufacturer.
    - c. Location(s): Jambs in Rooms 110, 111, 156 and 154.
- F. Adhesives and Primers: As recommended by manufacturer.

# 2.04 FABRICATION

- A. Fabricate components with tight joints, corners and seams.
- B. Pre-drill holes for attachment.
- C. Form end trim closure by capping and finishing smooth.

### 2.05 SOURCE QUALITY CONTROL

- A. See Section <u>01 4000 Quality Requirements</u>, for additional requirements.
- B. Provide wall and door protection systems of each type from a single source and manufacturer.

### PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.
- B. Verify that substrate surfaces for adhered items are clean and smooth.
- C. Start of installation constitutes acceptance of project conditions.

### 3.02 INSTALLATION

- A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to supporting construction.
- B. Position bottom of corner guards at top of wall base.
- C. Position protective wall covering no less than << <u>1 inch</u>; or \_\_\_\_\_ inch>> above finished floor to allow for floor level variation.
  - 1. Full-Height Installation: Establish a plumb line located at edge of starting point of first sheet to ensure following sheets will be installed plumb.
  - 2. Wainscot Installation: Establish a level line at the specified height for entire length of run. Install by aligning top of edge of covering with this line.

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- 3. Apply adhesive with <u>1/8 inch</u> V-notch trowel to an area of wall surface that can be completed within cure time of the adhesive.
- 4. Install trim pieces as required for a complete installation. Allow tolerance for thermal movement.
- 5. Use a roller to ensure maximum contact with adhesive.

# 3.03 TOLERANCES

- A. Maximum Variation From Required Height: << <u>1/4 inch;</u> or \_\_\_\_\_ inch>>.
- B. Maximum Variation From Level or Plane For Visible Length: << <u>1/4 inch;</u> or \_\_\_\_\_ inch>>.

## 3.04 CLEANING

A. Clean wall and door protection items of excess adhesive, dust, dirt, and other contaminants.

### **SECTION 10 2800** TOILET, BATH, AND LAUNDRY ACCESSORIES

## PART 1 GENERAL

## **1.01 SECTION INCLUDES**

- Commercial toilet accessories.
- B. Commercial shower and bath accessories.
- C. Healthcare accessories.
- D. Under-lavatory pipe supply covers.
- E. Diaper changing stations.
- F. Utility room accessories.
- G. Coat Hooks.

## 1.02 RELATED REQUIREMENTS

- A. Section 08 8300 Mirrors: Other mirrors.
- B. Section 09 3000 Tiling: Ceramic washroom accessories.
- C. Section 10 2113.17 Phenolic Toilet Compartments
- D. Section 22 4000 Plumbing Fixtures: Under-lavatory pipe and supply covers.

### 1.03 REFERENCE STANDARDS

- A. ADA Standards Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. ASTM A269/A269M Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2015a (Reapproved 2019).
- C. ASTM C1036 Standard Specification for Flat Glass; 2016.
- D. ASTM C1503 Standard Specification for Silvered Flat Glass Mirror; 2018.
- E. ASTM F2285 Standard Consumer Safety Performance Specification for Diaper Changing Tables for Commercial Use; 2004, with Editorial Revision (2016).
- F. ICC A117.1 Accessible and Usable Buildings and Facilities; 2017.

### **1.04 ADMINISTRATIVE REQUIREMENTS**

A. Coordinate the work with the placement of << internal wall reinforcement; concealed</p> ceiling supports; reinforcement of toilet partitions; and \_\_\_\_ >> to receive anchor attachments.

### 1.05 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements, for submittal procedures.
- B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.
- Manufacturer's Installation Instructions: Indicate << special procedures; conditions C. requiring special attention; and \_\_\_\_\_>>.

### PART 2 PRODUCTS

# 2.01 MANUFACTURERS

- A. Commercial Toilet Accessories:
  - AJW Architectural Products<< ; \_\_\_\_\_; or None N/A>>: www.ajw.com/#sle. American Specialties, Inc<< ; \_\_\_\_\_; or None N/A>>: 1.
  - 2.
  - www.americanspecialties.com/#sle.
  - 3. Bobrick.
  - Substitutions: << Section 01 6000 Product Requirements; Not permitted; or 4. >>.

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- B. Diaper Changing Stations:
  - 1. Koala Kare Products<< ; \_\_\_\_; or None N/A>>: www.koalabear.com/#sle.
  - 2. Substitutions: << 01 6000 Product Requirements; Not permitted; or \_\_\_\_>>.

## 2.02 MATERIALS

- A. Accessories General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
- B. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.
- C. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.
- D. Fasteners, Screws, and Bolts: Hot dip galvanized<< <u>; tamper-proof</u>; <u>;</u> <u>;</u> or None N/A>><< <u>; security type</u>; <u>;</u> <u>;</u> or None N/A>>.

### 2.03 FINISHES

A. Stainless Steel: << <u>Satin</u>; Bright polished; or \_\_\_\_\_>> finish<< <u>, unless otherwise</u> noted; , \_\_\_\_; or None - N/A>>.

### 2.04 COMMERCIAL TOILET ACCESSORIES

- A. Toilet Paper Dispenser:
  - 1. Products:
    - a. Bobrick, B-2888.
- B. Soap Dispenser: << Liquid soap; Soap lather; or \_\_\_\_>> dispenser, wall-mounted, << surface; recessed; or \_\_\_\_>>, with << stainless steel; or \_\_\_\_>> cover and horizontal stainless steel tank and working parts; push type soap valve, check valve, and window gauge refill indicator<< , tumbler lock; None N/A; or , \_\_\_\_>>.
  - 1. Products:
    - a. Bobrick, B-4112.
    - b. Substitutions: << <u>Section 01 6000 Product Requirements</u>; Not permitted; or \_\_\_\_\_>>.
- C. Mirrors: Stainless steel framed, <u>1/4 inch</u> thick << <u>annealed float glass</u>; <u>ASTM C1036</u>; tempered safety glass; ASTM C1048; acrylic plastic sheet; polycarbonate plastic sheet; abrasion-resistant coated acrylic plastic sheet; abrasion-resistant coated polycarbonate plastic sheet; or \_\_\_\_>>.
  - 1. Products:
    - a. Bobrick, B-165-2436.
    - b. Substitutions: << <u>Section 01 6000 Product Requirements</u>; Not permitted; or \_\_\_\_\_>>.
- D. Seat Cover Dispenser: << <u>Stainless steel</u>; or \_\_\_\_>>, << <u>surface-mounted</u>; recessed; partition mounting; two-sided partition mounting; or \_\_\_\_>>, reloading by << <u>concealed</u> <u>opening at base</u>; hinged access door; hinged front panel; or \_\_\_\_>><< <u>, tumbler lock</u>; None N/A; or , \_\_\_\_>>.
  - 1. Products:
    - a. Bobrick, B-4221.
    - b. Substitutions: << <u>Section 01 6000 Product Requirements</u>; Not permitted; or \_\_\_\_\_>>.
- E. Grab Bars: Stainless steel, << <u>smooth</u>; peened; textured; or \_\_\_\_>> surface.
  1. Standard Duty Grab Bars:
  - a. Push/Pull Point Load: << 250 pound-force; or \_\_\_\_ pound-force>>, minimum.
    - b. Dimensions: << <u>1-1/4 inch</u>; 1-1/2 inch; or \_\_\_\_\_ inch>> outside diameter, minimum << <u>0.05 inch</u>; or \_\_\_\_\_ inch>> wall thickness, << concealed; <u>exposed</u>; or \_\_\_\_\_ >> flange mounting, << <u>1-1/2 inch</u>; or \_\_\_\_\_ inch>> clearance between wall and inside of grab bar.
    - c. Finish: << <u>Satin;</u> Polished; or \_\_\_\_>>.

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- d. Length and Configuration: As indicated on drawings.
- e. Products:
  - Bobrick, B-5806 x 18. 1)
  - 2) Bobrick, B-5806 x 36.
  - Bobrick, B-5806 x 42. 3)
  - Substitutions: << Section 01\_6000 Product Requirements; Not permitted; 4) or >>.

#### 2.05 UNDER-LAVATORY PIPE AND SUPPLY COVERS

- A. Under-Lavatory Pipe and Supply Covers:
  - Insulate exposed drainage piping, including hot, cold, and tempered water supplies under 1. lavatories or sinks to comply with ADA Standards.
  - 2. Construction: 1/8 inch flexible PVC.
  - a. Comply with ICC A117.1.
  - Color: << <u>White;</u> Gray; or \_\_\_\_>>. 3.

### 2.06 DIAPER CHANGING STATIONS

- Diaper Changing Station: Wall-mounted folding diaper changing station for use in commercial Α. toilet facilities, meeting or exceeding ASTM F2285.
  - 1. Material: << Polyethylene; Stainless steel; or \_\_\_\_>>.
  - 2. Mounting: << Surface; Recessed; or >>.
  - Minimum Rated Load: << 250 pounds; 300 pounds; 400 pounds; or pounds>>. 3.
  - 4. Products:
    - a. Koala, KB310-SSWM.
    - b. Substitutions: << 01 6000 - Product Requirements; Not permitted; or >>.

#### 2.07 UTILITY ROOM ACCESSORIES

- A. Mop and Broom Holder: **0.05 inch** thick stainless steel, Type 304, hat-shaped channel.
  - Holders: << <u>Three;</u> Four; or \_\_\_\_>> spring-loaded rubber cam holders. Length: << <u>36 inches;</u> or \_\_\_\_ inches>>. 1.
  - 2.
- B. Combination Utility Shelf/Mop and Broom Holder: **0.05 inch** thick stainless steel, Type 304, with 1/2 inch returned edges. 0.06 inch steel wall brackets.
  - 1. Hooks: << Two; Three; Five; or \_\_\_\_>>, 0.06 inch stainless steel rag hooks at shelf front.
  - Mop/broom holders: << Three; Four; or \_\_\_>> spring-loaded rubber cam holders at 2. shelf front.
- C. Coat Hooks:
  - Products: 1.
    - a. Davis, Dots.
    - b. Color: Oak
    - c. Locations: TH Exam Rooms/ TH 125.

#### PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify exact location of accessories for installation.

#### 3.02 PREPARATION

- A. Deliver inserts and rough-in frames to site for timely installation.
- B. Provide templates and rough-in measurements as required.

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## 3.03 INSTALLATION

- A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.
- B. Install plumb and level, securely and rigidly anchored to substrate.
- C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.1. Grab Bars: As indicated on drawings.

## 3.04 PROTECTION

A. Protect installed accessories from damage due to subsequent construction operations.

#### SECTION 10 4400 FIRE PROTECTION SPECIALTIES

### PART 1 GENERAL

### 1.01 SECTION INCLUDES

- A. Fire extinguishers.
- B. Fire extinguisher cabinets.
- C. Accessories.

## 1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Wood blocking product and execution requirements.

### 1.03 REFERENCE STANDARDS

- A. ASTM E814 Standard Test Method for Fire Tests of Penetration Firestop Systems; 2013a (Reapproved 2017).
- B. FM (AG) FM Approval Guide; current edition.
- C. NFPA 10 Standard for Portable Fire Extinguishers; 2017, with Errata (2018).
- D. UL (DIR) Online Certifications Directory; Current Edition.

## 1.04 SUBMITTALS

- A. See Section <u>01 3000 Administrative Requirements</u>, for submittal procedures.
- B. Shop Drawings: Indicate << <u>locations of cabinets</u>; <u>cabinet physical dimensions</u>; rough-in measurements for recessed cabinets; locations of individual fire extinguishers; mounting measurements for wall bracket; installation procedures; accessories required for complete installation; and \_\_\_\_>>.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

# PART 2 PRODUCTS

# 2.01 MANUFACTURERS

- A. Fire Extinguishers:
  - 1. Kidde, a unit of United Technologies Corp<< ; \_\_\_\_\_; or None N/A>>: www.kidde.com/#sle.
  - 2. Substitutions: << See Section 01 6000 Product Requirements; or Not permitted>>.
- B. Fire Extinguisher Cabinets and Accessories:
  - 1. Kidde, a unit of United Technologies Corp<< ; \_\_\_\_\_; or None N/A>>: www.kidde.com/#sle.
  - 2. Substitutions: << See Section 01 6000 Product Requirements; or Not permitted>>.

### 2.02 FIRE EXTINGUISHERS

- A. Fire Extinguishers General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
  - Provide extinguishers labeled by << <u>UL (DIR)</u>; <u>FM (AG)</u>; United States Coast Guard; testing firm acceptable to authorities having jurisdiction; or \_\_\_\_\_>> for purpose specified and as indicated.
- B. << <u>Multipurpose Dry Chemical</u>; Halogenated Agents; or \_\_\_\_>> Type Fire Extinguishers: << <u>Carbon steel</u>; Aluminum; or \_\_\_\_>> tank, with pressure gauge.
  - 1. Class: << <u>A:B:C;</u> B:C; or \_\_\_\_>> type.
  - 2. Size: << 2.5 pound; 2.6 pound; 5 pound; 10 pound; 30 pound; or 20 pound>>.
  - 3. Finish: << <u>Baked polyester powder coat</u>, Red <u>color</u>; <u>Baked polyester powder coat</u>, <u>color as selected</u>; <u>\_\_\_\_</u>; or Polished chrome>>.

4. Temperature range: << <u>Minus 40 degrees F</u>; Minus 65 degrees F; or <u>degrees F</u>; or <u>degrees F</u>; or <u>120 degrees F</u>>>.

#### 2.03 FIRE EXTINGUISHER CABINETS

- A. Fire Rating: Listed and labeled in accordance with ASTM E814 requirements for fire resistance rating of walls where being installed.
- B. Cabinet Construction: Non-fire rated.
  - 1. Formed << <u>primed;</u> galvanized; stainless; or \_\_\_\_>> steel sheet; << <u>0.036 inch;</u> or \_\_\_\_\_inch>> thick base metal.
- C. Cabinet Configuration: << Recessed; <u>Semi-recessed</u>; Surface mounted; or \_\_\_\_>> type.
   1. Size to accommodate accessories.
  - 2. Trimless type.
  - 3. Provide cabinet enclosure with right angle inside corners and seams, and with formed perimeter trim<< <u>and door stiles;</u> or None N/A>>.
- D. Door: << 0.036 inch; or \_\_\_\_\_ inch>> metal thickness, reinforced for flatness and rigidity << with nylon catch; with roller type catch; with lock and breakable window access; or \_\_\_\_\_>>. Hinge doors for 180 degree opening with << two butt hinges; continuous piano hinge; or \_\_\_\_\_>>.
- E. Door Glazing: << <u>Float;</u> Tempered; Heat strengthened; or \_\_\_\_>> glass, clear, << <u>1/8</u> <u>inch;</u> or \_\_\_\_\_ inch>> thick, and set in resilient channel glazing gasket.
- F. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.
- G. Finish of Cabinet Exterior Trim and Door: << Primed for field paint finish; Polished chrome; Satin chrome; No.4 Brushed stainless steel; Red enamel; Red baked enamel; <u>Baked enamel</u>, white <u>color</u>; Baked enamel, color as selected; Anodized to <u>color</u>; Anodized to color as selected; or <u>>></u>.
- H. Finish of Cabinet Interior: << White colored enamel; \_\_\_\_\_ colored enamel; or \_\_\_\_>>.

### 2.04 ACCESSORIES

- A. Lettering: FIRE EXTINGUISHER decal, or vinyl self-adhering, pre-spaced black lettering in accordance with authorities having jurisdiction (AHJ).
- B. Wall sign:
  - 1. 24" tall triangular "FIRE EXTINGUISHER" sign with lettering on two sides over each FEC location.
  - 2. Sign size, font, font size and mounting height to comply with AHJ requirements.
- C. Self-Service Reloading Kits: << Type; Types; or \_\_\_\_>><< ABC; BC; and \_\_\_\_>>.

### PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify rough openings for cabinet are correctly sized and located.

#### 3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Secure rigidly in place.
- C. Place extinguishers<< <u>and accessories;</u> or None N/A>> << <u>in cabinets;</u> and on wall brackets>>.

#### 3.03 MAINTENANCE - SELF-SERVICE FIRE EXTINGUISHERS

- A. Monthly Inspections: Inspect self-service fire extinguishers on monthly basis in accordance with manufacturer's instructions, and requirements of the authorities having jurisdiction (AHJ).
- B. Annual Inspections: Inspect self-service fire extinguishers on annual basis in accordance with manufacturer's instructions, and requirements of the authorities having jurisdiction (AHJ).

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C. Inspection Certification Tag: Provide new tag indicating acceptable condition of fire extinguisher, date of inspection, and name of self-service inspector for each inspection.

# 3.04 SCHEDULES

### SECTION 10 5123 PLASTIC-LAMINATE-CLAD LOCKERS

### PART 1 GENERAL

### 1.01 SECTION INCLUDES

- A. Plastic-laminate-clad lockers.
- B. Locker benches.

#### 1.02 RELATED REQUIREMENTS

A. Section <u>06 1000 - Rough Carpentry</u>: Wood base construction.

#### 1.03 REFERENCE STANDARDS

- A. ADA Standards Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. NEMA LD 3 High-Pressure Decorative Laminates; 2005.

#### 1.04 SUBMITTALS

- A. See Section **<u>01 3000 Administrative Requirements</u>** for submittal procedures.
- B. Product Data: Manufacturer's published data on locker construction, sizes and accessories.
- C. Shop Drawings: Indicate locker plan layout, << <u>numbering plan;</u> <u>combination lock code;</u> key codes; and \_\_\_\_\_>>.
- D. Samples: Two << 3 by 6 inches; or <u>12 by 12 inches</u>>> in size, of<< <u>each</u>; or None N/A>> color << <u>scheduled</u>; or <u>selected</u>>>.

### 1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect locker finish and adjacent surfaces from damage.

### PART 2 PRODUCTS

### 2.01 MANUFACTURERS

### 2.02 LOCKER APPLICATIONS

- A. << <u>Student Lockers</u>; Wardrobe Lockers; or \_\_\_\_\_>>: Plastic-laminate-clad lockers, << recessed mounted; <u>wall mounted with matching closed base</u>; wall mounted for base indicated on drawings; or \_\_\_\_\_>>.
  - 1. Locker Configuration: << Single tier; <u>Two tier</u>; Three tier; Four tier; Five tier; Six tier; Z-tier (2 lockers each with a short and long compartment); or \_\_\_\_>>.
  - 2. Fittings: Size and configuration as indicated on drawings.
  - Locking: << Padlock hasps, for padlocks provided by Owner; Built-in key locks with spring bolt action; <u>Built-in combination locks</u>; Built-in digital keypad locks; or \_\_\_\_\_>.
- B. << Open-Front Athletic Lockers; Athletic Lockers; or \_\_\_\_>>: Plastic-laminate-clad lockers, << recessed mounted; wall mounted with matching closed base; wall mounted for base indicated on drawings; free-standing with matching closed base; free-standing for base indicated on drawings; or \_\_\_\_\_>>.
  - 1. Locker Configuration: << <u>Single tier</u>; Two tier; Three tier; Four tier; Five tier; Six tier; Z-tier (2 lockers each with a short and long compartment); or \_\_\_\_>>.
  - 2. Fittings: Size and configuration as indicated on drawings.
- C. Box Lockers: Plastic-laminate-clad lockers, << <u>free-standing with matching closed base;</u> free-standing for base indicated on drawings; or \_\_\_\_\_>>.
  - 1. Configuration: << Four tier; Five tier; <u>Six tier</u>; or \_\_\_\_>>.
  - 2. Fittings: Size and configuration as indicated on drawings.
  - 3. Ventilation: Manufacturer's standard louvers in door panel.
  - 4. Locking: << <u>Padlock hasps, for padlocks provided by Owner;</u> Built-in key locks with spring bolt action; Built-in combination locks; Built-in digital keypad locks; Built-in coin-return locks; Built-in token-return locks; or \_\_\_\_>>.

- D. Locker Benches: << <u>Stationary</u>; Free standing; or \_\_\_\_\_>> type; bench top of << <u>wood butcher block</u>; laminated birch; laminated maple; laminated \_\_\_\_\_; or \_\_\_\_\_>>; << painted steel; <u>aluminum</u>; satin stainless steel; or \_\_\_\_\_>> pedestals.
- E. Locker Bench Support Brackets: Welded structural aluminum << wall surface mount; wall recess mount; single arm, floor mount pedestal; double arm, floor mount pedestal; or \_\_\_\_\_\_\_>> bench support brackets; pre-drilled for bench top material attachment and for << wall; floor; or \_\_\_\_\_\_>> anchorage.

### 2.03 PLASTIC-LAMINATE-CLAD LOCKERS

- A. Lockers: Factory assembled, made of plastic-laminate-faced panels: fully finished inside and out; each locker capable of standing alone.
- B. Component Thicknesses:
  - 1. Doors: << <u>3/4 inch;</u> or \_\_\_\_\_ inch>> minimum thickness.
  - 2. End Panels and Filler Panels: << <u>1/2 inch</u>; or \_\_\_\_\_ inch>> minimum thickness.
  - 3. Sloped Tops: << <u>1/2 inch;</u> or \_\_\_\_\_ inch>> minimum thickness.
- C. Hinges: Full height of locker, manufacturer's standard heavy duty type.

# PART 3 EXECUTION

## 3.01 EXAMINATION

A. Verify that prepared bases are in correct position and configuration.

## 3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Place and secure on prepared base.
- C. Install lockers plumb and square.
- D. Install << end panels; filler panels; sloped tops; miscellaneous panels; and \_\_\_\_>>.
- E. Install fittings if not factory installed.
- F. Replace components that do not operate smoothly.

#### **SECTION 10 5500 POSTAL SPECIALTIES**

### <<<< UPDATE NOTES

#### PART 1 GENERAL

### 2.01 SECTION INCLUDES

A. Central mail delivery boxes.

### 2.02 REFERENCE STANDARDS

- 36 CFR 1191 Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Α. Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.
- 39 CFR 111 U.S. Postal Service Standard 4C: Current Edition. B

### 2.03 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's specifications and descriptive literature, installation instructions, maintenance information, and current USPS approval documentation.
- Shop Drawings: Indicate plans for each unit or groups of units, front elevations with C. compartment layout and model number, overall dimensions, rough-in opening sizes. construction and anchorage details.
- D. Samples: Submit << two; or \_\_\_\_>> sets of manufacturer's available colors.

### 2.04 WARRANTY

- A. See Section 01 7800 Closeout Submittals, for additional warranty requirements.
- B. Provide manufacturer's warranty against defects in materials or workmanship for a period of << <u>5 years;</u> or \_\_\_\_> from Date of Substantial Completion.

### PART 2 PRODUCTS

### 3.01 CENTRAL MAIL DELIVERY BOXES

- A. Manufacturers:
  - 1. Florence Manufacturing Company<< ; \_\_\_\_\_; or None N/A>>: www.florencemailboxes.com/#sle.
  - 2. Jensen Mailboxes<< ; \_\_\_\_\_; or None - N/A>>: www.jensenmailboxes.com/#sle.
  - Postal Products Unlimited, Inc<< ; \_\_\_\_\_; or None N/A>>: 3. www.postalproducts.com/#sle.
  - Salsbury Industries<< ; \_\_\_\_\_; or None N/A>>: www.mailboxes.com/#sle. Security Manufacturing Corp<< ; \_\_\_\_\_; or None N/A>>: 4.
  - 5. www.securitymanufacturing.com/#sle.
- B. Central Mail Delivery Boxes: Provide products approved for United States Postal Service (USPS) delivery.
  - 1. Materials: Aluminum with stainless steel hardware.
  - Finish: Powder coat in color selected by Architect from manufacturer's standard colors. 2.
  - Unit Types and Sizes: As << indicated on drawings; specified; or \_\_\_\_\_>>. 3.
  - Configurations: See drawings for overall dimensions and layouts. 4.
- C. Wall-Mounted Mailboxes: Fully-recessed, complying with 39 CFR 111 (USPS-STD-4C).
  - << Unit A; Unit \_\_\_\_; or \_\_\_\_>> << Front-loading with master door: Rear-loading 1. with hinged rear door panel; or \_\_\_\_\_>>, single-column design, << 3 customer; 4 customer; 5 customer; 6 customer; 7 customer; 8 customer; or \_\_\_\_\_ customer>> compartments, 1 outgoing mail compartment, and 1 parcel compartment.
    - a. Jensen Mailboxes; Model
    - b. Postal Products Unlimited, Inc; Model .
    - c. Salsbury Industries; Model

d. Security Manufacturing Corp; Model \_\_\_\_\_.

## 3.02 COMPONENTS

- A. Locking Front Loading Master Door: Three-point latching mechanism with USPS master lock furnished and installed by postmaster.
- B. Locking Customer Compartment Doors: USPS approved cam lock, 3 keys each lock.
- C. Locking Parcel Compartment Doors: Double-lock arrangement with USPS approved cam lock for customer access, and USPS master lock furnished and installed by postmaster.
- D. Identification Customer and Parcel Compartments: Sequential numerical or alphabetic characters, top to bottom, left to right; << <u>factory-installed</u>; or field-installed>>.
  - 1. Engraved characters, << <u>3/4 inch;</u> or \_\_\_\_\_ inch>> high<< <u>, with black fill;</u> , with white fill; , with \_\_\_\_\_; or None N/A>>.
  - Customer Name Marking: Name card holder, sized to hold << <u>3/4 inch</u>; or \_\_\_\_\_ inch>> high by minimum << <u>2-1/2 inch</u>; or \_\_\_\_\_ inch>> long name card; attach above or inside each compartment.

## PART 3 EXECUTION

## 4.01 EXAMINATION

- A. Verify that rough-openings are ready to receive wall-mounted units.
- B. Do not begin installation until unacceptable conditions are corrected.

### 4.02 INSTALLATION

- A. Install postal specialties in accordance with approved shop drawings, manufacturer's instructions, and USPS requirements.
- B. Adjust and lubricate door hardware to operate properly.

### SECTION 10 5617 WALL MOUNTED STANDARDS AND SHELVING

### PART 1 GENERAL

## 1.01 SECTION INCLUDES

- A. Steel shelf standards, brackets, and accessories.
- B. Steel shelf support brackets.
- C. Shelves.
- D. See drawings for locations and configurations.

### 1.02 RELATED REQUIREMENTS

- A. Section <u>06 1000 Rough Carpentry</u>: Wood blocking in walls for attachment of standards.
- B. Section 06 2000 Finish Carpentry: Wood shelves.
- C. Section <u>09 2116 Gypsum Board Assemblies</u>: Blocking in metal stud walls for attachment of standards.

## 1.03 REFERENCE STANDARDS

- A. ASTM A36/A36M Standard Specification for Carbon Structural Steel; 2014.
- B. ASTM B221 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2020.
- C. ASTM B221M Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.
- D. NEMA LD 3 High-Pressure Decorative Laminates; 2005.

## 1.04 SUBMITTALS

- A. See Section **<u>01 3000 Administrative Requirements</u>** for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used.
- C. Selection Samples: For each finish product specified, << <u>two</u>; or \_\_\_\_>> complete sets of color chips representing manufacturer's full range of available colors and patterns.

### 1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than << <u>three</u>; or \_\_\_\_>> years of << <u>documented</u>; or None - N/A>> experience.

### 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store products under cover and elevated above grade.
- B. Store products in manufacturer's unopened packaging until ready for installation.

# PART 2 PRODUCTS

# 2.01 MANUFACTURERS

- A. Steel Shelf Standards and Brackets:
  - Knape & Vogt Manufacturing Company<< <u>; 87<sup>™</sup>/187<sup>™</sup> Series</u>; ; 85<sup>™</sup>/185<sup>™</sup> Series; ; 83<sup>™</sup>/183<sup>™</sup> Series; ; 82<sup>™</sup>/182<sup>™</sup> Series; ; 80<sup>™</sup>/180<sup>™</sup> Series; ; \_\_\_\_\_; or None -N/A>>: www.knapeandvogt.com/#sle.
- B. Aluminum Shelf Standards, Brackets, and Accessories:
- C. Steel Shelf Support Brackets:
- D. Shelving:
  - 1. Rakks/Rangine Corporation; Aluminum Shelving: www.rakks.com/#sle.

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## 2.02 COMPONENTS

- A. Steel Shelf Standards, Brackets, and Accessories:
  - Heavy-Duty Shelf Standards and Brackets: Double-slotted channel standards for brackets adjustable in <u>1 inch</u> increments along entire length of standard, drilled and countersunk for screws.
    - a. Load Capacity: Recommended by manufacturer for loading of << <u>300 to 450</u> <u>pounds;</u> or \_\_\_\_\_ pounds>> per pair of standards.
    - b. Brackets: Double tab type, locking into slots; size to suit shelves; same finish as standards.
    - c. Bracket Quantity: Provide one bracket for each << <u>12 inches;</u> or \_\_\_\_\_ inches>> of standard length.
  - Heavy-Duty Shelf Standards and Brackets: Single-slotted channel standards for brackets adjustable in <u>1 inch</u> increments along entire length of standard, drilled and countersunk for screws.
    - a. Load Capacity: Recommended by manufacturer for loading of << <u>300 to 450</u> <u>pounds;</u> or <u>pounds>></u> per pair of standards.
    - b. Brackets: Double tab type, locking into slots; size to suit shelves; same finish as standards.
    - c. Bracket Quantity: Provide one bracket for each << <u>12 inches;</u> or \_\_\_\_\_ inches>> of standard length.
  - 3. Shelf Standard Accessories:
    - a. At shelves indicated as sloping provide adjustable slant brackets.
- B. Steel Shelf Support Brackets:
  - 1. Material: Steel, ASTM A36/A36M.
- C. Shelving:
  - 1. Laminate Faced Shelves: Particleboard or medium density fiberboard covered with high pressure decorative laminate on both sides.
    - a. Edge Finish: << <u>Matching laminate, all four edges</u>; Hot melt PVC banding, same color; Rubber T-molding; or \_\_\_\_\_>>.
    - b. Substrate Thickness: << <u>3/4 inch; or</u> \_\_\_\_ inch>>, nominal.
    - c. Laminate: NEMA LD 3 Type HGL.
- D. Fasteners: Screws as recommended by manufacturer for intended application or as otherwise required by project conditions. Finish of exposed to view fasteners to match finish of standards and other components.

# PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

### 3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

### 3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Mount standards or brackets to solid backing capable of supporting intended loads.
- C. Install brackets, shelving, and accessories.

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# 3.04 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

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# **SECTION 10 5620**

# MOBILE STORAGE SHELVING UNITS - MECHANICALLY-ASSISTED

### PART 1 GENERAL

## 1.01 RELATED DOCUMENTS

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

## 1.02 SUMMARY

- A. This Section includes the following:
  - 1. Mechanically assisted, carriage mounted high-density mobile storage units, support rails, fabrication, and installation including leveling of support rails.
- B. Related Work, Not Furnished:
  - 1. Structural floor system capable of supporting live and dead loads required by prevailing building codes, including rolling loads of storage units to be installed.
  - 2. Finish floor covering materials and installation on concrete with recessed rail installation.
- C. Related Sections:
  - 1. Section 03300 Concrete Work
  - 2. Sections in Division 9 Finishes, relating to finish floor and base materials.
- D. Alternates:

### 1.03 REFERENCES

- A. American National Standards Institute (ANSI) Standards:
  - 1. Applicable standards for fasteners used for assembly.
- B. American Society for Testing and Materials (ASTM) Standards:1. Applicable standards for steel materials used for fabrication.
- C. American Institute Of Steel Construction (AISC) Standards:
  - 1. Applicable standards for steel materials used for fabrication.

#### **1.04 SYSTEM DESCRIPTION**

- A. General: The system consists of manufactured storage units mounted on manufacturer's trackguided carriages to form a compact storage system. System design permits access to any single aisle by manually moving units until the desired aisle is opened. The carriage/rail system provides uniform carriage movement along the total length of travel, even with unbalanced loads.
- B. Carriage System Design and Features: The carriage system consists of a formed structural steel frame with machined and balanced wheels riding on steel rails recessed mounted to the floor. Rails shall be types selected by the manufacturer to ensure smooth operation and self-centering of mobile storage units during travel without end play or binding. Rail types, quantities and spacing shall be selected by the manufacturer to suit installation conditions and requirements. All bearings used in the drive mechanism shall be permanently shielded and lubricated.
- C. Movement Controls: Triple or single arm operating wheels with rotating hand knobs shall be provided on the accessible (drive) ends of shelf units, centered on the end panel, located 40 inches (1051MM) from the base of each unit to permit units to be moved to create a single aisle opening. Turning the handle transmits power through chain drive to drive wheels on each carriage.
- D. Drive System: The system shall be designed with a positive type mechanically-assisted drive which minimizes end play, ensures there is no play in the drive handle, and that carriages will stop without drifting.
  - 1. System shall include a chain sprocket drive system for each movable carriage to ensure that carriages move uniformly along the total length of travel, even with unbalanced loads.

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All system components shall be selected to ensure a smooth, even movement along the entire carriage length. Drive system gearing shall be designed to permit 1 lb. of force applied to the drive handle to move a minimum of 4,000 lbs. of load.

- 2. A tensioning device shall be provided on each chain drive with provision for adjusting tension without removing end panels.
- 3. All bearings used in the drive mechanism shall be permanently shielded and lubricated.
- E. Safety Features:
  - 1. Color-coded visual indicators shall provide verification that carriages are in a locked or unlocked mode.
  - 2. A single safety lock button, mounted on each operating wheel hub, will permit moving a carriage in either direction to create a new access aisle when pulled out (unlocked), or locking the carriage when pushed in.
- F. Finishes:
  - 1. Fabricated Metal Components And Assemblies: Manufacturer's standard powder coat paint finish.
  - 2. End Panels, Accessible Ends: Plastic laminate, manufacturer's standard textures and patterns.

### 1.05 PERFORMANCE REQUIREMENTS

- A. Design Requirements:
  - 1. Limit overall height to 90 inches.
  - 2. Limit overall length to 162 inches for SE35 and 102 inches for SE62.
  - 3. Limit overall width to 216 inches for SE35 and 135 inches for SE62.
- B. Ease of Movement: Provide mechanically assisted units capable of being moved by exerting a maximum horizontal force of 5 pounds on the operating wheel.
- C. Seismic Performance: Provide mobile storage units capable of withstanding the effects of earthquake movement when required by applicable building codes.

### 1.06 SUBMITTALS

- A. Product Data: Submit manufacturer's product literature and installation instructions for each type of shelving, track and installation accessory required. Include data substantiating that products to be furnished comply with requirements of the contract documents.
- B. Shop Drawings: Show fabrication, assembly, and installation details including descriptions of procedures and diagrams. Show complete extent of installation layout including clearances, spacings, and relation to adjacent construction in plan, elevation, and sections. Indicate clear exit and access aisle widths; access to concealed components; assemblies, connections, attachments, reinforcement, and anchorage; and deck details, edge conditions, and extent of finish flooring within area where units are to be installed.
  - 1. Show installation details at non-standard conditions. Furnish floor layouts, technical and installation manuals for every unit shipment with necessary dimensions for rail layout and system configuration at the project site. Include installed weight, load criteria, furnished specialties, and accessories.
  - 2. Provide layout, dimensions, and identification of each unit corresponding to sequence of installation and erection procedures. Specifically include the following:
    - a. Location, position, and configuration of tracks on all floors.
    - b. Plan layouts of positions of carriages, including all required clearances.
    - c. Details of shelving, indicating method and configuration of installation in carriages.
  - 3. Provide location and details of anchorage devices to be embedded in or fastened to other construction.
  - 4. Provide installation schedule and complete erection procedures to ensure proper installation.
- C. Provide calculations for floor loading and seismic anchorage in accordance with IBC and ASCE 7, certified by a qualified professional engineer, licensed in the state of the project.

- D. Submit adequate number of City Plan Review department set of shop drawings and seismic calculations for their review. Submit to City plan review and owner concurrently. Submit plan review approved set to Engineer when available. The submittals must include a licensed engineer's stamp and signature and shall be provided as a deferred submittal.
- E. Samples: Provide minimum 3 inch (76MM) square example of each color and texture on actual substrate for each component to remain exposed after installation.
- F. Selection Samples: For initial selection of colors and textures, submit manufacturer's color charts consisting of actual product pieces, showing full range of colors and textures available.
- G. Warranty: Submit draft copy of proposed warranty for review by the Architect.
- H. Maintenance Data: Provide in form suitable for inclusion in maintenance manuals for mobile storage units. Data shall include operating and maintenance instructions, parts inventory listing, purchase source listing, emergency instructions, and related information.
  - 1. Submit manufacturer's instructions for proper maintenance materials and procedures.
  - 2. Submit manufacturer's printed instructions for maintenance of installed work, including methods and frequency recommended for maintaining optimum condition under anticipated use conditions. Include precautions against using materials and methods which may be detrimental to finishes and performance.

### 1.07 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Engage an experienced manufacturer who is ISO 9001 certified for the design, production, installation and service of carriage mounted high-density mobile storage units and support rails. Furnish certificate attesting manufacturer's ISO 9001 quality system registration.
- B. Installer Qualifications: Engage an experienced installer who is a manufacturer's authorized representative for the specified products for installing carriages and anchoring shelving units to carriages.
  - 1. Minimum Qualifications: 1-year experience installing systems of comparable size and complexity to specified project requirements.
  - 2. Guaranteed 24-hour service response time.

### 1.08 DELIVERY, STORAGE AND HANDLING

A. Follow manufacturer's instructions and recommendations for delivery, storage and handling requirements.

### 1.09 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions before fabrication. Indicate verified measurements on Shop Drawings. Coordinate fabrication and delivery to ensure no delay in progress of the Work.
- B. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating mobile storage units. Coordinate construction to ensure actual dimensions correspond to established dimensions.

### 1.10 SEQUENCING AND SCHEDULING

- A. Sequencing: Coordinate storage shelving system installation with other work to minimize possibility of damage and soiling during remainder of construction period.
- B. Scheduling: Plan installation to commence after finishing operations, including painting have been completed.
- C. Built-In Items: Provide components which must be built in at a time which causes no delays general progress of the Work.
- D. Pre-installation Conference: Schedule and conduct conference on project site to review methods and procedures for installing mobile storage units including, but not limited to, the following:

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- 1. Review project conditions and levelness of flooring and other preparatory work performed under other contracts.
- 2. Review and verify structural loading limitations.
- 3. Recommended attendees include:
  - a. Owner's Representative.
  - b. Prime Contractor or representative.
  - c. The Architect.
  - d. Manufacturer's representative.
  - e. Subcontractors or installers whose work may affect, or be affected by, the work of this section.

### 1.11 WARRANTY

- A. Provide a written warranty, executed by Contractor, Installer, and Manufacturer, agreeing to repair or replace units which fail in materials or workmanship within the established warranty period. This warranty shall be in addition to, and not a limitation of, other rights the Owner may have under General Conditions provisions of the Contract Documents.
- B. Warrant the entire movable compact shelving installation against defects in materials and workmanship for a period of five years from date of acceptance by the Owner.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

- A. General: Products are based upon mobile shelving system products manufactured by Spacesaver Corporation. Contingent on meeting specification requirements, other acceptable manufacturers may be included.
- B. Supplier: Southwest Solutions Group;
- C. Jim Deller
- D. (425)-419-6100
- E. jdeller@southwestsolutions.com

#### 2.02 BASIC MATERIALS

- A. General: Provide materials and quality of workmanship which meet or exceed established industry standards for products specified. Material thicknesses/gauges are manufacturer's option unless indicated otherwise.
- B. Plastic Laminates: NEMA LD-3, GP-28, Vertical Grade.

### 2.03 GROUT

- A. General: Provide non-shrink, non-staining hydraulic cement compound conforming to the following requirements, based on the performance of the test specimens at room temperature and in laboratory air.
  - 1. Linear Movement: No shrinkage while setting; maximum expansion limited to .002 inches per linear inch.
  - 2. Compressive Strength: Based on two inch cubes made following ASTM standards, tested on a Balding-Southward machine of 60,000 pounds capacity, meet or exceed the following:
    - a. Age: 1 hour ---- 4,500 psi
    - b. 7 days ---- 8,000 psi

### 2.04 MANUFACTURED COMPONENTS

- A. Rails:
  - 1. Material: ASTM/AISI Type 1035 or 1045 steel, manufacturer's selection.
  - 2. Capacity: 1,000 pounds per lineal foot (1385kg/M) of carriage.
  - 3. Minimum Contact Surface: 5/8 inch (16MM) wide.
  - 4. Provide rail sections in minimum 6 foot (1.83M) lengths.

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- 5. Rail configuration shall permit attachment to top of structural floor system with provision for leveling rails to compensate for variations in floor surface level.
- 6. Provide rail connections designed to provide horizontal and vertical continuity between rail sections, to gradually transfer the concentrated wheel point load to and from adjoining rail sections. Butt joints are not permitted.
- 7. Anti-Tip Rail Form Covers: Manufacturer shall provide for protection if required to prevent damage to rails during concrete back pours and when anti-tip devices are installed.
- B. Floor / Ramp:
  - 1. Finished flooring materials shall be provided and installed by the general contractor.
- C. Carriages:
  - 1. Provide manufacturer's design movable carriages fabricated of welded or bolted steel construction. Galvanized structural components and/or riveted carriages are unacceptable.
  - 2. Provide fixed carriages of same construction and height as the movable carriages, anchored to rails. Setting fixed shelving directly on floors is not permitted.
  - 3. When required, provide bolted carriage splices designed to maintain proper unit alignment and weight load distribution.
  - 4. Design carriages to allow the shelving uprights to recess and interlock into the carriages a minimum of 3/4 inch (19MM). Top mount carriages are unacceptable.
  - 5. Provide each carriage with two wheels per rail.
- D. Drive / Guide System:
  - 1. Design: Provide drive system which prevents carriage whipping, binding and excessive wheel/rail wear under normal operation.
    - a. If line shafts are used, all wheels on one side of carriage shall drive.
    - b. If synchronized drives are used, a minimum of one wheel assembly driving both sides of carriage at center location required. Drive shaft shall exhibit no play or looseness over the entire length of that assembly.
  - 2. Shafts: Solid steel rod or tube.
  - 3. Shaft Connections: Secured couplings.
  - 4. Bearing Surfaces: Provide rotating load bearing members with ball or roller bearings. Provide shafts with pillow block or flanged self-aligning type bearings.
- E. Wheels:
  - 1. Capacity: Minimum load capacity per wheel: 3200 lbs (1455kg).
  - 2. Size: Minimum 5 inches (127MM), outside diameter drive wheels.
  - 3. Guides: Determined by manufacturer; minimum 2 locations.
- F. Face Panels:
  - 1. Materials: Plastic laminate clad particle board with plastic edging on vertical edges.
  - 2. Finishes: Selected from manufacturer's standard available colors and patterns by the Architect.
- G. Accessories:
  - 1. (Optional) Anti-Tip Devices: Provide manufacturer's standard fixtures.
  - 2. Mechanical Sweep and Safety Stop (Non-Powered).
  - 3. Every potential aisle shall be protected with a 3" (76 mm) high extruded aluminum safety sweep, hinged from the carriage using spring steel leaf springs, with the base edge maximum <sup>3</sup>/<sub>4</sub>" (19mm) from the floor. The carriage(s) shall stop when depressed at any location along the leading edge of the sweep surface. Activated safety sweep shall engage an impact- absorbing friction disk brake to protect occupants, stored media and the carriage system itself via a sheathed cable system comprised of aircraft-grade 3/64" (1.2mm) stainless steel core cables housed inside lined conduit. Safety sweep shall have bright, red and white safety identification tape applied full length marking its location. Safety sweep shall run the full length of both sides of each moveable carriage for full aisle coverage.

- 4. Mechanical safety sweep shall automatically reset to enable mobile system users to freely and safely back carriages away from aisle obstructions simply by reversing the direction of the rotating handle.
- 5. Safety sweep shall be operational when the carriages are not moving. Should a sweep be activated in an open aisle, the carriage with the activated sweep will not close on that aisle. Safety sweep shall automatically reset if activated and then released when the carriages are not moving.
- 6. Safety sweep shall require no electrical power or batteries to operate.

## 2.05 FABRICATION

- A. General: Coordinate fabrication and delivery to ensure no delay in progress of the Work.
- B. Wheels: Provide precision machined and balanced units with permanently shielded and lubricated bearings.
- C. Carriages: Fabricate to ensure no more than 1/4 inch (6MM) maximum deviation from a true straight line. Splice and weld to ensure no permanent set or slippage in any spliced or welded joint when exposed to forces encountered in normal operating circumstances.
- D. Shelving, Supports and Accessories: See individual descriptions in "Shelving" paragraphs.

### 2.06 FINISHES

- A. Colors: Selected from manufacturer's standard available colors.
- B. Paint Finish: Provide factory applied electrostatic powder coat paint. Meet or exceed specifications of the American Library Association.
- C. Laminate Finish: Provide factory applied laminate panels at locations indicated on approved shop drawings.
- D. Edgings: Provide preformed edging, color-matched to unit colors selected.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Examine floor surfaces with Installer present for compliance with requirements for installation tolerances and other conditions affecting performance of mobile storage units.
- B. Verify that building structural system is adequate for installing mobile storage units at locations indicated on approved shop drawings.
  - 1. For installations on existing floors, ensure that rail spacings indicated on shop drawings are in proper locations so existing load-bearing structural members are not over stressed.
- C. Verify that intended installation locations of mobile storage units will not interfere with nor block established required exit paths or similar means of egress once units are installed.
- D. Prepare written report, endorsed by Installer, listing conditions detrimental to proper performance of mobile storage units, once installed.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 INSTALLATION

- A. Rails:
  - 1. Lay out rails using full length units to the maximum extent possible. Use cut lengths only at ends to attain total length required. Locate and position properly, following dimensions indicated on approved shop drawings. Verify thickness of finished floor materials to be installed (by others) and install level 1/16 inch (0.6MM) above finished floor surfaces.
  - 2. Verify level, allowing for a minimum 1/4 inch (6MM) of grout under high points. Position and support rails so that no movement occurs during grouting.
  - 3. Set rails in full grout bed, completely filling any voids entire length of all rails including rail connectors. Trim up sides flush with rails to ensure proper load transfer from rail to supporting floor. Using shims in lieu of full grouting is not permitted.
  - 4. Installation Tolerances: Do not exceed levelness of installed rails listed below:

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- a. Maximum Variation From True Level Within Any Module: 3/32 inch (2.4MM).
- b. Maximum Variation Between Adjacent (Parallel) Rails: 1/16 inch (1.6MM), perpendicular to rail direction.
- c. Maximum Variation In Height: 1/32 inch (.8MM), measured along any 10 foot (3.05M) rail length.
- 5. Verify rail position and level; anchor to structural floor system with anchor type and spacings indicated on approved shop drawings.
- B. Floors/Ramps:
  - 1. General: Finished elevation shall be 1/16 inch (1.6MM) below top of rails.
  - 2. Place floors and ramps to the extent indicated on approved shop drawings. Extend ramps under all movable ranges. Provide ramp at both ends of mobile system. Do not extend ramps beyond the ends of carriages.
  - 3. Construct floors and ramps to prevent warping or deformation of floor panels in a normal operating environment. Support panels on levelers at maximum 16 inches on center.
  - 4. Ramp Slope: Do not exceed the following:
    - a. ADA Accessible Ramps: Maximum 1:12 slope (4.76 degrees).
    - b. Other Ramps: Maximum 9 degree slope (1.9:12).
    - c. Vertical Transition, Ramp edge to floor: Maximum 1/8 inch (3MM).
- C. Shelving Units Installation:
  - 1. General: Follow layout and details shown on approved shop drawings and manufacturer's printed installation instructions. Position units level, plumb; at proper location relative to adjoining units and related work.
  - 2. Carriages:
    - a. Place movable carriages on rails. Ensure that all wheels track properly and centering wheels are properly seated on centering rails. Fasten multiple carriage units together to form single movable base where required.
    - b. Position fixed carriage units to align with movable units.
  - 3. Shelving Units:
    - a. Permanently fasten shelving units to fixed and movable carriages with vibration-proof fasteners.
    - b. Stabilize shelving units following manufacturer's written instructions. Reinforce shelving units to withstand the stress of movement where required and specified.

#### 3.03 FIELD QUALITY CONTROL

- A. Verify shelving unit alignment and plumb after installation. Correct if required following manufacturer's instructions.
- B. Remove components which are chipped, scratched, or otherwise damaged and which do not match adjoining work. Replace with new matching units, installed as specified and in manner to eliminate evidence of replacement.

# 3.04 ADJUSTING

A. Adjust components and accessories to provide smoothly operating, visually acceptable installation.

### 3.05 CLEANING

A. Immediately upon completion of installation, clear components and surfaces. Remove surplus materials, rubbish and debris resulting from installation upon completion of work and leave areas of installation in neat, clean condition.

### 3.06 DEMONSTRATION/TRAINING

- A. Schedule and conduct demonstration of installed equipment and features with Owner's personnel.
- B. Schedule and conduct maintenance training with Owner's maintenance personnel. Training session should include lecture and demonstration of all maintenance and repair procedures

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that end user personnel would normally perform.

# 3.07 PROTECTION

A. Protect system against damage during remainder of construction period. Advise Owner of additional protection needed to ensure that system will be without damage or deterioration at time of substantial completion.

# END OF SECTION 10 5620

## SECTION 10 5723 CLOSET AND UTILITY SHELVING

## PART 1 GENERAL

### **1.01 SECTION INCLUDES**

- A. Wall mounted wire closet shelving.
- B. Accessories.

### 1.02 RELATED REQUIREMENTS

- A. Section <u>06 1000 Rough Carpentry</u>: Blocking in walls for attachment of shelving or storage system.
- B. Section **09 2116 Gypsum Board Assemblies**: Blocking in metal stud walls for attachment of standards or mounting rails.

### 1.03 SUBMITTALS

- A. See Section <u>01 3000</u> Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, with installation instructions.
- C. Shop Drawings: Provide drawings prepared specifically for this project; show dimensions of shelving or storage system and attachment to substrates.
- D. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

#### 1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than << <u>three</u>; or \_\_\_\_>> years of << <u>documented</u>; or None - N/A>> experience.

# 1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store products under cover and elevated above grade.
- C. Store flat to prevent warpage and bending.

#### 1.06 WARRANTY

- A. See Section 01 7800 Closeout Submittals for additional warranty requirements.
- B. Provide << <u>five</u>; or \_\_\_\_>> year manufacturer warranty for << <u>wire shelving systems</u>; <u>laminated wood storage systems</u>; and \_\_\_\_>>.

# PART 2 PRODUCTS

# 2.01 MANUFACTURERS

A. Wire Storage Shelving:

#### 2.02 WIRE STORAGE SHELVING SYSTEMS

- A. Applications:
- B. Wire Shelving: Factory-assembled coated wire mesh shelf assemblies for wall-mounting, with components and connections required to produce a rigid structure that is free of buckling and warping.
  - Construction: Cold-drawn steel wire with average tensile strength of << <u>100,000 psi</u>; or <u>psi>></u> resistance welded into uniform mesh units, square, rigid, flat, and free of dents or other distortions, with wires trimmed smooth.
  - Coating: << <u>PVC or epoxy</u>; PVC; Epoxy; or \_\_\_\_>>, applied after fabrication, covering surfaces.
  - 3. PVC Coating: << <u>9 to 11 mils;</u> or \_\_\_\_\_ inch>> thick.

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- Epoxy Coating: Nontoxic epoxy-polyester powder coating baked-on finish, << <u>3 to 5 mils</u>; or \_\_\_\_\_ inch>> thick.
- 5. Standard Mesh Shelves: Cross deck wires spaced at <u>1 inch</u>.
- C. Wall-Mounted Standards for Wire Shelving: Vertically slotted channel standards with doubletab cantilever brackets to suit shelving; factory finished to match shelving.
- D. Mounting Hardware for Wire Shelving: Provide manufacturer's standard mounting hardware; include support braces, wall brackets, back clips, end clips, poles, and other accessories as required for complete and secure installation; factory finished to match shelving.

# PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Inspect areas to receive shelving or storage system, to verify that spaces are properly prepared to receive shelf units, and are of dimensions indicated on shop drawings.
- B. Verify appropriate fastening hardware.
- C. Do not begin installation until substrates have been properly prepared.
- D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

### 3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

# 3.03 INSTALLATION

- A. Install wire shelving in accordance with manufacturer's instructions, with shelf surfaces level.
- B. Cap exposed ends of cut wire shelving.
- C. Install wire shelving back clips, end clips at side walls, and support braces at open ends. Install intermediate support braces as recommended by manufacturer.

#### 3.04 PROTECTION

- A. Protect installed work from damage.
- B. Touch-up, repair, or replace damaged products before Substantial Completion in a manner that eliminates evidence of replacement.

# END OF SECTION 10 5723

#### SECTION 11 3013 RESIDENTIAL APPLIANCES

# PART 1 GENERAL

## **1.01 SECTION INCLUDES**

A. Kitchen appliances.

### 1.02 RELATED REQUIREMENTS

- A. Section 22 1005 Plumbing Piping: Plumbing connections for appliances.
- B. Section 26 0583 Wiring Connections: Electrical connections for appliances.

### 1.03 REFERENCE STANDARDS

A. UL (DIR) - Online Certifications Directory; Current Edition.

### 1.04 SUBMITTALS

- A. See Section **<u>01 3000 Administrative Requirements</u>**, for submittal procedures.
- B. Product Data: Manufacturer's data indicating dimensions, capacity, and operating features of each piece of residential equipment specified.
- C. Copies of Warranties: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

## 1.05 QUALITY ASSURANCE

A. Electric Appliances: Listed and labeled by UL (DIR) and complying with NEMA Standards (National Electrical Manufacturers Association).

### 1.06 WARRANTY

- A. See Section 01 7800 Closeout Submittals, for additional warranty requirements.
- B. Provide << <u>five (5)</u>; or \_\_\_\_> year manufacturer warranty on refrigeration system of refrigerators.
- C. Provide << <u>ten (10);</u> or \_\_\_\_>> year manufacturer warranty on magnetron tube of microwave ovens.
- D. Provide << <u>ten (10);</u> or \_\_\_\_>> year manufacturer warranty on tub and door liner of dishwashers.

# PART 2 PRODUCTS

#### 2.01 KITCHEN APPLIANCES

- A. Provide commercial equipment compatible with USA standards for commercial electrical appliances and equipment.
- B. All appliances per Appliance Schedule in drawings.

# PART 3 EXECUTION

#### 3.01 EXAMINATION

A. Verify utility rough-ins are provided and correctly located.

#### 3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Anchor built-in equipment in place.

#### 3.03 ADJUSTING

A. Adjust equipment to provide efficient operation.

#### 3.04 CLEANING

A. Remove packing materials from equipment and properly discard.

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B. Wash and clean equipment.

# END OF SECTION 11 3013

# SECTION 11 40 00 FOOD SERVICE EQUIPMENT

# PART 1 GENERAL

# 1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. It is specifically noted that the Foodservice Consultant generated work is defined as the planning and design of all CSI Section 114000 Food Service Equipment (as defined by the Construction Specification Institute of America Alexandria, Virginia). This excludes the actual construction or installation of this equipment, work by "other divisions" including but not limited to millwork, interior design elements, i.e. furniture, bars, bar tops and dies, service stations, graphic, signage, lighting, and audio/visual systems work and the like, as well as structural, programs, and all base project mechanical, electrical, and plumbing requirements not directly associated with Section 114000 equipment and called out on project construction documents as part of its work. Prior to installation all work shall be field verified by the Foodservice Equipment Contractor and construction documentation shall be designated "for planning and guidance". The fully dimensioned and field verified Construction documentation will be provided by the Foodservice Equipment Contractor as part of the Submittal Process.
- C. The following information is provided for reference only and may not be totally inclusive for each specific trade noted. It is each trade's responsibility to ensure that it covers all elements of its work that may affect the final food service equipment installation.
- D. No responsibility is accepted by the Architect or Consultant for the placement or replacement of equipment by Owner, or Others, its' utilities, or structural impact on the project where the equipment is furnished by others including the Owner outside of this contract or where existing equipment may be reused and moved or kept on the same location by the Owner or others, where this equipment has been specifically identified as NIC (not in contract) at any time during the project work.

# 1.02 SUMMARY

- A. This Section includes equipment for food service facilities indicated on the Drawings.
- B. Foodservice Equipment Contractor (F.E.C.) furnished equipment.
  - 1. Furnish and install includes the work as follows, but not limited to:
    - a. Furnish all labor, materials and services necessary for the assembly and setting in place of the equipment in strict compliance and in accordance with the contract documents. Coordinate requirements for wall reinforcements and special support locations.
    - b. Provide stands and supports for equipment requiring such. In areas requiring seismic bracing and provide special support to comply with seismic standards. (Such supports shall be approved by the structural engineer.)
    - c. Cut holes, provide sleeves for pipes in equipment, for drains, electrical work, plumbing work, etc., as required for proper installation. Any base building work required to be coordinated through the Contractor.
    - d. Repair any damage to equipment or to work of other trades resulting from installation per methods defined in the specification section of the work that is damaged

- e. Remove all debris resulting from this installation, clean, repair, and adjust all equipment for operation, as well as provide an acceptance test to the Owner
- f. Contractor shall avail itself and pass directly on to Owner all lawful rebates, refunds, 'spiffs', credits, and discounts afforded it by virtue of its contract with the manufacturers providing equipment to this section of work, acquired or made available thru the use or application of the Owner's funds.
- C. Owner-Furnished Equipment: Where indicated, Owner will furnish equipment items.
- D. Related Sections include the following:

2.

- 1. Division 03 Section "Cast-in-Place Concrete" for the following:
  - a. Equipment bases
  - b. Requirements for slab depressions
  - c. Insulated slabs beneath walk-in refrigeration units
  - Division 05 Section "Metal Fabrications" for equipment supports.
- 3. Division 06 Section "Interior Architectural Woodwork" for custom casework and countertops.
- 4. Division 07 Section "Roof Accessories" for roof curbs and equipment supports.
- 5. Division 09 Section "Tiling" for floor finishes in walk-in refrigeration units.
- 6. Division 21, 22, and 23 Sections for supply and exhaust fans; exhaust ductwork; service roughing-ins; drain traps; atmospheric vents; valves, pipes, and fittings; fire-extinguishing systems; and other materials required to complete food service equipment installation.
- 7. Division 23 Section "Air Curtains" for air curtains protecting food service facility entranceways.
- 8. Division 23 Section "Commercial Kitchen Hoods" for ventilation hoods.
- 9. Division 26 Sections for connections to fire alarm systems, wiring, disconnect switches, and other electrical materials required to complete food service equipment installation.
- E. Food service Contract Documents:
  - 1. Equipment drawings are definitive only and shall not be used as construction documents or shop details
  - 2. Drawings and equipment specifications are intended to complement each other. Therefore, neither should be considered complete without the other
  - 3. Drawings are for reference, assistance and guidance only. Drawings indicate the preferred final location of equipment. The exact final location will be dictated by the building conditions
  - 4. Reproduction of Contract documents prepared by either the Architect or Consultant by any means will not be acceptable as Shop Drawings. Drawings submitted as original F.E.C. drawings having the appearance of being copies or modified versions of the original Contract Documents will be returned as being non-conforming to submittal requirements.

# 1.03 SUBMITTALS

- A. Product Data: For each type of product indicated. Include the following:
  - 1. Manufacturer's Model number

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- 2. Options, accessories, and components that will be included for Project
- 3. Clearance requirements for access and maintenance
- 4. Utility service connections for water, drainage, power, and fuel; include roughing-in dimensions.
- 5. Cut Sheet Book: Assemble and transmit in digital format. Show all specified accessories, utility requirements and all other pertinent information on equipment cuts. Every standard manufactured item of equipment must have a cut sheet.
- 6. Original digital copy of cut book will be forwarded to the Architect, Design Team, and Owner for further review and comment. Then distributed back to the Foodservice Equipment Contractor as per project protocol.
- 7. Improperly prepared or incomplete cut sheet book may be returned without comment and or rejected as noted.
- B. Provide Shop Drawings and Foodservice Equipment Contractor Rough-In Drawings prepared by persons highly skilled in preparation and presentation of architectural and engineering type drawings, charts, schedules and other related graphic illustrations and representations. Include plans, elevations, sections, roughing-in dimensions, fabrication details, utility service requirements, and attachments to other work. The shop details, rough-in drawings, and any other submittals for this section are to be submitted at the same time in a single package. Partial submittals will be held without action until the remainder of the submittals have been received. The consultant reserves the right to withhold action on submittals requiring cross-coordination with other submittal items until related submittals are received. If after 10 days there is no direction given, the Architect will be contacted for return instructions.
  - 1. Shop Details: Assemble and transmit one digital original scaled set of drawings of all fabricated equipment at minimum 3/4" = 1'-0" scale. Include with all custom fabrication drawings dimensions, fabrication methods, materials, thickness, details of construction, installation, method of field joints noted, and a full Bill of Materials (BOM). Shop details must indicate reinforcements, methods of anchorage and quality of finishing. Digital original drawing set will be reviewed, marked, stamped with required action noted and returned for appropriate action and copying for distribution. Contractor shall verify all field dimensions and incorporate them into shop drawings. Shop drawings must be project specific
  - 2. Rough-in Drawings: Assemble and transmit one digital original scaled set of drawings scaled of at minimum of 1/4" = 1'-0", and shall show every piece of equipment, all dimensions for rough-in points for electrical, plumbing, steam, exhaust, gas, thermofluid, refrigeration, wash down hoods, as well as concrete curbs, sleeves, supports, etc. and all core drilling needed. The vellums will be reviewed, marked, stamped with required action noted and returned for appropriate action and copying for distribution.
  - 3. One digital original drawing set will be reviewed, marked, stamped with required action noted and returned for appropriate action and copying for distribution.
  - 4. Record drawings, if required by the owner, will be prepared in Autocad Version 2004 or as required within 10 working days of the final punch. Drawings will be submitted electronically to the consultant for inclusion in the record drawing set not later than 15 working days from the final punch date
  - 5. Equipment drawings are definitive only and shall not be used as construction documents or shop details

- C. Allow sufficient time for review so that the installation will not be delayed as a result of the time required to process submittals, including time for re-submittals.
  - 1. Within 15 working days of award of contract, submittals are required to be submitted.
  - 2. Allow 15 working days for initial review. Allow additional time if processing requires additional submittal material for coordination (incomplete submittals). Consultant will advise the Architect in a timely manner when additional time is necessary to process submittals, including the reason for the delay.
  - 3. Allow 15 working days for initial review. Allow additional time if processing requires additional submittal material for coordination (incomplete submittals). Consultant will advise the Architect in a timely manner when additional time is necessary to process submittals, including the reason for the delay.
  - 4. Intermediate submittals are processed on the same time basis as the initial submittal.
  - 5. Allow 10 days for reproduction of submittal materials.
  - 6. No extension of Contract Time will be allowed because of failure of the Foodservice Equipment Contractor to transmit submittals complete and on time in order for the Architect and Consultant to properly process submittals.
- D. Coordination Drawings: For food service facilities.
  - 1. Indicate locations of food service equipment and connections to utilities.
  - 2. Key equipment using same designations as indicated on Drawings.
  - 3. Include plans and elevations; clearance requirements for equipment access and maintenance; wall backing, details of support for equipment; and utility service characteristics.
  - 4. Include details of seismic bracing for equipment as required by local authority.
- E. Samples for Initial Selection: For units with factory-applied color finishes.
- F. Samples for Verification: For each factory-applied color finish required, in manufacturer's standard sizes.
- G. Operation and Maintenance Data: For food service equipment to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 include the following:
  - 1. Within ten (10) working days of Final Punch, Furnish, and deliver to the General Contractor, eight (8) service/parts and maintenance manuals for all equipment supplied as part of this contract. The General Contractor will route one (1) copy to the Consultant for review. This copy will be retuned with comments as necessary:
  - 2. Product Schedule: For each food service equipment item, include the following:
    - a. Designation indicated on Drawings.
      - b. Manufacturer's name and Model number.
      - c. Prepare a list of service agencies authorized by each manufacturer to service its equipment. Include within this listing the name of the person to contact and a telephone number for reference purposes. One copy of the Service Agency List will be included in each manual.
- H. Warranty: Special warranty specified in this Section.

# 1.04 QUALITY ASSURANCE

- A. NSF Standards: Provide equipment that bears NSF Certification Mark or UL Classification Mark, permanently affixed to the device or equipment, certifying compliance with applicable NSF/ANSI standards.
- BISSC Standards: Provide bakery equipment that complies with BISSC's "Sanitation Standards for the Design and Construction of Bakery Equipment and Machinery."
   Provide BISSC-certified equipment.
- C. UL Certification: Provide electric and fuel-burning equipment and components that are evaluated by UL for fire, electric shock, and casualty hazards according to applicable safety standards and that are UL certified for compliance and labeled for intended use.
- D. Steam Equipment: Provide steam-generating and direct-steam heating equipment that is fabricated and labeled to comply with ASME Boiler and Pressure Vessel Code.
- E. Check and confirm that drawings and specifications meet all Federal, State and local government body regulations. The drawings and specifications govern wherever they have larger sizes or higher standards than required by such regulations. Applicable regulations will govern when they are more restrictive or require higher standards than requested by the Contract Documents. All costs for compliance with said regulations shall be borne by the Foodservice Equipment Contractor regardless of what is contained in the Contract Documents
- F. Subway grating when used on floor troughs must meet CBC (California Building Code) in such a way as to be flush with surrounding floor finish to avoid a trip hazard and grating spacing does not allow wheel chair or walking crutch interference catch points, to comply with all ADA. and handicap access requirements.
- G. Regulatory Requirements: Install equipment to comply with the following:
  - 1. ASHRAE 15, "Safety Code for Mechanical Refrigeration."
  - 2. NFPA 54, "National Fuel Gas Code." NFPA 54, "National Fuel Gas Code."
  - 3. NFPA 70, "National Electrical Code.
  - 4. NFPA 96, "Ventilation Control and Fire Protection of Commercial Cooking Operations. NFPA 96, "Ventilation Control and Fire Protection of Commercial Cooking Operations.
  - 5. U.S. Public Health Service
  - 6. Local Health Department
  - 7. O.S.H.A
  - 8. National Sanitation Foundation (N.S.F.)
  - 9. A.G.A
  - 10. A.S.M.E.
  - 11. A.S.T.M.
  - 12. ADA (CFR Part 36)
  - 13. Any other jurisdictional agency not listed.
- H. Seismic Restraints: Comply with SMACNA's "Kitchen Ventilation Systems and Food Service Equipment Fabrication and Installation Guidelines," Appendix A, "Seismic Restraint Details," unless otherwise indicated.
  - 1. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

# 1.05 PROJECT CONDITIONS

- A. Field Measurements: Indicate measurements on Coordination Drawings.
- B. Foodservice Equipment Contractor will verify all building conditions and coordinate with the General Contractor proper access of large equipment to the building prior to close of

bidding. Costs for any specific items or equipment required for the movement of large, heavy or bulky equipment including rigging, cartage, etc. is solely the responsibility of the Foodservice Equipment Contractor

# 1.06 COORDINATION

- A. Coordinate food service equipment layout and installation with other work, including lighting fixtures, HVAC equipment, and fire-suppression system components.
- B. Coordinate location and requirements of utility service connections.
- C. Coordinate size, location, and requirements of the following:
  - 1. Overhead equipment supports.
  - 2. Equipment bases.
  - 3. Floor depressions.
  - 4. Insulated floors.
  - 5. Floor areas with positive slopes to drains.
  - 6. Floor sinks and drains serving food service equipment.
  - 7. Roof curbs, equipment supports, and penetrations.

### 1.07 WARRANTIES:

- A. Minimum Warranty Period for all food service equipment will be parts and labor for one (1) year after substantial completion. All repairs and replacements will be made as required without charge to the owner within the warranty period.
- B. Refrigeration Compressor Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace compressors that fail in materials or workmanship within specified warranty period.
  - 1. Refrigeration systems shall include start-up and one (1) year parts and labor warranty as stated herein plus an additional four (4) year warranty on all refrigeration compressors. This includes compressors for refrigerators, ice cream cabinets, icemakers, freezers, dispensers, and all other refrigerated items.
  - 2. Failure includes, but is not limited to, inability to maintain set temperature.

# PART 2 PRODUCTS

# 2.01 MANUFACTURERS

Α. Supplemental to the base bid for the prime equipment as specified, the Contractor may propose substitution (alternate) equipment other than that specified. The Contractor must clearly and separately state that they are offering an alternate. The Contractor shall submit a letter of explanation addressing the advantages of substitution for each piece of equipment to be substituted not less than 10 working days prior to close of bidding, one copy of an original manufacturer's cut sheet, complete illustrations, specifications, capacities, and utilities, as well as all applicable operational data for all proposed alternates as well as applicable price differences. It is the Contractor's responsibility to prove that the item or items submitted as alternates are equal to the prime specified items. The Owner with counsel from the Food Service Consultant will be the final determining authority as to acceptability or equality of alternates. Items of standard equipment must be the latest Model and new at time of delivery. Approval prior to the bid date to submit alternates is not required. At a time requested in writing by the Owner and/or the Food service Consultant, the Contractor will be responsible for determining all relative costs associated with the use of alternate equipment. The net savings (gross food service equipment price deduct less base building/engineering

modifications) resulting from the use of alternate equipment will be a factor in the evaluation of the acceptability of the alternates. Upon approval, a list of approved alternates, not requiring further approval, will be published and distributed to all bidders at least five (5) days prior to close of bidding. It is understood that the alternate equipment will be provided 'same-as' that originally specified

- B. The base bid shall include all prime equipment specified. Including specific manufacturer, Model number, size, utilities requirements, capacities, etc., as well as options and accessories.
- C. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
  - 2. Products: Subject to compliance with requirements, provide one of the products specified.
  - 3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
  - 4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
  - 5. Basis-of-Design Product: The design for food service equipment item is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

# 2.02 FABRICATED EQUIPMENT

- A. Materials:
  - 1. Stainless Steel: ASTM A 666. Stainless Steel: Stainless steel shall be of U.S. Standard gauges as indicated, but not less than 20 gauge, Type 304 with No. 4 finish.
  - 2. Galvanized Steel: ASTM A 653/A 653M. Galvanized Steel: Galvanized Steel shall be of 14 gauge or as otherwise indicated on drawings or specifications and shall be hot dipped -galvanized. Galvanized steel may be used in all non-exposed areas, areas with no contact with food or serving items and in framework. When used in framework, galvanized steel shall be of welded construction (welding is to be done before galvanizing). Use of galvanized steel will be subject to final approval during submittal check. K.E.C. fabrication drawings will clearly identify location(s) of all galvanized components.
  - 3. Insulation Materials: For normal temperature applications, such as custom fabricated under-counter refrigerators, use extruded polystyrene material 2 in. (50 mm) thick, bonded at all joints
  - 4. For low temperature applications, such as ice bins, cold pans, or custom fabricated under counter freezers, use urethane, rigid foam board or foamed-in-place, not less than 2 in. (50 mm) thick, except that vertical surfaces of cold pans and ice bins may be 1 in. (25 mm) thick. Bond insulation at joints to prevent condensation on exterior
  - 5. At counter tops subject to heat from cooking equipment and/or refrigeration compressors, use 1 in. (25 mm) thick Manville Martinite 36, or equal, to insulate underside of top. Also add Martinite material between freezer or refrigerator and 14 gauge (1.98 mm) stainless steel top
  - 6. Fiberglass insulation materials shall not be used. Insulation shall be bonded to all surfaces.

- B. Miscellaneous Metals:
  - 1. Foodservice Equipment Contractor will provide and install 22 gauge stainless steel wall flashing from the top of floor cove base to under the lowest point of the exhaust hood(s). Flashing will extend the full width of the exhaust hood. 22ga stainless steel wall flashing will be installed from the top of the backsplash to the base of wall shelves at all sinks and work tables with sinks unless otherwise stated. Corner Guards (14ga Stainless Steel, 48" high, 4" x 4", broke at 90°, with a 5° return brake) will be installed at all outside corners of the food service areas. 90° brake angle will be adjusted to match the actual angle of the walls. Base of the corner guards will be at the top of the floor cove base. K.E.C. will provide and install all necessary trim panels and closures, including cosmetic coverings. Equipment closures will match the individual equipment finishes

# C. General requirements for fabricated equipment:

- 1. Fabrication methods shall conform to all generally accepted conventions and requirements of the food service industry and shall meet or exceed the latest National Sanitation Foundation standards including all revisions
- 2. Fabricated equipment will be manufactured to meet the intended needs of the final application. The Foodservice Equipment Contractor is responsible for reviewing the submittal drawings and monitoring the progress of the equipment during fabrication to insure that adequate oversight is maintained. Any potential variance from the design or intended purpose must be reported to the General Contractor immediately. The Food service Contractor is specifically charged with providing a fully functional, maintainable, and purpose compliant device that meets the expectations of the owner
- 3. Fabricated equipment approved as an alternate to specified factory manufactured will be constructed to match exactly the prime specified equipment
- 4. Metal tops to be one-piece 14 gauge stainless steel welded construction or as indicated on drawings or specifications, including field joints. Tops to be secured to a full perimeter galvanized steel channel frames except at wood top tables, drain boards and dish table where channel frames shall be stainless steel and cross braced not farther than 30 in. (760 mm) on center. Fasten top with stud bolts or tack welds. Coat underside of tops with a minimum 1/16 in. (1.6 mm) thick approved hard-drying, sound-deadening, mastic material. Apply all coatings by spreading after top has been secured to frame, such that top and frame are covered and sealed. Table tops must not deflect or distort when fully loaded
- Fabricate bases from not less than 18 gauge (1.27 mm) steel reinforced by forming metal ends and shelves. Partitions to be constructed of stainless steel. The ends and vertical partitions can be of single wall construction, with a 2 in. (50 mm) face partitions and sides shall be welded at intersections and be flush with the bottom edge of the bottom shelf
- 6. Unexposed cabinet backs and structural members will be stainless steel
- 7. Legs and cross rails to be of 1 5/8 in. diameter (941 mm), 16 gauge (1.59 mm) seamless stainless steel tubing. All cross rails to be continuously welded, ground and polished. Tack welds or other methods of connection are not acceptable. Bottoms of legs to be wedged inward and fitted with a stainless steel bullet-type foot with not less than 2 in. adjustment. Freestanding legs are to be pegged to floor with 1/4 in. (6 mm) diameter stainless steel rods
- 8. Stainless steel gussets shall not be less than 3 in. (76 mm) diameter and 3/4 in. (95 mm) long. Outer shell to be 16 gauge (1.59 mm) stainless steel reinforced

with 12 gauge (2.78 mm) mild steel insert welded to interior of shell. Gusset to be large enough to accommodate a 1-5/8 in. (41 mm) tube and shall have an Allen screw fastener

- Low counter legs shall be constructed of stainless steel exterior and shall be 5 3/4 in. (146 mm) minimum height or 7 in. (178 mm) maximum height with 3 1/2 in. (89 mm) square plate with four countersunk holes, welded to the top for fastening
- 10. Adjustable feet to be constructed of stainless steel 1/2 in. (38 mm) diameter tapered at the bottom to 1 in. (25 mm) diameter, fitted with a 3/4 in. (19 mm) cold-rolled rod threaded for minimum of 1/2 in. (38 mm) for fitting into a threaded plug welded to leg. A push-in foot is not acceptable. Tables with utilities will have flanged feet and will be securely bolted to the floor with stainless steel fasteners as required by local code
- 11. When legs are fastened to equipment, the following methods must be used
  - a. Sinks: Gussets shall be welded to triangular stainless steel plates, which in turn shall be welded to the underside of sink
  - b. Metal Top Table or Dish table: Gussets shall be welded to 14 gauge or heavier channel reinforcing.
  - c. Wood Top: Gusset shall be welded to a stainless steel channel of not less than 14 gauge stainless steel (1.98 mm), secured to the top with screws through slotted holes
- 12. Shelves:
  - a. When shelves are part of the fixture, the following must take place
  - b. Open base type shelf shall be notched around the leg and continuously welded to the leg
  - c. Cabinet base type shelf shall be turned-up 2" on the back side with a minimum of 1/4 in. (6 mm) radius to insure a tight fit to enclosure panels
- 13. Wall mounted shelves:
  - a. The F.E.C. will insure and obtain written verification that the General Contractor provides and installs wall backing of sufficient size and strength to support the intended fixture when fully loaded or at full capacity. F.E.C. will also provide a separate dimensioned drawing for approval that outlines the location of all wall backing required and the intended material to be used.
- 14. Sinks, Steam Tables, and Bain Maries:
  - a. When multiple compartments are part of the design, they shall be continuous on the exterior without applied facing strips or panels. Bottoms of each compartment to be creased to ensure complete drainage to waste opening
  - b. Partitions between compartments to be double thickness, continuous and welded
  - c. Where sink bowls are exposed, the exterior shall be polished to a number 4 finish
  - Faucets will be by Fisher Mfg. Co. or equal by Standard Keil, T&S or Chicago shipped loose for installation by the G.C. of the Plumbing Contractor. Janitors Sink Service Faucet - 8253. Pot Sinks - 5414, Pre-Rinse - 13382, 1/2" Faucet - 13250, Pot Sinks - 5414, Rotary Waste - 28940, Basket Waste - 30376, Bain Marie - 1731-1 Left, unless otherwise noted.
  - e. Water stand Bain maries shall be fitted with Fisher 28940 rotary waste with flat strainer, connected overflow and adapter to connect to 1-1/2 in. (38 mm) drain line.

- f. Furnish faucets for all sinks, Bain maries, water stations and other fixtures per 'D & E' above. If not otherwise specified, all faucets will be backsplash mounted
- g. Provide vacuum breakers on equipment requiring them as furnished under this contract in accordance with governing codes.
- 15. Refrigeration Compressors and Evaporators:
  - a. All Walk-In refrigeration condensing units and evaporator coil assemblies shall include pre-wiring, pre-piping, crankcase regulator, head pressure regulator, factory-installed suction line accumulator, phased loss protection (not needed with RDT package) interconnecting refrigerant lines, five year warranty, main fuse disconnect, structural steel frame and weather-proof carbon steel body panel with epoxy paint finish, and refrigerant detective alarm (see Thermalrite spec).

# 2.03 BY PURVEYOR, BY OPERATOR, OR EXISTING EQUIPMENT

- A. Any and all food service equipment and equipment systems noted as "by owner", "by purveyor", "by operator" or "existing" in the food service construction documents are presented *for reference only*. These representations must be verified in writing by the Foodservice Equipment Contractor, Owner, Operator, and/or General Contractor prior to the release of "for construction" documentation. It will be the general contractor's responsibility to further verify and coordinate all necessary information pertaining to this equipment or systems making up, or relating to, this equipment including, but not limited to, local health department regulations, local sanitation code requirements, mechanical, structural, plumbing and electrical requirements prior to commencement of construction. Consultant or Architect take no responsibility for design, intent, function, performance, utility requirements, or code compliance of non-specified equipment.
- B. Equipment listed as 'Existing' and identified for re-use will be removed from current location, thoroughly cleaned (steam cleaning preferred), refinished (including, but not limited to polishing and painting), lubricated, adjusted, functionally tested, and all knobs, handles, and fixtures replaced. Equipment will have the appearance of extensive reconditioning, and be ready to be placed into service.

# 2.04 MISCELLANEOUS MATERIALS

- A. Installation Accessories, General: NSF certified for end-use application indicated.
- B. Elastomeric Joint Sealant: ASTM C 920; Type S (single component), Grade NS (nonsag), Class 25, Use NT (non-traffic) related to exposure, and Use M, G, A, or O as applicable to joint substrates indicated.
  - 1. Public Health and Safety Requirements:
    - a. Sealant is certified for compliance with NSF standards for end-use application indicated.
    - b. Washed and cured sealant complies with the FDA's regulations for use in areas that come in contact with food.
    - c. Cylindrical Sealant Backing: ASTM C 1330, Type C, closed-cell polyethylene, in diameter larger than joint width.
  - 2. Trimming and sealing of equipment:
    - a. Any space between units to walls, ceilings, floors and adjoining non-portable units shall be completely sealed against entrance of food particles or vermin by means of trim strips, welding, soldering, or commercial joint material suitable to the nature of the equipment and acceptable to Architect.

# 2.05 OTHER CUSTOM FABRICATED COMPONENTS

- A. Casters: Shall be heavy-duty type, ball-bearing, solid or disc wheel with non-marking greaseproof rubber, neoprene or polyurethane tires as specified.
- B. Wheels shall be 5 in. (127 mm) diameter or as specified, minimum width of tread 2 1/2 in. (30 mm), with a minimum capacity per caster of 250 lbs. (113.4 kg), unless otherwise specified.
- C. Solid material wheels shall be provided with stainless steel rotating wheel guards.
- D. Shall be sanitary, have sealed wheel and swivel bearings and polished plate finish (per N.S.F.-7).
- E. Doors: Metal doors shall be double-cased stainless steel. Outer pan shall be 18 gauge (1.27 mm) stainless steel with corners welded, ground smooth, and polished. Inner pan shall be 20 gauge (.95 mm) stainless steel fitted tightly into outer pan with a sound-deadening material such as Celotex or extruded polystyrene used as a core. The two pans shall be tack-welded together and joints solder-filled. Doors shall be finished approximately 3/4 in. (19 mm) thick, and be fitted with flush recessed type stainless steel door pulls.
- F. Sliding doors shall be self-closing, mounted on large, quiet ball-bearing rollers in 14 gauge (1.98 mm) stainless steel overhead tracks and be removable without the use of tools. Bottom of cabinet to have stainless steel guide-pins and not channel tracks for doors.
- G. Wood doors to be custom fabricated as detailed. All sides and edges shall be laminated.
- H. Hinged doors to be mounted on heavy-duty N.S.F. approved hinges, Model #2970-1010-1250 by Standard Keil or as noted on plans or specifications.
- I. Hardware: Shall be solid, heavy-duty type.
- J. Identify manufacturer's name and number so that broken or worn parts may be replaced.
- K. Submit samples for approval, when requested.
- L. Pulls shall be Standard Keil Hardware, or approved equal as follows: Door Pulls - Model No. 1263-1010-1283 Drawer Pulls - Model No. 1263-1012-1283
- M. Dipper wells: Dipper wells shown on drawings or specified shall be Fisher Mfg. Co. Model 3041 or equal by Standard Keil.
- N. Drawer Assemblies: Assemblies shall consist of removable drawer body mounted in a ball bearing slide assembly with padlock hasp.
- O. Slide assembly shall consist of one pair of stainless steel roller bearing, self-closing extension slides with side and back enclosure panels, front spacer angle, two drawer carrier angles secured to slides and stainless steel front.
- P. Slides are to be Model No. 3320-22 (250 lb. capacity fully extended) (113.4 kg) made by Grant Pulley and Hardware Co., or equal.
- Q. Drawer bodies for general storage shall be 20" X 20" (508 mm X 508 mm) or as specified with Royalite containers as manufactured by United States Rubber Co.
- R. Drawers intended shall hold food products to be removable type with 12" x 20" (305 mm X 508 mm) stainless steel assembly.
- S. Drawer fronts shall be double cased, 3/4 in. (19 mm) thick, with 18 gauge (1.27 mm) stainless steel welded and polished front pan. Stainless steel back pan is shall be tightly fitted and tack welded. Sound deaden with rigid insulation.
- T. Provide all drawers with replaceable soft neoprene bumpers or, for refrigerated drawers, a full perimeter soft gasket.

# 2.06 CUSTOM FABRICATED WORKMANSHIP

- A. Items of specialty custom fabricated equipment must be custom fabricated by an acceptable manufacturer, who is N.S.F. approved and custom fabricated in an approved manner to the complete and final satisfaction of the Contractor.t
- B. Welding and Soldering: Materials 18 gauge (1.27 mm) or heavier, shall be welded.
- C. Seams and joints shall be shop-welded or soldered as the nature of the material will require.
- D. Welds shall be ground smooth and polished to match original finish.
- E. Where galvanizing has been burned off, the weld shall be cleaned and touched up with high-grade aluminum paint.
- F. Fasteners and Joints: The following will not be accepted: Exposed screw or bolt heads. Rivets.
  Butt joints made by riveting straps under seams and then filled with solder. All fasteners exposed to moisture will be stainless steel.
- G. Rolled Edges: Rolled edges to be as detailed, with corners bull nosed, ground and polished.
- H. Coved Corners: All stainless steel food service equipment shall have 3/4 in. (15 mm) or larger radius coves in all horizontal and vertical corners and intersections per N.S.F-7. Standards.
- I. Closures: Where ends of fixtures, backsplashes, shelves, etc. are open, fill by forming the metal, or weld sections, if necessary, to close entire opening flush to walls or adjoining fixtures.
- J. Fabricated equipment having a specified manufacturer, if fabricated by another manufacturer; It shall be specifically understood that all standard accessories, construction details, and features, whether stated or not, will be met, and/or, provided by the current manufacturer.
- K. All shelf, counter, or other penetrations will have properly sized grommets installed and secured to prevent accidental removal.

# 2.07 OPERATION REQUIREMENTS

- A. Insure quiet operation of food service and related equipment. Provide sound deadening on all tables, counters, under shelves, sinks and drain boards.
- B. Insure bumper gaskets, stops, and any other protection is installed on all custom fabricated equipment as needed.

# 2.08 CONNECTION TERMINALS

A. All custom fabricated equipment shall be provided with standard connection terminals to allow other contractors to make final connections on job site.

# 2.09 EXHAUST HOODS, WALK-IN COOLERS AND DISHMACHINES

- A. Verify size and location of all connections required before fabrication.
- B. Check job site prior to installation of walk-in coolers to verify proper dimensions and for required trim.
- C. Provide all stainless steel duct connections and collars.
- D. 22 Gauge Stainless Steel Wall Flashing is required from the lowest point of the Exhaust Hood to the top of the cove base, and full width of the hood. All seams and edges will be fully finished. Overlap seams or raw edges are not acceptable.

E. Fire dampers, if required, are to be provided by the F.E.C. and installed by the Mechanical Contractor, and subject to the requirements of prevailing local codes.

# 2.010 INSERT PANS

- A. All cut-outs, openings, drawers, and equipment specified or detailed to hold stainless steel insert pans shall be provided with a full complement of pans as follows:
- B. One (1) stainless steel, 20 gauge (.95 mm) minimum, solid stainless steel insert pan for each space, sized per plans, details, and specifications.
- C. Where pan sizes are not indicated in plans, details, or specifications, provide one full-size stainless steel pan to securely fit each opening.
- D. Provide a maximum depth pan to suit each application and space allocated for same.
- E. Provide 18 gauge (1.27 mm) removable stainless steel adapter bars where applicable.

# 2.011 TRAY SLIDES

- A. Verify the following before fabrication of counters with tray slides:
- B. Configuration of all corners, turns, and shape of tray slides for proper support and safe guidance of trays.
- C. Size and shape of tray to be used in operation.

# 2.012 ENCLOSURES

A. Provide and install enclosure panels secured or removable as specified for any item which houses equipment with movable parts, i.e. compressors, pumps, etc. Also, cover and provide protection for any exposed steam line or condensate line, which may be within reach of operating personnel.

# 2.013 DISPENSER (SELF-LEVELING)

A. Verify make of ware, their dimensions, and weight and submit to the dispenser manufacturer at earliest possible date so that springs may be properly calibrated.

# 2.014 WATER FILTER-PURIFIER

A. Furnish in-line water filter-purifiers to remove contaminants, minerals, taste, or odors from beverage system, coffee urns, and icemakers, and steamers, manufactured by Everpure or equal. Provide proper size filter - purifier for equipment being supplied. Locate to insure easy access for cartridge replacement.

# 2.015 ELECTRICAL WORK - GENERAL REQUIREMENTS

- A. Before ordering equipment, confirm with the Contractor, all pertinent electrical requirements such as actual voltages available, number of phases and number of wires in the system.
- B. Electrical work for custom fabricated equipment shall be completely wired by this Contractor to a junction or pull box, easily accessible, mounted on the equipment. Wiring shall be labeled for outlet or item served.
- C. Components and assemblies shall bear the U.L. label or be approved by the prevailing authority.

- D. Provide custom fabricated and standard refrigerated units with vapor tight receptacles, shatterproof lamps and automatic switches. All wiring to be concealed.
- E. Electrical Contractor shall provide all code conforming electrical receptacles serving applicable Section 11400 Food service Equipment.
- F. Electrical Contractor shall provide and install shunt trip breakers as required.
- G. Electrical Contractor shall provide and install spiral wrap heat tape at the rate of 6W per foot on condensate drain lines in all walk-in freezers.

# 2.016 INTERNAL WIRING OF FIXTURES AND EQUIPMENT

- A. Contractor shall be responsible for internal wiring of electrical devices, and shall build them into or form them as an integral part of the custom fabricated equipment items. Wiring to be placed in metal conduit to a pull box tagged for intended use. Check with the Contractor for color-coding of wiring.
- B. Each standard item shipped in sections shall be properly connected internally and verified.
- C. Provide dishwashers and conveyors internally wired to junction box or distribution panel as specified, including push button switches, motors, immersion heaters, solenoids, etc.
- D. Where light fixtures are specified or detailed as part of counters, cases or fixtures, light fixtures and lamps to be provided unless otherwise specified. If fluorescent light fixtures are specified, all ballasts shall be included.
- E. Wiring for built-in strip heaters or immersion-type elements shall be provided as follows:
- F. In heat zone, have U.L. approved insulation and not less than 300 volt rated with nickel wire.
- G. Connection wiring extended in raceway or conduit to junction or pull box shall not be less than 600 volt rated A.V.A. insulation covered wire, U.L. approved, or equal.
- H. Wiring for custom fabricated refrigerator and freezer cabinets shall be U.L. approved, insulated cable from exterior junction box to internal components within insulation, unless code requires metallic conduit:
- I. Conduit shall be Electrical Metallic Tubing, rigid or flexible (Greenfield). For freezer applications, Seal Tite Flex or approved equal shall be used.
- J. Internal wiring shall be U.L. approved rubber covered 600 volt rated conductor except door heaters, which shall be nichrome wire with silicone braided jacket having resistance of 10.4 watts per lineal foot.
- K. Convenience outlets, lighting receptacles (rubber or porcelain), and door switches shall be mounted in approved boxes. Convenience outlets for evaporators shall be twist-lock type. Solid connections as for freezer evaporators shall be made vapor tight.
- L. Exposed flexible steel conduit on kitchen equipment shall be neoprene jacketed "Seal-Tite" conduit equal to Anaconda type "UV" U.L. approved, complete with approved liquid-tight connectors on each end, designed to provide electrical grounding continuity.
- M. Exposed electrical conduit used in kitchen wet area applications, except for flexible connections, shall be rigid galvanized steel. Thin wall conduit (EMT) will not be permitted for wet areas. Exposed outlet boxes shall be liquid-tight with thread hubs.

# 2.017 CONVENIENCE AND POWER OUTLETS

- A. Make cut-outs and install appropriate boxes or outlets in custom fabricated fixtures complete with wiring conduit, outlet and cover plate.
- B. All outlets and plugs shall conform to NEMA standards. Convenience (and all 120V outlets) will be NEMA 5-20R, horizontally mounted.

C. All electrical outlets and devices shall be first quality "Specification Grade."

# 2.018 PLUGS AND CORDS

A. Where cords and plugs are used, they must comply with National Electrical Manufacturer's Association (NEMA.) requirements.

#### 2.019 HEATING EQUIPMENT

- A. Electric and heating equipment to be installed so as shall be readily cleanable or easily removable for cleaning.
- B. Steam-heated custom fabricated equipment shall be of self-contained assembly complete with control valves located in an accessible position.

### 2.020 STARTERS, SWITCHES AND CONTROLS

- A. Furnish all starters, motor controls, remote controls and transformers as required.
- B. Locate all switches out of heat zone.
- C. All starters, switches and controls shall have white on black phenolic plastic identification plates with stainless steel screws conspicuously located on adjacent surfaces.

## 2.021 REFRIGERATION

A. Compressors and related components must be fully accessible for service and maintenance.

## 2.022 COLD PANS

A. Ice pans, refrigerated pans and cabinets to be provided with breaker strips where adjoining top or cabinet face materials, to prevent transfer of cold.

# 2.023 VENTILATION OF REFRIGERATED EQUIPMENT

- A. Adequate air supply and exhaust shall be provided for all self-contained or remote refrigeration condensing units, both custom fabricated and standard, as required for proper operation.
- B. If additional ventilation is required to ensure correct operating temperatures, so state in a letter to the Contractor for evaluation and decision before purchase/fabrication.

# 2.024 COMPONENTS

- A. Coils: Coils for standard and custom fabricated refrigerators to have vinyl plastic coatings, stainless steel housings and shall be installed in such a manner as to be replaceable.
- B. Expansion Valves: Standard reach-in refrigerators and freezers, for remote refrigeration systems, shall be complete with thermostatic expansion valves at the evaporator.
- C. Thermometers: Refrigerated compartments, custom fabricated and standard, shall be fitted with flush digital type thermometers with chrome-plated bezels. Thermometers to be adjustable and shall be calibrated after installation. Thermometers shall have an accuracy of + 2°F. (1°C). Walk-in boxes will have digital alarms as noted in itemized specifications.

- D. Hardware: Refrigerator hardware for standard and custom fabricated refrigerator compartments shall be solid, heavy-duty components. Hinges must be self-closing. Latches shall be magnetic edge mount-type unless specified or detailed otherwise.
- E. Locks: Doors and drawers for reach-in refrigerated compartments, both custom fabricated and standard, to be fitted with cylinder locking type latches, and provided with master keys.

# 2.025 MANUFACTURERS' ITEMIZED EQUIPMENT

- A. The following equipment is to be provided with all necessary components and accessories necessary for operation unless otherwise stated. This includes, but is not limited to; Hoses, disconnects, cords, plugs, adapters, regulators, back flow prevention devices, filters, isolation mounts, seals, closures, fillers, or restraints.
- B. All fasteners will be stainless steel, and fastener heads will be burr free.
- C. Each of the following items is to be complete with all factory accessories and options included in the specified Model as well as options, modifications, or accessories as listed. Each item will be of the size and shape as shown on the plan. Each will meet all applicable federal, state, and local code requirement(s).
- D. Equipment will be set in place per plan, and be fully operational unless otherwise directed.
- E. Equipment listed as existing will be thoroughly cleaned and inspected for functional serviceability. Defects will be noted and reported to owner for disposition.
- F. Equipment that attaches to walls, and has legs, will be attached to the wall under the backsplash with 'Z' clips every 32" or closer, and the legs pinned to the floor with stainless steel pins. All wall mounted equipment must have wall backing at the mounting points. Tables with utilities will have flanged feet bolted to the floor. The General Contractor will provide suitable wall backing located by the K.E.C. on the Building Conditions Plan Sheet(s).
- G. K.E.C. will provide and install wall bumpers wherever impact damage from mobile equipment is possible in addition to locations pre-designated on drawings. Wall bumpers will be by Boston Bumper.
- H. Gas connections will be 3/4" rear entry unless otherwise noted. Connection will be with a properly installed, correct length, (Dormont PN 1675KITCFS48 or equal) and an approved safety restraint cable.
- I. Shelving will be assembled first shelf ten inches (10") off floor, or as required by local code, with the balance of shelves equally spaced to top of post.
- J. All work must meet all applicable federal, state, and local laws, rules, regulations, and codes.
- K. Plate Lowerators, Tray Dispensers, and other dispensing type devices. F.E.C. must confirm container or tray sizes required by owner or operator.
- L. Roof curbs for refrigeration equipment are coordinated by the F.E.C., sized by the refrigeration supplier, and provided by the General Contractor. Roof curbs for refrigeration equipment are coordinated by the F.E.C., sized by the refrigeration supplier, and provided by the General Contractor.
- M. Gas supply cut-off valves (considered part of the fire suppression system)will be supplied by the F.E.C. and installed by the Mechanical Contractor. In every case the valves will be electrically tripped, and manually reset. Electric or automatic reset valves are not permitted. Gas supply cut-off valves (considered part of the fire suppression system) will be supplied by the F.E.C. and installed by the Mechanical Contractor. In every case the

valves will be electrically tripped, and manually reset. Electric or automatic reset valves are not permitted.

# PART 3 EXECUTION

# 3.01 INSTALLATION

- A. Install food service equipment level and plumb, according to manufacturer's written instructions.
  - 1. Connect equipment to utilities to be by building trades (not included in Section 114000 required work).
  - 2. Provide cutouts in equipment, neatly formed, where required to run service lines through equipment to make final connections. No cutting, notching, drilling, or altering of any kind will be done to the building by any Foodservice Equipment Contractor without first obtaining permission from the General Contractor.
  - 3. Do all cutting and fitting required on the equipment during installation and hook up. Should any repairs to food service equipment be required due to neglect of other contractors, all extra charges are to be approved and all repairs are to be noted in writing before work is performed, stipulating the price and to whom the extra expense is to be paid. In case the Contractor does not secure such extra order, the expense will be borne by him.
- B. Complete equipment assembly where field assembly is required.
  - 1. Provide closed butt and contact joints that do not require a filler.
  - 2. Grind field welds on stainless-steel equipment smooth, and polish to match adjacent finish.
  - 3. Ends of hollow sections shall be closed
- C. Install equipment with access and maintenance clearances that comply with manufacturer's written installation instructions and requirements of authorities having jurisdiction.
- D. Foodservice Equipment Contractor will verify all building conditions and coordinate with the General Contractor proper access of large equipment to the building prior to close of bidding. Costs for any specific items or equipment required for the movement of large, heavy or bulky equipment including rigging, cartage, etc. is solely the responsibility of the Foodservice Equipment Contractor
- E. Install cabinets and similar equipment on concrete or masonry bases in a bed of sealant as applicable.
- F. Install closure-trim strips and similar items requiring fasteners in a bed of sealant.
- G. Install joint sealant in joints between equipment and abutting surfaces with continuous joint backing, unless otherwise indicated. Produce airtight, watertight, vermin-proof, sanitary joints.
- H. Beverage system line runs of any kind and at any configuration, size, or length will be required to run through an authorized conduit system properly planned and executed through coordination with the appropriate divisions.
  - 1. The conduit system shall be furnished and installed by the electrical division if routed overhead in strict coordination with and through direction from the appropriate design team members and project participants be they the beverage system provider, the soft drink purveyor or others as assigned, the owner and operators of the facility. Beverage system for-construction drawings and specifications will be generated by the electrical division with approval required by the selected beverage system provider, soda system provider, and assigned

project engineers prior to commencement of construction. An authorized conduit system shall consist of 4", 6", 8" or 10" diameter (as required) corrosion-resistant aluminum tubing, conforming to ASTM-B313 and ANSI-H26 and H35.1. Conduit bends shall be long sweep type, of the same grade and coated in the same manner as the conduit lines. Minimum centerline radius of all bends shall be 24" for 4" O.D., 30" for 6" O.D., 32" for 8" O.D. and 32 for 10" O.D. No segmented elbows or short radius plumbing elbows shall be permitted. All joints shall be made with a liquid-tight mechanical bolted coupling system or liquid-tight slip coupling system. Edges of tubing and bends must be de-burred and smoothed prior to forming joints. Expansion sleeves with a moisture barrier must be provided where the conduit crosses building expansion joints, liquid-tight integrity maintained

# 3.02 CLEANING AND PROTECTING

- A. After completing installation of equipment, repair damaged finishes.
- B. Clean and adjust equipment as required to produce ready-for-use condition.
- C. Protect equipment from damage during remainder of the construction period.
  - 1. Contractor will be responsible during the progress of the work to protect equipment against theft and/or damage until final acceptance by the Owner. All items delivered to the job site prior to final acceptance shall be signed for, as delivered, by the Contractor. Responsibility for safekeeping will rest with the Contractor in coordination with the Contractor's requirements.
  - 2. Pre-fabricated walk-in boxes, on-site and installed in advance of the rest of the equipment, are not to be used for general storage by other trades and shall be locked by this contractor before leaving the site. It is the Contractor's responsibility to insure proper ventilation is provided during the cleaning and curing of masonry wearing floors inside the walk-in boxes. Damage and/or theft resulting from failure to secure boxes will be repaired/replaced at Foodservice Equipment Contractor's expense.

# 3.03 DEMONSTRATION

- A. Provide factory-trained engineers for start-up and demonstration of equipment. Demonstration shall be done in two stages: one for operation and the second to maintenance personnel, Refer to Division 01 for additional requirements.
- B. Return to the job site within ten (10) days after the demonstration for final adjustment and calibration of equipment.
- C. The Foodservice Equipment Contractor shall provide a trained and qualified Service Agency facility and personnel to be available within 24 hours after request by an authorized representative of the Owner to repair or replace defective equipment (as specified in section 11400) for the Warranty period without cost to the Owner's representative, including all costs such as labor, materials, parts, travel, travel time, lodging, out of pocket expenses, and other expenses, unless such service is required because of misuse, negligence, willful damage, improper maintenance or accident by other parties. Refer to other sections for further information regarding Warranty requirements.

# FOLLOWINS IS AN ITEMIZED LIST/DESCRIPTION OF SECTION 114000 EQQUIPMENT FOODSERVICE AREAS AS FOLLOWS:

# **RETAIL CAFÉ SERVING COUNTER & KITCHEN**

# ITEM NO. 1 - REFRIGERATED GRAB N GO CASE W/ AMBIENT CASE

STRUCTURAL CONCEPTS, Model: Reveal Series NR4851RRSV

(REFRIGERATED BELOW, AMBIENT ABOVE)

Components: Item to be complete with all standard factory features and accessories, including the following options and modifications:

- Equipped to match utility requirements as shown on FS Series drawings.
- 48" wide display case (refrigerated below and ambient case above).
- Includes LED top light.
- Equipped with fixed vertical glass, black front panel, upper rear clear glass sliding doors.
- Standard interior color finish (black powder coat).
- Exterior finish to be verified with Architect prior to ordering (assume powder coat standard finish for bid purposes).
- Refrigeration system with blue fin coated coil and including condensate pan
- Self-contained refrigeration with rear air intake with front air exhaust (must not be blocked).
- Standard locking casters supports (allows for moving for cleaning under unit).
- Power cord and plug set.

ITEM NO. 2 – FRONT COUNTER (BY GENERAL CONTRACTOR)

- 34" ADA counter top height is assumed.
- Millwork Contractor to coordinate drop-in equipment requirements with Foodservice Equipment Contractor.

# ITEM NO. 3 – POS STATION (BY OWNER)

## ITEM NO. 4 – KNOCK BOX

VOLLRATH, Model: E06064-KB

Components: Item to be complete with all standard factory features and accessories, including the following options and modifications:

- Equipped as a 22 gauge stainless steel removable 1/6 pan size unit.
- Includes rubber coated knock bar.
- Coordinate cut out size and installation requirements with Millwork Contractor.

ITEM NO. 5 – SHELF, RETAIL DISPLAY (BY GENERAL CONTRACTOR)

- Self-contained refrigeration for Item #1 Display Cases with rear air intake with front air exhaust (must not be blocked).
- Coordinate mounting methods for this item with Item #1 Display Cases

ITEM NO. 6 – AIR POT DISPLAY RACK (BY VENDOR) Similar to: BUNN, Model: 32125.0000 (AIR POTS) & 35728.0000 (RACK)

#### ITEM NO. 7 – WATER FILTER

EVERPURE (PENTAIR), Model: EV9272-00

- Sized for use with associated appliance.
- Interior cabinet mount bracket and hardware.
- As required by local code add a back flow preventer device to comply with local code.

# ITEM NO. 8 - SEMI AUTOMATIC ESPRESSO MACHINE

#### BUNN, Model: BW3-CTS

Components: Item to be complete with all standard factory features and accessories, including the following options and modifications:

- Equipped to match utility requirements as shown on FS Series drawings.
- Two-Step Model (automatic espresso + steam wand) with hot water dispenser wand automatically steams to proper milk temperature.
- Steams 1 liter of milk in under one minute.
- Equipped with two hoppers allow for choice of fresh espresso beans.
- Controls with easy-to-use touch screen.
- Exterior finish polished housing.
- Hopper capacity of 3.3 lbs.
- Equipped with dispense spout that adjusts from 3" to 6.8".
- With heated stainless steel brew chamber.
- Includes heavy duty grinder.
- Modular design of systems allows for easy maintenance.
- Cleaning system with reminder and lockout.
- With built-in troubleshooting menu.
- Power cord and plug set.

ITEM NO. 9 – DIGITAL BOARDS (BY OWNER).

### ITEM NO. 10 – SPARE NUMBER

### ITEM NO. 11 – UNDERCOUNTER REFRIGERATOR

TRUE, Model: TUC-48-HC

Components: Item to be complete with all standard factory features and accessories, including the following options and modifications:

- Equipped to match utility requirements as shown on FS Series drawings.
- Two door, 48" wide, self-contained refrigeration (front breathing) unit.
- Exterior finish to be stainless steel front, top, and sides with aluminum back panel.
- Interior finish to be insulated aluminum with stainless steel bottom and with pvc bottom/mid wire shelves.
- Self-closing doors with locks.
- Add 1-1/2" casters (for overall 31-7/8" height) to bit below 34" A.F.F ADA counter top). Coordinate with millwork details prior to ordering this unit.
- Power cord and plug set.

#### ITEM NO. 12 - BLENDER W/ SOUND ENCLOSURE

#### WARING, Model: MX1500XTXP

- Equipped to match utility requirements as shown on FS Series drawings.
- High power blender (heavy duty) unit.
- Includes 48oz. BPA Free co-polyester container
- Equipped with electronic membrane keypad, LCD display with blue backlight
- Controls including four (4) reprogrammable blending modes.
- With sound enclosure and one piece removable jar pad.
- 3.5 hp motor.
- Power cord and plug set.

# ITEM NO. 13 – UNDERCOUNTER ICE MACHINE

SCOTSMAN, Model: PRODIGY CU3030MA-1

Components: Item to be complete with all standard factory features and accessories, including the following options and modifications:

- Equipped to match utility requirements as shown on FS Series drawings.
- Undercounter ice maker with bin and cube style ice maker.
- 30" width unit.
- Self-contained, air cooled, condenser (front breathing).
- Production capacity up to 313 lb/24 hours at 70°/50° (224 lb AHRI certified at 90°/70°).
- 110 lb. bin storage capacity, medium cube size.
- With auto alert indicator lights and water sense adaptive purge control.
- Metallic finish body
- Add under mount floor mount kit such that overall height does not exceed 33-1/4" (to fit below 36" high counter top).
- Power cord and plug set.

### ITEM NO. 14 – WATER FILTER

### EVERPURE, Model: EV9324-01

Components: Item to be complete with all standard factory features and accessories, including the following options and modifications:

- Sized for use with associated appliance.
- Interior cabinet mount bracket and hardware.
- As required by local code add a back flow preventer device to comply with local code.

# ITEM NO. 15 – DROP IN DIPPER WELL

#### FISHER, Model: 3041

Components: Item to be complete with all standard factory features and accessories, including the following options and modifications:

- 6-7/8" diameter drop in unit.
- With stainless steel fill faucet and drain piece.
- Stainless steel well assembly finish.
- Includes removable inner shell for cleaning.
- Coordinate cut out size and installation fabricated counter top.

# ITEM NO. 16 – DUMP SINK WITH GLASS RINSER

#### RUVATI, Model: RVH8542

- Coordinate cut out size and installation requirements with #27 Counter top.
- 16 gauge type 304 stainless steel sink bowl.
- With built-in glass rinser and drying rack.
- Sink assembly includes basket strainer drain piece, mounting clips, flex water hose, sprayer assembly, drain cover, rinse grid, cutting boards, and drainer grate.
- Add splash mount faucet T&S Brass B-0231-12 (12" swing spout) swing faucet.
- Provide with wrist style blades at faucet.
- Add water restrictor device to output spigot to reduce gpm flow rate per local code.
- Coordinate cut out size (per cut out template) and installation requirements with Millwork Contractor.

# ITEM NO. 17 - WALL CABINETS (BY GENERAL CONTRACTOR)

- Contractor to coordinate cabinets with counter top equipment below as not to interfere with operation or placement of equipment.
- For Vendor provided coffee and beverage equipment, verify height restrictions and clearances prior to fabricating cabinets.

# ITEM NO. 18 - HOT, COLD, SPARKLING WATER DISPENSER SYSTEM

MARCO, Model: FRIIA HCS Plus 5002867US

Bundle includes Chiller/Carbonator, 8 liter Boiler Unit, & 3 button Faucet w/ drip pan

Components: Item to be complete with all standard factory features and accessories, including the following options and modifications:

- Equipped to match utility requirements as shown on FS Series drawings.
- Provide with all necessary connecting hardware for installation in the field.
- Bundle package includes 3B FONT 1000862 counter top mount 3 button faucet with drip pan. Coordinate counter top cut out requirements with #27 Counter
- Bundle package includes Chiller/Carbonator 1001861US water unit. Coordinate cabinet mounting requirements with #27 Counter.
- Bundle package includes MIX UC8 1000887US (8 liter) boiler unit for hat water. Coordinate cabinet mounting requirements with #27 Counter.
- Item #27 Counter cabinet to be constructed to provide adequate ventilation per manufacture requirements.
- Separate power cord and plug sets for carbonator and boiler units.

# ITEM NO. 19 – SPARE NUMBER

# ITEM NO. 20 – BEER KEGORATOR

# TRUE, Model: TDD-1-HC

Components: Item to be complete with all standard factory features and accessories, including the following options and modifications:

- Equipped to match utility requirements as shown on FS Series drawings.
- Overall cabinet size of 23-1/2" side.
- With stainless steel counter top.
- Includes door with lock
- With one column type beer faucet/tower and drip pan.
- Standard black vinyl exterior.
- Includes resilient non-marking castors.
- Self-contained R290 Hydrocarbon refrigeration system (air cooled).
- Upgrade to stainless steel interior with stainless steel floor.
- Equipped to hold at least one half keg plus CO2 tank (stored in interior cabinet). Verify with Owner and beer Vendor prior to ordering.
- CO2 tank and by Vendor including any necessary connection hardware.
- Power cord and plug set.

# ITEM NO. 21 – UNDERCOUNTER REFRIGERATOR

# TRUE, Model: TUC-24-HC

- Equipped to match utility requirements as shown on FS Series drawings.
- One door, 24" side, self-contained refrigeration (front breathing) unit.
- Exterior finish to be stainless steel front, top, and sides with aluminum back panel.

- Interior finish to be insulated aluminum with stainless steel bottom and with pvc bottom/mid wire shelves.
- Self-closing door with lock.
- Add 1-1/2" casters (for overall 31-7/8" height) to bit below 36" counter top).
- Power cord and plug set.

# ITEM NO. 22 – SOUP KETTLE

### VOLLRATH, Model: 72170 (7 QT.)

Components: Item to be complete with all standard factory features and accessories, including the following options and modifications:

- Equipped to match utility requirements as shown on FS Series drawings.
- Colonial style kettle, 7 quart capacity.
- Warmer unit with black finish merchandiser package
- Included with 7 quart, inset, cover with hinge, soup cards, and clip
- Unit size as 15-3/4" diameter x 11-1/2"H.
- Cast aluminum body with recessed controls and unbreakable legs
- 700w heater.
- Power cord and plug set.

### ITEM NO. 23 – 3 COMPARTMENT SINK

EAGLE, Model: SR14-16-9.5.3

Components: Item to be complete with all standard factory features and accessories, including the following options and modifications:

- Drop-in triple sink unit 21" deep (front to back) x 48" long (overall) x 9-1/2" (sink bowls).
- Includes one 4" O.C. deck mount with 12" swing faucet with removable three drain baskets.
- Sink bowls to be heavy 18 gauge type 304 stainless steel.
- Coordinate cut out and installation requirements with #27 Back Counter.
- Add three drain tail pieces.
- All other water and drain connections to water and floor sink by Plumbing Contractor.

# ITEM NO. 24 – COFFEE BREWER (BY VENDOR) FOR AIRPOTS

Similar to: BUNN, Model: 38700.0013 TWIN (INCLIUDE W/ 32125.0000 AIRPOTS)

# ITEM NO. 25 – SPARE NUMBER

#### ITEM NO. 26 - DROP IN HAND SINK

EAGLE, Model: HWB-T

Components: Item to be complete with all standard factory features and accessories, including the following options and modifications:

- Coordinate installation details with #27 Back Counter.
- Stainless steel, recessed design with built-in soap and towel dispenser
- T&S deck mount goose neck faucet with wrist blades and removable scrap basket.
- Add water restrictor device to faucet output spigot to reduce gpm flow rate as required by local codes or regulations.
- Water restrictor device shall a maximum flow rate of 1.8 gpm at 60 psi. Not to exceed 2.2 gpm flow rate allowed on a temporary basis but must default back to 1.8 gpm

#### ITEM NO. 27 – BACK COUNTER

EAGLE, Model: CB30SE-BS SERIES (SPEC FAB)

- Coordinate installation requirements with all related drop-in and built-in equipment.
- L-shaped size and configuration as shown on plan (174" +/- long x 148" +/- long x 30" wide x 36" high work top).
- Field verify dimension in relationship to drop in equipment, surrounding finished walls, and exact wall angle.
- 14 gauge type 304 stainless steel table top with 4-1/2" back splash when abutting walls.
- 18 gauge stainless steel cabinet base/body.
- 20 gauge stainless steel hinged doors at front face.
- 16 gauge stainless steel bottom.
- Add an adjustable 16 gauge mid shelf when possible.
- 6" stainless steel adjustable bullet legs.
- Provide shop drawing for approval prior to fabrication of this item.

# ITEM NO. 28 - RAPID COOK, VENTLESS

#### TURBO, Model: i3-9500-801 1 PHASE

Components: Item to be complete with all standard factory features and accessories, including the following options and modifications:

- Equipped to match utility requirements as shown on FS Series drawings.
- Two-tone type 304 stainless steel front, top and sides finish.
- With 304 stainless steel removable grease collection pan
- Oven includes: Ergonomic door handle, rubber seal for surface mounting on counter tops, and side hand grips for lifting (to make cleaning easier).
- Fully insulated cook chamber with top/bottom jet plates and removable rack.
- Equipped with integral recirculating catalytic converter for UL (KNLZ) listed ventless operation (no exhaust hood required).
- Vent catalyst included to further limit emissions
- Equipped with independently-controlled dual motors for vertically-recirculated air impingement.
- For microwave mode include a top-launched microwave system.
- Oven equipped with stirrer to help ensure even distribution of air and microwave with removable external air filtration.
- Controls with: Smart menu system capable of storing up to 200 recipes, flash software updates via smart card, single or multiple-temperature interface, smart voltage Sensor technology, built-in self-diagnostics for monitoring oven components and performance.
- Field-configurable for single or three phase operation.
- Includes standard warranty 1 year parts and labor.
- Accessories included are: Aluminum Paddle (NGC-1478), one bottle Oven Cleaner (103180), one bottle oven Guard (103181), two trigger sprayers (103182), and two PTFE Baskets (NGC-1331).
- Power cord and plug set.

#### ITEM NO. 29 – AIR POTS W/ RACK (BY VENDOR) Similar to: BUNN, Model: 32125.0000 (AIR POTS) & 35728.0000 (RACK)

#### ITEM NO. 30 – SPARE NUMBER

ITEM NO. 31 – WORK COUNTER W/ SINK EAGLE, Model: CB30SE-BS SERIES (SPEC FAB). Components: Item to be complete with all standard factory features and accessories, including the following options and modifications:

- L-shaped size and configuration as shown on plan (54" +/- long x 89" +/- long x 30" wide x 36" high work top).
- Field verify dimension in relationship to drop in sink, surrounding finished walls, and exact wall angle.
- 14 gauge type 304 stainless steel table top with 4-1/2" back splash when abutting walls.
- 18 gauge stainless steel cabinet base/body.
- 20 gauge stainless steel hinged doors at front face.
- 16 gauge stainless steel bottom.
- Add an adjustable 16 gauge mid shelf when possible.
- Stainless steel 16" wide x 21" front to back x 12" deep Integral sink.
- Sink fitted with T&S rotary waste valve similar to B-3940 with drain lever bracket.
- One T&S Brass B-0231-12 (12" swing spout) splash mount swing faucet.
- Provide with wrist style blades at faucet.
- 6" stainless steel adjustable bullet legs.
- Provide shop drawing for approval prior to fabrication of this item.

# ITEM NO. 32 - PREP REFRIGERATOR

# TRUE, Model: TFP-48-18M

Components: Item to be complete with all standard factory features and accessories, including the following options and modifications:

- Equipped to match utility requirements as shown on FS Series drawings.
- 48" wide, self-contained refrigeration (front breathing) unit.
- Two door unit, sandwich/Salad Unit, 34" work surface height.
- Hinged per plan view.
- Equipped with eighteen (18) 1/6 size (4"D) poly pans.
- Top with stainless steel insulated hinged removable cover.
- Includes removable 8" deep cutting board
- With four (4) PVC coated adjustable wire shelves.
- Stainless steel top, front and sides.
- Aluminum back, aluminum interior with stainless steel floor
- With resilient non-marking 2-1/2" castors.
- Add door locks.
- Add exterior digital thermometer.
- Power cord and plug set.

# ITEM NO. 33 – REACH IN REFRIGERATOR

# TRUE, Model: STG2R-2S-HC

- Equipped to match utility requirements as shown on FS Series drawings.
- Stainless steel exterior two door model.
- Aluminum sides.
- Aluminum interior back and sides with chrome wire adjustable shelving.
- Self-closing, full height stainless steel door(s) hinged per plan view with finger pulls
- Exterior digital temperature display with electronic control.
- Standard LED interior lighting.
- Door lock(s).
- Power cord and plug set.
- 5" resilient plate non-marking casters with front brakes.

# ITEM NO. 34 – REACH IN FREEZER

TRUE, Model: STG2F-2S-HC

Components: Item to be complete with all standard factory features and accessories, including the following options and modifications:

- Equipped to match utility requirements as shown on FS Series drawings.
- Stainless steel exterior two door model.
- Aluminum sides.
- Aluminum interior back and sides with chrome wire adjustable shelving.
- Self-closing, full height stainless steel door(s) hinged per plan view with finger pulls
- Exterior digital temperature display with electronic control.
- Standard LED interior lighting.
- Door lock(s).
- Power cord and plug set.
- 5" resilient plate non-marking casters with front brakes.

### ITEM NO. 35 – SPARE NUMBER

### ITEM NO. 36 - SHELVING, METAL WIRE (CHROME)

#### EAGLE, Model: S4-74-2448C

Components: Item to be complete with all standard factory features and accessories, including the following options and modifications:

- Final size and configuration to fit space and as shown on plan.
- Four 24" x 48" chrome wire shelves per shelving section.
- Four 74" high chrome finish posts per shelving section.

# ITEM NO. 37 – MOP SINK STORAGE CABINET

#### EAGLE, Model: F1916-VSCS

Components: Item to be complete with all standard factory features and accessories, including the following options and modifications:

- Equipped with mop rack/shelf (holds 2 mops).
- Includes standard hot/cold water service faucet.
- Depending on local code, add second utility faucet for purpose of mixing/diluting chemicals.
- Stainless steel cabinet body with 20 gauge double pan access doors.

#### ITEM NO. 38 - WALL CABINET (BY GENERAL CONTRACTOR)

• Contractor to coordinate cabinets with counter top equipment below as not to interfere with operation or placement of equipment.

#### ITEM NO. 39 – SPARE NUMBER

ITEM NO. 40 – SPARE NUMBER

ITEM NO. 41 – SHELVING, METAL WIRE (CHROME)

EAGLE, Model: S4-74-1842C

Components: Item to be complete with all standard factory features and accessories, including the following options and modifications:

- Final size and configuration to fit space and as shown on plan.
- Four 18" x 42" chrome wire shelves per shelving section.
- Four 74" high chrome finish posts per shelving section.

# ITEM NO. 42 – SHELVING, METAL WIRE (CHROME)

# EAGLE, Model: S4-74-1848C

Components: Item to be complete with all standard factory features and accessories, including the following options and modifications:

- Final size and configuration to fit space and as shown on plan.
- Four 18" x 48" chrome wire shelves per shelving section.
- Four 74" high chrome finish posts per shelving section.

# ITEM NO. 43 – SHELVING, METAL WIRE (CHROME)

EAGLE, Model: S4-74-1848C

Components: Item to be complete with all standard factory features and accessories, including the following options and modifications:

- Final size and configuration to fit space and as shown on plan.
- Four 18" x 48" chrome wire shelves per shelving section.
- Four 74" high chrome finish posts per shelving section.

ITEM NO. 44 thru 100 - SPARE NUMBERS

-END OF SECTION-

## SECTION 11 8129 FACILITY FALL PROTECTION

# PART 1 GENERAL

# 1.01 SECTION INCLUDES

- A. Roof anchors.
- B. Horizontal lifeline systems.

#### 1.02 RELATED REQUIREMENTS

- A. Section **<u>05 5213 Pipe and Tube Railings</u>**: Safety railings and gates.
- B. Section 07 5323 Ethylene-Propylenediene-Monomer (EPDM) Roofing

### 1.03 ABBREVIATIONS AND ACRONYMS

A. HLL: Horizontal Lifeline.

### 1.04 DEFINITIONS

- A. Anchorage: A secure connecting point or a terminating component of a fall protection system or rescue system capable of safely supporting the impact forces applied by a fall protection system or anchorage subsystem.
- B. Anchorage Connector: A component or subsystem that functions as an interface between the anchorage and a fall protection, work positioning, rope access, or rescue system for the purpose of coupling the system to the anchorage.
- C. Fall Arrest System: A system designed to stop you in the process of a fall, typically including an anchor point or series of anchor points, a safety lanyard or self-retracting lifeline, and a harness.
- D. Fall Restraint System: A system designed to keep you from getting close enough to the fall hazard to fall, typically including an anchor point or series of anchor points, a safety lanyard or self-retracting lifeline, and a harness.
- E. Fall Protection System: System can be either a fall arrest or a fall restraint system.
- F. Lifeline: A component of a fall protection system consisting of a flexible line designed to hang vertically, a vertical lifeline, or connecting to anchorages or anchorage connectors at both ends to span horizontally, a horizontal lifeline.

#### 1.05 REFERENCE STANDARDS

- A. 29 CFR 1910 Occupational Safety and Health Standards; current edition.
- B. 29 CFR 1910.140 Personal fall protection systems; Current Edition.
- C. 29 CFR 1926 U.S. Occupational Safety and Health Standards; current edition.
- D. 29 CFR 1926.502 Fall protection systems criteria and practices; Current Edition.
- E. ANSI/ASSP Z359.18 Safety Requirements for Anchorage Connectors for Active Fall Protection Systems; 2017, with Errata (2021).
- F. ASTM A6/A6M Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling; 2019.
- G. ASTM A36/A36M Standard Specification for Carbon Structural Steel; 2014.
- H. ASTM A123/A123M Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- I. ASTM A283/A283M Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2018.
- J. ASTM A1023/A1023M Standard Specification for Carbon Steel Wire Ropes for General Purposes; 2021.

K. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2014 (Amended 2015).

## 1.06 SUBMITTALS

- A. See Section **<u>01 3000 Administrative Requirements</u>** for submittal procedures.
- B. Product Data: Provide manufacturer's data sheets on each ladder safety system product to be used, including installation instructions.
- C. Product Data: Material, equipment, and fixture lists. Manufacturer's catalog data indicating the sizes, descriptions, capacities, test certifications, and other descriptive data showing in sufficient detail that product complies with contract requirements. Equipment and performance data including but not limited to lifeline anchors, safety tieback anchors, and lifeline cable.
- D. Shop Drawings: Installation details: plan showing locations and types of anchorage points for personal fall protection systems and building maintenance equipment.
  - 1. Detail mounting, securing, and flashing of roof-mounted items to roof structure. Indicate coordinating requirements with roof membrane system.
- E. Delegated Design Documents: Drawings and calculations<< <u>sealed by Designer</u>; ; or None - N/A>> for fall protection system, indicating compliance with performance requirements and design criteria.
- F. Manufacturer's Installation Instructions: Instructions indicating recommended method and sequence of installation for lifeline anchors, safety tieback anchors, energy-absorbing devices, and lifeline cable.
- G. Manufacturer's qualification statement.
- H. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated within the previous << <u>12 months</u>; or \_\_\_\_>>.
- I. Designer's qualification statement.
- J. Installer's qualification statement.
- K. Operation Data: Provide operating instructions and identify unit limitations.
- L. Maintenance Data: Include parts list and maintenance requirements for equipment.

#### 1.07 QUALITY ASSURANCE

- A. Designer Qualifications: Perform design under direct supervision of a Professional << <u>Structural</u>; or None N/A>> Engineer experienced in design of this work and licensed in the State in which the Project is located.
- B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least << <u>five</u>; or \_\_\_\_>> years of<< <u>documented</u>; \_\_\_\_; or None N/A>> experience.
- C. Installer Qualifications: Company specializing in performing work of type specified and with at least << <u>three</u>; or \_\_\_\_\_>> years of<< <u>documented</u>; \_\_\_\_; or None N/A>> experience<< and approved by manufacturer; or <u>None N/A</u>>>.

### 1.08 WARRANTY

A. See Section <u>01 7800 - Closeout Submittals</u> for additional warranty requirements.

# PART 2 PRODUCTS

#### 2.01 ROOF ANCHORS

- A. Manufacturers:
- B. Application:
  - 1. OSHA and ANSI one person PPE anchor.
- C. Description:

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- 1. Roof anchorage points for personal fall protection systems; used exclusively for employee fall protection and independent of any anchorage used to suspend employees or platforms on which employees work.
- Roof anchorage points for primary suspension lines for << <u>bosun's chairs</u>; <u>work cages</u>; <u>suspended platforms</u>; and \_\_\_\_>> used for window washing or facade access.
- D. Structural Performance: Provide safety tieback anchors capable of withstanding design loads as required by governing regulations and codes.
- E. Anchors:
- F. Anchor Installation:

# 2.02 HORIZONTAL LIFELINE SYSTEMS

- A. Manufacturers:
- B. Description: A system comprised of a flexible line such as wire rope or cable, with connectors at both ends to secure it horizontally between two anchorages or anchorage connectors.
- C. Structural Performance: Provide fall-arresting lifeline systems capable of withstanding design loads as required by governing regulations and codes.
- D. Design Criteria:
- E. Wire Rope: ASTM A1023/A1023M, << <u>7x7</u>; 7x19; or \_\_\_\_>><< <u>galvanized wire</u>; stainless steel wire; or \_\_\_\_\_>>, << <u>5/16 inch</u>; 3/8 inch; or \_\_\_\_\_ inch>> diameter.

### 2.03 MATERIALS - STEEL

- A. Structural Steel Sections: << <u>ASTM A36/A36M;</u> or \_\_\_\_>>.
- B. Steel Plates, Shapes, and Bars: ASTM A6/A6M or ASTM A283/A283M.

### 2.04 FABRICATION

A. Fabricate work true to dimension, square, plumb, level, and free from distortion or defects detrimental to appearance and performance.

#### 2.05 FINISHES

- A. Galvanizing: Hot-dip galvanize to minimum requirements of ASTM A123/A123M.
  - 1. Touch up abraded areas after fabrication using specified touch-up primer for galvanized surfaces.

# PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Examine area for compliance with requirements for installation tolerances and other conditions related to this work.
- B. Confirm that the ladder structure to which the ladder safety system is installed can withstand the loads applied by the system in the event of a fall.

#### 3.02 PREPARATION

A. Coordinate location of fall protection equipment indicated to be attached to structural substrate or surface of roofing system and provide anchoring devices with templates, diagrams, and installation instructions.

# 3.03 INSTALLATION

A. Install anchorage and fasteners in accordance with shop drawings and manufacturer's recommendations to obtain allowable working loads published in product literature and in accordance with this specification.

# 3.04 FIELD QUALITY CONTROL

A. See Section <u>01 4000 - Quality Requirements</u> for additional requirements.

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# 3.05 ADJUSTING

A. Adjust fall protection components to function smoothly and safely.

# 3.06 CLEANING

A. Clean exposed surfaces in accordance with fall protection system manufacturer's written instructions.

## 3.07 CLOSEOUT ACTIVITIES

Demonstrate proper operation of << <u>roof safety anchors</u>; davit arms; davit bases; or \_\_\_\_\_\_\_>> to Owner's designated representative.

# 3.08 MAINTENANCE

A. See Section <u>01 7000 - Execution and Closeout Requirements</u> for additional requirements relating to maintenance service.

# END OF SECTION 11 8129
### SECTION 12 2400 WINDOW SHADES - MECHOSHADE SYSTEMS

### PART 1 GENERAL

### **1.01 SECTION INCLUDES**

- A. Manual roller shades and accessories.
- B. Motorized roller shades and accessories.
- C. Motor controls, interfaces, and accessories.

### 1.02 REFERENCE STANDARDS

- A. NFPA 70 National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- B. UL 325 Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems; Current Edition, Including All Revisions.
- C. WCMA A100.1 Safety of Window Covering Products; 2018.

## 1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Where motorized shades are to be controlled by control systems provided under other sections, coordinate the work with other trades to provide compatible products.
  - 2. Coordinate the work with other trades to provide rough-in of electrical wiring as required for installation of hardwired motorized shades.
- B. Sequencing:
  - 1. Do not fabricate shades until field dimensions for each opening have been taken with finished conditions in place. "Hold to" dimensions are not acceptable.
  - 2. Do not install shades until final surface finishes and painting are complete.

#### 1.04 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product to be used including materials, finishes, fabrication details, dimensions, profiles, mounting requirements, and accessories.
  - 1. Motorized Shades: Include power requirements and standard wiring diagrams solely for the specified products.
- C. Shop Drawings: Include << shade schedule indicating size, location and keys to details; head, jamb and sill details; mounting dimension requirements for each product and condition; operation direction; and \_\_\_\_\_>>.
  - 1. Motorized Shades: Include one-line diagrams, wire counts, coverage patterns, and physical dimensions of each item. Include location plan showing all switch and control zones, switches, sensors and other control accessories.
- D. Selection Samples: Include << <u>fabric samples in full range of available colors and</u> <u>patterns</u>; and \_\_\_\_\_>>.
- E. Verification Samples: Minimum size << <u>6 inches</u>; or \_\_\_\_ inches>> square, representing actual materials, color and pattern.
- F. Project Record Documents: Record actual locations of control system components and show interconnecting wiring.
- G. Operation and Maintenance Data: List of all components with part numbers, and operation and maintenance instructions; include copy of shop drawings.
- H. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.

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## 1.05 QUALITY ASSURANCE

- A. Motorized Shades: Comply with NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than ten years of documented experience.
- C. Installer Qualifications: Company specializing in performing work of this type with minimum ten years of documented experience with shading systems of similar size, type, and complexity; manufacturer's authorized representative.

## 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver shades in manufacturer's unopened packaging, labeled to identify each shade for each opening.
- B. Handle and store shades in accordance with manufacturer's recommendations.

## 1.07 WARRANTY

- A. See Section 01 7800 Closeout Submittals, for additional warranty requirements.
- B. Provide manufacturer's standard, non-depreciating warranty, for interior shading only, covering the following:
  - 1. Shade Hardware: 10 years unless otherwise indicated.
  - 2. Shade Fabric: 10 years unless otherwise indicated.
  - 3. Electric Motors, Controls, and Accessories: Five years.

## PART 2 PRODUCTS

## 2.01 MANUFACTURERS

- A. Basis of Design: MechoShade Systems LLC; www.mechoshade.com/#sle.
- B. Substitutions: << See Section 01 6000 Product Requirements; or Not permitted>>.

## 2.02 ROLLER SHADES

- A. General:
  - 1. Provide shade system components that are capable of being removed or adjusted without removing mounted << <u>shade brackets</u>; <u>cassette support channel</u>; or \_\_\_\_>>.
  - 2. Provide shade system that operates smoothly when shades are raised or lowered.
  - 3. Electrical Components: Listed, classified, and labeled as suitable for the purpose intended. Individual testing of components will not be acceptable in lieu of system testing. Where applicable, system components to be FCC compliant.
- B. Roller Shades<< <u>Type</u> WS-1, WS-3; \_\_\_\_\_; or None N/A>> Basis of Design: MechoShade Systems LLC; Mecho/5 System; www.mechoshade.com/#sle.
  - 1. (WS-1) Description: << <u>Single;</u> Double; or \_\_\_\_>> roller, manually operated fabric window shades.
    - a. Fabric: Eurotwill 6000 Series 3%; Slate.
    - b. Drop Position: Regular roll.
    - c. Mounting: Recess mounted in ceiling pocket.
    - d. Size: As indicated on drawings.
  - 2. (WS-2) Designation not used.
  - 3. (WS-3) Description: Double roll, manually operated fabric window shades.
    - a. Fabric: Eurotwill 6000 series 3%; slate and room darkening
    - b. Drop Position: << <u>Regular roll</u>; Reverse roll; or \_\_\_\_>>.
    - Mounting: << Ceiling mounted; <u>Recess mounted in ceiling pocket</u>; Wall mounted; Window jamb mounted; or \_\_\_\_\_>>.
    - d. Size: << <u>As indicated on drawings;</u> <u>feet wide by</u> <u>feet high; or</u>
  - 4. Brackets and Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.

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- a. Material: Steel, <u>1/8 inch</u> thick.
- b. Double Roller Brackets: Configured for light-filtering and room-darkening shades in one opening.
  - 1) Light-Filtering Fabric: << <u>Room-side</u>; Glass-side; or \_\_\_\_>> of opening.
  - 2) Room-Darkening Fabric: << <u>Glass-side</u>; Room-side; or \_\_\_\_>> of opening.
- c. Multiple Shade Band Operation: Provide hardware as necessary to operate more than one shade band using a single clutch operator.
- 5. Roller Tubes:
  - a. Material: Extruded aluminum.
  - b. Size: As recommended by manufacturer; selected for suitability for installation conditions, span, and weight of shades.
  - c. Fabric Attachment: Utilize extruded channel in tube to accept vinyl spline welded to fabric edge. Shade band to be removable and replaceable without removing roller tube from brackets or inserting spline from the side of the roller tube.
  - d. Roller tubes to be capable of being removed and reinstalled without affecting roller shade limit adjustments.
- 6. Hembars: Designed to maintain bottom of shade straight and flat.
  - a. Style: Full wrap fabric covered bottom bar, flat profile with heat sealed closed ends.
- 7. Clutch Operator: Manufacturer's standard material and design integrated with bracket/brake assembly.
  - a. Provide a permanently lubricated brake assembly mounted on a oil-impregnated hub with wrapped spring clutch.
  - b. Brake must withstand minimum pull force of **<u>50 pounds</u>** in the stopped position.
  - c. Mount clutch/brake assembly on the support brackets, fully independent of the roller tube components.
- Drive Chain: Continuous loop stainless steel beaded ball chain, << <u>95 pound</u>; or \_\_\_\_\_\_
   pound>> minimum breaking strength. Provide upper and lower limit stops.
  - a. Chain Retainer: Chain tensioning device complying with WCMA A100.1.
- Managed Lift: Required lifting force of <u>3 pounds</u> to a maximum of <u>8.5 pounds</u> for single band or multi-band shades up to 5 bands and a maximum of <u>30 pounds</u> hanging weight.
- 10. Accessories:
  - Fascia: Removable extruded aluminum fascia, size as required to conceal shade mounting, attachable to brackets without exposed fasteners; << clear anodized finish; <u>baked enamel finish</u>; fabric wrapped finish to match shade; or

    - 2) Color: << Black; White; Bronze; Gray; or Selected from manufacturer full line>>.
    - 3) Profile: << <u>Square;</u> Radiused; or \_\_\_\_>>.
  - b. Ceiling Pockets: Premanufactured metal shade pocket with removable closure panel<< <u>and ceiling tile support</u>; and \_\_\_\_; or None - N/A>>, for recess mounting in acoustical tile or drywall ceilings; size and configuration as indicated on drawings.
  - c. Ceiling Pockets with Prewired Raceway: UL 325 listed, extruded aluminum shade pocket with removable closure panel<< <u>and ceiling tile support</u>; None N/A; or and \_\_\_\_\_>>, for recess mounting in acoustical tile or drywall ceilings; size and configuration as indicated on drawings.
    - 1) Designed to accommodate installation of motor control and wiring accessories within pocket including, but not limited to, line voltage disconnect modular connector, MechoNet Wireless Controller, IQ2 Dual Splitter, and non-plenum rated daisy chain wiring.
  - d. Room-Darkening Channels, Standard: Extruded aluminum side and center channels with brush pile edge seals, SnapLoc mounting base, and concealed fasteners.

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> Channels to accept one-piece exposed blackout hembar to assure side light control and sill light control.

- Roller Shades<< <u>Type</u> WS-1E; \_\_\_\_\_; for Secondary MagnaShade System; or None N/A>> Basis of Design: MechoShade Systems LLC<< <u>; ElectroShade with</u> C. Roller Shades<< Type WS-1E; WhisperShade IQ2 EDU, line voltage (120 VAC); ; ElectroShade with WhisperShade IQ2-DC EDU, low voltage (24 VDC); ; \_\_\_\_; or None - N/A>>; www.mechoshade.com/#sle. 1. Description: << <u>Single</u>; Double; or \_\_\_\_>> roller, motor operated fabric window
  - shade system complete with mounting brackets, roller tubes, hembars, hardware, and accessories.
    - a. Drop Position: << <u>Regular roll;</u> Reverse roll; or \_\_\_\_>>.
    - b. Mounting: << Ceiling mounted; Recess mounted in ceiling pocket; Wall mounted; Window jamb mounted; or \_\_\_\_\_>>.
      c. Size: << <u>As indicated on drawings;</u> feet wide by \_\_\_\_ feet high; or
    - >>.
    - d. Fabric: << As indicated under Shade Fabric article.; or Eurotwill 6000 Series 3%: Slate>>

~~~~ PROJECT NOTE ~~~~~ ~~~ END OF PROJECT NOTE ~~~~

> D. Roller Shades<< <u>Type</u> WS-3E; \_\_\_\_\_; for Secondary MagnaShade System; or None - N/A>> - Basis of Design: MechoShade Systems LLC<< ; ElectroShade with WhisperShade IQ2 EDU, line voltage (120 VAC); ; ElectroShade with WhisperShade IQ2-DC EDU, low voltage (24 VDC); ; \_\_\_\_\_; or None - N/A>>; www.mechoshade.com/#sle.

~~~~ PROJECT NOTE ~~~~~

If specifying a double roller system, be sure to specify both types of fabric and bracket configuration. ~~~ END OF PROJECT NOTE ~~~~

> Description: << Single; <u>Double</u>; or \_\_\_\_>> roller, motor operated fabric window 1. shade system complete with mounting brackets, roller tubes, hembars, hardware, and accessories.

~~~~ PROJECT NOTE ~~~~~

Shade Positions: - Regular Roll: Fabric falls close to the glass off the back of the roller tube. - Reverse Roll: Fabric falls off the room-side of the roller tube.

~~~ END OF PROJECT NOTE ~~~~

a. Drop Position: << <u>Regular roll</u>; Reverse roll; or \_\_\_\_>>.

~~~~ PROJECT NOTE ~~~~~

Coordinate mounting description here with horizontal tolerances specified under "Fabrication". ~~~ END OF PROJECT NOTE ~~~~

- b. Mounting: << Ceiling mounted; Recess mounted in ceiling pocket; Wall mounted; Window jamb mounted; or \_\_\_\_>>.
- c. Size: << As indicated on drawings; \_\_\_\_ feet wide by \_\_\_\_ feet high; or >>.

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- d. Fabric: << As indicated under Shade Fabric article.; or Eurotwill 6000 Series 3%; Slate>>
- e. Fabric: Room darkening.
- Ε.
- 1. Brackets and Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.
  - a. Double Roller Brackets: Configured for light-filtering and room-darkening shades in one opening.
    - 1) Light-Filtering Fabric: << <u>Room-side</u>; Glass-side; or \_\_\_\_>> of opening.
    - 2) Room-Darkening Fabric: << <u>Glass-side</u>; Room-side; or \_\_\_\_\_>> of opening.
  - b. Multiple Shade Operation: Provide hardware as necessary to operate more than one shade using a single motor.
- 2. Roller Tubes:
  - a. Material: Extruded aluminum.
  - b. Size: As recommended by manufacturer; selected for suitability for installation conditions, span, and weight of shades.
  - c. Fabric Attachment: Utilize extruded channel in tube to accept vinyl spline welded to fabric edge. Shade band to be removable and replaceable without removing roller tube from brackets or inserting spline from the side of the roller tube.
- 3. Hembars: Designed to maintain bottom of shade straight and flat.
- a. Style: Full wrap fabric covered bottom bar, flat profile with heat sealed closed ends.
- 4. Accessories:
  - Fascia: Removable extruded aluminum fascia, size as required to conceal shade mounting, attachable to brackets without exposed fasteners; << clear anodized finish; <u>baked enamel finish</u>; fabric wrapped finish to match shade; or >>.
    - Fascia to be capable of installation across two or more shade bands in one piece.
    - Color: << Black; White; Bronze; Gray; or Selected from manufacturer full line>>.
    - 3) Profile: << <u>Square;</u> Radiused; or \_\_\_\_>>.
  - b. Ceiling Pockets: Premanufactured metal shade pocket with removable closure panel, for recess mounting in acoustical tile or drywall ceilings; size and configuration as indicated on drawings.
  - c. Ceiling Pockets with Prewired Raceway: UL 325 listed, extruded aluminum shade pocket with removable closure panel<< <u>and ceiling tile support</u>; None N/A; or and \_\_\_\_\_>>, for recess mounting in acoustical tile or drywall ceilings; size and configuration as indicated on drawings.
    - Designed to accommodate installation of motor control and wiring accessories within pocket including, but not limited to, line voltage disconnect modular connector, MechoNet Wireless Controller, IQ2 Dual Splitter, and non-plenum rated daisy chain wiring.
    - Product: MechoShade Systems LLC; ElectroPocket<< ; Model \_\_\_\_;;</li>
       ; or None N/A>>; www.mechoshade.com/#sle.
  - d. Room-Darkening Channels, Standard: Extruded aluminum side and center channels with brush pile edge seals, SnapLoc mounting base, and concealed fasteners. Channels to accept one-piece exposed blackout hembar to assure side light control and sill light control.

## 2.03 INTELLIGENT ENCODED ELECTRONIC DRIVE SYSTEM

- A. Electronic Drive Unit (EDU) System General Requirements:
  - 1. System to be certified and labelled as a UL 325 listed solution. Recognized component certification is not acceptable in lieu of system testing. Listing label and motor rating to be readily visible for inspection without requiring dismounting of shade assembly for motor or EDU to be removed from shade roller tube.

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- 2. EDU size and configuration to be as recommended by manufacturer for the type, size, and arrangement of shades to be operated.
- 3. Conceal EDU inside shade roller tube.
- 4. Use EDU's rated at the same nominal speed for shades in the same room.
- 5. Total hanging weight of shade band not to exceed 80 percent of rated lifting capacity of shade EDU and tube assembly.
- 6. Provide EDU with capability of upgrading firmware from anywhere on network without touching the motor.
- B. Line Voltage EDU (120 VAC):
  - 1. Basis of Design: MechoShade Systems LLC; WhisperShadelQ2 System; www.mechoshade.com/#sle.
  - 2. Description: Tubular, asynchronous (non-synchronous), with integral AC motor and reversible capacitor operating at 120 VAC, single phase, 60 Hz; temperature Class B, thermally-protected, totally enclosed, maintenance-free; powered by line voltage power supply connection equipped with locking disconnect plug assembly furnished with EDU.
  - 3. Audible Noise: 46 dBA or less measured 3 feet from the motor unit, depending on motor torque.
  - 4. Nominal Speed: Minimum of 34 RPM; does not vary due to load/lift capacity.
  - 5. EDU to provide isolated, low voltage power supply for powering external accessories connected to either the dry contact port or the network port. Products that require accessories to be powered by a plug-in or externally-supplied power supply are not acceptable.
- C. Modes of Operation:
  - 1. Uniform Mode: Allows for shades to move only to defined intermediate stop positions in order to maintain aesthetic uniformity.
  - 2. Normal Mode: Allows for shades to move to defined intermediate stop positions plus any position between defined upper and lower limits.
  - 3. Maintenance Mode: Prevents shade from moving to newly commanded positions via dry contact or network control commands until EDU has been serviced and/or Maintenance Mode has been cleared/disabled.
- D. Control Methods: Support both local isolated dry contact input and network control.
  - 1. Local Isolated Dry Contact Inputs:
    - a. Supports local switch control and third party system integration without separate interface.
    - b. Supports moving EDU/shade to upper and lower limits and to local switch preset positions.
    - c. Allows for configuration of upper and lower limits, custom presets, and key modes of operation without requiring a PC or similar microprocessor-based tools.
    - d. Supports configuration under protected sequences to prevent changes by casual user.
    - e. Switch Personalities: Allows for configuration of the dry contact control port over network such that virtually any type of dry contact keypad/third-party interface and actuation methodology (maintained and/or momentary actuation) can be used to operate shade. Dry contact control connection options to include:
      - 1) 1-button.
      - 2) 2-button.
      - 3) 3-button with ability to support configuring limits, presets, and key operating modes (default).
      - 4) 3-button without configuration capability in order to prevent accidental changes in settings.
- E. Alignment Positions:
  - 1. Each EDU to support positioning commands from 0 to 100 percent in 1 percent increments and 32 customizable presets, including three intermediate dry contact presets

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resulting in repeatable and precisely aligned shade positions and limits.

- 2. Shades on the same switch circuit or with the same network group address with the same opening height to align at each limit or preset (intermediate stopping position) when traveling from any position, up or down.
- 3. Shades of differing heights to be capable of custom, aligned intermediate stop positions when traveling from any position, up or down.
- 4. Alignment of standard shade bands mechanically aligned on the same EDU not to exceed plus/minus **0.125 inch** when commanded to the same alignment position.
- 5. Alignment of standard shades on adjacent EDU's not to exceed plus/minus <u>0.25 inch</u> when commanded to the same alignment position.
- F. Local Switch Presets:
  - 1. Provide a minimum of three customizable preset positions accessible over the local dry contact control inputs and over the network connection.
  - 2. Preset positions to be customizable to any position between and including the defined upper and lower limits (initially defaults to 25, 50, and 75 percent of shade travel).
  - 3. Support configuration of custom preset positions using either a handheld removable program module/configurator or a local switch.

## 2.04 MOTOR CONTROLS

- A. Unless specifically indicated to be excluded, provide all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system that provides the control intent indicated.
- B. Provide all components and connections necessary to interface with other systems as indicated.
- C. Low-Voltage Wall Controls; IQ Switch:
  - 1. Momentary dry contact switch enables manual local control or network control of any individual shade motor or shade group/sub-group on MechoNet network.
  - 2. Control Functions:
    - a. Open: Automatically open controlled shade(s) to fully open position when button is pressed.
    - b. Close: Automatically close controlled shade(s) to fully closed position when button is pressed.
    - c. Presets: For selection of predetermined shade positions.
  - 3. Finish: White.

# 2.05 ROLLER SHADE FABRICATION

- A. Field measure finished openings prior to ordering or fabrication.
- B. Dimensional Tolerances: Fabricate shades to fit openings within specified tolerances.
  - Vertical Dimensions: Fill openings from head to sill with << <u>1/2 inch</u>; or \_\_\_\_ inch>> space between bottom bar and << window sill; finish floor; window stool; or >>.
  - 2. Horizontal Dimensions Inside Mounting: Fill openings from jamb to jamb.
- C. At openings requiring continuous multiple shade units with separate rollers, locate roller joints at window mullion centers; butt rollers end-to-end.

# PART 3 EXECUTION

# 3.01 EXAMINATION

- A. Examine finished openings for deficiencies that may preclude satisfactory installation.
- B. Start of installation shall be considered acceptance of substrates.

## 3.02 PREPARATION

A. Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under the project conditions.

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B. Coordinate with window installation and placement of concealed blocking to support shades.

# 3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions and approved shop drawings, using mounting devices as indicated.
- B. Adjust level, projection, and shade centering from mounting bracket. Verify there is no telescoping of shade fabric. Ensure smooth shade operation.

# 3.04 SYSTEM STARTUP

A. Motorized Shade System: Provide services of a manufacturer's authorized representative to perform system startup.

# 3.05 CLEANING

- A. Clean soiled shades and exposed components as recommended by manufacturer.
- B. Replace shades that cannot be cleaned to "like new" condition.

## 3.06 CLOSEOUT ACTIVITIES

- A. See Section 01 7800 Closeout Submittals, for closeout submittals.
- B. See Section 01 7900 Demonstration and Training, for additional requirements.
- C. Demonstration: Demonstrate operation and maintenance of window shade system to Owner's personnel.

## 3.07 PROTECTION

- A. Protect installed products from subsequent construction operations.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

## 3.08 MAINTENANCE

A. See Section <u>01 7000 - Execution and Closeout Requirements</u>, for additional requirements relating to maintenance service.

## 3.09 SCHEDULE

# END OF SECTION 12 2400

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| Design Development Phase | 12 2400 - 8 | Systems                    |

### SECTION 12 3200 MANUFACTURED WOOD CASEWORK

## PART 1 GENERAL

## 1.01 SECTION INCLUDES

- A. Manufactured << standard; and <u>custom</u>>> casework, with cabinet hardware.
- B. Special purpose units.
- C. Countertops.

## 1.02 RELATED REQUIREMENTS

- A. Section <u>01 6000 Product Requirements</u>: Requirements for sustainably harvested wood.
- B. Section 06 1000 Rough Carpentry: Blocking and nailers for anchoring casework.
- C. Section 06 2000 Finish Carpentry: Adjacent woodwork
- D. Section <u>07 9200 Joint Sealants</u>: Sealing joints between casework and countertops and adjacent walls, floors, and ceilings.
- E. Section **<u>08 8000 Glazing</u>**: Methods for shop-glazing of casework.
- F. Section **09 2116 Gypsum Board Assemblies**: Reinforcements in metal-framed partitions for anchoring casework.
- G. Section <u>12 3600 Countertops</u>: Additional requirements for countertops.
- H. Section <u>22 4000 Plumbing Fixtures</u>: Sinks and fittings installed in casework.
- I. Section <u>26 2726 Wiring Devices</u>: Switches, receptacles installed in casework.

## 1.03 DEFINITIONS

- A. Exposed: Portions of casework visible when drawers and cabinet doors are closed, including end panels, bottoms of cases more than <u>42 inches</u> above finished floor, tops of cases less than <u>72 inches</u> above finished floor and all members visible in open cases or behind glass doors.
- B. Semi-Exposed: Portions of casework and surfaces behind solid doors, tops of cases more than <u>72 inches</u> above finished floor and bottoms of cabinets more than <u>30 inches</u> but less than <u>42</u> <u>inches</u> above finished floor.
- C. Concealed: Sleepers, web frames, dust panels and other surfaces not generally visible after installation and cabinets less than <u>30 inches</u> above finished floor.

## 1.04 REFERENCE STANDARDS

- A. ANSI A135.4 Basic Hardboard; 2012 (R2020).
- B. AWI (QCP) Quality Certification Program; Current Edition.
- C. AWI/AWMAC/WI (AWS) Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).
- D. AWMAC/WI (NAAWS) North American Architectural Woodwork Standards, U.S. Version 3.1; 2017, with Errata (2019).
- E. BHMA A156.9 American National Standard for Cabinet Hardware; 2015.
- F. IAPMO Z124 Plastic Plumbing Fixtures; 2017.
- G. NEMA LD 3 High-Pressure Decorative Laminates; 2005.

## 1.05 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting<< <u>one week</u>; at least one week; \_\_\_\_; or None - N/A>> prior to the start of the work of this section; require attendance by all affected installers.

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# 1.06 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements for submittal procedures.
- B. Product Data: Component dimensions, configurations, construction details, joint details, attachments.
- C. Shop Drawings: Indicate casework types, sizes, and locations, using large scale plans, elevations, and cross sections. Include rough-in and << <u>anchors; reinforcements;</u> and <u>blocking>>, << placement dimensions and tolerances; clearances required; keying information;</u> and \_\_\_\_\_>.
- D. Samples for Finish Selection: Fully finished, for << <u>color</u>; <u>species</u>; <u>and</u> \_\_\_\_>> selection. Minimum sample size: << 2 inches by 3 inches; <u>6 inches by 6 inches</u>; or \_\_\_\_\_ inches by \_\_\_\_\_ inches>>.
  - 1. Wood samples for color and species selection.
  - 2. Plastic laminate samples, for color, texture, and finish selection.
  - 3. Thermally fused laminate samples, for color, texture, and finish selection.
- E. Casework Samples: Representative of types in the project.
  - 1. Base Cabinet: Cabinet with drawer and door and specified hardware.<< <u>Type indicated</u> <u>on drawings.; or None N/A>></u>
  - Tall Cabinet: Cabinet with<< <u>shelves and supports</u>; or None N/A>> door and specified hardware.<< <u>Type indicated on drawings</u>; or None - N/A>>
  - Wall Cabinet: Cabinet with<< <u>shelves and supports</u>; or None N/A>> door and specified hardware.<< <u>Type indicated on drawings</u>; or None - N/A>>
  - 4. Display Casework.
- F. Manufacturer's Installation Instructions.
- G. Manufacturer's Qualification Statement.
- H. Installer's Qualification Statement.
- I. Maintenance Data: Manufacturer's recommendations for care and cleaning.
- J. Finish touch-up kit for each type and color of materials provided.

## 1.07 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum << <u>three</u>; or \_\_\_\_\_>> years of<< documented; or <u>None -</u> <u>N/A</u>>> experience.
- B. Quality Certification: Comply with << <u>AWI (QCP)</u>; AWMAC (GIS); WI (CCP); WI (CSIP); WI (MCP); or \_\_\_\_\_>> woodwork association quality certification service/program in accordance with requirements for work specified in this section.
  - Provide labels or certificates indicating that the installed work complies with <<
     <u>AWI/AWMAC/WI (AWS)</u>; <u>AWMAC/WI (NAAWS)</u>; or \_\_\_\_\_>> requirements for grade or
     grades specified.
  - 2. This AWI (QCP) project is registered as project number \_\_\_\_\_
  - 3. Provide designated labels on shop drawings as required by certification program.
  - 4. Provide designated labels on installed products as required by certification program.
  - 5. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.
  - 6. Replace, repair, or rework all work for which certification is refused.
- C. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than << <u>three</u>; or \_\_\_\_\_>> years of<< <u>documented</u>; \_\_\_\_\_; or None N/A>> experience<< <u>and approved by manufacturer</u>; or None N/A>>.

## 1.08 DELIVERY, STORAGE, AND HANDLING

A. Protect items provided by this section, including finished surfaces and hardware items during handling and installation. For metal surfaces, use polyethylene film or other protective material

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standard with the manufacturer.

- B. Acceptance at Site:
  - 1. Do not deliver or install casework until the conditions specified under Part 3, Examination Article of this section have been met. Products delivered to sites that are not enclosed and/or improperly conditioned will not be accepted if warping or damage due to unsatisfactory conditions occurs.
- C. Storage:
  - 1. Store casework in the area of installation. If necessary, prior to installation, temporarily store in another area, meeting the environmental requirements specified under Part 3, "Site Verification of Conditions" Article of this section.

### 1.09 MOCK-UPS

- A. Provide full size << <u>base cabinet</u>; <u>upper cabinet</u>; <u>wall base</u>; and \_\_\_\_\_>> complete with drawers, door, adjustable shelf and countertop.
- B. See Section 01 4000 Quality Requirements for additional requirements.
- C. Locate << where directed; as indicated on drawings; or Selected break room, exam room, work room, reception, & large conference room>>.
- D. Mock-up << <u>may</u>; or may not>> remain as part of the work.

## 1.10 WARRANTY

- A. See Section 01 7800 Closeout Submittals for additional warranty requirements.
- B. Correct defective Work within a **<< two; five; or one>>** year period after Date of Substantial Completion, at no additional cost to Owner. Defects include, but are not limited to:
  - 1. Ruptured, cracked, or stained finish coating.
  - 2. Discoloration or lack of finish integrity.
  - 3. Cracking or peeling of finish.
  - 4. Delamination of components.
  - 5. Failure of adhesives.
  - 6. Failure of hardware.

## PART 2 PRODUCTS

#### 2.01 CASEWORK, GENERAL

- A. Quality Standard: << <u>AWI/AWMAC/WI (AWS)</u>; <u>AWMAC/WI (NAAWS)</u>; or \_\_\_\_\_>>, unless noted otherwise.
- B. Types: More than one type is required. See drawings for location of each type of casework.
- C. Wood Veneer Faced Cabinets: << <u>Premium Grade</u>; Custom Grade; Economy Grade; Grades as indicated; or \_\_\_\_\_>>.
- D. Plastic Laminate Faced Cabinets: << <u>Premium Grade</u>; Custom Grade; Economy Grade; Grades as indicated; or \_\_\_\_\_>>.

## 2.02 FABRICATION

- A. Assembly: Shop assemble casework items for delivery to site in units easily handled and to permit passage through building openings.
- B. Construction: As required for selected grade.
- C. Structural Performance: Safely support the following minimum loads:
  - 1. Base Units: << <u>500 pounds per linear foot;</u> or <u>pounds per linear foot>></u> across the cabinet ends.
  - 2. Suspended Units: << <u>300 pounds;</u> or <u>pounds>></u> static load.
  - 3. Drawers: << <u>125 pounds;</u> or <u>pounds>></u>, minimum.
  - 4. Hanging Wall Cases: << <u>300 pounds</u>; or \_\_\_\_\_ pounds>>.
  - 5. Shelves: << <u>100 pounds;</u> or <u>pounds>></u>, minimum.

- D. Seismic Performance: Casework<< <u>, including attachments to other work</u>; or None N/A>> able to withstand the effects of earthquake motions determined according to << <u>ASCE/SEI 7</u>; or \_\_\_\_\_>>.
  - 1. Component Importance Factor: << <u>1.0;</u> or 1.5>>.
- E. Glazing for Doors<< None N/A; or <u>and Other Cabinet Components</u>>>: << <u>Clear</u> <u>tempered glass</u>; Tinted tempered glass; Clear laminated tempered glass; Tinted laminated tempered glass; Clear acrylic sheet; Colored acrylic sheet; Clear polycarbonate sheet; or \_\_\_\_>.
  - 1. Glazing: With gaskets and removable stops; minimize rattling and vibration.
- F. Fittings and Fixture Locations: Cut and drill components for fittings and fixtures.
- G. Hardware Application: Factory-machine casework members for hardware that is not surface applied.
- H. Access Panels: Where indicated, for maintenance of utility service and mechanical and electrical components.
- I. Removable back panels on << all base; indicated base; or access required>> cabinets. << <u>Provide partial height back panels at sink cabinets.</u>; or None - N/A>>
- J. << <u>Fixed</u>; or Removable>> panels at backs of open spaces between base cabinets.
   1. Provide cutouts for << <u>power</u>; and <u>data</u>>> receptacles where indicated on drawings.
- K. Edging: Fit shelves, doors, and exposed edges with<< <u>specified</u>; or <u>specified</u> and <u>detailed>></u> edging. Do not use more than one piece for any single length.
- L. Scribes and Fillers: Panels of matching construction and finish, for locations where cabinets do not fit tight to adjacent construction.
- M. Matching Wood Grain: Comply with requirements of quality standard for specified grade << <u>and as follows:</u>; or \_\_\_\_\_>>
  - 1. Provide << center matched ; balance matched ; or \_\_\_\_>>panels << at each elevation; as indicated; or \_\_\_\_>>.
- N. Apron Frames: Construction similar to other cabinets, with modifications.
  - 1. Frames fabricated from panels standard with the manufacturer. Include front and back panels, with drawer suspension framing mechanically fastened to support channels spanning between them.
  - 2. Apron Drawers: Manufacturer's standard drawer construction and size for apron installation. Single drawer for aprons up to << <u>48 inches</u>; or \_\_\_\_\_ inches>> wide, two drawers for wider aprons.
- O. Countertop Panel-Type Supports: Materials similar to adjacent casework, << <u>1-1/2 inch</u>; or \_\_\_\_\_\_ inch>> in width, with front-to-back and toe space dimensions matching base cabinet. Designed to be secured in a concealed fashion to countertop material. Include two leveling devices per support panel.

## 2.03 PLASTIC-LAMINATE-CLAD CASEWORK

- A. Plastic-Laminate-Clad Casework: Solid wood and wood panel construction; each unit selfcontained and not dependent on adjacent units or building structure for rigidity; in sizes necessary to avoid field cutting except for scribes and filler panels. Include adjustable levelers for base<< None - N/A; or <u>and tall</u>>> cabinets.
  - Style: << <u>Flush overlay</u>; Reveal overlay; Lipped overlay; Flush inset, in frameless cabinet; Flush inset, in face frame cabinet; or \_\_\_\_\_>>. Ease doors and drawer fronts slightly at edges.
  - 2. Cabinet Nominal Dimensions: Unless otherwise indicated, provide cabinets of widths and heights indicated on drawings
    - a. Lockers: See section 10 5100 Lockers
  - 3. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline.

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- a. Finish: << Matte or suede, gloss rating of 5 to 20; or See drawings>>.
- b. Surface Color and Pattern: << <u>As indicated on drawings</u>; As scheduled; or Wilsonart, Natural Recon 7996-38.>>.
- c. Exposed Interior Surfaces: << Thermally fused laminate; or Melamine resin>>.
   1) Color: << <u>White;</u> or \_\_\_\_>>.
- d. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
  - 1) Matching Wood Grain Pattern: Comply with requirements of quality standard for specified grade << <u>and as follows:</u>; or \_\_\_\_\_>>

>>

- (a) Provide << center matched ; <u>balance matched</u> ; or \_\_\_\_\_ >>panels << <u>at each elevation</u>; as indicated; or \_\_\_\_\_
- e. Cap exposed plastic laminate finish edges with << <u>material of same finish and</u> <u>pattern;</u> plastic trim; aluminum trim; or \_\_\_\_\_>>.

## 2.04 COUNTERTOPS

A. Countertops: See Section <u>12 3600</u>.

## 2.05 SPECIAL PURPOSE UNITS

- A. Mailroom/Mail Cubby Special Units.
  - 1. Style: << <u>Flush overlay;</u> Reveal overlay; Lipped overlay; Flush Inset, Type A; Flush Inset, Type B; or \_\_\_\_\_>>. Ease doors and drawer fronts slightly at edges.
  - 2. Primary Construction<< , Type \_\_\_; or <u>None N/A</u>>>: << Wood veneer faced; Plasticlaminate clad; Solid phenolic; and <u>Thermally fused laminate</u>>> units.
    - a. Finish, Surface Color and Pattern: << <u>As indicated on drawings</u>; As scheduled; or \_\_\_\_\_>>.
  - 3. Mail Slot Units: Manufacturer's standard units; sizes and configurations indicated on drawings.
  - 4. Sort Module Units: Manufacturer's standard << <u>closed-back</u>; and open-back>> units; sizes and configurations indicated on drawings.

## 2.06 CABINET HARDWARE

- A. Comply with BHMA A156.9 requirements.
  - Acceptable base materials for plated finishes include << brass; bronze; steel; and \_\_\_\_\_>>.
- B. Label Holders: Manufacturer's standard, sized to hold standard label cards<<, bright chromium plated over nickel on base material; <u>satin chromium plated over nickel on base material</u>; <u>satin chromium pla</u>
- C. Locks: Provide locks on casework drawers and doors where indicated.
  - 1. Basis of Design Manufacturer: Codelocks www.codelocks.us
  - 2. Product Basis of Design: KL1000 Classic KitLock Locker Lock
  - 3. Finish: Silver Grey
  - 4. Accessories:Gasket for KitLock
- D. Shelves in Cabinets:
- E. Swinging Doors: Hinges
  - 1. Basis of Design Manufacturers:
    - a. Blum, Inc; CLIP top BLUMOTION: www.blum.com/#sle.
    - b. Substitutions: See Section01 6000-Product Requirements.
  - 2. Hinges: << Visible; Semi-concealed; <u>Concealed</u>; or Invisible>>, number as required by referenced standards for width, height, and weight of door.
  - 3. Pulls: Satin << <u>Chrome;</u> Brass; Nylon; or \_\_\_\_>> << <u>wire pulls;</u> decorative design; or \_\_\_\_\_>>, << <u>4 inches;</u> or \_\_\_\_ inches>> wide.

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- F. Drawers: Pulls and slides.
  - 1. Slides: self-close; soft-close; concealed; heavy-duty Blum Movento or equal
    - a. Type: Full extension with overtravel.
    - b. Static Load Capacity: Heavy Duty grade.
    - c. Mounting: Bottom mounted.
    - d. Stops: Integral type.
    - e. Features: Provide self closing/stay closed type.
    - f. Basis of Design Manufacturers & System:
      - 1) Blum, Inc; MOVENTO: www.blum.com/#sle.Blum, Inc; TANDEM: www.blum.com/#sle.

## 2.07 MATERIALS

- A. Wood-Based Materials:
  - 1. Solid Wood: Air-dried to 4.5 percent moisture content, then tempered to 6 percent moisture content before use.
- B. Solid Wood: Clear, dry, sound, plain sawn, selected for<< <u>compatible</u>; well-matched; or None N/A>><< <u>species</u>; or None N/A>> grain and color, no defects.
- C. Particleboard: Composite panel composed of cellulosic particles, additives, and bonding system; comply with ANSI A208.1
  - 1. Grade: M-S; moisture resistance: MR30.Panel Thickness: 3/4 inch.
- D. Medium Density Fiberboard (MDF): Composite panel composed of cellulosic fibers, additives, and bonding system; cured under heat and pressure; comply with ANSI A208.2.
  - 1. Grade: 130; moisture resistance: MR30.
  - 2. Panel Thickness: 3/4 inch.
- E. Concealed Solid Wood or Plywood: Any species and without defects affecting strength or utility.
- F. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications. complying with Grade requirements, and standard with the manufacturer.
- G. Thermally Fused Laminate (TFL): << <u>Melamine</u>; or Polyester>> resin, NEMA LD 3, Type VGL laminate panels.
- H. Glass: See section

## 2.08 ACCESSORIES

- A. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; << <u>galvanized</u>; chrome-plated; or \_\_\_\_\_>> finish in concealed locations and << <u>stainless</u> <u>steel</u>; chrome-plated; or \_\_\_\_\_>> finish in exposed locations.
- B. Grommets: Standard << plastic; <u>painted metal</u>; rubber; or \_\_\_\_\_>> grommets for cutouts, in color << <u>to match adjacent surface</u>; to blend with adjacent surface; to contrast with adjacent surface; as scheduled; as indicated; or \_\_\_\_\_>>.

# PART 3 EXECUTION

# 3.01 PREPARATION

A. Large Components: Ensure that large components can be moved into final position without damage to other construction.

# 3.02 EXAMINATION

- A. Site Verification of Environmental Conditions:
  - . Do not deliver casework until the following conditions have been met:
    - a. Building has been enclosed (windows and doors sealed and weather-tight).
    - b. An operational HVAC system that maintains temperature and humidity at occupancy levels has been put in place.
    - c. Ceiling, overhead ductwork, piping, and lighting have been installed.

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- d. Installation areas do not require further "wet work" construction.
- B. For Base Cabinets Installation: Examine floor levelness and flatness of installation space. Do not proceed with installation if encountered floor conditions required more than <u>1/2 inch</u> leveling adjustment. When installation conditions are acceptable, for each space, establish the high point of the floor. Set and make level and plumb first cabinet in relation to this high point.
- C. For Wall Cabinets Installation: Examine wall surfaces in installation space. Do not proceed with installation if the following conditions are encountered:
- D. Verify adequacy of support framing and anchors.
- E. Verify that service connections are correctly located and of proper characteristics.

### 3.03 INSTALLATION

- A. Perform installation in accordance with manufacturer's instructions<< <u>None N/A;</u> or and with SEFA 2.3>>.
- B. Use anchoring devices to suit conditions and substrate materials encountered. Use concealed fasteners to the greatest degree possible. Use exposed fasteners only where allowed by approved shop drawings, or where concealed fasteners are impracticable.
- C. Set casework items plumb and square, securely anchored to building structure.
- D. Align cabinets to adjoining components, install filler and/or scribe panels where necessary to close gaps.
- E. Fasten together cabinets in continuous runs, with joints flush, uniform and tight. Misalignment of adjacent units not to exceed <u>1/16 inch</u>. In addition, do not exceed the following tolerances:
  - Variation of Tops of Base Cabinets from Level: <u>1/16 inch</u> in << <u>10 feet;</u> or <u>feet>></u>.
  - Variation of Faces of Cabinets from a True Plane: <u>1/8 inch</u> in << <u>10 feet;</u> or \_\_\_\_\_\_ feet>>.
  - 3. Variation of Adjacent Surfaces from a True Plane (Lippage): <u>1/32 inch</u>.
  - 4. Variation in Alignment of Adjacent Door and Drawer Edges: <u>1/16 inch</u>.
- F. Secure wall and floor cabinets to concealed << <u>reinforcement</u>; and blocking>> at gypsum board assemblies.
- G. Base Cabinets: Fasten cabinets to service space framing and/or wall substrates, with fasteners spaced not more than << <u>16 inches</u>; or \_\_\_\_\_ inch>> on center. Bolt adjacent cabinets together with joints flush, tight, and uniform.
  - Where base cabinets are installed away from walls or service space framing, anchor to floor at toe space at not more than << <u>24 inches</u>; or \_\_\_\_\_ inches>> on center, and at sides of cabinets with not less than two fasteners per side.
- H. Wall Cabinets: Fasten to hanging strips, and/or wall substrates. Fasten each cabinet through back, near top, at not less than << <u>16 inches</u>; or <u>\_\_\_\_\_</u> inch>> on center.
- I. Install hardware uniformly and precisely.
- J. Countertops: Install countertops intended and furnished for field installation in one true plane, with ends abutting at hairline joints, and no raised edges.
- K. Replace units that are damaged, including those that have damaged finishes.

## 3.04 ADJUSTING

A. Adjust operating parts, including doors, drawers, hardware, and fixtures to function smoothly.

## 3.05 CLEANING

A. Clean casework and other installed surfaces thoroughly.

## 3.06 PROTECTION

A. Do not permit finished casework to be exposed to continued construction activity.

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- B. Protect casework and countertops from ongoing construction activities. Prevent workmen from standing on, or storing tools and materials on casework or countertops.
- C. Repair damage, including to finishes, that occurs prior to Date of Substantial Completion, using methods prescribed by manufacturer; replace units that cannot be repaired to like-new condition.

# END OF SECTION 12 3200

### SECTION 12 3600 COUNTERTOPS

## PART 1 GENERAL

## 1.01 SECTION INCLUDES

- A. Countertops for casework.
- B. Wall-hung counters and vanity tops.
- C. Sinks molded into countertops.

## 1.02 RELATED REQUIREMENTS

- A. Section 06 1000 Rough Carpentry: backing, blocking, etc.
- B. Section 06 200 Finish Carpentry: adjacent woodwork
- C. Section <u>06 4100 Architectural Wood Casework</u>.
- D. Section 22 4000 Plumbing Fixtures: << Sinks; or Other sinks>>.

## 1.03 REFERENCE STANDARDS

- A. ANSI A208.1 American National Standard for Particleboard; 2016.
- B. ANSI A208.2 Medium Density Fiberboard (MDF) for Interior Applications; 2016.
- C. AWI/AWMAC/WI (AWS) Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).
- D. AWMAC/WI (NAAWS) North American Architectural Woodwork Standards, U.S. Version 3.1; 2017, with Errata (2019).
- E. IAPMO Z124 Plastic Plumbing Fixtures; 2017.
- F. ISFA 2-01 Classification and Standards for Solid Surfacing Material; 2013.
- G. PS 1 Structural Plywood; 2009 (Revised 2019).

## 1.04 SUBMITTALS

- A. See Section <u>01 3000 Administrative Requirements</u> for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
  - 1. Preparation instructions and recommendations.
  - 2. Storage and handling requirements and recommendations.
  - 3. Specimen warranty.
- C. Shop Drawings: Complete details of materials and installation << ; combine with shop drawings of cabinets and casework specified in other sections; or None N/A>>.
- D. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.
- E. Verification Samples: For each finish product specified, minimum size << <u>6 inches</u>; or \_\_\_\_\_ inches>> square, representing actual product, color, and patterns.
- F. Test Reports: Chemical resistance testing, showing compliance with specified requirements.
- G. Certificate: Submit labels and certificates required by quality assurance and quality control programs.
- H. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

## 1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than << three; or five>> years of<< <u>documented;</u> ; or None N/A>> experience<< and approved by manufacturer; or <u>None N/A</u>>>.
- B. Quality Certification:

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- Provide labels or certificates indicating that the installed work complies with <<
   <u>AWI/AWMAC/WI (AWS)</u>; <u>AWMAC/WI (NAAWS)</u>; or \_\_\_\_>> requirements for grade or
   grades specified.
- 2. Provide designated labels on shop drawings as required by certification program.
- 3. Provide designated labels on installed products as required by certification program.
- 4. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.

## 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

## 1.07 FIELD CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

## PART 2 PRODUCTS

## 2.01 COUNTERTOPS

- A. Quality Standard: << Economy Grade; Custom Grade; Premium Grade; Grade as indicated on drawings; or \_\_\_\_\_>>, in accordance with << <u>AWI/AWMAC/WI (AWS)</u>; <u>AWMAC/WI (NAAWS)</u>; or \_\_\_\_>>, unless noted otherwise.
- B. Solid Surfacing Countertops: Solid surfacing sheet or plastic resin casting << <u>over continuous</u> <u>substrate</u>; self-supporting over structural members; or \_\_\_\_\_>>.
  - 1. Flat Sheet Thickness: << 1/4 inch; 1/2 inch; 3/4 inch; or \_\_\_\_\_ inch>>, minimum.
  - Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; << <u>acrylic or polyester</u>; acrylic; polyester; or \_\_\_\_\_>> resin, << <u>mineral filler</u>.; or unfilled,>> and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
    - a. Manufacturers:
      - 1) See drawings..
      - Substitutions: << <u>See Section 01 6000 Product Requirements</u>; or Not permitted>>.
    - b. Sinks and Bowls: << <u>Integral castings;</u> Separate units for undercounter mounting; or \_\_\_\_>; minimum << <u>3/4 inch;</u> or \_\_\_\_ inch>> wall thickness<<; <u>comply with IAPMO Z124;</u> ; comply with \_\_\_\_; or None - N/A>>.
    - c. Finish on Exposed Surfaces: << Matte, gloss rating of 5 to 20; Semi-gloss, gloss rating of 25 to 50; Polished, gloss rating of 55 to 80; or see drawings>>.
    - d. Color and Pattern: << <u>As indicated on drawings;</u> As indicated; or \_\_\_\_\_>>.
  - Other Components Thickness: << <u>1/2 inch;</u> or \_\_\_\_\_ inch>>, minimum.
  - Exposed Edge Treatment: Built up to minimum << <u>1-1/4 inch</u>; or \_\_\_\_\_ inch>> thick; << <u>square edge</u>; radiused edge; bullnosed edge; marine edge; edge profile as indicated on drawings; or \_\_\_\_>><< ; use marine edge at sinks; or None N/A>>.
  - 5. Back and End Splashes: Same sheet material, **<< square;** <u>radiused;</u> or \_\_\_\_>> top; min. 4 inches unless otherwise noted.
  - Fabricate in accordance with << <u>AWI/AWMAC/WI (AWS)</u>; <u>AWMAC/WI (NAAWS)</u>; or \_\_\_\_\_>>, Section 11 Countertops, << <u>Premium Grade</u>; or \_\_\_\_\_>>.

## 2.02 MATERIALS

- A. Plywood for Supporting Substrate: PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum << <u>3/4 inch</u>; or \_\_\_\_\_ inch>> thick; join lengths using metal splines.
- B. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.

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C. Joint Sealant: << <u>Mildew-resistant silicone</u>; Silicone; or \_\_\_\_>> sealant, << white; clear; or color match>>.

## 2.03 ACCESSORIES

- A. Fixed Top-Mounted Countertop Support Brackets<< for Island Applications; for Knee-Wall Applications; for Pony-Wall Applications; \_\_\_\_; or <u>None N/A</u>>>:
  - 1. Material: Steel.
  - 2. Color: << Black; White; or to be selected from the manufacturer's standard offerings>>.
  - 3. Products:
    - a. Rakks, Surface mount EH.
    - b. Substitutions: << <u>See Section 01 6000 Product Requirements</u>; or Not permitted>>.
- B. Grommets: for wire and cable management.
  - 1. Material: Plastic
  - 2. Shape: 2" round, recessed

## 2.04 FABRICATION

- A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
  - 1. Join lengths of tops using best method recommended by manufacturer.
  - 2. Fabricate to overhang fronts and ends of cabinets << <u>1 inch</u>; or <u>inch</u>>> except where top butts against cabinet or wall.
  - 3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.
- B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
  - 1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
  - 2. Height: << <u>4 inches;</u> 3-1/2 inches; or \_\_\_\_\_ inches>>, unless otherwise indicated.
- C. Solid Surfacing: Fabricate << tops; wall panels; and \_\_\_\_>> up to << 144 inches; or \_\_\_\_\_inches>> long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.
- D. Wall-Mounted Counters: Providesolid surface << <u>skirts;</u> <u>aprons;</u> <u>brackets;</u> <u>braces;</u> <u>and</u> >> as indicated on drawings<< <u>None - N/A;</u> <u>finished to match;</u> or \_\_\_\_\_>>.
  - 1. Provide Rakks supports @ such that no portion of counter is unsupported for more than 32 inches.

# PART 3 EXECUTION

## 3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

## 3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

## 3.03 INSTALLATION

A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.

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| Design Development Phase | 12 3000 - 3 | Countertops |

- B. Attach epoxy resin countertops using compatible adhesive.
- C. Seal joint between back/end splashes and vertical surfaces.

## 3.04 TOLERANCES

- A. Variation From Horizontal: << <u>1/8 inch in 10 feet;</u> or \_\_\_\_\_ inch in \_\_\_\_ feet>>, maximum.
- B. Offset From Wall, Countertops: << <u>1/8 inch</u>; or \_\_\_\_ inch>> maximum; << <u>1/16 inch</u>; or \_\_\_\_\_ inch>> minimum.
- C. Field Joints: << <u>1/8 inch</u>; or \_\_\_\_ inch>> wide, maximum.

## 3.05 CLEANING

A. Clean countertops surfaces thoroughly.

## 3.06 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

# END OF SECTION 12 3600

### SECTION 12 5000 FURNITURE

### PART 1 GENERAL

## 1.01 SECTION INCLUDES

- A. Specialty furniture items for Pharmacy Department
- B. Specialty furniture items for Audiology Department
- C. Specialty furniture items for Traditional Healing Department

### 1.02 RELATED REQUIREMENTS

- A. Section 26 0533.13 Conduit for Electrical Systems.
- B. Section 26 0553 Identification for Electrical Systems: Identification products and requirements.

### 1.03 PRICE AND PAYMENT PROCEDURES

A. Allowances: See Section 01 2100 - Allowances, for cash allowances affecting this section.

### 1.04 REFERENCE STANDARDS

- A. ADA Standards Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. ASCE 7 Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
- C. NECA 1 Standard for Good Workmanship in Electrical Construction; 2015.
- D. NFPA 70 National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

### 1.05 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements, for submittal procedures.
- B. Product Data: Submit manufacturer's data sheets on each product to be used, including:
  - 1. System components.
  - 2. Accessories.
  - 3. Substrate preparation instructions and recommendations.
  - 4. Storage and handling requirements and recommendations.
  - 5. Installation methods.
  - 6. Specimen warranty.
- C. Shop Drawings: Indicate location, type, and layout of furniture items, including lengths, heights, and aisle layout, and relationship to adjacent construction.
  - 1. Indicate location and configuration of all items.
  - 2. Indicate method of installation and configuration for shelving/casework mounted on walls.
  - 3. Provide location and details of anchorage devices to be embedded in or fastened to the structure.
  - 4. Provide location and configuration of power and data connections.
- D. Selection Samples: For each finish product specified, provide color chips representing manufacturer's full range of available colors and finishes.
- E. Design Data: Provide design calculations, bearing seal and signature of structural engineer licensed to practice in the State in which the Project is located, showing loads at points of attachment to the building structure.
- F. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

# 1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

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| Design Development Phase | 12 5000 - 1 | FURNITURE |

B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years of documented experience.

## 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Inspect for dents, scratches, or other damage. Replace damaged components.
- B. Store in manufacturer's unopened packaging until ready for installation.
- C. Store under cover and elevated above grade.

### 1.08 WARRANTY

- A. See Section 01 7800 Closeout Submittals, for additional warranty requirements.
- B. Provide one year manufacturer warranty covering defects of manufacturing and workmanship and rust and corrosion.

## PART 2 PRODUCTS

## 2.01 PRODUCTS

A. Basis of Design: See drawings.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that substrate is in proper condition to install rails and flooring system per manufacturer's requirements.
- C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

#### 3.02 INSTALLATION

- A. General: Install system components and accessories in accordance with manufacturer's printed instructions.
- B. Position system components level and plumb within manufacturer's specified tolerances.
- C. Anchor floor system to structure as indicated on drawings.
- D. Install shelving with shelf surfaces level and vertical supports plumb

#### 3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

## 3.04 CLEANING

A. Clean furniture and surrounding area after installation.

#### 3.05 CLOSEOUT ACTIVITIES

- A. See Section 01 7800 Closeout Submittals, for closeout submittals.
- B. See Section 01 7900 Demonstration and Training, for additional requirements.
- C. Demonstration: Demonstrate proper operation of system to Owner, and correct deficiencies or make adjustments as directed.

#### 3.06 PROTECTION

A. Protect installed system from subsequent construction operations.

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|--------------------------|-------------|-----------|
| Design Development Phase | 12 3000 - 2 | FURNITURE |

B. Touch-up, repair or replace damaged products before Date of Substantial Completion. END OF SECTION 12 5000

### SECTION 13 1100 SWIMMING POOLS

### PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. << <u>Prefabricated</u>; or Shotcrete concrete>> swimming pools and pool accessories.

### 1.02 RELATED REQUIREMENTS

- A. Section 03 3000 Cast-in-Place Concrete.
- B. Section <u>22 1005 Plumbing Piping</u>: Piping, valves, and fittings.

### **1.03 ADMINISTRATIVE REQUIREMENTS**

A. Preinstallation Meeting: Convene << <u>one week</u>; or \_\_\_\_>> before starting work of this section.

### 1.04 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on accessories << , and \_\_\_\_\_; or None N/A>>.
- C. Shop Drawings: Indicate << <u>pool layout</u>; configuration; pool tank cross sections; lighting locations; equipment locations; dimensions; details of assembly; anchors; utility rough-in locations; and \_\_\_\_\_>>.
   1. Indicate pool tank structural supports: Include layout, details, and seal and signature of
  - 1. Indicate pool tank structural supports: Include layout, details, and seal and signature of design professional responsible for design.
- D. Samples: Submit << <u>two</u>; or \_\_\_\_>> sample panels, <u>12x12 inch</u> in size, illustrating pool tank surface finish, color, and texture.
- E. Manufacturer's Installation Instructions: Indicate << <u>special installation procedures</u>; temporary bracing; and \_\_\_\_\_>>.
- F. Operation Data: Provide operating instructions << , and \_\_\_\_\_; or None N/A>>.
- G. Maintenance Data: Provide maintenance instructions, maintenance schedules << <u>, and</u> \_\_\_\_\_; or None N/A>>.

#### 1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this Section with minimum << <u>three</u>; or \_\_\_\_>> years<< <u>documented</u>; or None - N/A>> experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least << <u>three</u>; or \_\_\_\_\_>> years of<< <u>documented</u>; \_\_\_\_; or None N/A>> experience<< and approved by manufacturer; or <u>None N/A</u>>>.

#### 1.06 WARRANTY

- A. See Section <u>01 7800 Closeout Submittals</u>, for additional warranty requirements.
- B. Correct defective Work within a << <u>five;</u> or \_\_\_\_>> year period after Date of Substantial Completion.

## PART 2 PRODUCTS

## 2.01 MANUFACTURERS

- A. Swimming Pool:
  - 1. Hydroworx.
  - 2. Substitutions: << <u>See Section 01 6000 Product Requirements</u>; or Not permitted>>.

## 2.02 REGULATORY REQUIREMENTS

A. Comply with << <u>applicable codes;</u> or \_\_\_\_>> for pools and associated equipment.

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## 2.03 PREFABRICATED SWIMMING POOL

A. Swimming Pool: Prefabricated, packaged unit, composed of modular << <u>aluminum;</u> reinforced glass fiber; or \_\_\_\_\_>> panels<< ; configured to a \_\_\_\_\_ shape; or <u>None - N/A</u>>>.

## 2.04 ACCESSORIES

- A. Pool Access Lift
  - 1. Manufacturer: Aqua Creek Products
  - 2. Model: Admiral Pool Lift
  - 3. Color: Grey
- B. Anchors: << Non-corrosive; Stainless steel; Chrome plated steel; or \_\_\_\_\_>>.

## PART 3 EXECUTION

## 3.01 EXAMINATION

- A. Verify excavation surfaces are clean, smooth, and without voids or irregularities.
- B. Verify << grounding; or bonding>> of electrical and metallic components before shotcreting.

## 3.02 INSTALLATION - PREFABRICATED POOL

- A. Install prefabricated pool panels to final assembly in accordance with manufacturer's instructions.
- B. Lock panels into position, level and plumb.
- C. Coordinate installation of mechanical and electrical components; connect to utilities.
- D. Fill pool, activate filtration and circulation equipment, and chemically stabilize.

## 3.03 INSTALLATION - ACCESSORIES

A. Install pool accessories and fittings in accordance with component manufacturer's instructions.

## END OF SECTION 13 1100

### SECTION 14 2400 HYDRAULIC ELEVATORS

### PART 1 GENERAL

#### **1.01 SECTION INCLUDES**

- A. Complete hydraulic elevator systems.
  - 1. Passenger type.
  - 2. Freight type.

### 1.02 RELATED REQUIREMENTS

- A. Section <u>03 3000 Cast-in-Place Concrete</u>: Includes << <u>elevator machine foundation</u>; <u>enclosed hoistway</u>; <u>elevator pit</u>; <u>divider beams</u>; <u>overhead hoist beams</u>; <u>grouting</u> <u>thresholds</u>; <u>grouting hoistway entrance frames</u>; and \_\_\_\_\_>>.
- B. Section <u>05 1200 Structural Steel Framing</u>: Includes << <u>hoistway framing</u>; <u>divider beams</u>; <u>overhead hoist beams</u>; and \_\_\_\_\_>>.
- C. Section <u>07 8100 Applied Fire Protection</u>: Fireproofing of guide rail brackets where attached to building structural members.
- D. Section <u>07 8400 Firestopping</u>: Fire rated sealant in hoistway.
- E. Section **<u>08 3100 Access Doors and Panels</u>**: Fire rated access doors into hoistway.
- F. Section 09 2116 Gypsum Board Assemblies: Gypsum shaft walls.
- G. Section 09 6813 Tile Carpeting: << Floor finish in car; Product requirements for floor finish in car; or \_\_\_\_>>.
- H. Section <u>09 6816 Sheet Carpeting</u>: << <u>Floor finish in car</u>; <u>Product requirements for floor finish in car</u>; or \_\_\_\_\_>.
- I. Section <u>10 4400 Fire Protection Specialties</u>: Fire extinguisher in elevator machine room.
- J. Section <u>21 1300 Fire-Suppression Sprinkler Systems</u>: Sprinkler heads in hoistway.
- K. Section 26 0533.13 Conduit for Electrical Systems:
- L. Section 26 0583 Wiring Connections:
- M. Section 28 4600 Fire Detection and Alarm:

## 1.03 REFERENCE STANDARDS

- A. AAMA 611 Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).
- B. ADA Standards Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- C. AISC 360 Specification for Structural Steel Buildings; 2016 (Revised 2021).
- D. ASME A17.1 Safety Code for Elevators and Escalators; 2019.
- E. ASME A17.2 Guide for Inspection of Elevators, Escalators, and Moving Walks; 2020.
- F. ASTM B221 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2020.
- G. ASTM B221M Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.
- H. AWS D1.1/D1.1M Structural Welding Code Steel; 2020.
- I. NEMA LD 3 High-Pressure Decorative Laminates; 2005.
- J. NEMA MG 1 Motors and Generators; 2018.
- K. NFPA 70 National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- L. NFPA 80 Standard for Fire Doors and Other Opening Protectives; 2019.
- M. PS 1 Structural Plywood; 2009 (Revised 2019).

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## 1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Coordinate work with other installers to provide conduits necessary for installation of wiring including but not limited to:
- B. Preinstallation Meeting: Convene meeting at least << <u>one week;</u> or \_\_\_\_>> prior to start of this work.
  - 1. Review schedule of installation, proper procedures and conditions, and coordination with related work.
- C. Construction Use of Elevator: << <u>Provide designated elevator</u>; Provide one elevator; Provide Elevator No. \_\_\_; Elevator may be used; or \_\_\_\_>> for transport of construction personnel and materials in compliance with ASME A17.1.
  - 1. Owner to negotiate with manufacturer/installer for construction use of elevator in accordance with terms and conditions of manufacturer's temporary acceptance form.
  - Make elevator available for construction use << on or before \_\_\_\_\_; <u>as early as possible</u>; or \_\_\_\_\_>>.
  - 3. Enclose car with protective << <u>plywood</u>; or \_\_\_\_\_>> on floor, walls, and ceiling.
  - 4. Provide temporary lighting.
  - 5. Provide control panel with manual<< <u>and emergency;</u> ; or None N/A>> operation.

## 1.05 SUBMITTALS

- A. See Section **<u>01 3000 Administrative Requirements</u>** for submittal procedures.
- B. Product Data: Submit data on following items:
  - 1. Signal and operating fixtures, operating panels, and indicators.
  - 2. Car design, dimensions, layout, and components.
  - 3. Car and hoistway door and frame details.
  - 4. Electrical characteristics and connection requirements.
- C. Shop Drawings: Include appropriate plans, elevations, sections, diagrams, and details on following items:
  - 1. Elevator Equipment and Machines: Size and location of driving machines, power units, controllers, governors, and other components.
  - 2. Hoistway Components: Size and location of car guide rails, buffers, jack unit and other components.
  - 3. Rail bracket spacing; maximum loads imposed on guide rails requiring load transfer to building structural framing.
  - 4. Clearances and over-travel of car.
  - 5. Locations in hoistway<< <u>and machine room;</u> \_\_\_\_; or None N/A>> of traveling cables and connections for << <u>car lighting;</u> <u>telephone;</u> and \_\_\_\_>>.
  - 6. Location and sizes of hoistway and car doors and frames.
  - 7. Electrical characteristics and connection requirements.
  - 8. Indicate arrangement of elevator equipment and allow for clear passage of equipment through access openings.
- D. Testing Agency's Qualification Statement.
- E. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- F. Operation and Maintenance Data:
  - 1. Parts catalog with complete list of equipment replacement parts; identify each entry with equipment description and identifying code.
  - 2. Operation and maintenance manual.
  - Schematic drawings of equipment<< <u>and hydraulic piping;</u>; or None N/A>>, and wiring diagrams of installed electrical equipment with list of corresponding symbols to identify markings on << <u>machine room;</u> <u>hoistway apparatus;</u> and \_\_\_\_\_>>.

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|--------------------------|-------------|----------------------|
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## 1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum << <u>ten</u>; or <u>>></u> years<< <u>documented</u>; <u>;</u> or <u>None</u> N/A>> experience.
- B. Installer Qualifications: Company specializing in performing the work of this section and approved by elevator equipment manufacturer.
- C. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of type specified in this section.

## 1.07 WARRANTY

- A. See Section <u>01 7800 Closeout Submittals</u> for additional warranty requirements.
- B. Provide manufacturer's warranty for elevator operating equipment and devices for **<< 90 days**; <u>one year</u>; or \_\_\_\_\_>> from Date of Substantial Completion.

## PART 2 PRODUCTS

## 2.01 MANUFACTURERS

- A. Hydraulic Elevator Manufacturers:
  - 1. Otis Elevator Company<< ; HydroFit; ; \_\_\_\_; or None N/A>>: www.otis.com/#sle.

# 2.02 HYDRAULIC ELEVATORS

## 2.03 COMPONENTS

- A. Elevator Equipment:
  - 1. Motors, Hydraulic Equipment, Controllers, Controls, Buttons, Wiring, Devices, and Indicators: Comply with NFPA 70; see Section <u>26 0583</u>.
  - 2. Guide Rails, Cables, Buffers, Attachment Brackets and Anchors: Design criteria for components includes safety factors in accordance with applicable requirements of Elevator Code, ASME A17.1.
  - 3. Buffers:
  - 4. Lubrication Equipment:
- B. Electrical Equipment:
  - 1. Motors: << <u>NEMA MG 1;</u> or \_\_\_\_>>.
  - Boxes, Conduit, Wiring, and Devices: As required by NFPA 70; see Sections <u>26 0533.13</u> and <u>26 0583</u>.
  - Spare Conductors: Provide << <u>ten</u>; or \_\_\_\_>> percent in extra conductors and << <u>two</u>; or \_\_\_\_>> pairs of shielded audio cables in traveling cables.
  - 4. Include wiring and connections to elevator devices remote from hoistway<< <u>and between</u> <u>elevator machine room;</u> \_\_\_\_; or None - N/A>>.<< <u>Provide additional</u> <u>components and wiring to suit machine room layout.;</u> \_\_\_\_.; or None - N/A>> See Section <u>26 0583</u>.

## 2.04 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with << <u>ASME A17.1</u>; <u>applicable local codes</u>; <u>authorities having jurisdiction (AHJ)</u>; and \_\_\_\_\_>>.
- B. Accessibility Requirements: Comply with ADA Standards.
- C. Perform structural steel design, fabrication, and installation in accordance with AISC 360.
- D. Perform welding of steel in accordance with AWS D1.1/D1.1M.
- E. Fabricate and install door and frame assemblies in accordance with NFPA 80 and in compliance with requirements of authorities having jurisdiction.
- F. Perform electrical work in accordance with NFPA 70.

## 2.05 OPERATION CONTROLS

- A. Elevator Controls: Provide << <u>landing operating panels</u>; <u>landing indicator panels</u>; and \_\_\_\_\_>>.
  - 1. Landing Operating Panels: Metallic type, one for originating "Up" and one for originating "Down" calls, one button only at terminating landings; with illuminating indicators.
  - 2. Landing Indicator Panels: Illuminating.
  - 3. Comply with ADA Standards for elevator controls.
- B. Interconnect elevator control system with building << <u>security</u>; <u>fire alarm</u>; <u>card access</u>; <u>smoke alarm</u>; <u>building management control</u>; and \_\_\_\_>> systems.
- C. Door Operation Controls:
  - 1. Program door control to open doors automatically when car arrives at floor landing.
  - 2. Render "Door Close" button inoperative when car is standing at dispatch landing with doors open.
  - 3. Door Safety Devices: Moveable, retractable safety edges, quiet in operation; equipped with << photo-electric light rays; object proximity detector device; or \_\_\_\_\_>>.
- D. Lobby Monitoring Panel:

  - 2. << <u>Etch</u>; Engrave; or \_\_\_\_\_>> face plate markings in panel, and fill with paint of contrasting color.
  - 3. Include direction indicator displaying landing "Up" and "Down" calls registered at each landing floor.
  - 4. Include position and motion display for direction of travel of each elevator. Display << <u>appropriate graphic characters on non-glare screen</u>; vertical rows of lights that illuminate sequentially; or \_\_\_\_\_>>. Indicate position of cars at rest and in motion.
  - Include "Firefighter's Service Switch" that manually recalls each elevator to << main floor; or \_\_\_\_\_>>.
- E. Provide "Firefighter's Emergency Operation" in accordance with << <u>ASME A17.1;</u> <u>applicable</u> <u>building codes;</u> <u>authorities having jurisdiction (AHJ);</u> and \_\_\_\_\_>>.

# 2.06 OPERATION CONTROL TYPE

# 2.07 SERVICE CONTROL TYPE

## 2.08 EMERGENCY POWER

- A. Set-up elevator operation to run with << <u>building emergency power supply</u>; elevator emergency power supply; or \_\_\_\_\_>> when the normal building power supply fails, and in compliance with ASME A17.1 requirements.
- B. Building Emergency Power Supply: Supplied by << <u>backup generator</u>; or \_\_\_\_>; provide elevator system components as required for emergency power characteristics with phase rotation the same as for normal power.
  - 1. Provide transfer switches and auxiliary contacts.
  - 2. Install connections to power feeders.
- C. Emergency Lighting: << <u>Comply with</u> <u>ASME A17.1 elevator lighting requirements;</u> As selected from manufacturers standard line; or \_\_\_\_>>.
- D. Provide operational control circuitry for adapting the change from normal to emergency power.
- E. Upon transfer to emergency power, advance one elevator at a time to a pre-selected landing, stop car, open doors, disable operating circuits, and hold in standby condition.

## 2.09 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M), << <u>natural anodized</u>; or \_\_\_\_\_> finish<< <u>unless otherwise indicated</u>; \_\_\_\_; or None - N/A>>.

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- B. Plywood: PS 1, Structural I, Grade << <u>C-D</u>; or \_\_\_\_>> or better, << <u>sanded</u>; unsanded; or \_\_\_\_>>.
- C. Carpet Flooring: See Section <u>09 6816</u><< , <u>Type</u> ; or None N/A>>.
- D. Plastic Laminate: NEMA LD 3,<< <u>Type HGS</u>,; Type VGS,; Type HGF,; \_\_\_\_\_,; or None N/A>> color as selected by Architect from manufacturer's standard line of colors.

## 2.10 CAR AND HOISTWAY ENTRANCES

- A. Elevator, << <u>No.</u>; Ltr.\_\_; \_\_\_; or Shaft \_\_\_>>:
  - Car and Hoistway Entrances<< <u>, Main Elevator Lobby</u>; <u>, Each Elevator Floor Lobby</u>; <u>,</u> ; or None - N/A>>:
    - a. Framed Opening Finish and Material: << <u>Alkyd enamel on steel</u>; Baked enamel on steel; Brushed stainless steel; As indicated on drawings; or \_\_\_\_>.
    - b. Car Door Material: << Bronze; Stainless steel; <u>Powder coat on steel;</u> Alkyd enamel on steel; Baked enamel on steel; As indicated on drawings; To match hoistway entrance doors; Plastic laminate covered steel, edged with stainless steel; or \_\_\_\_>, with rigid sandwich panel construction.
    - c. Hoistway Door Material: << Bronze; Stainless steel; <u>Powder coat on steel;</u> Alkyd enamel on steel; Baked enamel on steel; As indicated on drawings; To match cab entrance doors; Plastic laminate covered steel, edged with stainless steel; or \_\_\_\_>, with rigid sandwich panel construction.

## 2.11 CAR EQUIPMENT AND MATERIALS

- A. Elevator Car<< <u>. No.</u>; , Ltr. ; , ; or None N/A>>:
  - 1. Car Operating Panel: Provide << main; auxiliary; and \_\_\_\_\_>>; << flush-mounted applied face plate; or \_\_\_\_\_>>, with<< illuminated; \_\_\_\_\_; or None N/A>> call buttons corresponding to floors served with << "Door Open/Door Close" buttons; "Door Open" button; "Door Close" button; alarm button; and \_\_\_\_\_>>.

    - b. Car Floor Position Indicator: << <u>Above door</u>; Above car operating panel; or \_\_\_\_\_\_\_> with illuminating position indicators.
    - c. Locate alarm button where it is unlikely to be accidentally actuated; not more than << <u>54 inch; or \_\_\_\_\_ inch>></u> above car finished floor.
  - 2. Flooring: << Style \_\_\_\_; Carpeting; Carpet tile; Resilient vinyl tile; Resilient sheet flooring; or \_\_\_\_>>.
  - 3. Front Return Panel: << <u>Match material of car door</u>; <u>Match material of side walls</u>; Stainless steel; Bronze; Baked enamel on steel; or \_\_\_\_\_>>.
  - Door Wall: << <u>Plastic laminate on plywood</u>; Plastic laminate on \_\_\_\_\_; Baked enamel on steel; Stainless steel; or \_\_\_\_>>.
     << <u>Hand</u>; Bumper; or \_\_\_\_>> Rail: << <u>Aluminum</u>; Brass (Architectural bronze);
  - 5. << <u>Hand</u>; Bumper; or \_\_\_\_>> Rail: << <u>Aluminum</u>; Brass (Architectural bronze); Brass (Commercial bronze); Stainless steel; Wood; \_\_\_\_; or Type \_\_\_\_ by \_\_\_\_>>, at << rear wall; each side wall; <u>all three sides</u>; or \_\_\_\_>>. << <u>Provide</u> <u>open clearance space 1-1/2 inch (38 mm) wide to face of wall.</u>; Provide open clearance space \_\_\_ inch ( \_\_\_ mm) wide to face of wall.; \_\_\_\_\_.; or None - N/A>>
    - a. Aluminum Finish: << Mill; <u>Clear anodized</u>; Color anodized, <u>\_\_\_\_</u> color; High performance organic finish, <u>\_\_\_\_</u> color; Polished; Brushed; Painted; As scheduled; As selected by Architect; or <u>\_\_\_</u>>>.
  - 6. Ceiling: << Type \_\_\_\_\_ by \_\_\_\_\_.; or <u>None N/A</u>>>

## 2.12 FINISHES

- A. Powder Coat on Steel: Clean and degrease metal surface; apply one coat of primer; two coats of powder coat.
- B. Finish Paint for Metal Surfaces: Alkyd enamel, << <u>semi-gloss</u>; or \_\_\_\_\_>>, << <u>color as</u> <u>selected</u>; or \_\_\_\_\_ color>>, complying with VOC limitations of authorities having jurisdiction

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(AHJ).

C. Clear Anodized Finish: Class I, AAMA 611<< <u>AA-M12C22A41;</u> ; or None - N/A>>, clear anodic coating with electrolytically deposited organic seal; not less than <u>0.7 mil, 0.0007</u> <u>inch</u> thick.

# PART 3 EXECUTION

## 3.01 EXAMINATION

- A. Verify existing conditions before starting this work.
- B. Verify that << <u>hoistway</u>; <u>pit</u>; <u>machine room</u>; and \_\_\_\_\_>> are ready for work of this section.
- C. Verify hoistway shaft and openings are of correct size and within tolerance.
- D. Verify location and size of machine foundation and position of machine foundation bolts.
- E. Verify that electrical power is available and of correct characteristics.

## 3.02 PREPARATION

- A. Arrange for temporary electrical power for installation work and testing of elevator components; see Section **<u>01 5000 Temporary Facilities and Controls</u>** for additional requirements.
- B. Maintain elevator pit excavation free of water.

## 3.03 INSTALLATION

- A. Coordinate this work with installation of hoistway wall construction.
- B. Install system components, and connect equipment to building utilities.
- C. Provide conduit, electrical boxes, wiring, and accessories; see Sections <u>26 0533.13</u> and <u>26 0583</u>.
- D. Install hydraulic piping between cylinder and pump unit.
- E. Mount << <u>machines;</u> <u>motors;</u> <u>pumps;</u> and \_\_\_\_>> on vibration and acoustic isolators.
  - 1. Place on structural supports and bearing plates.
  - 2. Securely fasten to building supports.
  - 3. Prevent lateral displacement.
- F. Install hoistway, elevator equipment, and components in accordance with approved shop drawings.
- G. Install guide rails to allow for thermal expansion and contraction movement of guide rails.
- H. Accurately machine and align guide rails, forming smooth joints with machined splice plates.
- I. Install hoistway door sills, frames, and headers in hoistway walls; grout sills in place, set hoistway floor entrances in alignment with car openings, and align plumb with hoistway.
- J. Structural Metal Surfaces: Clean surfaces of rust, oil or grease; wipe clean with solvent; prime two coats.
- K. Wood Surfaces not Exposed to Public View: Finish with one coat primer; << <u>one coat</u>; two coats; or \_\_\_\_>> enamel.
- L. Adjust equipment for smooth and quiet operation.

## 3.04 TOLERANCES

- A. Guide Rail Alignment: Plumb and parallel to each other in accordance with ASME A17.1 and ASME A17.2.
- B. Car Movement on Aligned Guide Rails: Smooth movement, without any objectionable lateral or oscillating movement or vibration.

## 3.05 FIELD QUALITY CONTROL

- A. See Section <u>01 4000 Quality Requirements</u> for additional requirements.
- B. Perform testing and inspection in accordance with requirements.

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# C. Operational Tests:

- 1. Perform operational tests in the presence of Owner and Architect.
- 2. At an agreed time, and the building occupied with normal building traffic, conduct tests to verify performance.
  - a. Furnish event recording of each landing call registrations, time initiated, and response time throughout entire working day.
- 3. Set period of time elevator takes to travel between typical floor landings at not more than \_\_\_\_\_\_seconds.
  - a. Measure time from moment doors start to close until car has stopped level at next floor landing and doors are opening.

## 3.06 ADJUSTING

- A. Adjust for smooth acceleration and deceleration of car to minimize passenger discomfort.
- B. Adjust with automatic floor leveling feature at each floor landing to reach <u>1/4 inch</u> maximum from flush with sill.

### 3.07 CLEANING

- A. Remove protective coverings from finished surfaces.
- B. Clean surfaces and components in accordance with manufacturers written instructions.

### 3.08 CLOSEOUT ACTIVITIES

A. Demonstrate proper operation of equipment to Owner's designated representative.

### 3.09 PROTECTION

- A. Do not permit construction traffic within car after cleaning.
- B. Protect installed products until << <u>Date of Substantial Completion</u>; date as established by the Owner; or \_\_\_\_>>.
- C. Touch-up, repair, or replace damaged products and materials prior to Date of Substantial Completion.

## END OF SECTION 14 2400

### SECTION 21 0500 COMMON WORK RESULTS FOR FIRE SUPPRESSION

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

- A. Wet Pipe Sprinkler System.
- B. Dry Pipe Sprinkler System.
- C. Standpipe System.
- D. Fire Department Connections.
- E. System Design, Materials, Installation, and Certification.
- F. System Supervision Alarms.

### 1.02 SCOPE DESCRIPTION

- A. VNPCC1 Modify the existing NFPA 13 wet sprinkler system in accordance with the design documents. FM Global shall not be applied to this building. All modifications to the fire protection systems shall be in compliance with the contract documents, applicable codes and standards, as well as the Authority having jurisdiction.
- B. VNPCC2 Install all components in accordance with FM Global requirements. The following systems are required:
  - 1. Provide a complete automatic fire sprinkler system, hydraulically calculated to protect the entire facility, complete and in operating order. These fire protection systems shall be in compliance with the contract documents, applicable codes and standards, as well as the Authority having jurisdiction. Sprinklers shall be installed throughout the building, including outside roof canopies, utilizing systems compatible with the specific application.
  - 2. This project requires the system be installed in accordance with FM Global standards where they have requirements in excess of NFPA 13 only to the addition. Use of FM Global standards on this project does not permit any installation that does not fully comply with NFPA 13. In the perception of a conflict between the documents, consult the Engineer for interpretation.
  - 3. Provide a complete a combination of wet and dry sprinkler risers to protect the facility, as indicated on the drawings.
  - 4. Provide a wet standpipe system connected to the wet sprinkler system with hose valves on the outside of the penthouse mechanical room. Provide indoor manual gate for valve for isolation of water to prevent freezing.

#### 1.03 SPECIAL REQUIREMENTS

- A. South Central Foundation fire protection sprinkler projects are subject to review by the Factory Mutual Insurance Company, 601 108th Ave. NE, Suite 1400, Bellevue, WA 98004/Tel: (425) 455-5333/Fax: (425) 454-7847, in addition to the review by the Matanuska-Susitna Borough Fire Department.
- B. Provide complete interface with elevator equipment to comply with ANSI/ASME A17.1c Section 102. Specifically with regard to hoistways, machine rooms, and machinery spaces for protecting these areas only, the following practices apply:
  - 1. All risers and returns shall be located outside these areas.
  - 2. Branchlines in the hoistway shall supply sprinklers at not more than one floor level.
  - 3. Control valves shall be provided, in accessible locations, for each branchline supplying sprinklers in these spaces.
  - 4. Means shall be provided to automatically disconnect the main line power supply to the affected elevator and machine room prior to the application of water. This means shall not

be self-resetting. The activation of sprinklers outside the hoistway shall not disconnect the main line power supply.

- C. Provide complete interface with electrical/transformer rooms and areas in compliance with the NEC. Apply the following practices:
  - 1. Route no piping through electrical rooms with the following exceptions:
    - a. Branch piping supplying sprinklers protecting the electrical room. Note: This branch piping shall not exit the electrical room to supply additional sprinklers outside the room.
  - 2. No piping shall be routed above electrical panels in compliance with the NEC.
- D. Sprinkler mains shall not be routed through aquatherapy pool area.
- E. Provide complete interface with building smoke and fire alarm system.
- F. Provide valve supervision and water flow alarms and trouble signal monitoring system and shall automatically transmit to an approved station in accordance with the International Fire Code.

### 1.04 CODES AND STANDARDS

- A. IBC Latest Adopted Edition.
- B. NEC Latest Adopted Edition.
- C. UPC Latest Adopted Edition.
- D. IMC Latest Adopted Edition.
- E. IFC Latest Adopted Edition.
- F. FM Global Data Sheet 2-0 Installation Guidelines for Automatic Sprinklers.
- G. FM Global Data Sheet 2-8 Earthquake Protection for Water-Based Fire Protection Systems.
- H. FM Global Data Sheet 3-26 Fire Protection Water Demand for Nonstorage Sprinklered Properties.
- I. FM Global Data Sheet 8-9, Storage of Class 1,2,3,4 and Plastic Commodities.
- J. NFPA 13 Standard for the Installation of Sprinkler Systems, latest adopted edition.
- K. NFPA 25 Water-Based Fire Protection Systems, latest adopted edition.
- L. NFPA 291, Recommended Practice for Fire Flow Testing and Marking of Hydrants, latest adopted edition.
- M. ASCE Standard 7, Minimum Design Loads for Buildings and Other Structures, latest adopted edition.

#### 1.05 REFERENCES

- A. AWWA C510 Backflow Prevention Devices reduced pressure type and double check valve type.
- B. USC University of Southern California: Foundation for Cross-connection Control and Hydraulic Research.

#### 1.06 QUALITY ASSURANCE

- A. Unless otherwise noted, this is substantially a "performance" specification.
- B. Minimum qualifications of the contractor/subcontractor shall include the following:
  - 1. Specialist Firm: Company specializing in automatic fire protection/sprinkler systems, possessing a minimum of three years' experience with systems similar in nature to the type specified herein.
  - 2. Design Certification: Shop drawings shall be prepared by a person with a minimum certification of level II designer, supervised by a Licensed Professional Engineer or a level III or IV Fire Sprinkler Designer, certified by the National Institute For Certification In

Engineering Technologies (NICET), in Fire Protection Engineering Technology Automatic Fire Sprinkler System Layout.

- 3. Equipment and components: Bear the "UL" label or the "FM" approval marking.
- 4. Maintain a complete stock of replacement parts.
- 5. Remain on 24 hour call for emergency service.
- 6. Maintain an office and telephone, with authorized representatives of the Fire Protection Contractor's firm, including the Designated Project Mechanical Sprinkler Supervisor, with a physical presence and address in Alaska.
- 7. Bids of wholesalers, contractor or any firm whose principal business is not that of manufacturing and/or installing fire protection systems is not acceptable.
- C. Backflow Prevention: Installation and testing by a certified backflow assembly tester, in accordance with the Uniform Plumbing Code (UPC).

### 1.07 SUBMITTALS

- A. Submit under provisions of Division 01.
- B. Submit complete and all at one time; partial submittals will not be considered. Submittals shall be provided in electronic PDF Format. The data in the electronic file shall be arranged and indexed under basic categories. An index shall be included with bookmarks and identifying tabs between sections.
- C. Submit contractor's qualifications, proof of 3 years' experience under this contractor's firm name, and references for at least 5 projects in Alaska of similar type, size, and complexity.
- D. Submit a copy of designer's NICET certification and resume', or Alaska P.E. license number.
- E. Submit shop drawings and hydraulic calculations concurrently to the engineer and the Borough Fire Marshal for review. Submit one set of stamped approved shop drawings and hydraulic calculations to the Architect/Engineer when available from AHJ. Engineer will retain 1 set of "stamped approved" shop drawings. These sets must include the NICET certification or stamp of a licensed professional engineer as described above.
- F. Obtain FM Global (Factory Mutual) acceptance of plans for all elements of fixed automatic fire protection prior to fabrication. Design parameters for these installations, based upon proposed occupancy, may be obtained from FM Global prior to system design. Allow minimum 10 business days for FM Global review of submittals. Submit Hard Copy and Electronic Copies of shop drawings, product data, hydraulic calculations and seismic bracing load calculations for the automatic sprinkler system. Submitted to FM Global as follows:

Hard Copy Submittals: Attn: FM Global - Plan Review 601 - 108th Avenue NE, Suite 1400 Bellevue, WA 98004 Tel. (425) 455-5333 Electronic Submittals: ENGSanFranciscoPlanReview@fmglobal.com

- G. Submit backflow assembly tester UPC certificate. Submit letter of certification for installation signed by tester.
- H. Submit all written reviews and contractor responses to reviews to the Architect/Engineer.
- I. Submit product data, and sprinkler head layout. Sprinkler head layout shall be reviewed by the Architect/Engineer. All other approvals shall be secured prior to materials fabrication. Additional sprinklers as required shall be added at no additional cost to the contract.
- J. Shop Drawings shall include the following information in compliance with FM Global:
  - 1. Name of Owner, occupant and Building Permit Number.
  - 2. Location, including street address and legal description.

- 3. Point of compass.
- 4. Fire Department Connections.
- 5. All necessary controlling equipment.
- 6. Location of water source, type, routing, depth of bury and size of supply piping. Identify location and size of city main and whether it is dead-end or circulating loop, and distance to the flow data test hydrant.
- 7. All distribution system piping and outlets. Include pipe and fitting types.
- 8. Location, make, model, size, and power requirements of dry pipe system nitrogen generator, low air alarm switch, air maintenance device, alarm pressure switch as well as the holding capacity, in gallons, for the dry pipe system.
- 9. Reflected ceiling plan showing ceiling heights, construction type, proposed location and type of sprinkler heads, and other ceiling devices such as HVAC diffusers, loud speakers, type and location of light fixtures, etc.
- 10. Interference control between sprinkler system and other trades.
- 11. Full height cross section.
- 12. Location of partitions. Identification of full height walls and draft stops.
- 13. Location and size of unsprinklered concealed spaces.
- 14. Identification of unheated areas.
- 15. Water Flow Test Results; include testing agency; time, date and location of test; actual pitot reading at flow hydrant; and equipment used to perform the test.
- 16. Make, model, Type, orifice, finish and Temperature rating of sprinklers and their respective locations.
- 17. On systems that are hydraulically calculated, indicate the square footage area protected by each system.
- 18. Hydraulic node points.
- 19. Make, model, and size of all fire protection control valves, alarm valves, pumps, controllers, and related equipment, and check valves.
- 20. Identify low point drain and inspector test stations.
- 21. Indicate the type and location of all piping hangers and equipment supports.
- 22. Indicate the type and location of all seismic bracing and restraint.
- 23. Make, model, size, and locations of all pipe couplings, fittings and flanges.
- 24. Make, model, size, power requirement, and location of alarm bells, buzzers, detectors, and/or alarm panels.
- 25. Make, model, size, and configuration of fire pump as well as its installation into the system.
- 26. Provisions for flushing.
- 27. When the equipment to be installed is an addition or renovation to an existing sprinkler system, enough of the existing system shall be shown on the shop drawings to indicate the total number of sprinklers and the total square foot area protected by the entire system.
- 28. Name, address and telephone number of the contractor. If design is by a separate firm, include the name address and telephone number of the design facility.
- 29. Complete legend of all abbreviations and symbols indicated.
- 30. Complete schedule of all room occupancies.
- 31. Location of all unit heaters.
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- 32. Location of all structural penetrations.
- 33. Note the location of all "exposed" piping.
- 34. Valve Supervision Alarm:
  - a. Make and model on all supervisory switches, alarm and monitoring panel.
  - b. Shop drawing and wire diagram of alarm system.
  - c. Location of alarm annunciator, or remote monitoring method to be utilized for offsite monitoring.

#### 1.08 MAINTENANCE INFORMATION, FRAMED BUILDING PLAN AND RECORD DRAWINGS

- A. Submit under provisions of Division 01.
- B. Provide a complete building floor plan showing all system control valves, drain stations, air compressors, alarm and control panels, test valves, and other primary fire protection devices. Indicate all sprinkler zones, boundaries, and types of systems. Submit this plan prior to substantial completion for review by the mechanical engineer. Enclose the plan in an architectural metal picture frame with 1/8" rigid clear plastic cover. Minimum 1/2" frame width. Locate the framed plan in the fire protection control valve room on the wall with the spare sprinkler cabinet.
- C. Include step by step instructions to place the fire protection system in service as well as to take it out of service. Provide complete maintenance information of all primary fire protection equipment, including valves, fittings, sprinklers. Identify equipment indicating whether devices are replacement items or repairable. Provide parts list and suppliers for repairable items. Include complete detailed "Record Drawings" and record calculations of the fire protection sprinkler system.
- D. Install one copy of the record hydraulic calculations and shop drawings in a metal sleeve box on the wall near the fire sprinkler riser.
- E. Provide 1 *original* copy of NFPA 25 in each O&M manual.
- F. The contractor shall maintain current and up-to-date "Record Drawings" of the fire protection system at the job site, in accordance with Division 01. Significant changes in piping due to onsite coordination with other trades will require recalculation to confirm adequate pipe sizing.

#### 1.09 REVIEWS, APPROVALS, AND PERMITS

- A. Obtain written review and/or approval of the entire fire protection system design and arrangement from the following authorities:
  - 1. Architect/Engineer.
  - 2. Matanuska-Susitna Borough Fire Marshal.
  - 3. Owner's Insurance Underwriters.
- B. Comply with all review comments, revising the system design as required, and resubmitting in a timely manner, so as not to hinder the construction schedule.
- C. Obtain and pay for all required permits, inspections, tests, and approvals as required by authorities having jurisdiction.

#### 1.10 WATER FLOW INFORMATION, HYDRAULIC CALCULATIONS, SEISMIC CALCULATIONS

- A. Obtain and verify the water supply Static Pressure, Residual Pressure, at full flow of the test hydrant, at a time of day, during the peak demand on the system, at the point of connection to the water utility system or at a nearby point acceptable to the approval authority. Obtain this data from actual flow test. Identify the testing agency and the source of the test data.
- B. The test shall be conducted by the designated project Design Supervisor, or Field Superintendent. The test shall be conducted in accordance with NFPA 291, Recommended Practice for Fire Flow Testing and Marking of Hydrants.

- C. Hydraulic Calculations shall be accomplished in compliance with the procedures established in FM Global Data Sheet 2-0. In addition to FM Global standards, a minimum 15% pressure buffer is required to be designed into the system. Where local authorities require additional buffer, the contractor shall comply with the more demanding requirement. Do not apply the design area reduction allowed by NFPA for quick response sprinklers in the Hydraulic calculations. FM Global does not allow the design area reduction for quick response sprinklers.
- D. Hydraulic Calculations accomplished by computer program for submittal shall be accompanied by a complete legend of the abbreviations, nodes, and symbols utilized on the computer readout.
- E. Hydraulic Calculations shall clearly identify the following:
  - 1. System type, sprinkler "K" factor, and "C" factor.
  - 2. Pipe and fittings type.
  - 3. Fitting Equivalent Length chart which complies with the "C" factor and pipe type.
  - 4. FM Global Hazard Category, Design Density and size of the Design Remote Area.
  - 5. The Elevation of the "highest" sprinkler.
  - 6. The available water supply and system demand at the point of connection to the water supply, indicated on a logarithmic graph. Include hose demands.
- F. Seismic Bracing Calculations shall clearly identify the following:
  - 1. Type, length and size of brace.
  - 2. Angle allowed of brace.
  - 3. Maximum horizontal load of brace.
  - 4. Brace attachment to structure and load rating.
  - 5. Brace attachment to pipe and load rating.
  - 6. Calculated load to be braced.
  - Seismic bracing calculations, a minimum "G" factor of 0.75 should be used in accordance with FM Global Property Loss Prevention Data Sheet 2-8, Earthquake Protection for Water-Based Fire Protection Systems, Section 2.2.1.2.2. as this facility is located in a FM Global 50-year earthquake zone.

### 1.11 COORDINATION REQUIRED

- A. The contractor shall examine the structural, architectural, mechanical, electrical and all other drawings relating to the building and plan his work accordingly. He shall check and verify all dimensions at the site before fabricating any portion of the system. Any discrepancies in piping and head locations resulting from failure to do so shall be corrected expeditiously to provide proper coordination of all trades.
- B. Coordinate work with that of other trades to ensure that adequate space is provided for all work, including requirements for serviceability and accessibility. Locate sprinkler heads to avoid conflict with light fixtures and other installed equipment.
- C. Structural penetrations for piping shall be identified and details of those penetrations shall be submitted to the structural engineer for approval, in a timely manner. Structural members which are damaged cut or penetrated without approval shall be replaced at no additional expense to the Owner.
- D. Sprinklers shall be "centered" in both directions in units of the ceiling suspension system. Adjust the final location of the sprinklers in the field to accomplish these requirements.
- E. Automatic fire protection piping in correctional facilities, psychiatric institutions shall be designed with full consideration given to the building occupants, minimizing inherent health risks caused by self-inflicted injury from the fire protection system. This includes but is not

limited to exposed piping, security of all system controls and service points, and sprinkler types specifically listed for institutional application.

- F. Dry Pipe Sprinkler System shall be designed to produce sprinkler flow at the most remote sprinkler, within 60 seconds of system actuation.
- G. Wet pipe sprinkler system piping in residential occupancies shall be designed to locate all wet pipe within the thermal "envelope" and vapor barrier of the building. Absolutely no wet pipe shall be routed in cold attic areas. Wet pipe sprinkler system piping shall not be routed in exterior walls. Piping shall be concealed in interior walls utilizing sidewall sprinkler heads or soffited in below top floor ceilings to provide coverage in compliance with FM Global Data Sheet 2-0.

## 1.12 MATERIALS HANDLING AND STORAGE

A. Deliver, store, protect, and handle products to the site under provisions of Division 01. Deliver and store valves in manufacturer packaging with labeling in place. Prior to installation, piping onsite shall be wrapped with protective wrapping. Valves, piping, materials, and equipment shall be clean and new when system is accepted by the Owner.

## PART 2 PRODUCTS

## 2.01 GENERAL

- A. Provide only new materials and equipment, which are standard products of a manufacturer regularly engaged in the manufacture of fire protection equipment.
- B. All products shall bear the "UL" label and be FM Approved and listed in the FM Approval Guide, a publication of FM Approvals and be specifically approved for fire protection application where they are used.

### 2.02 PIPING

- A. Wet Pipe Sprinkler Systems:
  - 1. Black steel piping, ASTM A135 schedule 10 or ASTM A795 schedule 40, UL Listed or FM Approved for fire sprinkler service.
  - 2. Piping may be roll-grooved, threaded, flanged, or welded for connection. All threaded pipe shall be schedule 40. No plain-end pipe fitting connections are allowed.
  - 3. CPVC piping is not allowed for use on this project due to Seismic Bracing requirements of FM Global.
- B. Dry Pipe Sprinkler Systems:
  - 1. Pipe shall be schedule 40 steel pipe. No substitutions allowed.
- C. All piping between the fire protection system connection to the potable water supply and the fire protection backflow prevention device shall be Ductile Iron piping.

## 2.03 GROOVED FITTINGS, COUPLINGS, AND MECHANICAL TEES

- A. Grooved Fittings shall be Victaulic, Gruvlok, or equal. Galvanized fittings shall accompany galvanized piping. Couplings and mechanical tees shall be standard painted Victaulic, Gruvlok, or equal.
- B. Slip-Fit fittings and couplings utilized for joining branch piping to new main piping shall not be allowed.
- C. Contractor shall follow the manufacturer's suggested methods to prepare, carefully, the ends for these fittings to prevent leakage or system breakdown.

# 2.04 THREADED PIPE FITTINGS

A. Threaded pipe fitting for this system shall be cast iron 125# ANSI B16.4 or malleable iron 150# ANSI B16.3.

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## 2.05 PIPE FLANGES

A. Pipe flanges for this system shall be Cast Iron Class 125# ANSI B16.5.

#### 2.06 PIPING HANGERS AND SUPPORTS

A. Pipe hangers shall conform to NFPA 13 standards.

### 2.07 FLEXIBLE SPRINKLER HOSE FITTINGS

- A. FM approved and UL listed for use in fire protection service.
- B. Seismically qualified for use pursuant to ICC-ES AC-156 Acceptance Criteria for Seismic Qualification by Shake-Table Testing of Nonstructural Components and Systems.
- C. Composition: 100% Type 304 Stainless Steel. 175 or 300 PSI minimum rated pressure as appropriate for installed system.
- D. Fully welded non-mechanical fittings, braided, leak-tested with minimum 1 inch true-bore internal corrugated hose diameter.
- E. Ceiling bracket of G90 galvanized steel with snap-on clip ends positively attached to the ceiling using tamper-resistant screws. Flexible hose attachment shall be removable hub type with set screw.

## 2.08 ACCEPTABLE MANUFACTURERS FIRE PROTECTION VALVES AND EQUIPMENT

- A. Reliable.
- B. Tyco.
- C. Potter Electric.
- D. Notifier.
- E. Victaulic.
- F. Potter Roemer.
- G. Croker.
- H. Viking.

## 2.09 VALVES AND ALARMS ASSEMBLIES

- A. Fire Protection Valves:
  - 1. Control Valves: All Fire protection system control valves shall be supervised with switches compatible with the fire alarm system.
    - a. OS&Y Gate Valves: Minimum working pressure 175 PSI non-shock cold water. UL listed for fire protection Victaulic Series 771 or equal.
    - b. Butterfly Valves: UL listed for fire protection 175 PSI non-shock cold water, with integrated supervisory switch. Grooved, threaded, or wafer type acceptable. Victaulic Firelock Series 705 or 707 or equal.
    - c. Swing Check Valves: UL listed for fire protection 175 PSI non-shock cold water, ductile iron body, stainless steel clapper assembly. Grooved, flanged, or wafer type acceptable. Victaulic Firelock Series 717 or equal.
- B. Wet Pipe Sprinkler Systems:
  - 1. Alarm Check Valve Assemblies:
    - a. Provide sprinkler alarm valve assemblies, appropriate to the system, complete with all trimmings and accessories for proper alarm initiation and interface with fire alarm system. Include inlet and outlet pressure gauges, and main drain with discharge to the outside.
  - 2. Water Flow Detectors:

- a. Provide water flow detectors installed at each system or zone control and for the main system header for multiple zone systems. Potter Electric, model VSR-F.
- C. Dry Pipe Sprinkler Systems:
  - 1. Dry Pipe Valve:
    - a. Dry Pipe Valve, complete with all required trimmings, including inlet and outlet pressure gauges and main drain that discharges outside. Victaulic Firelock NXT, or equal.
    - b. Pressure Switch: To signal system discharge. Potter Electric Model PS-10 or equal.
    - c. Low Pressure Alarm Switch: To signal low pressure in the dry pipe fire protection system. Potter Electric Model PS-40-2 or equal.
    - d. Accelerator: As required. Compatible with the Dry Pipe Valve. Victaulic 746-LPA with trim or equal.
    - e. Nitrogen Generator:
      - 1) The nitrogen generator shall be sized to serve the dry sprinkler systems with supervisory nitrogen gas. Sizing shall be based on the total volume of all fire sprinkler systems being served by the nitrogen generator as determined by hydraulic calculations for each system. Documentation of the calculations and nitrogen generator sizing must be provided with the submittals.
      - 2) The integral air compressor shall be capable of producing a continuous volume of compressed air that is sufficient to fill the largest FPS being supplied by the air compressor to operating pressure within thirty (30) minutes in accordance with NFPA 13 requirements and meet the compressed air requirements of the nitrogen generator it is supplying.
        - a) Models:
        - b) AG-950 Wall Mount: 265 Gal. @40 psig/590 Gal. @20 psig
    - f. All electrical alarm and control wiring shall be provided in accordance with Division 26.

#### 2.10 HOSE VALVES

- A. Hose Valves shall be 2-1/2" angle pattern. 2-1/2" valves shall be provided with cast brass caps.
- B. Where static pressure exceeds 60 PSI at any hose station, provide pressure reducing valves to maximize pressure at the nozzle at 60 psi.
- C. Provide caution signs at all hose stations where pressures exceed 30 PSI requesting the operator to read operating instructions, handle with extreme caution and grasp nozzle with a firm grip before opening the hose valve.

#### 2.11 ELECTRIC ALARM

A. Electrically operated 10" diameter red gong.

#### 2.12 HOSE VALVES

- A. Hose Valves shall be 2-1/2" angle pattern. 2-1/2" valves shall be provided with cast brass caps.
- B. Where static pressure exceeds 60 PSI at any hose station, provide pressure reducing valves to maximize pressure at the nozzle at 60 psi.
- C. Provide caution signs at all hose stations where pressures exceed 30 PSI requesting the operator to read operating instructions, handle with extreme caution and grasp nozzle with a firm grip before opening the hose valve.

## 2.13 FIRE DEPARTMENT CONNECTION

- A. Provide connection with four 2-1/2" female threaded hose connections. Coordinate thread type with local fire department.
  - 1. All exposed surfaces to be polished bronze.
  - 2. Connection to be complete with 1/2" automatic ball drip.
  - 3. Escutcheon Plate to be labeled AUTO SPRINKLER or DRY STANDPIPE, depending on system.
  - 4. Provide 2-1/2" x 2-1/2" x 4" Fire Department roof manifold with escutcheon plate at location indicated on the plans.
  - 5. Provide signage over the FDC as required by the AHJ and architectural plans and specifications.

### 2.14 SPRINKLERS

- A. Provide sprinklers as required by FM Global Data Sheets and in compliance with the IBC chapter 9 for the entire project. Sprinkler finish and style as follows:
  - 1. Concealed sprinklers shall be used throughout all public spaces in the facility. Cover plate shall screw over the recessed sprinkler head and be almost flush with the ceiling. Cover plate shall be white or color match to adjacent ceiling.
  - 2. In all areas with surface mounted light fixtures attached to finished suspended ceilings, provide standard spray pendant sprinklers, and extended escutcheons to position the sprinkler deflector below the light fixture. Sprinklers and escutcheons to be chrome finish. Tyco TY-FRB or equal.
  - 3. In storage rooms with recessed lighting flush to the suspended ceiling finish, provide recessed standard spray pendant sprinklers. Sprinklers and escutcheons to be chrome finish. Tyco TY-FRB or equal.
  - 4. Sprinklers above ceilings and throughout shop and mechanical service areas shall be bronze finish, standard spray, upright or pendant type as required.
  - 5. Sidewall sprinklers shall be bronze finish in all service areas, and chrome throughout all public areas.
  - Concealed, dry pendant sprinklers protecting entry vestibules and outside overhangs shall be chrome finish Tyco DS-1 recessed or equal. Dry pendant sprinklers protecting unheated areas and piped from wet pipe systems shall have an "A Length" dimension of not less than 18".
  - 7. For sprinkler heads located in Aquatherapy and adjoining spaces, provide stainless steel sprinkler heads.
  - 8. Sprinkler Guards shall be of the same manufacturer and finish as the sprinkler which they are to be installed on. Red guards are acceptable for bronze sprinklers only. Chrome finish guards are required for chrome sprinkler heads.
  - 9. Sprinklers of correct temperature rating shall be installed according to FM Global.
  - 10. Sprinklers for new additions of existing facilities shall match Make, Model, and finish for existing sprinklers, while complying with NFPA 13 standards, provided those sprinklers are still being manufactured.
  - 11. Provide sprinkler wrenches for each type of sprinkler.
  - 12. Spare sprinkler cabinet to be red sheet steel manufactured by the same company that made the sprinklers. Size the cabinet in accordance with FM Global standards. Provide sprinklers for the cabinet representative of the assortment provided for the system. Mount cabinet on the wall within 60" of the sprinkler control riser.

# 2.15 ACCEPTABLE MANUFACTURERS - BACKFLOW PREVENTERS

- A. Watts.
- B. Hersey.
- C. Cla-Val.
- D. Febco.
- E. Wilkins.
- F. Substitutions: Under provisions of Division 01.

# 2.16 BACKFLOW PREVENTERS

- A. General: IAPMO (UPC) approved.
- B. Double Check Valve Assemblies: ASSE 1015; Two independent check modules within a single housing, four test cocks, and two resilient seated drip tight shutoff valves. The check valves shall be removable and serviceable without the use of special tools. Check valves shall have reversible elastomer discs and shall produce drip tight closure against the reverse flow of liquid caused by backpressure or backsiphonage. Assembly shall be available in horizontal, vertical, or N pattern installations. Lead free construction. Shutoff valves shall include integral tamper switches. Ames C200 or equal.

## PART 3 EXECUTION

## 3.01 CONTRACTOR COORDINATION

- A. The fire protection contractor shall coordinate his work with the work of all other trades to assure timely installation and efficient use of mechanical areas including but not limited to boiler rooms, fan rooms, and ceiling spaces.
- B. Any work installed without proper coordination shall be promptly removed and reinstalled in a manner to allow for a good practical arrangement of all items which need to be installed by all crafts involved.
- C. In case of coordination dispute, the Architect/Engineer shall be consulted and his decision shall be binding.
- D. All costs associated with coordination and arranging or rearranging of the fire protection system shall be borne by the affected contractor, without causing any additional expense to the Owner.

#### 3.02 PIPING INSTALLATION

- A. Install piping to conserve building space and route piping around access panels and openings. Piping shall not restrict any access opening.
- B. Install low point drain stations in accordance with FM Global standards. Identify the location of drain and test stations with signs on access panels, ceiling panels, or walls adjacent to the station, visible from the floor. Discharge all test pipes and system main drain to outside. Coordinate discharge point with Owner's field representative.
- C. Provide seismic protection for the piping system in accordance with FM Global Data Sheet 2-8 and NFPA 13. Attach bracing to structure with through bolts, washers, and nuts. Provide clearance at all structural penetrations. Provide oversized escutcheon plates or flexible connections where sprinklers penetrate non-frangible ceiling membranes.
- D. Dry system piping shall be installed to allow full service and complete drainage of the entire system. All dry piping shall be sloped to accomplish this requirement.
- E. Piping shall be concealed in all areas with finished ceilings.
- F. Piping concealed in walls shall be secured to stude 48" 60" above the floor.
- G. Pipe penetrations through rated fire walls shall be sealed by a "UL" listed system utilizing fire rated caulking. Submit data under paragraph 1.8 (Submittals) of this specification.

- H. When piping is supported from manufactured structural members, the Installation of pipe hangers shall comply with truss manufacturer's recommendations for hanger attachments and loading.
- I. When pipe hangers are attached to bar joist with wood top and bottom chords, chords shall be predrilled for fasteners, and fasteners shall maintain a minimum distance of 0'-6" from truss "panel points".
- J. All "beam clamp" type fasteners shall be installed with retainer straps and locking nuts.
- K. Pipe hangers shall be "Rod and Ring" type hangers throughout. Piping hangers shall have a minimum of 1/2" of adjustment on each side of the hanger ring nut, to allow for piping grade adjustment in the future.
- L. All Trapeze members shall be fastened to truss chords or structural members.
- M. Provide isolation mounts for air compressor.
- N. Installation of all valves and equipment shall comply with manufacturer's suggested installation practices and directions.
- O. Provide service access around all equipment.

## 3.03 SYSTEM TEST

- A. Hydrostatically test the entire system in accordance with FM Global standards.
- B. Test all system alarm actuations and alarms.
- C. Trip test dry pipe system to confirm system discharge time.
- D. Perform main drain test.
- E. 48-hour advance notice required for all tests to allow Owner's field representative to witness these tests.

#### 3.04 PAINTING

A. Paint exposed piping in accordance with Division 09. Color to be determined by Architect.

## 3.05 PROJECT CLOSEOUT

- A. The fire protection contractor shall submit a written affidavit at the completion of the system, stating that the fire protection system as installed complies with all referenced codes and standards, Local Fire Marshal's Office, and the Owner's Insurance Underwriters.
- B. Forward one copy of the Contractor's Materials and Test Certificate, FM Global Form 85A and commissioning tests to FM Global for their records upon completion of fire protection installations.
- C. Furnish Written Guarantee to the Owner, that materials installations are free from mechanical defects and guaranteeing to replace and repair any and all unsatisfactory and defective work and items, to the satisfaction of the Owner, in a timely manner, for a period of one year after final acceptance of the building by the Owner, and to be responsible for any damage caused to the premises for any such unsatisfactory work.
- D. The contractor shall respond within reasonable time, not to exceed 15 days to repair or replace latent or hidden defects at such time as they are discovered.
- E. Provide hydraulic placard on system riser. Placard shall indicate sprinkler demand and hose demand as separate numbers.
- F. Post the results of the original main drain test and date performed on the system riser in a permanent fashion.
- G. Contractor shall fully train the Owner's designated maintenance engineer in the operation and maintenance of the entire fire protection system.

## END OF SECTION 21 0500

### SECTION 21 0800 COMMISSIONING OF FIRE SUPPRESSION

## PART 1 GENERAL

#### 1.01 SUMMARY

- A. Section includes Cx process requirements for the following fire-suppression systems, assemblies, and equipment:
  - 1. Water-based fire-suppression systems.
  - 2. Fire-extinguishing systems.
  - 3. Fire pumps.
- B. Related Requirements:
  - 1. Section <u>01 9113 General Commissioning Requirements</u> for general Cx process requirements and CxA responsibilities.
  - 2. For Prefunctional checklists, comply with requirements in various Division 21 Sections specifying fire-suppression systems, system components, equipment, and products.

#### 1.02 DEFINITIONS

- A. Cx: Commissioning, as defined in Section <u>01 9113 General Commissioning Requirements</u>.
- B. CxA: Commissioning Authority, as defined in Section <u>01 9113 General Commissioning</u> <u>Requirements</u>.
- C. "Systems," "Assemblies," "Subsystems," "Equipment," and "Components": Where these terms are used together or separately, they shall mean "as-built" systems, assemblies, subsystems, equipment, and components.

### 1.03 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fire-suppression testing technician.
- B. Prefunctional checklists: Draft prefunctional checklists will be created by CxA for Contractor review.

#### 1.04 QUALITY ASSURANCE

- A. Fire-Suppression Testing Technician Qualifications: Technicians to perform fire-suppression Prefunctional checklist verification tests, Prefunctional checklist verification test demonstrations, Cx tests, and Cx test demonstrations shall have the following minimum gualifications:
  - 1. Journey level or equivalent skill level with knowledge of fire-suppression system, electrical concepts, and building operations.
  - 2. Minimum [three years'] < Insert time> experience installing, servicing, and operating systems manufactured by approved manufacturer.
- B. Clean-Agent Fire-Suppression Systems Testing Technician Qualifications: Technicians to perform clean-agent fire-suppression system Prefunctional checklist verification tests, Prefunctional checklist verification test demonstrations, Cx tests, and Cx test demonstrations shall have the following minimum qualifications:
  - Journey level or equivalent skill level. Vocational school four-year-program graduate or an Associate's degree in mechanical systems, fire-suppression systems, or similar field. Degree may be offset by three years' experience in servicing fire-suppression systems in the clean-agent fire-suppression systems industry. Generally, required knowledge includes clean-agent fire-suppression systems, electrical concepts, building operations, and application and use of tools and instrumentation to measure performance of firesuppression system equipment, assemblies, and systems.
  - 2. Minimum [three years'] < Insert time> experience installing, servicing, and operating systems manufactured by approved manufacturer.
- C. Testing Equipment and Instrumentation Quality and Calibration:
  - 1. Capable of testing and measuring performance within the specified acceptance criteria.

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- 2. Be calibrated at manufacturer's recommended intervals with current calibration tags permanently affixed to the instrument being used.
- 3. Be maintained in good repair and operating condition throughout duration of use on Project.
- 4. Be recalibrated/repaired if dropped or damaged in any way since last calibrated.
- D. Proprietary Test Instrumentation and Tools:
  - 1. Equipment Manufacturer's Proprietary Instrumentation and Tools: For installed equipment included in the Cx process, test instrumentation and tools manufactured or prescribed by equipment manufacturer to service, calibrate, adjust, repair, or otherwise work on its equipment or required as a condition of equipment warranty, shall comply with the following:
    - a. Be calibrated by manufacturer with current calibration tags permanently affixed.
    - b. Include a separate list of proprietary test instrumentation and tools in operation and maintenance manuals.
    - c. Fire-suppression system proprietary test instrumentation and tools become property of Owner at the time of Substantial Completion.

# PART 2 PRODUCTS (Not Used)

## PART 3 EXECUTION

# 3.01 PREFUNCTIONAL CHECKLIST REVIEW

- A. Review and provide written comments on draft Prefunctional checklists. CxA will create required draft Prefunctional checklists and provide them to Contractor.
- B. Return draft Prefunctional checklist review comments within [10] < Insert number> days of receipt.
- C. When review comments have been resolved, the CxA will provide final Prefunctional checklists, marked "Approved for Use, (date)."
- D. Use only Prefunctional checklists, marked "Approved for Use, (date)."

## 3.02 Cx TESTING PREPARATION

- A. Certify that fire-suppression systems, subsystems, and equipment have been installed, calibrated, and started and that they are operating according to the Contract Documents and approved submittals.
- B. Certify that fire-suppression systems instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents and approved submittals, and that pretest set points have been recorded.
- C. Set systems, subsystems, and equipment into operating mode to be tested according to approved test procedures (for example, normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).

# 3.03 Cx TEST CONDITIONS

- A. Perform tests using design conditions, whenever possible.
  - 1. Simulated conditions may, with approval of Architect, be imposed using an artificial load when it is impractical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by CxA and document simulated conditions and methods of simulation. After tests, return configurations and settings to normal operating conditions.
  - 2. Cx test procedures may direct that set points be altered when simulating conditions is impractical.
  - 3. Cx test procedures may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are impractical.
- B. If tests cannot be completed because of a deficiency outside the scope of the fire-suppression system, document the deficiency and report it to Architect. After deficiencies are resolved, reschedule tests.

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C. If seasonal testing is specified, complete appropriate initial performance tests and documentation and schedule seasonal tests.

### 3.04 Cx TESTS COMMON TO FIRE-SUPPRESSION SYSTEMS

- A. Measure capacities and effectiveness of systems, assemblies, subsystems, equipment, and components, including operational and control functions, to verify compliance with acceptance criteria.
- B. Test systems, assemblies, subsystems, equipment, and components operating modes, interlocks, control responses, responses to abnormal or emergency conditions, and response according to acceptance criteria.
- C. Coordinate schedule with, and perform Cx activities at the direction of, CxA.
- D. Comply with Prefunctional checklist requirements, including material verification, installation checks, startup, and performance tests requirements specified in Division 21 Sections specifying fire-suppression systems and equipment.
- E. Provide technicians, instrumentation, tools, and equipment to perform and document the following:
  - 1. Prefunctional checklist verification tests.
  - 2. Prefunctional checklist verification test demonstrations.
  - 3. Cx tests.
  - 4. Cx test demonstrations.
- F. Vibration Isolation in Fire-Suppression Systems:
  - 1. Prerequisites: Acceptance of results of Prefunctional checklists for vibration[ and seismic] control devices specified in [Section 210548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment."] [Section 210548.13 "Vibration Controls for Fire-Suppression Piping and Equipment."]
  - 2. Components to Be Tested:
    - a. Vibration isolation[ **and seismic**] control devices in water-based fire-suppression systems.
    - b. Structural systems.
  - 3. Test Purpose: Evaluate effectiveness of vibration isolation[ and seismic] control devices.
  - 4. Test Conditions: Measure vibration of the facility structure at [three] <Insert number> locations designated by Owner's witness while the isolated equipment operates.
  - 5. Test Conditions: Measure vibration of the facility structure at [three] <Insert number> locations designated by Owner's witness at the following operating conditions:
    - a. Maximum speed.
    - b. Minimum speed.
    - c. Critical speed.
  - 6. Acceptance Criteria: Structure-borne vibration not to exceed specified performance.
- G. Supervision of Fire-Protection Valves in Water-Based Fire-Suppression Systems:
  - 1. Prerequisites: Acceptance of results of Prefunctional checklists for valves specified in the Sections listed below:
    - a. Section 21 0500 Common Work Results for Fire Suppression
    - b. Section 21 3000 Fire Pumps
    - c. Section 28 4600 Fire Detection and Alarm
  - 2. Equipment and Systems to Be Tested:
    - a. Supervised valves in water-based fire-suppression systems.
    - b. Division 28 fire-detection and -alarm systems.
  - 3. Test Purpose: Verify generation of supervisory alarm at the fire-alarm control panel in response to activation of valve supervision device or tamper switch.
  - 4. Test Conditions:
    - a. Fire-alarm system operating in normal, automatic mode.
    - b. Activate valve supervision devices and tamper switches, one at a time.

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- 5. Acceptance Criteria: Activation of valve supervision device or tamper switch generates supervisory alarm at fire-alarm control panel.
- H. Heat Tracing in Water-Based Fire-Suppression Systems:
  - 1. Prerequisites: Acceptance of results of Prefunctional checklists for heat tracing specified in water-based fire-suppression systems.
  - 2. Equipment and Systems to Be Tested:
    - a. Self-regulating, parallel-resistance heating cables.
    - b. Heater trace circuit controller.
    - c. Interface with fire-alarm control panel.
  - 3. Test Purpose:
    - a. Evaluate response to ambient temperature below freeze-protection set point.
    - b. Evaluate heating cable fault alarm.
  - 4. Test Conditions:
    - a. Subject temperature sensor to temperature approximately [3 deg F] <Insert value> above freeze-protection set point (initial set point [41 deg F] <Insert value>). Monitor sensed temperature with a calibration-grade thermometer. Gradually change set point or sensed temperature until freeze-protection circuit is energized.
    - b. Subject temperature sensor to temperature approximately [3 deg F] <Insert value> below freeze-protection set point (initial set point [41 deg F] <Insert value>). Monitor sensed temperature with a calibration-grade thermometer. Gradually change set point or sensed temperature until freeze-protection circuit is de-energized.
    - c. Simulate an electrical fault on the heating cable.
  - 5. Acceptance Criteria:
    - a. Freeze-protection circuit is energized at set-point temperature minus 2 deg F.
    - b. Freeze-protection circuit is de-energized at set-point temperature plus 2 deg F.
    - c. Heater trace circuit controller initiates an alarm of cable fault. Alarm is correctly reported at the fire-alarm control panel.

## 3.05 Cx TESTS FOR DRY-PIPE SPRINKLER PIPING, FITTINGS, SPRINKLERS, AND SPECIALTIES.

- A. Air Compressor Run Time:
  - 1. Prerequisites: Acceptance of results of Prefunctional checklists specified in Section <u>21 0500</u> <u>– Common Work Results for Fire Suppression</u>.
  - 2. Systems and Equipment to Be Tested:
    - a. Air compressors in fire-suppression systems.
    - b. Associated compressed air piping, valves, and appurtenances.
    - c. Associated air pressure controllers.
  - 3. Test Purpose: Evaluate air compressor run time and number of compressor starts.
  - 4. Test Conditions:
    - a. Keep compressed air and associated sprinkler piping openings closed during test.
    - b. For systems with multiple compressors, lock out compressor motors on all but one compressor. Repeat test for each compressor in turn.
    - c. Record number of air compressor motor starts during a 14-day period.
    - d. Record air compressor motor run time during the same 14-day period.
  - 5. Acceptance Criteria:
    - a. Number of compressor motor starts during test period shall not exceed [20] < Insert number>.
    - b. Compressor motor run time during test period shall not exceed [60 minutes] <Insert time>.

# END OF SECTION 21 0800

#### SECTION 21 3000 FIRE PUMPS

### PART 1 GENERAL

### 1.01 SECTION INCLUDES

- A. Automatic Fire Pumps and Controllers.
- B. System Design, Materials, Installation, and Certification.

## 1.02 SCOPE DESCRIPTION

A. Provide a complete Automatic Electric Motor Driven Fire Pump, complete with control panel, pump test, and pressure maintenance pump, connected to an underground supply main as indicated on the drawings, sized in accordance with NFPA Standards, as required to be compatible with the automatic fire sprinkler system pressure and flow demand, provided for by these documents.

### 1.03 CODES AND STANDARDS

- A. IBC Latest Adopted Edition.
- B. NEC Latest Adopted Edition.
- C. UPC Latest Adopted Edition.
- D. IMC Latest Adopted Edition.
- E. IFC Latest Adopted Edition.
- F. NFPA 13 Standard for the Installation of Sprinkler Systems, latest adopted edition.
- G. NFPA 13R Standard for the Installation of Sprinkler Systems in Residential Occupancies up to Four Stories in Height, latest adopted edition.
- H. NFPA 14 Standard for the Installation of Standpipe and Hose Systems, latest adopted edition.
- I. NFPA 25 Water-Based Fire Protection Systems, latest adopted edition.
- J. NFPA 291, Recommended Practice for Fire Flow Testing and Marking of Hydrants, latest adopted edition.
- K. ASCE Standard 7, Minimum Design Loads for Buildings and Other Structures, latest adopted edition.
- L. NFPA 20 Standard for Centrifugal Fire Pumps.
- M. NFPA 22 Standard for Water Tanks for Private Fire Protection.
- N. NFPA 37 Installation and Use of Stationary Combustion Engines and Gas Turbines.

## 1.04 QUALITY ASSURANCE

- A. Unless otherwise noted, this is substantially a "performance" specification.
- B. Minimum qualifications of the contractor/subcontractor shall include the following:
  - 1. Specialist Firm: Company specializing in automatic fire protection/sprinkler systems, possessing a minimum of three years' experience with systems similar in nature to the type specified herein.
  - 2. Design Certification: Shop drawings shall be prepared by a person with a minimum certification of level II designer, supervised by a Licensed Professional Engineer or a level III or IV Fire Sprinkler Designer, certified by the National Institute For Certification In Engineering Technologies (NICET), in Fire Protection Engineering Technology Automatic Fire Sprinkler System Layout.
  - 3. Equipment and components: Bear the "UL" label or the "FM" approval marking.
  - 4. Maintain a complete stock of replacement parts.

- 5. Remain on 24 hour call for emergency service.
- 6. Maintain an office and telephone, with authorized representatives of the Fire Protection Contractor's firm, including the Designated Project Mechanical Sprinkler Administrator, with a physical presence and address in Alaska.
- 7. Bids of wholesalers, contractor or any firm whose principal business is not that of manufacturing and/or installing fire protection systems not acceptable.

### 1.05 SUBMITTALS

- A. Submit under provisions of Division 01.
  - 1. Fire pump:
    - a. Name and address of the Manufacture and Vender for the fire pump.
    - b. Provide product data including literature on manufacturer's general assembly, pump curves showing performance characteristics with pump and system, operating point indicated, NPSH curve, controls complete with customized wiring diagrams indicating controller specialties matching these contract/bid documents. For electric motor driven pumps provide specific power requirements and loads.
    - c. Provide manufacturer's installation instruction, including details, connection requirements, and start up instructions for the fire pump.
    - d. Provide certification from vendor that all related fire pump equipment including but not limited to Jockey pump and fire pump controllers are purchased as a complete package in compliance with NFPA 20.
    - e. Once the fire pump has been assembled, provide Manufacturer's certified pump curves and certification that fire pump meets or exceeds the specified requirements at specified operating conditions.

#### 1.06 MAINTENANCE INFORMATION

- A. Submit under provisions of Division 01.
- B. Provide 1 original copy of NFPA 20 in each O&M Manual.
- C. Include step by step procedures for required operational weekly/monthly/annual service and fire pump tests, and check lists for trouble shooting pumps, drivers, and controllers. Provide a complete report of field test operation prior to final completion. This field test shall include the actual readings plotted on the certified pump curve.

### 1.07 COORDINATION REQUIRED

- A. The contractor shall examine the structural, architectural, mechanical, electrical and all other drawings relating to the building and plan his work accordingly. He shall check and verify all dimensions at the site before fabricating any portion of the system. Any discrepancies in piping and head locations resulting from failure to do so shall be corrected expeditiously to provide proper coordination of all trades.
- B. Coordinate work with that of other trades to ensure that adequate space is provided for all work, including requirements for serviceability and accessibility.

### 1.08 MATERIALS HANDLING AND STORAGE

A. Deliver, store, protect, and handle products to the site under provisions of Division 01. Deliver and store valves in manufacturer packaging with labeling in place. Prior to installation, piping on site shall be wrapped with protective wrapping. Valves, piping, materials, and equipment shall be clean and new when system is accepted by the Owner.

## PART 2 PRODUCTS

#### 2.01 GENERAL

- A. Provide only new materials and equipment, which are standard products of a manufacturer regularly engaged in the manufacture of fire protection equipment.
- B. All products shall bear the "UL" label or "FM" listing and be specifically approved for fire protection application where they are used.

### 2.02 FIRE PUMPS

- A. All automatic fire pump equipment including but not limited to the primary fire pump, jockey pump, fire pump controller, jockey pump controller, and test apparatus shall be provided as a unit package in compliance with NFPA 20 standards. All equipment shall bear the "UL" label for fire protection application.
- B. Acceptable manufacturers:
  - 1. Fairbanks Morse.
  - 2. Aurora.
  - 3. Patterson.
  - 4. Bell & Gossett.
  - 5. Tolco.
- C. Electric Motor Driven Vertical In-line Pump:
  - 1. Automatic electric motor driven fire pump sized in accordance with designed system water demand at the discharge flange of the fire pump.
  - 2. Automatic fire pump controller with the following features:
    - a. Full service, soft start with integral disconnect.
  - 3. Jockey (pressure maintenance) pump sized to maintain system pressure under normal leakage condition. It shall be able to maintain the desired fire protection system pressure.
  - 4. Jockey pump controller with full voltage starter to start jockey pump on pressure drop of the system. Fire pump shall start automatically on further pressure drop or on jockey pump failure.

## PART 3 EXECUTION

#### 3.01 CONTRACTOR COORDINATION:

- A. The fire protection contractor shall coordinate his work with the work of all other trades to assure timely installation and efficient use of mechanical areas including but not limited to boiler rooms, fan rooms, and ceiling spaces.
- B. Any work installed without proper coordination shall be promptly removed and reinstalled in a manner to allow for a good practical arrangement of all items which need to be installed by all crafts involved.
- C. In case of coordination dispute, the Architect/Engineer shall be consulted and his decision shall be binding.
- D. All costs associated with coordination and arranging or rearranging of the fire protection system shall be borne by the affected contractor, without causing any additional expense to the Owner.

#### 3.02 PUMP INSTALLATION

- A. Provide "city bypass" connection fitted with supervised control valves and swing check valve check.
- B. Provide pipe flow test meter in pipe routed to pump suction. Additionally pipe pump discharge to test header. Fit with appropriate supervised valving to flow water to the pump suction or exterior. Discharge test header to exterior. Coordinate discharge location with owner.

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- C. Provide seismic protection for the pumps system in accordance with NFPA 20 standards.
- D. Installation of all valves and equipment shall comply with manufacturer's suggested installation practices and directions.
- E. Provide service access around all equipment.

### 3.03 SYSTEM TEST

- A. Test automatic pump start by opening inspector's test port.
- B. Flow test fire pump in accordance with NFPA 20. Take pressure readings on pump with certified gauges and plot flow points on certified pump curve. Submit test results.
- C. 24 hour advanced notice required for all tests to allow Owner's field representative to witness these tests.

# 3.04 PAINTING

A. Refer to Division 09.

# END OF SECTION 21 3000

#### SECTION 22 0500 COMMON WORK RESULTS FOR PLUMBING

### PART 1 GENERAL

## 1.01 SCOPE

A. All provisions of the Contract including the General and Supplementary Conditions and the General Requirements apply to this work.

### 1.02 WORK INCLUDED

- A. The work to be included in these and all other plumbing subsections shall consist of providing, installing, adjusting and setting into proper operation complete and workable systems for all items shown on the drawings, described in the specifications or reasonably implied. This shall include the planning and supervision to coordinate the work with other crafts and to maintain a proper time schedule for delivery of materials and installation of the work.
- B. Division 01 of the specifications is to be specifically included as well as all related drawings.

## 1.03 RELATED WORK

- A. Related Work Specified Elsewhere:
  - 1. Fire Suppression Specifications: Division 21.
  - 2. Heating, Ventilating and Air Conditioning (HVAC) Specifications: Division 23.
  - 3. Electrical Specifications: Division 26.
  - 4. Motors and Connections: Division 26.
  - 5. Starters and Disconnects: Division 26.
- B. Unless otherwise indicated on the electrical drawings or the electrical schedules, provide all plumbing equipment motors, motor starters, thermal overload switches, control relays, time clocks, thermostats, motor operated valves, float controls, electric switches, electrical components, wiring and any other miscellaneous Division 22 controls. Disconnect switches are included in the electrical work, unless specifically called out on mechanical plans.
- C. Carefully coordinate all work with the electrical work shown and specified elsewhere.

## 1.04 REFERENCED CODES - LATEST ADOPTED EDITION

- A. NFPA 13 Installation of Sprinkler Systems.
- B. NFPA 70 National Electrical Code (NEC).
- C. IMC International Mechanical Code.
- D. UPC Uniform Plumbing Code.
- E. IECC International Energy Conservation Code.
- F. IFC International Fire Code.
- G. IFGC International Fuel Gas Code.
- H. IBC International Building Code.

#### 1.05 PROJECT RECORD DRAWINGS

- A. In addition to other requirements of Division 01, mark up a clean set of drawings as the work progresses to show the dimensioned location and routing of all mechanical work which will become permanently concealed. Show routing of work in concealed blind spaces within the building. Show exact dimensions of buried piping off of columns or exterior walls.
- B. Maintain record documents at job site in a clean, dry and legible condition. Keep record documents available for inspection by the Project Manager.
- C. Show the location of all valves and their appropriate tag identification.

D. At completion of project, deliver these drawings to the Owner and obtain a written receipt.

### 1.06 SUBMITTALS

- A. See General Conditions and the General Requirements in Division 01 regarding submittals.
- B. Submit by specification section complete and all at one time; partial submittals will not be considered. Submittals shall be provided in electronic PDF Format. The data in the electronic file shall be arranged and indexed under basic categories in order of the Specification Sections. An index shall be included with bookmarks and identifying tabs between sections and references to sections of specifications.
- C. Catalog sheets shall be complete and the item or model to be used shall be clearly marked, and identified as to which item in the specifications or on the drawings is being submitted and with drawing fixture number where applicable.
- D. Only submit on items specifically required by each specification section. If a submittal has not been requested, it will not be reviewed.

### 1.07 OPERATING AND MAINTENANCE MANUALS

- A. See General Conditions and the General Requirements in Division 01 regarding Operating and Maintenance Manuals.
- B. Submit maintenance manuals to the Engineer covering all equipment, fixtures, devices, etc. installed by the Contractor.
- C. The operation and maintenance manuals shall be submitted by specification section complete and all at one time; partial operations and maintenance manual submittals will not be considered. The Operation and maintenance manuals shall be provided in electronic PDF Format. The data in the electronic file shall be arranged and indexed under basic categories. An index shall be included with bookmarks and identifying tabs between sections and references to sections of specifications. The manual shall contain, but not limited to, the following types of information:
  - 1. Cover sheet with name, address, telephone number of Contractor, General Contractor and major equipment suppliers.
  - 2. Catalog cuts of all equipment, fixtures, etc. installed (Marked to identify the specific items used).
  - 3. Manufacturer's maintenance and overhaul instruction booklets including exploded views.
  - 4. Identification numbers of all parts and nearest sources for obtaining parts and services.
  - 5. A copy of valve schedule and reduced scale drawings showing valve locations.
  - 6. Written summary of instructions to Owner.
  - 7. All manufacturers' warranties and guarantees.
  - 8. Contractors Warranty Letter.
- D. A periodic maintenance form that includes all of the equipment shall be provided with the maintenance manual. The form shall list each piece of equipment with a list of manufacturers recommended inspection and maintenance tasks, and how often maintenance is required (daily, weekly, monthly, annually). Opposite each task shall be squares for check-off for a full year (initials) to verify that the tasks are being done.

#### 1.08 HANDLING

- A. See General Conditions and the General Requirements in Division 01 regarding material handling.
- B. Deliver packaged materials to job site in unbroken packages with manufacturer's label, and store to facilitate inspection and installation sequence. All items must be labeled and identified as to make, size and quality.

### 1.09 SUBSTITUTIONS

- A. See General Conditions and the General Requirements in Division 01 for substitution request procedures.
- B. In accordance with the General Conditions and the General Requirements in Division 01, Substitution and Product Options, all substitute items must fit in the available space, and be of equal or better quality including efficiency performance, size, and weight, and must be compatible with existing equipment. The Owner shall be the final authority regarding acceptability of substitutes.

### 1.10 DIMENSIONS

- A. Before ordering any material or doing any work, the Contractor shall verify all dimensions, including elevations, and shall be responsible for the correctness of the same. No extra charge or compensation will be allowed on account of differences between actual dimensions and measurements indicated on the drawings.
- B. Any differences, which may be found, shall be submitted to the Owner for consideration before proceeding with the work.

### 1.11 MANUFACTURER'S DIRECTIONS

A. All manufactured articles shall be applied, installed and handled as recommended by the manufacturer, unless specifically called out otherwise. Advise the Architect/Engineer of any such conflicts before installation.

### 1.12 PERMITS, FEES, ETC.

A. The Contractor under each Division of these specifications shall arrange for a permit from the local authority. The Contractor shall pay for any inspection fees or other fees and charges required by ordinance, law, codes and these specifications.

### 1.13 TESTING

A. The Contractor under each section shall perform the various tests as specified and required by the Architect, Engineer and as required by applicable code, the State and local authorities. The Contractor shall furnish all labor, fuel and materials necessary for making tests.

### 1.14 TERMINOLOGY

- A. Whenever the words "furnish", "provide", "furnish and install", "provide and install", and/or similar phrases occur, it is the intent that the materials and equipment described be furnished, installed and connected under this Division of the Specifications, complete for operation unless specifically noted to the contrary.
- B. Where a material is described in detail, listed by catalogue number or otherwise called for, it shall be the Contractor's responsibility to furnish and install the material.
- C. The use of the word "shall" conveys a mandatory condition to the contract.
- D. "This section" refers to the section in which the statement occurs.
- E. "The project" includes all work in progress during the construction period.
- F. In describing the various items of equipment, in general, each item will be described singularly, even though there may be a multiplicity of identical or similar items.

## 1.15 SCHEDULE OF WORK

A. The work under the various sections must be expedited and close coordination will be required in executing the work. The various trades shall perform their portion of the work at such times as directed so as to meeting scheduled completion dates, and to avoid delaying any other trade. The Architect will set up completion dates. Each contractor shall cooperate in establishing these times and locations and shall process work so as to ensure the proper execution of it.

### 1.16 COOPERATION AND CLEANING UP

- A. The Contractor for the work under each section of the specifications shall coordinate the Contractors work with the work described in all other sections of the specifications to the end that, as a whole, the job shall be a finished one of its kind, and shall carry on the work in such a manner that none of the work under any section of these specifications shall be handicapped, hindered or delayed at any time.
- B. At all times during the progress of the work, the Contractor shall keep the premises clean and free of unnecessary materials and debris. The Contractor shall, on direction at any time from the Architect, clear any designated areas or area of materials and debris. On completion of any portion of the work, the Contractor shall remove from the premises all tools and machinery and all debris occasioned by the work, leaving the premises free of all obstructions and hindrances.

#### 1.17 WARRANTY

A. Unless a longer warranty is hereinafter called for, all work, materials and equipment items shall be warrantied for a period of one year after acceptance by the Owner. All defects in labor and materials occurring during this period, as determined by the Architect/Engineer, shall be repaired and/or replaced to the complete satisfaction of the Architect/Engineer. Warranty shall be in accordance with Division 01.

### 1.18 COMPLETION REQUIREMENTS

- A. In accordance with the General Conditions and the General Requirements in Division 01, Project Closeout; before acceptance and final payment, the Contractor shall furnish:
  - 1. Accurate project record drawings, shown in red ink on prints, showing all changes from the original plans made during installation of the work.
  - 2. Contractors One Year Warranty.
  - 3. All Manufacturers' Guarantees.
  - 4. Operation and Maintenance Manuals.

#### 1.19 INSPECTION OF SITE - REMODEL PROJECTS

A. The accompanying plans do not indicate completely the existing plumbing and mechanical installations. The bidders for the work under these sections of the specifications shall inspect the existing installations and thoroughly acquaint themselves with conditions to be met and the work to be accomplished in removing and modifying the existing work, and in installing the new work in the present building and underground serving to and from that structure. Failure to comply with this shall not constitute grounds for any additional payments in connection with removing or modifying any part of the existing installations and/or installing any new work.

# 1.20 RELOCATION OF EXISTING INSTALLATIONS

A. There are portions of the existing plumbing, mechanical and electrical systems, which shall remain in use to serve the finished building in conjunction with the indicated new installations. By actual examination at the site, each bidder shall determine those portions of the remaining present installations, which must be relocated to avoid interference with the installations of new work of the Contractors particular trade and that of all other trades. All such existing installations, which interfere with new installations, shall be relocated by the Contractor.

## 1.21 SALVAGE MATERIALS

- A. The Contractor shall remove existing equipment, piping, controls and other items associated with the mechanical systems where no longer required for the project. Where such items are exposed to view or uncovered by any cutting or removal of general construction and has no continuing function (as determined by the Architect/Engineer), they shall be removed.
- B. All items or materials removed from the project shall be made available for the Owner's inspection. The Owner retains the option to claim any item or material. Contractor shall deliver

any claimed item or material in good condition to the place designated by the Owner. All items not claimed become the property of the contractor and shall be removed from the site.

### PART 2 PRODUCTS

#### 2.01 MATERIALS

- A. All equipment shall be regularly cataloged items of the manufacturer and shall be supplied as a complete unit in accordance with the manufacturer's standard specifications along with any optional items required for proper installation unless otherwise noted. Maintain manufacturer's identification, model number, etc. on all equipment at all times.
- B. Where more than one of an item is to be provided, all of the items shall be identical manufacture, make, model, color, etc.

#### 2.02 RESTRICTED MATERIALS

- A. No materials containing asbestos in any form shall be allowed.
- B. No solder or flux containing lead shall be used on this project.
- C. Any pipe or plumbing fitting or fixture, any solder, or any flux utilized on this project shall be "lead free" in accordance with the Safe Drinking Water Act, Section 1417. "Lead free" materials utilized in domestic water system shall not contain more than 0.2 percent lead when used with respect to solder and flux; and not more than a weighted average of 0.25 percent lead when used with respect to the wetted surfaces of pipes, pipe fittings, plumbing fittings, and fixtures. All materials utilized in domestic water system shall be certified by an ANSI accredited organization to conform to ANSI/NSF Standard 61.
- D. Where materials or equipment provided by this Contractor are found to contain restricted materials, such items shall be removed and replaced with non-restricted materials items. Entire cost of restricted materials removal and disposal and cost of installing new items shall be the responsibility of the Contractor for those restricted materials containing items installed by the Contractor.

#### 2.03 ELECTRICAL MOTORS

- A. Motors: Furnish electric motors designed for the specific application and duty applied, and to deliver rated horsepower without exceeding temperature ratings when operated on power systems with a combined variation in voltage and frequency not more than + 10% of rated voltage. Motors for pumps and fans shall be selected to be non-overloading.
- B. Verify from the drawings and specifications the available electrical supply characteristics and furnish equipment that will perform satisfactorily under the conditions shown and specified.
- C. All motors for use with equipment with variable frequency drives shall be inverter ready motors. Verify compatibility and sizing of motor with variable frequency drive.
- D. Size motors for 1.15 service factor and not to exceed 40° C temperature rise above ambient.
- E. Fractional horsepower motors to have self-resetting thermal overload switch.
- F. Provide Premium Efficiency, motors for all three phase motors one horsepower and larger. Standard efficiency motors will not be acceptable.

#### PART 3 EXECUTION

#### 3.01 DRAWINGS

A. The drawings are partly diagrammatic, not necessarily showing all offsets or exact locations of piping, unless specifically dimensioned. The contractor shall provide all materials and labor necessary for a complete and operable system. Complete details of the building which affect the mechanical installation may not be shown. For additional details, see Architectural, Structural, Civil and Electrical Drawings. Coordinate work under this section with that of all related trades.

### 3.02 INSTALLATION

- A. All work shall comply with the latest adopted applicable codes and ordinances including, but not limited to, the IMC, UPC, IBC, NEC, NFPA, IECC, IFGC and IFC Standards; all local and state amendments to all codes and standards.
- B. Obtain and pay for all inspection fees, connection charges and permits as a part of the Contract.
- C. Compliance with codes and ordinances shall be at the Contractor's expense.

### 3.03 MEASUREMENTS

- A. Verify all measurements on the job site.
- B. Locate all equipment and fixtures on the centers of walls, openings, spaces, etc., unless specified otherwise.
- C. Check all piping, equipment, etc. to clear openings.
- D. Rough-in dimensions shall be per manufacturer's recommendations and in compliance with current ADA and ANSI 117.1 standards.

### 3.04 OPERATING INSTRUCTIONS

- A. Before the facility is turned over to the Owner, instruct the Owner or Owner's personnel in the operation, care and maintenance of all systems and equipment under the jurisdiction of the Plumbing Division. These instructions shall also be included in a written summary in the Operating Maintenance Manuals.
- B. The Operation and Maintenance Manuals shall be utilized for the basis of the instruction. Provide a minimum of eight hours of onsite instruction to the owner designated personnel.
- C. When required by individual specification sections provide additional training on plumbing systems and equipment as indicated in the respective specification section.
- D. Provide schedule for training activities for review prior to start of training.

### 3.05 SYSTEM ADJUSTING

A. Each part of each system shall be adjusted and readjusted as necessary to ensure proper functioning of all plumbing systems. Test all plumbing equipment, fixtures and piping for proper water distribution, drainage, pressure and flow, adjust systems as required to eliminate splashing, noise and vibration.

## 3.06 CUTTING, FITTING, REPAIRING, PATCHING AND FINISHING

- A. Arrange and pay for all cutting, fitting, repairing, patching and finishing of work by other trades where it is necessary to disturb such work to permit installation of mechanical work. Perform work only with craftsmen skilled in their respective trades.
- B. Avoid cutting, insofar as possible, by setting sleeves, frames, etc. and by requesting openings in advance. Assist other trades in securing correct location and placement of rough-frames, sleeves, openings, etc. for piping.
- C. Cut all holes neatly and as small as possible to admit work. Include cutting where sleeves or openings have been omitted. Perform cutting in a manner so as not to weaken walls, partitions or floors. Drill holes required to be cut in floors without breaking out around holes.

### 3.07 PAINTING

- A. Perform all of the following painting in accordance with provisions of Division 09 with colors as selected by the Architect. Provide the following items as a part of plumbing work:
  - 1. Factory applied prime and finish coats on plumbing equipment.
  - 2. Factory applied prime coat on access doors.
  - 3. Pipe identification where specified.

B. If factory finish on any equipment furnished is damaged in shipment or during construction, refinish to equal original factory finish.

### 3.08 INSTALLATION OF EQUIPMENT

- A. Unless otherwise indicated, mount all equipment and install in accordance with manufacturer's recommendations and approved submittals.
- B. Maintain manufacture recommended minimum clearances for access and maintenance.
- C. Where equipment is to be anchored to structure, furnish and locate necessary anchoring and vibration isolation devices.
- D. Furnish all structural steel, such as angles, channels, beams, etc. required to support all piping, equipment and accessories installed under this Division. Use structural supports suitable for equipment specified or as indicated. In all cases, support design will be based upon data contained in manufacturer's catalog. Provide Seismic Restraint in Accordance with Specification Section 22 0548.
- E. Openings: Arrange for necessary openings in buildings to allow for admittance and reasonable maintenance or replacement of all equipment furnished under this Contract.
- F. Access Doors: Provide as necessary for reasonable maintenance of all equipment valves, controls, etc.

#### END OF SECTION 22 0500

#### SECTION 22 0505 SELECTIVE DEMOLITION FOR PLUMBING

### PART 1 GENERAL

#### 1.01 DESCRIPTION

- A. Work specified in this Section includes the demolition, removal, and disposition of certain mechanical work.
- B. Drawings, the provisions of the Agreement, and Administrative Specification Sections apply to all work of this Section.

### PART 2 PRODUCTS (Not Used)

#### PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence. Notify the Architect in writing of conditions detrimental to the proper and timely completion of the work.
- B. Do not begin installation until all unsatisfactory conditions are resolved. Beginning work constitutes acceptance of conditions as satisfactory.

#### 3.02 DEMOLITION, REMOVAL AND DISPOSITION

- A. Saw-cut concrete as shown or required.
- B. Piping and Equipment to Be Removed: Remove all piping and equipment as indicated on the Drawings.
- C. Piping Removed: Drawings do not show all existing piping which is to be removed. Unless indicated otherwise, where existing equipment has been removed, or its use replaced by new equipment, remove connecting piping back to the branch in the main so that there will be no dead ends or unused pipe lines in mechanical spaces at completion.
- D. Materials to Owner: All items or materials removed from the project shall be made available for the Owner's inspection. The Owner retains the option to claim any item or material. The Contractor shall deliver any claimed item or material in good condition to the place designated by the Owner. All items not claimed become the property of the Contractor and shall be removed from the site by the Contractor.
- E. Materials to Owner: As indicated on the Drawings.
- F. Re-use of Materials: Only where indicated on Drawings.
- G. Materials to Contractor: Materials shown or specified to be removed, other than the materials indicated to be turned over to Owner.
- H. Protect any active piping and/or wiring encountered; remove, plug or cap utilities to be abandoned. Notify the Architect of utilities encountered whose service is not known.
- I. Debris Removal: Existing materials removed and not reinstalled or turned over to the Owner shall be immediately removed from the site and disposed of by the Contractor.
- J. Repairs: Any portion of the facility damaged, cut back or made inoperable by this Contractor shall be repaired with similar materials as the existing structure and/or damaged item as instructed by the Architect.

## END OF SECTION 22 0505

### SECTION 22 0516 EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

- A. Flexible pipe connectors.
- B. Expansion joints and compensators.
- C. Pipe alignment guides.
- D. Swivel joints.
- E. Pipe anchors.

### 1.02 RELATED SECTIONS

- A. Section 22 0500 Common Work Results for Plumbing.
- B. Section 22 0529 Hangers and Supports for Plumbing Piping and Equipment.
- C. Section 22 0548 Vibration and Seismic Controls for Plumbing Piping and Equipment.

### 1.03 REFERENCES

- A. ASME B31.1 Power Piping.
- B. ASME B31.9 Building Services Piping.
- C. ASME Section IX Boiler and Pressure Vessel Code Welding and Brazing Qualifications.
- D. AWS D1.1 Structural Welding Code Steel.

### 1.04 PERFORMANCE REQUIREMENTS

A. Provide structural work and equipment required to control expansion and contraction of piping. Verify that anchors, guides, and expansion joints provided, adequately protect system.

#### 1.05 SUBMITTALS

- A. Submit under provisions of Division 01.
- B. Product Data:
  - 1. Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-toface length, live length, hose wall thickness, hose convolutions per foot and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.
  - 2. Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.
- C. Manufacturer's Installation Instructions: Indicate special procedures, and external controls.
- D. Welders' Certificate: Include welders' certification of compliance with ASME Section IX.

#### 1.06 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 01.
- B. Record actual locations of flexible pipe connectors, expansion joints, anchors, and guides.

#### **1.07 OPERATION AND MAINTENANCE DATA**

- A. Submit under provisions of Division 01.
- B. Maintenance Data: Include adjustment instructions.

### 1.08 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.

# 1.09 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of Division 01.
- B. Accept expansion joints on site in factory packing with shipping bars and positioning devices intact. Inspect for damage.
- C. Protect equipment from exposure by leaving factory coverings, pipe end protection, and packaging in place until installation.

### 1.10 WARRANTY

A. Provide manufacturer's warranty under provisions of Division 01.

### PART 2 PRODUCTS

### 2.01 ACCEPTABLE MANUFACTURERS

- A. Hyspan.
- B. Mason Industries.
- C. Mercer Rubber Co.
- D. Metraflex.
- E. Substitutions under provisions of Division 01.

## 2.02 FLEXIBLE PIPE CONNECTORS

- A. Steel Piping:
  - 1. Inner: 321 stainless steel, close pitch, annular corrugated hose.
  - 2. Exterior: 304 stainless steel double braided outer covering.
  - 3. Pressure Rating: 125 psig at 450° F, 200 psig at 70° F.
  - 4. Joint: As specified for pipe joints.
  - 5. Size: Use pipe sized units.
  - 6. Maximum offset: <sup>3</sup>/<sub>4</sub> inch on each side of installed center line.
  - 7. Connectors shall be Lead Free and UL classified in accordance with ANSI/NSF 61 standard.
- B. Copper Piping:
  - 1. Inner Hose: Close pitch, annular corrugated bronze hose.
  - 2. Outer House: Bronze double braided outer covering.
  - 3. Pressure Rating: 125 psig at 450° F, 150 psig at 70° F.
  - 4. Joint: As specified for pipe joints.
  - 5. Size: Use pipe sized units.
  - 6. Maximum offset: <sup>1</sup>/<sub>2</sub> inch on each side of installed center line.
  - 7. Connectors shall be Lead Free and UL classified in accordance with ANSI/NSF 61 standard.

#### 2.03 EXPANSION JOINTS

- A. Flexible Expansion Loop (Thermal and Seismic Applications):
  - 1. Flexible loops shall be capable of movement in the  $\pm X$ ,  $\pm Y$ , and  $\pm Z$  planes and must completely isolate the equipment from the piping.
  - 2. Flexible expansion/seismic loops shall consist of two flexible sections of hose and braid, two 90° elbows, and a 180° return assembled in such a way that the piping does not change direction, but maintains its course along a single axis.

- 3. Flexible loops shall have a factory supplied, center support nut located at the bottom of the 180° return, and a drain/air release plug.
- 4. Flexible loops shall impart no thrust loads to system support anchors or building structure. Loops shall be installed in a neutral, pre-compressed or pre-extended condition as required for the application.
- 5. Materials of construction and end fitting type shall be consistent with pipe material and equipment/ pipe connection fittings.
- 6. For potable water service, connectors shall be UL classified in accordance with ANSI/NSF 61-1977 standards.
- 7. Install and guide per manufacturer's recommendations. Materials of construction and end fitting type shall be consistent with pipe material and equipment/ pipe connection fittings.

### 2.04 ACCESSORIES

- A. Pipe Alignment Guides, Spider Type: Primary and intermediate guides shall be of the radial type employing a heavy wall guide cylinder with weld down or bolt down anchor base. A two section guide spider, having 1/8" maximum diametrical clearance with guide cylinder inside diameter, bolted or welded tight to the carrier pipe which slides through the guide cylinder I.D. Cylinder shall be of sufficient size to clear pipe insulation and long enough to prevent over travel of the spider.
- B. Pipe Alignment Guides, Slide Type: Primary and intermediate guides shall be of the sliding type. Two piece construction employing a sliding member to be welded to the carrier pipe and a weld down or bolt down anchor base. Sliding member shall be of sufficient height to clear pipe insulation and long enough to prevent over travel of the slide. Load bearing surfaces shall be Teflon to Teflon (T/T-standard), Teflon to Stainless (T/S), or Graphite to Graphite (G/G) as required for the application.

### PART 3 EXECUTION

#### 3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Construct spool pieces to exact size of flexible connection for future insertion.
- C. Install flexible pipe connectors on pipes connected to equipment supported by vibration isolation. Provide line size flexible connectors.
- D. Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end. Install in horizontal plane unless indicated otherwise.
- E. Rigidly anchor pipe to building structure where necessary. Provide pipe guides so movement is directed along axis of pipe only. Erect piping such that strain and weight is not on cast connections or apparatus.
- F. Provide support and equipment required to control expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where indicated.
- G. Provide expansion loops as indicated on drawings.
- H. Flexible loops shall be located at, or near the building seismic joint. A vertical support hanger, located within 4 pipe diameters, shall be installed on each side of the flexible loop. Each hanger to be transversely and longitudinally braced per local codes. Seismic bracing shall not pass through building seismic joint and shall not connect or tie together different sides or parts of building structure. Flexible loops shall be capable of move in the ±X, ±Y, and ±Z planes.

## END OF SECTION 22 0516

## SECTION 22 0519 METERS AND GAUGES FOR PLUMBING PIPING

## PART 1 GENERAL

## 1.01 SECTION INCLUDES

- A. Water Meters.
- B. Pressure Gauges and Pressure Gauge Taps.
- C. Thermometers and Thermometer Wells.
- D. Flow Indicators.

### 1.02 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Section 22 1000 - Plumbing Piping: Installation of thermometer wells, pressure gauge tappings.

## 1.03 REFERENCES

- A. ASTM E1 Specification for ASTM Thermometers.
- B. ASTM E77 Verification and Calibration of Liquid-in-Glass Thermometers.
- C. AWWA C700 Cold Water Meters Displacement Type.
- D. AWWA C706 Direct Reading Remote Registration Systems for Cold Water Meters.

### 1.04 SUBMITTALS

- A. Submit under provisions of Division 01.
- B. Product Data: Include list which indicates use, operating range, total range and location for manufactured components.
- C. Submit manufacturer's installation instructions under provisions of Division 01.

#### 1.05 PROJECT RECORD DOCUMENTS

- A. Submit documents under provisions of Division 01.
- B. Accurately record actual locations of instrumentation.

#### 1.06 ENVIRONMENTAL REQUIREMENTS

A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

## PART 2 PRODUCTS

#### 2.01 MANUFACTURERS

- A. Trerice.
- B. Marsh.
- C. Ashcroft.
- D. Enerpac.
- E. Sisco.
- F. Petersen.
- G. Weiss.
- H. Winters.
- I. Substitutions: In accordance with Division 01.

#### 2.02 PRESSURE GAUGES

A. 3½" diameter dial size with a flangeless cast aluminum case, stainless steel friction ring and glass window. Movement will be brass with a bronze bourdon tube and brass socket. Dial face will be white with black figures; pointer will be friction adjustable type. Accuracy will be ±1% of

scale range, ASME B40.1 Grade 1A. All wetted parts shall be Lead-Free (PBF) meeting NSF/ANSI Standards 372 and 61. Model 600C as manufactured by Trerice.

#### 2.03 PRESSURE GAUGE TAPS

- A. Gauge Isolation Valve: Lever handle ball valve, forged brass body, chrome plated brass ball, viton o-rings for maximum 150 psig. Model Mini T-82-M as manufactured by Jomar or approved equal.
- B. Needle Valve: Brass for maximum 150 psig. Model 735 as manufactured by Trerice or approved equal.
- C. Pulsation Damper: Pressure snubber, brass with 1/4 inch connections. Series 870 as manufactured by Trerice or approved equal.

#### 2.04 STEM TYPE THERMOMETERS

A. 9 inch scale, universal adjustable angle, blue organic spirit fill, lens front tube, cast aluminum case with blue epoxy finish and clear acrylic window, extended brass stem, cast aluminum adjustable joint with positive locking device, 2 percent of scale accuracy to ASTM E77, scale calibrated in both degrees F and degrees C. BX9 series as manufactured by Trerice.

#### 2.05 DIAL THERMOMETERS

A. Direct mounted, solid liquid filled, 3-1/2 inch diameter dial in stainless steel case, adjustable angle, brass movement with silicone fluid dampening, white with black markings and black pointer, sealed glass lens [silicone dampening of case and bearing points]; brass bulb, brass removable union connection, 1% of full scale accuracy, calibrated in both degrees F and degrees C. Model L80030 as manufactured by Trerice or approved equal.

## 2.06 THERMOMETER SUPPORTS

A. Socket: Brass separable sockets for thermometer stems with or without extensions as required.

#### 2.07 WATER METERS (LIQUID)

- A. Manufacturers:
  - 1. Neptune.
  - 2. Badger Meters.
  - 3. Hersey.
  - 4. Substitutions: Under provisions of Division 01.
- B. Compound Meter service size 2" 6" Compound dual turbine measuring elements suitable for fluid with dual hermetically sealed registers. All components of lead-free bronze alloy Permanently sealed register or encoder with magnetic drive register coupling. Conforming to AWWA Standard C700. with remote reading register conforming to AWWA C706. Neptune T-10 meter or approved equal.
- C. Electromagnetic Flow Meter. Metering system shall be capable of measuring the volumetric flow rate of liquids having an electrical conductivity as low as 5.0 microohms per centimeter. Metering tube constructed of 316 stainless for steel pipe flanges per ANSI B16.5 with insulating liner material made of a NSF-listed hard rubber or an NSF-listed PTFE. Measurement electrodes of Alloy C or 316 stainless steel. NEMA 4X detector and signal amplifier housing. Provide 4 digital outputs, one analog output, and Modbus/RTU protocol. Neptune TRU/FLO compound meter or approved equal.

### PART 3 EXECUTION

### 3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

- B. Install water meters with strainer upstream and isolating valves on inlet and outlet. Provide pressure gauge downstream of check valve. Provide full line size valved bypass for liquid service meters.
- C. Size and install water meters in accordance with Anchorage Waste Water Utility (AWWU) Design and Construction Practices Manual, current edition. Coordinate meter installation with AWWU Field Service Supervisor.
- D. Install electromagnetic flow meter on water line serving building. Integrate into DDC.
- E. Install pressure gauges with pulsation dampers. Provide needle valve or gauge isolation valve to isolate each gauge.
- F. Provide two pressure gauges per pump, installing taps on suction and discharge of pump. Pipe to gauge with isolation valve to each tapping.
- G. Thermometers for measuring fluid temperatures shall have stems with insertion lengths of roughly half of the pipe diameter; minimum insertion length will be 2". Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inch for installation of thermometer sockets. Select bulb length to reach centerline of pipe. Thermometers installed on tanks will have a minimum insertion length of 5".
- H. Where insulation thickness exceeds 2", provide a longer stem thermometer with an extension neck, lead free brass (PBF) thermowell. The extension neck shall be at least 2" long.
- I. Coat thermometer stem with heat transfer paste prior to installing into the thermowell.
- J. Install thermometer sockets adjacent to controls system thermostat, transmitter, or sensor sockets.
- K. Provide instruments with scale ranges selected according to service with largest appropriate scale and range selected so that the operating temperature or pressure of the material being measured will fall approximately in the middle of the scale.
- L. Install gauges and thermometers in locations where they are easily read from normal operating level.

## 3.02 PRESSURE GAUGE SCHEDULE

| LOCATION              | SCALE RANGE   |  |  |
|-----------------------|---------------|--|--|
| Pumps                 | 0 - 100 PSIG  |  |  |
| Domestic Water System | 0 - 100 PSIG  |  |  |
| Others                | As applicable |  |  |

#### 3.03 STEM TYPE THERMOMETER SCHEDULE

| LOCATION                              | SCALE RANGE   |
|---------------------------------------|---------------|
| Domestic Cold water system            | 0 - 100°F     |
| Domestic Hot Water Supply and Recirc. | 0 - 200°F     |
| Others                                | As applicable |

## 3.04 POSITIVE DISPLACEMENT METER SCHEDULE

| LOCATION            | SCALE RANGE |
|---------------------|-------------|
| Domestic cold water | 0 - 300 GPM |

## END OF SECTION 22 0519

#### SECTION 22 0529 HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

## PART 1 GENERAL

### 1.01 WORK INCLUDED

- A. Piping and equipment hangers, supports, and associated anchors.
- B. Equipment bases and supports.
- C. Sleeves and seals.
- D. Flashing.

### 1.02 PRODUCTS FURNISHED BUT INSTALLED UNDER OTHER SECTIONS

A. Furnish hanger and support sleeves for placement into formwork.

## 1.03 RELATED WORK

- A. Division 03 Cast in Place Concrete: Equipment Bases.
- B. Division 07 Fire Stopping: Joint Seals for Piping Penetration of Fire Rated Assemblies.
- C. Division 09 Painting.
- D. Section 22 0500 Common Work Results for Plumbing.
- E. Section 22 0516 Expansion Fittings and Loops for Plumbing Piping.
- F. Section 22 0519 Meters and Gages for Plumbing Piping.
- G. Section 22 0548 Vibration and Seismic Controls for Plumbing Piping and Equipment.
- H. Section 22 0553 Identification for Plumbing Piping and Equipment.
- I. Section 22 0700 Plumbing Insulation.
- J. Section 22 1000 Plumbing Piping.
- K. Section 22 3000 Plumbing Equipment.
- L. Section 22 4000 Plumbing Fixtures.
- M. Section 22 4500 Emergency Plumbing Fixtures.
- N. Section 22 6000 Gas and Vacuum Systems for Laboratory and Healthcare Facilities.

## 1.04 REFERENCES

- A. ASME B31.1 Power Piping.
- B. ASME B31.9 Building Services Piping.
- C. ASTM F708 Design and Installation of Rigid Pipe Hangers.
- D. ANSI/MSS SP58 Pipe Hangers and Supports Materials, Design and Manufacturer.
- E. ANSI/MSS SP69 Pipe Hangers and Supports Selection and Application.
- F. MSS SP89 Pipe Hangers and Supports Fabrication and Installation Practices.

## 1.05 REGULATORY REQUIREMENTS

A. Conform to applicable code for support of plumbing piping.

## 1.06 SUBMITTALS

- A. Submit under provisions of Division 01.
- B. Product Data: Provide manufacturers catalog data including load capacity. Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.

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# PART 2 PRODUCTS

## 2.01 PIPE HANGERS AND SUPPORTS

- A. Acceptable Manufacturers:
  - 1. Anvil.
  - 2. Eaton.
  - 3. Erico.
  - 4. Holdrite.
  - 5. PHD Manufacturing, Inc.
- B. Plumbing Piping DWV:
  - 1. Conform to ANSI/MSS SP58.
  - 2. Hangers for Pipe Sizes  $\frac{1}{2}$  to  $1-\frac{1}{2}$  Inch: Malleable iron or carbon steel, adjustable swivel, split ring.
  - 3. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
  - 4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
  - 5. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
  - 6. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
  - 7. Vertical Support: Steel riser clamp.
  - 8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
  - 9. Copper Pipe Support: Carbon steel ring, adjustable, copper plated with neoprene isolation pad.
- C. Plumbing Piping Water:
  - 1. Conform to ANSI/MSS SP58.
  - 2. Hangers for Pipe Sizes  $\frac{1}{2}$  to 1- $\frac{1}{2}$  Inch: Malleable iron or carbon steel, adjustable swivel, split ring.
  - 3. Hangers for Cold Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
  - 4. Hangers for Hot Pipe Sizes 2 to 4 Inches: Carbon steel, adjustable, clevis.
  - 5. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
  - 6. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 Inches and Over: Steel channels with welded spacers and hanger rods, cast iron roll.
  - 7. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
  - 8. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
  - 9. Vertical Support: Steel riser clamp.
  - 10. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
  - 11. Floor Support for Hot Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
  - 12. Copper Pipe Support: Carbon steel ring, adjustable, copper plated with neoprene isolation pad.
- D. Design hangers to allow installation without disengagement of supported pipe.

- E. Copper Plating: All hanger elements in metal-to-metal contact with copper pipe shall have copper plating, hanger rings with factory-applied 1/16 inch minimum thick plastic, or tape cushion strip over all contact surfaces.
- F. Strut Type Pipe Hanging System: Unistrut P-1000 series; framing members shall be No. 12 gage formed steel channels, 1-5/8 inch square, conforming to ASTM A 570 GR33, one side of channel shall have a continuous slot with inturned lips; framing nut with grooves and spring 1/2 inch size, conforming to ASTM 675 GR60; screws conforming to ASTM A 307; fittings conforming to ASTM A 575; all parts enamel painted or electro-galvanized.
- G. Shield for Insulated Piping 1-1/2 Inches and Smaller: 18 gauge galvanized steel shield over insulation in 180° segments, minimum 12 inches long at pipe support.
- H. Shield for Insulated Piping 2 Inches and Larger: Hard block, calcium silicate insert, 180° segment, 12 inch minimum length, block thickness same as insulation thickness, flame resistant vapor barrier covering and 18 gauge galvanized shield.
- I. Shields for Vertical Copper Pipe Risers: Galvanized steel pipe.

## 2.02 HANGER RODS

A. Steel Hanger Rods: Mild steel, threaded both ends, threaded one end, or continuous threaded. Minimum Hanger Rod Sizes:

| PIPE AND TUBE SIZE<br>(INCHES) | ROD SIZE<br>(INCHES) |
|--------------------------------|----------------------|
| 1/4-4                          | 3/8                  |
| 5-8                            | 1/2                  |
| 10-12                          | 5/8                  |

#### 2.03 INSERTS

A. Inserts: Malleable iron case of steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

## 2.04 ANCHOR BOLTS

A. Anchor (Expansion) Bolts: Shall be carbon steel to ASTM A 307; nut shall conform to ASTM A194; shall be drilled-in type. Design values for shear and tension shall be not more than 80 percent of the allowable load.

#### 2.05 EQUIPMENT CURBS

A. Fabricate curbs of concrete, unless specifically called out otherwise.

## 2.06 FLASHING

A. Per arch.

## 2.07 SLEEVES

- A. Sleeves for Pipes Through Non-fire Rated Floors: Form with 18 gauge galvanized steel for 4 inch diameter and larger, 22 gauge up to 3" diameter.
- B. Sleeves for Pipes through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Form with steel pipe or 18 gauge galvanized steel for 4 inch diameter and larger, 22 gauge up to 3" diameter.
- C. Sleeves for Pipes through Fire Rated and Fire Resistive Floors and Walls, and Fireproofing: Prefabricated fire rated sleeves including seals, UL listed caulking.
- D. Fire Stopping Insulation: Mineral fiber type, non- combustible.
- E. Caulk: Fire stop sealant in compliance with ASTM E814 and UL 1479. Refer to Division 07.

F. Mechanical Sleeve Seals: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

# 2.08 FORMED STEEL CHANNEL

- A. Manufacturers:
  - 1. Atkore Allied Tube & Conduit Corp.
  - 2. Eaton B-Line Series.
  - 3. PHD Manufacturing, Inc.
  - 4. Subsitutions under provisions of Division 01.
- B. Product Description: Galvanized 12 gauge (2.8 mm) thick steel. With holes 1-1/2 inches (38 mm) on center.

# PART 3 EXECUTION

# 3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install pipe hangers in accordance with ANSI/MSS-SP-69.

# 3.02 PIPE HANGERS AND SUPPORTS

- A. Support plumbing piping in accordance with the latest adopted edition of the UPC.
- B. Support horizontal piping as follows:

| MATERIALS                                             | TYPES OF JOINTS                                                                                                 | HORIZONTAL                                                                                                                                                    | VERTICAL                                                                                                                                                    |
|-------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Cast-Iron Hub-<br>less                                | Shielded Coupling                                                                                               | Every other joint, unless<br>over 4 feet then support<br>each joint <sup>1,2,3.4</sup>                                                                        | Base and each floor,<br>not to exceed 15 feet                                                                                                               |
| Copper Tube<br>and Pipe                               | Soldered or Brazed                                                                                              | 1 ½ inches and smaller, 6<br>feet; 2 inches and larger,<br>10 feet                                                                                            | Each floor, not to ex-<br>ceed 10 feet <sup>5</sup>                                                                                                         |
| Steel and Brass<br>Pipe for Water<br>or DWV           | Threaded or Welded                                                                                              | <sup>3</sup> / <sub>4</sub> inch and smaller, 10<br>feet; 1 inch and larger,<br>12 feet                                                                       | Every other floor, not to exceed 25 feet <sup>5</sup>                                                                                                       |
| Steel, Brass,<br>and Tinned<br>Copper Pipe for<br>Gas | Threaded or Welded                                                                                              | <sup>1</sup> / <sub>2</sub> inch, 6 feet; <sup>3</sup> / <sub>4</sub> inch and<br>1 inch, 8 feet; 1 <sup>1</sup> / <sub>4</sub> inches<br>and larger, 10 feet | <sup>1</sup> / <sub>2</sub> inch, 6 feet; <sup>3</sup> / <sub>4</sub> inch<br>and 1 inch, 8 feet; 1 <sup>1</sup> / <sub>4</sub><br>inches every floor level |
| Schedule 40<br>PVC and ABS<br>DWV                     | Solvent Cemented                                                                                                | All sizes, 4 feet; allow for expansion every 30 feet                                                                                                          | Base and each floor'<br>provide mid-story<br>guides; provide for ex-<br>pansion every 30 feet <sup>6</sup>                                                  |
| CPVC                                                  | Solvent Cemented                                                                                                | 1 inch and smaller, 3 feet;<br>1 <sup>1</sup> / <sub>4</sub> inches and larger, 4<br>feet                                                                     | Base and each floor;<br>provide mid-story<br>guides <sup>6</sup>                                                                                            |
| PEX                                                   | Cold Expansion, Insert and Compression                                                                          | 1 inch and smaller, 32<br>inches; 1 <sup>1</sup> / <sub>4</sub> inches and<br>larger, 4 feet                                                                  | Base and each floor;<br>provide mid-story<br>guides                                                                                                         |
| Polypropylene<br>(PP)                                 | Fusion weld (socket,<br>butt, saddle, electrofu-<br>sion), threaded (metal<br>threads only), or me-<br>chanical | 1 inch and smaller, 32<br>inches; 1 <sup>1</sup> / <sub>4</sub> inches and<br>larger, 4 feet <sup>7</sup>                                                     | Base and each floor;<br>provide mid-story<br>guides <sup>7</sup>                                                                                            |

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### Notes:

- <sup>1</sup> Support adjacent to joint, not to exceed 18 inches.
- <sup>2</sup> Brace not to exceed 40 foot intervals to prevent horizontal movement.
- <sup>3</sup> Support at each horizontal branch connection.
- <sup>4</sup> Hangers shall not be placed on the coupling.
- <sup>5</sup> Vertical water lines shall be permitted to be supported in accordance with recognized engineering principles with regard to expansion and contraction, where first approved by the Authority Having Jurisdiction.
- <sup>6</sup> See the appropriate IAPMO Installation Standard for expansion and other special requirements.
- <sup>7</sup> See manufacturer installation instructions for additional requirements.
  - C. Install hangers to provide minimum ½ inch space between finished covering and adjacent work.
  - D. Place a hanger within 12 inches of each horizontal elbow.
  - E. Use hangers with 1-1/2 inch minimum vertical adjustment.
  - F. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
  - G. Support riser piping independently of connected horizontal piping.
  - H. Design hangers for pipe movement without disengagement of supported pipe.
  - I. Provide copper plated hangers and supports for copper piping.
  - J. Prime coat exposed steel hangers and supports. Refer to Division 09. Hangers and supports located in crawlspace, pipe shafts, and suspended ceiling spaces are not considered exposed.
  - K. Provide guides and anchors in accordance with Specification Section 22 0516.
  - L. Provide Seismic restraint in accordance with Specification Section 22 0548.

#### 3.03 INSERTS

- A. Provide inserts for placement in concrete formwork.
- B. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
- C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
- D. Where concrete slabs form finished ceiling, provide inserts to be flush with slab surface.
- E. Where inserts are omitted, drill through concrete slab from below and provide thru-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.

#### 3.04 EQUIPMENT BASES AND SUPPORTS

- A. Provide equipment bases of where shown on plans and where required by equipment manufacturer installation instructions.
- B. Provide templates, anchor bolts, and accessories for mounting and anchoring equipment.
- C. Construct support of steel members. Brace and fasten with flanges bolted to structure.
- D. Provide housekeeping pads of concrete, minimum 4 inches thick and extending 6 inches beyond supported equipment anchors. Refer to Division 03.
- E. Provide rigid anchors for pipes after vibration isolation components are installed.
- F. Anchor (Expansion) Bolts: Install anchor bolts for all plumbing piping and equipment as required. Tightly fit and clamp base-supported equipment anchor bolts at all equipment support points. Provide locknuts where piping and equipment is hung. Install anchor (expansion) bolts in holes drilled in concrete where necessary to hang piping or equipment, or to anchor stationary equipment from existing concrete slabs.

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#### 3.05 FLASHING

- A. Provide flexible flashing and metal counter-flashing where piping penetrates weather or waterproofed walls, floors, and roofs. For pipes through outside walls, turn flanges back into wall and caulk, metal counter-flash and seal.
- B. Seal floor drains watertight to adjacent materials.
- C. Flash vent pipes projecting 12 inches minimum above finished roof surface with premanufactured butyl boot.
- D. Adjust storm collars tight to pipe with bolts; caulk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.
- E. Provide acoustical flashing around pipes penetrating equipment and exam rooms, installed in accordance with manufacturer's instructions for sound control.

### 3.06 SLEEVES

- A. Set sleeves in position in construction. Provide reinforcing around sleeves.
- B. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- C. Extend sleeves through floors one inch above finished floor level. Pack and caulk sleeves full depth and provide floor plate.
- D. Where piping penetrates floor, ceiling, or wall, install sleeve, close off space between pipe and adjacent work with fire stopping insulation and caulk seal. Use fire rated caulking where area or occupancy separation walls are penetrated. Provide close fitting metal collar or escutcheon covers at both sides of penetration.
- E. Install chrome plated steel escutcheons at finished surfaces.

## END OF SECTION 22 0529
## **SECTION 22 0548**

### VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

### PART 1 GENERAL

#### 1.01 WORK INCLUDED

A. This section provides minimum acceptance requirements for vibration isolation and seismic/wind restraints for all plumbing equipment and piping.

### 1.02 GENERAL

A. The requirements for seismic protection measures to be applied to plumbing equipment and systems specified herein are in addition to any other items called for in other sections of these specifications.

### 1.03 PLUMBING EQUIPMENT AND PIPING

- A. New and existing plumbing equipment shall include the following items to the extent required on plans or in other sections of these specifications.
  - 1. Water Heaters.
  - 2. Water Softeners.
  - 3. Hot Water Generators.
  - 4. Expansion Tanks.
  - 5. Control Panels.
  - 6. Pumps with Motors.
  - 7. Domestic Water Piping.
  - 8. Drain, Waste and Vent Piping.

### 1.04 RELATED WORK SPECIFIED ELSEWHERE

- A. Concrete work is provided in Division 03.
- B. Seismic restraints for fire suppression systems are provided in Division 21.
- C. Vibration isolation and seismic/wind restraints for heating, fuel and ventilation systems are specified elsewhere in Division 23.
- D. Vibration isolation and seismic restraints for electrical systems are provided in Division 26.

### 1.05 QUALITY ASSURANCE

- A. The following codes and standards will apply:
  - 1. International Building Code.
  - 2. American Society of Civil Engineers (ASCE) 7-16.
- B. Manufacturer's Qualifications: Firms regularly engaged in manufacture of vibration control and wind restraint products of type, size, and capacity required, whose products have been in satisfactory use in similar service for not less than 5 years.
- C. The following guides may be used for supplemental information on typical seismic installation practices:
  - 1. Federal Emergency Management Agency (FEMA) manuals 412, Installing Seismic Restraints for Mechanical Equipment and 414, Installing Seismic Restraints for Ductwork and Pipe.
  - 2. Sheet Metal and Air-conditioning Contractors' National Association's (SMACNA) Seismic Restraint Manual Guidelines for Mechanical Systems.
  - 3. American Society for Heating, Refrigerating and Air-conditioning Engineers' (ASHRAE) A Practical Guide to Seismic Restraint.

4. Manufacturers Standardization Society of the Valve and Fittings Industry MSS SP-127-2014a, Bracing for Piping Systems, Seismic - Wind - Dynamic, Design, Selection, Application.

# 1.06 COMPONENT IMPORTANCE FACTOR

- A. In order to identify systems requiring seismic restraint and to define those from which restraints may be excluded, utility components are assigned an ASCE 7 Importance Factor (Ip) on the basis of the following:
  - Ip = 1.5 Medical gas piping, vacuum piping, and any other piping carrying hazardous materials: Ip=1.5.
  - Ip = 1.0 All other components.

## 1.07 SUBMITTALS

- A. Submit shop drawings and manufacturer's data in accordance with Division 01.
- B. Provide calculations for selection of seismic/wind restraints in accordance with IBC and ASCE 7, certified by a qualified professional engineer, licensed in the state of the project.
- C. Provide Seismic Restraint plans and calculations for FM Global (Factory Mutual) review. Design parameters for these installations, may be obtained from FM Global prior to system design.

FM Global – Plan Review 601 – 108<sup>th</sup> Avenue NE, Suite 1400 P.O. Box 96077 Bellevue, WA 98004 Tel. (425) 455-5333

- D. Provide Shop drawings along with catalog cuts, templates and erection and installation details, as appropriate, for the items listed. Submittals shall be complete in detail; shall indicate thickness, type, grade, class of metal; and dimensions; and shall show construction details, reinforcement, anchorage, and installation with relation to the building construction.
  - 1. Sway Braces.
  - 2. Seismic Cable Restraint.

## PART 2 PRODUCTS

## 2.01 ACCEPTABLE MANUFACTURERS

- A. Seismic Restraint shall be manufactured by:
  - 1. Amber/Booth.
  - 2. Cooper Industries.
  - 3. International Seismic Application Technology.
  - 4. Mason Industries.
  - 5. Substitutions: Items of same function and performance are acceptable in conformance with Division 01.

## 2.02 SEISMIC BRACING AND SUPPORT OF SYSTEMS AND COMPONENTS

- A. General:
  - 1. Seismic restraint designer shall coordinate all attachments with the structural engineer of record.
  - 2. Design analysis shall include calculated dead loads, static seismic loads, and capacity of materials utilized for the connection of the equipment or system to the structure.
  - 3. Analysis shall detail anchoring methods, bolt diameter, and embedment depth.
  - 4. All seismic restraint devices shall be designed to accept without failure the forces calculated per the applicable building code and as summarized in installation requirements.

- 5. The total height of the structure (h) and the height of the system to be restrained within the structure (z) shall be determined in coordination with architectural plans and the General Contractor.
- B. Friction from gravity loads shall not be considered resistance to seismic forces.

## 2.03 SEISMIC BRACING COMPONENTS

- A. Steel strut shall be 1-5/8 inch wide in varying heights and mig-welded combinations as required to meet load capacities and designs indicated. A material heat code, part number, and manufacturer's name shall be stamped on all strut and fittings to maintain traceability to material test reports.
  - 1. Material for epoxy painted strut: ASTM A1011, SS, Grade 33.
  - 2. Material for pre-galvanized strut: ASTM A653, SS, Gr. 33.
  - 3. Material for Hot-Dip Galvanized strut: ASTM A1011, SS, Grade 33 and hot-dip galvanized after fabrication in accordance with ASTM A123.
  - 4. Material for fittings and accessories: ASTM A907 Gr. 33, Structural Quality or ASTM A1011, SS. Gr.33.
  - 5. Fittings and accessories: Products shall be of the same manufacturer as strut and designed for use with that product.

### PART 3 EXECUTION

### 3.01 GENERAL

- A. Coordinate size, doweling, and reinforcing of concrete equipment housekeeping pads and piers with vibration isolation and seismic restraint device manufacturer to ensure adequate space and prevent edge breakout failures. Pads and piers must be adequately doweled in to structural slab.
- B. Coordinate locations and sizes of structural supports with locations of vibration isolators and seismic/wind restraints (e.g., roof curbs, etc.).
- C. Isolated and restrained equipment and piping located on roofs must be attached to the structure. Intermediate supports between the restraint and structure that are not attached to the structure must be approved by the restraint manufacturer.

### 3.02 SEISMIC/WIND RESTRAINTS

- A. General:
  - 1. All equipment and piping shall be restrained to resist seismic/wind forces per the applicable building code(s) as a minimum. Restraint attachments shall be made by bolts, welds or a positive fastening method. Friction shall not be considered. All attachments shall be proven capable of accepting the required wind load by calculations. Additional requirements specified herein are included specifically for this project.
  - 2. Install seismic and wind restraint devices per the manufacturer's submittals. Any deviation from the manufacturer's instructions shall be reviewed and approved by the manufacturer.
  - 3. Attachment to structure for suspended equipment and pipe: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
  - 4. Wall penetrations may be used as bracing locations provided the wall can provide adequate resistance without significant damage.
  - 5. Coordinate sizes and locations of cast-in-place inserts for post-tensioned slabs with seismic restraint manufacturer.
  - 6. Provide hanger rod stiffeners where indicated or as required to prevent buckling of rods due to seismic forces.

- 7. Where rigid restraints are used on equipment or piping, support rods for the equipment or piping at restraint locations must be supported by anchors rated for seismic use. Post-installed concrete anchors must be in accordance with ACI 355.2.
- 8. Ensure housekeeping pads have adequate space to mount equipment and seismic restraint devices and shall also be large enough to ensure adequate edge distance for restraint anchor bolts to avoid housekeeping pad breakout failure.
- B. Concrete Anchor Bolts:
  - Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid pre- or post-tensioned tendons, electrical and telecommunications conduit, and gas lines.
  - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
  - 3. Mechanical Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
  - 4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
  - 5. Set anchors to manufacturer's recommended torque, using a torque wrench.
- C. Equipment Restraints:
  - 1. Seismically restrain equipment as indicated on the schedule. Install fasteners, straps and brackets as required to secure the equipment.
  - 2. Install neoprene grommet washers on equipment anchor bolts where clearance between anchor and equipment support hole exceeds 1/8" (3.2 mm).
  - 3. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- D. Piping Systems:
  - 1. For projects with a Seismic Design Category of D provide seismic cable restraints on the following:
    - a. All piping greater than 3" (75 mm) nominal diameter.
    - b. All piping systems assigned a component importance factor, lp, of 1.5 with a nominal pipe diameter greater than 1" (25 mm) or trapeze-supported piping with combined operating weight over 10 lbs/ft (15 kg/m).
  - 2. "12-inch rule", where pipe can be exempted from seismic restraint based on the length of the support rods, is accepted if one of the following conditions are met:
    - a. Hangers are detailed to avoid bending of the hangers and their attachment; and provisions are made for piping to accommodate expected deflections. The maximum stress due to combined loading including bending in the hangers must be less than 21.6 ksi.
    - b. Isolation hangers are added to hanger rod to provide swivel joint and to prevent bending moment in hanger.
  - 3. Restraint spacing:

- a. For ductile piping, space lateral supports a maximum of 40' (12 m) o.c., and longitudinal supports a maximum of 80' (24 m) o.c.
- b. For non-ductile piping (e.g., cast iron, PVC) space lateral supports a maximum of 20' (6 m) o.c., and longitudinal supports a maximum of 40' (12 m) o.c.
- c. For piping with hazardous material inside (e.g., natural gas, medical gas) space lateral supports a maximum of 20' (6 m) o.c., and longitudinal supports a maximum of 40' (12 m) o.c.
- d. For pipe risers, restrain the piping at floor penetrations using the same spacing requirements as above.
- 4. Brace a change of direction longer than 12' (3.7 m).
- 5. Longitudinal restraints for single pipe supports shall be attached directly to the pipe, not to the pipe hanger.
- 6. For supports with multiple pipes (trapezes), secure pipes to trapeze member with clamps approved for application.
- E. Install restraint cables so they do not bend across edges of adjacent equipment or building structure.
- F. Install flexible metal hose loops in piping which crosses building seismic joints, sized for the anticipated amount of movement.

## 3.03 INSPECTION AND CERTIFICATION

- A. After installation, arrange and pay for the vibration isolation product manufacturer, or representative, to visit the site to verify that the vibration isolation systems are installed and operating properly, and shall submit a certificate so stating. Verify that isolators are adjusted, with springs perpendicular to bases or housing, adjustment bolts are tightened up on equipment mountings, and hangers are not cocked.
- B. After installation, arrange and pay for the seismic restraint product manufacturer, or representative, to visit the site to verify that the seismic and wind restraint systems are installed properly, and shall submit a certificate so stating.

## END OF SECTION 22 0548

### SECTION 22 0553 IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

### PART 1 GENERAL

### 1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this section.

### 1.02 SUMMARY

- A. Section Includes identification of plumbing piping and equipment installed under Division 22.
- B. Related Sections:
  - 1. Division 09 Painting and Coating: Execution requirements for painting specified by this section.

### 1.03 REFERENCES

- A. ANSI/ASME A13.1 Scheme for the Identification of Piping Systems.
- B. NFPA 99 Standard for Health Care Facilities.

## 1.04 SUBMITTALS

A. Submit product data under provisions of Division 01.

## 1.05 QUALITY ASSURANCE

- A. Conform to ANSI/ASME A13.1 for color scheme for identification of piping systems and accessories.
- B. Conform to NFPA 99 requirements for labeling and identification of medical gas piping systems and accessories.

## PART 2 PRODUCTS

## 2.01 ACCEPTABLE MANUFACTURERS

- A. Seton.
- B. Marking Services Inc.
- C. Craftmark Identification Systems.
- D. Substitutions: Under provisions of Division 01.

### 2.02 MATERIALS

- A. Color: Unless specified otherwise, conform with ANSI/ASME A13.1.
- B. Plastic Nameplates: Laminated three-layer plastic with engraved black or white letters on contrasting background color. Plate size minimum <sup>3</sup>/<sub>4</sub>" X 2-<sup>1</sup>/<sub>2</sub>".
- C. Plastic Tags: Laminated three-layer plastic with engraved black or white letters on contrasting background color. Tag size minimum 1-1/2 inch square.
- D. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.
- E. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and fluid being conveyed. Larger sizes may have maximum sheet size with spring fastener.
- F. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.
- G. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape of not less than 6 inch wide by 4 mil thick, manufactured for direct burial service.

- H. Ceiling Labels: 3/4" x 2" vinyl label, 3.0 Mil self-adhesive vinyl similar to DuraLabel Pro. Label color shall be black text on a white background.
- I. Valve Chart Frame: Aluminum frame with plastic windows.

# PART 3 EXECUTION

# 3.01 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.
- B. Prepare surfaces in accordance with Division 09 for stencil painting.

# 3.02 INSTALLATION

- A. Apply stencil painting in accordance with Division 09.
- B. Install identifying devices after completion of coverings and painting.
- C. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.
- D. Install labels with sufficient adhesive for permanent adhesion and seal with clear lacquer. For unfinished canvas covering, apply paint primer before applying labels.
- E. Install tags using corrosion resistant chain. Number tags consecutively by location.
- F. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.
- G. Install piping identification on medical gas systems. Refer to Section 22 6013.
- H. Identify water heaters, pumps, tanks, and water treatment devices with plastic nameplates. Identify in-line pumps and other small devices with tags.
- I. Identify control panels and major control components outside panels with plastic nameplates.
- J. Identify valves in main and branch piping with tags showing service and valve number.
- K. Identify piping, concealed or exposed, with plastic pipe markers. Tags may be used on small diameter piping. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.
- L. Provide ceiling tacks to locate valves above T-bar type panel ceilings. Locate in corner of panel closest to equipment.
- M. Locations: Nameplates shall be located so as to be readily visible to maintenance personnel. Motor nameplates shall be readily visible on accessible, three phase motors, otherwise a duplicate motor nameplate shall be permanently affixed to the driven machinery in a visible locations.

## 3.03 VALVE CHART AND SCHEDULE

A. Provide valve chart and schedule at location as directed. Chart shall show valve number, service and normal position. Provide a reduced scale copy of drawings showing valves and valve number. Provide copies of valve chart and drawings for inclusion in operation and maintenance manuals in accordance with Section 22 0500.

# END OF SECTION 22 0553

# SECTION 22 0700 PLUMBING INSULATION

## PART 1 GENERAL

# 1.01 SECTION INCLUDES

- A. Piping Insulation.
- B. Equipment Insulation.
- C. Jackets and Accessories.

# 1.02 RELATED WORK

- A. Division 09 Painting: Painting Insulation Jacket.
- B. Section 22 0500 Common Work Results for Plumbing.
- C. Section 22 0516 Expansion Fittings and Loops for Plumbing Piping.
- D. Section 22 0529 Hangers and Supports for Plumbing Piping and Equipment.
- E. Section 22 0553 Identification for Plumbing Piping and Equipment.
- F. Section 22 1000 Plumbing Piping.
- G. Section 22 3000 Plumbing Equipment.
- H. Section 22 4000 Plumbing Fixtures.
- I. Section 22 4500 Emergency Plumbing Fixtures.

## 1.03 REFERENCES

- A. ASTM B209 Aluminum and Aluminum-alloy Sheet and Plate.
- B. ASTM C450 Standard Practice for Fabrication of Thermal Insulating Fitting Covers for NPS Piping, and Vessel Lagging.
- C. ASTM C518 Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
- D. ANSI/ASTM C533 Calcium Silicate Block and Pipe Thermal Insulation.
- E. ANSI/ASTM C534 Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
- F. ANSI/ASTM C547 Mineral Fiber Preformed Pipe Insulation.
- G. ANSI/ASTM C552 Cellular Glass Block and Pipe Thermal Insulation.
- H. ANSI/ASTM C553 Mineral Fiber Blanket Thermal Insulation.
- I. ANSI/ASTM C578 Rigid, Cellular Polystyrene Thermal Insulation.
- J. ASTM C585 Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).
- K. ANSI/ASTM C612 Mineral Fiber Block and Board Thermal Insulation.
- L. ASTM C1136 Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
- M. ASTM C1427 Extruded Preformed Flexible Cellular Polyolefin Thermal Insulation in Sheet and Tubular Form.
- N. ASTM D635 Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.
- O. ASTM E84 Test Method for Surface Burning Characteristics of Building Materials.
- P. ASTM E96 Test Methods for Water Vapor Transmission of Materials.
- Q. UL 723 Test for Surface Burning Characteristics of Building Materials.

## 1.04 SUBMITTALS

- A. Submit product data under provisions of Division 01.
- B. Include product description, thermal performance, thickness for each service, and locations.
- C. Submit manufacturer's installation instructions.

### 1.05 QUALITY ASSURANCE

- A. Applicator: Company specializing in piping insulation application with three years minimum experience.
- B. Pipe insulation manufactured in accordance with ASTM C585 for inner and outer diameters.
- C. Materials: Flame spread/smoke developed rating of 25/50 in accordance with UL 723, or ASTM E84.
- D. Factory fabricated fitting covers manufactured in accordance with ASTM C450.

### 1.06 DELIVERY STORAGE AND HANDLING

- A. Division 01 Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- C. Shipment of materials from manufacturer to installation location shall be in weather tight transportation.
- D. Protect insulation from weather and construction traffic, dirt, water, chemical, and damage, by storing in original wrapping.

### 1.07 ENVIRONMENTAL REQUIREMENTS

A. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.

### 1.08 FIELD MEASURMENTS

A. Verify field measurements prior to fabrication.

### 1.09 WARRANTY

A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.

## PART 2 PRODUCTS

### 2.01 ACCEPTABLE MANUFACTURERS

- A. Armacell.
- B. Certain-Teed.
- C. IMCOA.
- D. Johns Manville.
- E. Knauf.
- F. Manson.
- G. K-Flex USA.
- H. Armstrong.
- I. TRUEBRO.
- J. Substitutions: Under provisions of Division 01.

## 2.02 INSULATION - PIPING

- A. Type A: Glass fiber, rigid, molded, non-combustible insulation; ANSI/ASTM C547; 'k' value of 0.23 at 75° F, rated from 0° F to 850° F, vapor retarder jacket of Kraft paper bonded to aluminum foil, self-sealing lap and butt strips; Johns Manville "Micro-Lok" or approved equal.
- B. Type F: ADA insulation; preformed cellular foam, preformed for P-trap and hot water angle stop and supply tube at handicap sinks and lavatories; in compliance with the Americans with Disability Act (ADA); burning characteristics per ASTM D635; TRUEBRO "Lav Guard 2" or approved equal.

### 2.03 INSULATION - EQUIPMENT

- A. Type I: Reusable Thermal Insulation Covers: 2" thermal insulating wool, 2.4 lb./cu.ft. density, maximum temperature rating of 1000 Deg. F; Interior/Exterior Fabric: 17 oz./sq. yd. silicone coated fiberglass cloth, maximum temperature range of -80 to 500 Deg F; Securement: [\*\*\*most commonly used\*\*\* Lacing Anchors, fourteen gauge stainless steel with 1.5" diameter stainless steel speed washers; Sewing Thread: Kevlar/Stainless Steel S-110 Natural with stainless steel core, all blanket seems to be fourteen gauge stainless steel buckle and strap assembly. Thermal Energy Products "Energy-Wrap EW.2T.NM.SH.SC" or approved equal.
- B. Type J: Reusable Valve Wrap Insulation Covers: Removable and reusable wraps packaged with a 1" thick fiberglass blanket insert to completely cover the insulated equipment. The outer cover of the shall be made of DuPont Tychem® QC that is secured with a Velcro closure. Tychem® QC consists of a durable Tyvek® substrate quality coated with polyethylene that is impermeable to water. K= .28 @ 100° F; Temperature Limits 0°F to 450°F; Water Vapor Transmission ASTM E 96 0.01 Perms at 37.8C/100F-RH/100%; Breaking Strength Grab (md/cd) ASTM D5034-90 43/49 lbs; Tearing Strength Trapezoid (md/cd) ASTM D1117-80 7/5 lbs; Weatherable Grade; UV resistant; White/gloss finish; UL25/50 rating and are non-combustible per ASTM E 136. NOSWEAT Reusable Valve Wraps or approved equal.

### 2.04 FIELD APPLIED JACKET

- A. Vapor Barrier Jackets: Kraft reinforced foil vapor barrier with self-sealing adhesive joints.
- B. PVC Jackets and solvent welding adhesive: One piece, pre-molded type, Johns Manville "Zeston 2000", fitting covers and jacketing material. Johns Manville "Perma-Weld" solvent welding adhesive.

### 2.05 INSULATION ACCESSORIES

- A. Adhesives: Waterproof and fire-retardant type.
- B. Canvas Lagging Adhesive: Fire resistive to ASTM E84 and UL 723.
- C. Impale Anchors: Galvanized steel, 12 gauge, self-adhesive pad.
- D. Joint Tape: Glass fiber cloth, open mesh.
- E. FSK Joint Tape; ASTM C1136 Foil-Scrim-Kraft (FSK) lamination coated with solvent acrylic pressure sensitive adhesive; capable of adhering to fibrous and sheet metal surfaces; tridirectionally reinforced 2x3 squares per inch fiberglass scrim; 9.5 mils thick, -40 to 240° F service temperatures; Venture Tape "1525CW" or approved equal.
- F. Tie Wire: Annealed steel, 16 gauge.
- G. Insulated pipe supports: Calcium silicate with galvanized steel jacket (min. 24 gauge); ANSI/ASTM C533; rigid white; 'k' value of 0.37 at 100° F, rated to 1,200° F; Thermal Pipe Shields "T-2000 Calsil" or equal.

### PART 3 EXECUTION

## 3.01 PREPARATION

- A. Install materials after piping and equipment has been tested and approved.
- B. Clean surfaces for adhesives.

C. Prepare surfaces in accordance with manufacturer's recommendations.

## 3.02 INSTALLATION - PIPING

- A. Install materials in accordance with manufacturer's recommendations, building codes and industry standards.
- B. Continue insulation vapor barrier through penetrations except where prohibited by code.
- C. Locate insulation and cover seams in least visible locations.
- D. Neatly finish insulation at supports, protrusions, and interruptions.
- E. Provide insulated cold pipes conveying fluids below ambient temperature with vapor retardant jackets with self-sealing laps. Insulate complete system, including under fitting jackets.
- F. For insulated pipes conveying fluids above ambient temperature, secure jackets with selfsealing lap or outward clinched, expanded staples. Bevel and seal ends of insulation at equipment, flanges, and unions. Insulate complete system, including under fitting jackets.
- G. Provide insert fabricated of Johns Manville Thermo-1200 or other heavy density insulating material suitable for temperature between support shield and piping on piping 1-½" inches diameter or larger. Insulation inserts shall not be less than the following lengths:

| 1-1⁄2" to 2-1⁄2" pipe size | 10" long |
|----------------------------|----------|
| 3" to 6" pipe size         | 12" long |

- H. Fully insulate all piping including all spaces under jacketing.
- I. Jackets:
  - 1. Indoor, Concealed Applications: Insulated pipes shall have vapor barrier jackets, factoryapplied. Vapor barrier PVC fittings may also be used provided joints are sealed with solvent welding adhesive approved by the jacket manufacturer.
  - 2. For pipe exposed in mechanical equipment rooms or in finished spaces below 10 feet above finished floor, finish with PVC jacket and fitting covers or metal jacket.
  - 3. Insulate all exposed trap arms, drains, and hot water supplies for handicap protection on handicap accessible fixtures.

## 3.03 SCHEDULE – PIPING

| PIPING                                                   | TYPE | PIPE SIZE<br>Inch | MINIMUM<br>INSULATION<br>THICKNESS<br>Inch |
|----------------------------------------------------------|------|-------------------|--------------------------------------------|
| Domestic Cold Water                                      | А    | All Sizes         | 1"                                         |
| Domestic Hot Water – Smaller then<br>1-1/2"              | A    | All Sizes         | 1"                                         |
| Domestic Hot Water – 1-1/2" and<br>Larger                | A    | All Sizes         | 1-1/2"                                     |
| Domestic Hot Water Recirculated –<br>Smaller then 1-1/2" | A    | All Sizes         | 1"                                         |
| Domestic Hot Water Recirculated –<br>1-1/2" and Larger   | A    | All Sizes         | 1-1/2"                                     |
| Rain Leaders                                             | A    | All Sizes         | 1"                                         |
| Roof Drain Sumps                                         | A    | All Sizes         | 2"                                         |
| Handicap lavatories, sinks @ waste<br>and supply         | F    | All Sizes         | 1⁄2"                                       |

## 3.04 INSTALLATION - EQUIPMENT

A. Install materials in accordance with manufacturer's instructions.

- B. Do not insulate factory insulated equipment.
- C. Do not insulate over nameplate or ASME stamps. Bevel and seal insulation around such.
- D. When equipment with insulation requires periodical opening for maintenance, repair, or cleaning, install insulation in such a manner that it can be easily removed and replaced without damage.

## 3.05 SCHEDULE - EQUIPMENT

| EQUIPMENT                | INSULATION<br>TYPE | THICKNESS<br>INCH |
|--------------------------|--------------------|-------------------|
| Domestic Water Softeners |                    | 1"                |

END OF SECTION 22 0700

## SECTION 22 0800 COMMISSIONING OF PLUMBING

## PART 1 GENERAL

## 1.01 SUMMARY

- A. Section includes Cx process requirements for the following plumbing systems, assemblies, and equipment:
  - 1. Domestic hot- and cold-water piping.
  - 2. Sanitary waste and vent piping.
  - 3. Storm drainage piping.
  - 4. Plumbing pumps.
  - 5. General-service compressed air piping and equipment.
  - 6. Plumbing equipment.
  - 7. Vacuum piping and equipment for laboratory and healthcare facilities.
  - 8. Medical gases piping, equipment, and alarms.
  - 9. Chemical waste systems for laboratory and healthcare facilities.
- B. Related Requirements:
  - 1. See Section <u>01 9113 General Commissioning Requirements</u> for general Cx process requirements and CxA responsibilities.
  - 2. For prefunctional checklists, comply with requirements in various Division 22 Sections specifying plumbing systems, system components, equipment, and products.

# 1.02 DEFINITIONS

- A. Cx: Commissioning, as defined in Section 01 9113 General Commissioning Requirements.
- B. CxA: Commissioning Authority, as defined in Section <u>01 9113 General Commissioning</u> <u>Requirements</u>.
- C. "Systems," "Assemblies," "Subsystems," "Equipment," and "Components": Where these terms are used together or separately, they shall mean "as-built" systems, assemblies, subsystems, equipment, and components.

## **1.03 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For plumbing testing technician.
- B. Prefunctional checklists: Draft prefunctional checklists will be created by CxA for Contractor review.
- C. Test equipment and instrumentation list, identifying the following:
  - 1. Equipment/instrument identification number.
  - 2. Planned Cx application or use.
  - 3. Manufacturer, make, model, and serial number.
  - 4. Calibration history, including certificates from agencies that calibrate the equipment and instrumentation.
  - 5. Equipment manufacturers' proprietary instrumentation and tools. For each instrument or tool, identify the following:
    - a. Instrument or tool identification number.
    - b. Equipment schedule designation of equipment for which the instrument or tool is required.
    - c. Manufacturer, make, model, and serial number.
    - d. Calibration history, including certificates from agencies that calibrate the instrument or tool, where appropriate.

# 1.04 QUALITY ASSURANCE

- A. Plumbing Testing Technician Qualifications: Technicians to perform plumbing prefunctional checklist verification tests, prefunctional checklist verification test demonstrations, Cx tests, and Cx test demonstrations shall have the following minimum qualifications:
  - 1. Journey level or equivalent skill level with knowledge of plumbing system, electrical concepts, and building operations.
  - 2. Minimum [three years'] < Insert time> experience installing, servicing, and operating systems manufactured by approved manufacturer.
- B. Medical Gas Piping Systems Testing Technician Qualifications: Technicians to perform medical compressed-air, vacuum, and medical gas piping for laboratory and healthcare facilities system prefunctional checklist verification tests, prefunctional checklist verification test demonstrations, Cx tests, and Cx test demonstrations shall have the following minimum qualifications:
  - Journey level or equivalent skill level. Vocational school four-year-program graduate or an Associate's degree in mechanical systems, plumbing systems, or similar field. Degree may be offset by three years' experience in servicing plumbing systems in the gas piping for laboratory and healthcare facilities plumbing systems industry. Generally, required knowledge includes gas piping for laboratory and healthcare facilities systems, electrical concepts, building operations, and application and use of tools and instrumentation to measure performance of plumbing system equipment, assemblies, and systems.
  - 2. Minimum [three years'] < Insert time> experience installing, servicing, and operating systems manufactured by approved manufacturer.
- C. Testing Equipment and Instrumentation Quality and Calibration:
  - 1. Capable of testing and measuring performance within the specified acceptance criteria.
  - 2. Be calibrated at manufacturer's recommended intervals with current calibration tags permanently affixed to the instrument being used.
  - 3. Be maintained in good repair and operating condition throughout duration of use on Project.
  - 4. Be recalibrated/repaired if dropped or damaged in any way since last calibrated.
- D. Proprietary Test Instrumentation and Tools:
  - 1. Equipment Manufacturer's Proprietary Instrumentation and Tools: For installed equipment included in the Cx process, test instrumentation and tools manufactured or prescribed by equipment manufacturer to service, calibrate, adjust, repair, or otherwise work on its equipment or required as a condition of equipment warranty, shall comply with the following:
    - a. Be calibrated by manufacturer with current calibration tags permanently affixed.
    - b. Include a separate list of proprietary test instrumentation and tools in operation and maintenance manuals.
    - c. Plumbing system proprietary test instrumentation and tools become property of Owner at the time of Substantial Completion.

## PART 2 PRODUCTS (Not Used)

## PART 3 EXECUTION

### 3.01 PREFUNCTIONAL CHECKLIST REVIEW

- A. Review and provide written comments on draft prefunctional checklists. CxA will create required draft prefunctional checklists and provide them to Contractor.
- B. Return draft prefunctional checklist review comments within [10] < Insert number> days of receipt.
- C. When review comments have been resolved, the CxA will provide final prefunctional checklists, marked "Approved for Use, (date)."
- D. Use only prefunctional checklists, marked "Approved for Use, (date)."

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# 3.02 Cx TESTING PREPARATION

- A. Certify that plumbing systems, subsystems, and equipment have been installed, calibrated, and started and that they are operating according to the Contract Documents and approved submittals.
- B. Certify that plumbing systems instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents and approved submittals, and that pretest set points have been recorded.
- C. Set systems, subsystems, and equipment into operating mode to be tested according to approved test procedures (for example, normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).

## 3.03 Cx TEST CONDITIONS

- A. Perform tests using design conditions, whenever possible.
  - 1. Simulated conditions may, with approval of Architect, be imposed using an artificial load when it is impractical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by CxA and document simulated conditions and methods of simulation. After tests, return configurations and settings to normal operating conditions.
  - 2. Cx test procedures may direct that set points be altered when simulating conditions is impractical.
  - 3. Cx test procedures may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are impractical.
- B. If tests cannot be completed because of a deficiency outside the scope of the plumbing system, document the deficiency and report it to Architect. After deficiencies are resolved, reschedule tests.
- C. If seasonal testing is specified, complete appropriate initial performance tests and documentation and schedule seasonal tests.

## 3.04 Cx TESTS COMMON TO PLUMBING

- A. Measure capacities and effectiveness of systems, assemblies, subsystems, equipment, and components, including operational and control functions, to verify compliance with acceptance criteria.
- B. Test systems, assemblies, subsystems, equipment, and components operating modes, interlocks, control responses, responses to abnormal or emergency conditions, and response according to acceptance criteria.
- C. Coordinate schedule with, and perform Cx activities at the direction of, CxA.
- D. Comply with prefunctional checklist requirements, including material verification, installation checks, startup, and performance tests requirements specified in Division 22 Sections specifying plumbing systems and equipment.
- E. Provide technicians, instrumentation, tools, and equipment to perform and document the following:
  - 1. Prefunctional checklist verification tests.
  - 2. Prefunctional checklist verification test demonstrations.
  - 3. Cx tests.
  - 4. Cx test demonstrations.
- F. Vibration Isolation in Plumbing Systems:
  - 1. Prerequisites: Acceptance of results of prefunctional checklists for vibration and seismic control devices specified in Section <u>22 0548 Vibration and Seismic Controls for</u> <u>Plumbing Piping and Equipment</u>.
  - 2. Components to Be Tested:
    - a. Vibration isolation and seismic control devices in plumbing systems.
    - b. Structural systems.

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- 3. Test Purpose: Evaluate effectiveness of vibration isolation and seismic control devices.
- 4. Test Conditions: Measure vibration of the facility structure at [three] <Insert number> locations designated by Owner's witness while the isolated equipment operates.
- 5. Test Conditions: Measure vibration of the facility structure at [three] <Insert number> locations designated by Owner's witness at the following operating conditions:
  - a. Maximum speed.
  - b. Minimum speed.
  - c. Critical speed.
- 6. Acceptance Criteria: Structure-borne vibration not to exceed specified performance.
- G. Supervision of Alarms in Plumbing Systems:
  - 1. Prerequisites: Acceptance of results of prefunctional checklists for plumbing systems specified in the Sections listed below:
    - a. Section 22 1000 Plumbing Piping.
    - b. Section 22 6013 Gas and Vacuum System for Laboratory and Healthcare Facilities.
  - 2. Scope:
    - a. [Supervised] [Monitored] plumbing system alarms.
  - 3. Purpose:
    - a. Verify reporting of [supervised] [monitored] plumbing alarm at [building management system] [security monitoring service] [alarm monitoring service] [other alarm monitoring system] lnsert system>.
  - 4. Conditions of the Test:
    - a. Alarm monitoring systems operating in normal, automatic mode.
    - b. Activate [**supervised**] [**monitored**] plumbing alarms, one at a time.
  - 5. Acceptance Criteria:
    - a. Activation of [supervised] [monitored] plumbing alarm generates alarm at [building management system] [security monitoring service] [alarm monitoring service] [other alarm monitoring system] <Insert system> control panel.
- H. Plumbing Meter Reporting:
  - 1. Prerequisites: Acceptance of results of prefunctional checklists for plumbing systems specified in the Sections listed below:
    - a. Section 22 1000 Plumbing Piping.
    - b. Section 22 3000 Plumbing Equipment.
    - c. Section 22 4000 Plumbing Fixtures.
  - 2. Scope:
    - a. [Supervised] [Monitored] plumbing system water meters.
  - 3. Purpose:
    - a. Verify accuracy of reporting of [supervised] [monitored] plumbing system water meters at [building management system] [utility management service] [other utility consumption management system] <Insert system>.
  - 4. Conditions of the Test:
    - a. Plumbing system water meter recording systems operating in normal, automatic mode.
    - b. Compare cumulative consumption data at plumbing system water meter recording systems with independent, calibrated flow-measuring instrumentation under the following conditions:
      - 1) Low Flow: [1] < Insert number> percent of maximum design flow rate for a period of [four hours] < Insert value>.
      - High Flow: [80] <Insert number> percent of maximum design flow rate for a period of [20 minutes] <Insert value>.
    - c. Activate [supervised] [monitored] plumbing alarms, one at a time.
  - 5. Acceptance Criteria:
    - a. Cumulative flow reported for low-flow condition is within [5] <**Insert number**> percent flow recorded by calibrated flow-measuring instrumentation.

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- b. Cumulative flow reported for high-flow condition is within [1] <**Insert number**> percent flow recorded by calibrated flow-measuring instrumentation.
- I. Heat Tracing in Plumbing Systems:
  - Prerequisites: Acceptance of results of prefunctional checklists for heat tracing specified in heat-tracing systems. Comply with requirements listed in Section <u>26 0580 – Heating</u> <u>Cables</u>.
  - 2. Equipment and Systems to Be Tested:
    - a. Self-regulating, parallel-resistance heating cables.
    - b. Heater trace circuit controller.
  - 3. Test Purpose:
    - a. Evaluate response to ambient temperature below freeze-protection set point.
    - b. Evaluate heating cable fault alarm.
  - 4. Test Conditions:
    - a. Subject temperature sensor to temperature approximately [3 deg F] <Insert value> above freeze-protection set point (initial set point [41 deg F] <Insert value>). Monitor sensed temperature with a calibration-grade thermometer. Gradually change set point or sensed temperature until freeze-protection circuit is energized.
    - b. Subject temperature sensor to temperature approximately [3 deg F] <Insert value> below freeze-protection set point (initial set point [41 deg F] <Insert value>). Monitor sensed temperature with a calibration-grade thermometer. Gradually change set point or sensed temperature until freeze-protection circuit is de-energized.
    - c. Simulate an electrical fault on the heating cable.
  - 5. Acceptance Criteria:
    - a. Freeze-protection circuit is energized at set-point temperature minus 2 deg F.
    - b. Freeze-protection circuit is de-energized at set-point temperature plus 2 deg F.
    - c. Heater trace circuit controller initiates an alarm of cable fault. Alarm is correctly reported at the fire-alarm control panel.

# 3.05 Cx TESTS FOR COMPRESSED AIR SYSTEMS

- A. Air Compressor Run Time:
  - 1. Prerequisites:
    - a. Acceptance of results of prefunctional checklists specified in the following:
      - 1) Section <u>22 6013 Gas and Vacuum Systems for Laboratory and Healthcare</u> <u>Facilities</u>.
  - 2. Scope:
    - a. Air compressors in plumbing systems.
    - b. Associated compressed air piping, valves, and appurtenances.
    - c. Associated air pressure controllers.
  - 3. Purpose: Evaluate air compressor run time and number of compressor starts.
  - 4. Conditions of the Test:
    - a. Keep compressed air openings closed during test.
    - b. For systems with multiple compressors, lock out compressor motors on all but one compressor. Repeat test for each compressor in turn.
    - c. Record number of air compressor motor starts during a 14-day period.
    - d. Record air compressor motor run time during the same 14-day period.
  - 5. Acceptance Criteria:
    - a. Number of compressor motor starts during test period shall not exceed [20] < Insert number>.
    - b. Compressor motor run time during test period shall not exceed [60 minutes] < Insert time>.

# 3.06 Cx TESTS FOR VACUUM SYSTEMS

- A. Vacuum Pump Run Time:
  - 1. Prerequisites:

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- a. Acceptance of results of prefunctional checklists for vacuum equipment for laboratory and healthcare facilities.
- 2. Scope:
  - a. Vacuum pumps in plumbing systems.
  - b. Associated vacuum piping, valves, and appurtenances.
  - c. Associated vacuum pressure controllers.
- 3. Purpose:
  - a. Evaluate vacuum pump run time and number of vacuum pump starts.
- 4. Conditions of the Test:
  - a. Keep vacuum piping openings closed during test.
  - b. For systems with multiple vacuum pumps, lock out vacuum pump motors on all but one pump. Repeat test for each vacuum pump in turn.
  - c. Record number of vacuum pump motor starts during a 14-day period.
  - d. Record vacuum pump motor run time during the same 14-day period.
- 5. Acceptance Criteria:
  - a. Number of vacuum pump motor starts during test period shall not exceed [20] < Insert number>.
  - b. Vacuum pump motor run time during test period shall not exceed [60 minutes] < Insert time>.

# END OF SECTION 22 0800

## SECTION 22 1000 PLUMBING PIPING

## PART 1 GENERAL

## 1.01 WORK INCLUDED

- A. Sanitary Sewer Piping.
- B. Water Piping.
- C. Storm Drain Piping.
- D. Valves.
- E. Strainers.
- F. Backflow Preventers.
- G. Water Hammer Arrestors.
- H. Dielectric Connections.
- I. Cleanouts.
- J. Trap Primer Valves.
- K. Thermostatic Mixing Valves.

# 1.02 RELATED WORK

- A. Division 02 Excavating, Backfilling, Trenching.
- B. Section 22 0500 Common Work Results for Plumbing.
- C. Section 22 0516 Expansion Fittings and Loops for Plumbing Piping.
- D. Section 22 0519 Meters and Gages for Plumbing Piping.
- E. Section 22 0529 Hangers and Supports for Plumbing Piping and Equipment.
- F. Section 22 0553 Identification for Plumbing Piping and Equipment.
- G. Section 22 0700 Plumbing Insulation.
- H. Section 22 3000 Plumbing Equipment.
- I. Section 22 4000 Plumbing Fixtures.
- J. Section 22 4500 Emergency Plumbing Fixtures.

## 1.03 QUALITY ASSURANCE

- A. Valves: Manufacturer's name and pressure rating marked on valve body.
- B. Any pipe or plumbing fitting or fixture, any solder, or any flux utilized on this project shall be "lead free" in accordance with the Safe Drinking Water Act, Section 1417. "Lead free" materials utilized in domestic water system shall not contain more than 0.2 percent lead when used with respect to solder and flux; and not more than a weighted average of 0.25 percent lead when used with respect to the wetted surfaces of pipes, pipe fittings, plumbing fittings, and fixtures. All materials utilized in domestic water system shall be certified by an ANSI accredited organization to conform to ANSI/NSF Standard 61.

## 1.04 SUBMITTALS

- A. Submit product data under provisions of Division 01.
- B. Include data on pipe materials, pipe fittings, valves and accessories.
- C. Shop Drawings: Submit pipe fabrication drawings, drawn to scale not smaller than 1/8" inch equals 1 foot, on drawing sheets same size as Contract Documents, indicating:
  - 1. Fabrication, assembly, and installation details, including plans, elevations, sections, details of components, and attachments to other work.

2. Piping layout, indicating pipe materials and sizes in plan view.

# 1.05 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of piping, valves, and components.
- B. Disinfection and Test reports: Submit to owner for approval. Include all disinfection and testing reports in O&M manuals.

## 1.06 WARRANTY

- A. Polypropylene pipe and fittings shall be covered by a factory warranty for 30 years to be free of defects in materials or manufacturing.
- B. PEX pipe and fittings shall be covered by a manufacturer warranty for a duration of 25 years.
- C. Epoxy coated cast iron soil pipe shall have a 10-year warranty.

# 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site under provisions of Division 01.
- B. Store and protect products under provisions of Division 01.
- C. Deliver and store valves in shipping containers with labeling in place.

# PART 2 PRODUCTS

# 2.01 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Cast Iron Pipe: ASTM A74 service weight. Fittings: Cast iron. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets.
- B. Cast Iron Pipe: CISPI 301, hubless, service weight. Fittings: Cast iron. Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies, Husky Series SD 4000 or approved equal.
- C. Copper Tubing: ASTM B306, DWV. Fittings: ASME B16.3, cast bronze, or ASME B16.29, wrought copper. Joints: ASTM B32, solder, Grade 95TA; Flux: ASTM B813.

## 2.02 SANITARY SEWER PIPING, ABOVE GRADE

- A. Cast Iron Pipe: CISPI 301, hubless, service weight. Fittings: Cast iron. Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies, Husky Series SD 4000 or approved equal.
- B. Copper Pipe: ASTM B306, DWV. Fittings: ASME B16.3, cast bronze, or ASME B16.29, wrought copper. Joints: ASTM B32, solder, Grade 95TA; Flux: ASTM B813.
- C. ABS Schedule 40 Cellular Core (Foam Core) Pipe: Pipe and fittings shall be manufactured from ABS compound with a cell class of 42222 for pipe and 32222 for fittings as per ASTM D 3965 and conform with National Sanitation Foundation (NSF) standard 14. ASTM D 2661 Fittings. Joints: ASTM D 2235 solvent welded. Installation of ABS piping in return air plenums is prohibited.
- D. PVC Pipe: ASTM D2729. Fittings: PVC. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

## 2.03 FOUNDATION DRAIN

A. Per Civil.

## 2.04 FORCED WASTE PIPING

A. Copper Tubing: ASTM B88, Type L, hard drawn. Fittings: ASME B16.18, cast copper alloy, or ASME B16.22, wrought copper. Joints: ANSI/ASTM B32, solder, Grade 95TA; Flux: ASTM B813.

## 2.05 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Copper Tubing: ASTM B42, Type K, annealed. Fittings; ANSI/ASME B16.22, wrought copper. Joints: AWS A5.8, BCuP silver braze; Flux: ASTM B813.
- B. Ductile Iron Pipe: AWWA C151. Fittings: Ductile iron, standard thickness. Joints: AWWA C111, rubber gasket with <sup>3</sup>/<sub>4</sub> inch diameter rods.

- C. PVC Pipe: AWWA C900.
- D. High Density Polyethylene Pipe: ASTM D 3350 HDPE designation code of PE 4710 or PE 3608. The material shall meet the requirements of and shall have a minimum cell classification of PE445474C for PE 4710 and PE345464C for PE 3608. In addition, the pipe shall be listed as meeting NSF-61 and AWWA C901. Fittings: ASTM D3261 Butt Fusion Fittings. ASTM F1055 Electrofusion Fittings. ASTM D 3261 Flanged and Mechanical Joint Adapters.

## 2.06 DOMESTIC WATER PIPING, ABOVE GRADE

- A. Copper Tubing: ASTM B88, Type L, hard drawn.
  - 1. Fittings: ASME B16.18, cast copper alloy, or ASME B16.22, wrought copper.
  - 2. Joints: ANSI/ASTM B32, solder, Grade 95TA; Flux: ASTM B813 or Press-Fit.
  - 3. Press Fittings: The press fittings connections shall be compatible with seamless K, L or M copper tube made to ASTM B 88. Fittings shall comply with NSF 61, CSA and the UPC. The Fittings shall have a maximum non-shock working pressure of 200 PSI between the temperatures of -20°F and +250°F. Elastomeric seals shall be made of EPDM material. Acceptable manufacturers: Viega ProPress or Nibco Press System.
- B. PEX Piping(under slab to prime floor drains only):
  - 1. PEX-a (Engel-method crosslinked polyethylene), ASTM F876 and F877, SDR 9, CTS, 1/2 inch through 3 inch nominal pipe size. Piping shall be rated for not less than 180°F working temperature and 100 psig working pressure.
  - 2. Third-party certified to NSF 14 and ASTM F1960 cold-expansion with PEX reinforcing ring and shall comply with ASTM F876 and ASTM F877, 1/2 inch through 3 inch nominal pipe size fittings manufactured from lead-free (LF) brass. Reinforcing cold-expansion rings shall be manufactured from the same source as PEX-a piping manufacturer and marked "F1960".

### 2.07 STORM DRAIN PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Cast Iron Pipe: ASTM A74 service weight. Fittings: Cast iron. Hub-and-Spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets.
- B. Cast Iron Pipe: CISPI 301, hubless, service weight. Fittings: Cast iron. Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies, Husky Series SD 4000 or approved equal.
- C. ABS Schedule 40 Cellular Core (Foam Core) Pipe: Pipe and fittings shall be manufactured from ABS compound with a cell class of 42222 for pipe and 32222 for fittings as per ASTM D 3965 and conform with National Sanitation Foundation (NSF) standard 14. ASTM D 2661 Fittings. Joints: ASTM D 2235 solvent welded.
- D. PVC Pipe: ASTM D3034. Fittings: PVC. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

### 2.08 STORM DRAIN PIPING, ABOVE GRADE

- A. Cast Iron Pipe: CISPI 301, hubless, service weight. Fittings: Cast iron. Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies, Husky Series SD 4000 or approved equal.
- B. ABS Schedule 40 Cellular Core (Foam Core) Pipe: Pipe and fittings shall be manufactured from ABS compound with a cell class of 42222 for pipe and 32222 for fittings as per ASTM D 3965 and conform with National Sanitation Foundation (NSF) standard 14. ASTM D 2661 Fittings. Joints: ASTM D 2235 solvent welded. Installation of ABS piping in return air plenums is prohibited.
- C. PVC Pipe: ASTM D2729. Fittings: PVC. Joints: ASTM D2855, solvent weld.

## 2.09 INTERIOR TRENCH EXCAVATION AND BACKFILL

- A. General
  - 1. This section describes general requirements, products, and methods of execution relating to excavation, back-fill, and compaction of inside trenches for mechanical work. Inside

trenches are those which occur within an arbitrary, imaginary boundary five feet beyond the outside perimeter of the structure.

- 2. Provide all trench work for mechanical work of every description and of whatever substance encountered to the depth indicated, or to provide pipe slopes and elevations shown on the drawings. Excavate and backfill utility trenches. Place and compact bedding material. Compact backfill material.
- B. Bedding Material
  - 1. Select bedding material from trench excavation using care to separate it from unsuitable material. If suitable bedding material is not available from trench excavation, import it from sources approved by the Owner.
  - 2. Use granular material, free from large stones, boulders, debris, and frozen material. Maximum aggregate size <sup>3</sup>/<sub>4</sub>" minus to have less than 6% passing through a #200 sieve. Maintain moisture content within a range that will allow specified compaction.
  - 3. Do not use any frost susceptible materials.
- C. Trench Backfill
  - 1. Backfill material shall be 3/8" pea gravel of smaller. In the case of cast iron drain, waste and vent piping, the backfill material shall be 3/4" gravel and earth or smaller.

# 2.10 FLANGES, UNIONS, AND COUPLINGS

- A. Pipe Size 2 Inches and Under: 150 psig malleable iron unions for threaded ferrous piping; bronze unions for copper pipe, soldered joints.
- B. Pipe Size Over 2 Inches: 150 psig forged steel slip-on flanges for ferrous piping; bronze flanges for copper piping: 1/16 inch thick preformed neoprene bonded to fiber.
- C. Grooved and Shouldered Pipe End Couplings: Malleable iron housing clamps to engage and lock, designed to permit some angular deflection, contraction, and expansion; "C" shape composition sealing gasket; steel bolts, nuts, and washers; galvanized couplings for galvanized pipe.

# 2.11 ACCEPTABLE MANUFACTURERS - DIELECTRIC CONNECTIONS

- A. Elster Perfection Clearflow.
- B. Substitutions: Under provisions of Division 01.

## 2.12 DIELECTRIC CONNECTIONS

A. Dielectric Connections: Dielectric waterway fitting shall have zinc electroplated steel casing with polypropylene inner lining to provide a dielectric waterway. The fitting shall be designed to meet requirements of ASTM F1545 for continuous use at temperatures up to 225°F and for pressures up to 300 psi. IAPMO, UPC and NSF-61 listed for use with potable water.

# 2.13 ACCEPTABLE MANUFACTURERS - ALL VALVE TYPES

- A. Apollo.
- B. FNW.
- C. Hammond.
- D. Milwaukee.
- E. NIBCO.
- F. Red-White Valve Corp.
- G. Substitutions: Under provisions of Division 01.

# 2.14 GATE VALVES

A. Not permitted. Use ball or butterfly valves for isolation service.

# 2.15 GLOBE VALVES

A. Not permitted. Use ball or butterfly valves for throttling service.

### 2.16 BALL VALVES

- A. Up to 2 Inches: 600 PSI CWP Lead free bronze two piece body, full port, forged lead free brass ball, Teflon seats and adjustable packing, lever handle, solder, threaded or press-fit ends.
- B. Over 2 Inches: Cast steel, two piece body, full port chrome plated steel ball, Teflon seat and stuffing box seals, lever handle, flanged, solder, threaded or press-fit ends.

### 2.17 BUTTERFLY VALVES

- A. High Performance (Double Offset) Butterfly Valves:
  - 1. Body: One-piece wafer, lug or double flanged design with extended neck to allow for 2" of piping insulation. ASME 150 Flange. Provided with top and bottom stem bearings consisting of a 316 stainless steel shell with a TFE/glass fabric liner bearing surface. Equipped with an externally adjustable stem packing system that allows packing adjustment without removing the actuator. Internal over-travel stop shall be provided to prevent over-travel of the disc and minimize possible seat damage.
  - 2. Disc: Disc edge shall be hand polished for minimum torque and maximum sealing capability.
  - 3. Stem: One-piece design provided with blow-out proof stem retention system to assure full retention of the stem in the unlikely event of an internal stem failure.
  - 4. Seat: Design shall consist of a resilient energizer totally encapsulated by the seat. Seat retainer shall be full-faced and firmly attached by bolts located outside the sealing area to protect them from corrosion. The seat assembly shall be locked in the body recess by the full-faced retainer. The seat shall be self-adjusting for wear and temperature changes. The seat shall be easily field replaceable.
  - 5. Valve shall be tested for tight shut-off per API 598 requirements.
  - 6. ANSI/NSF 61/372 Certification.
  - 7. Provide with multi position valve operator/lever handle.
  - 8. Bray/McCannalok High Performance Butterfly Valve or Approved Equal.

# 2.18 SWING CHECK VALVES

- A. Up to 2 Inches: 200 PSI CWP lead free bronze swing with PTFE disc, solder, screwed or pressfit ends.
- B. Over 2 Inches: 285 PSI CWP ductile iron body, stainless steel trim, swing disc, renewable disc and seat, flanged ends.

### 2.19 SPRING LOADED CHECK VALVES

- A. Up to 2 inches: 250 PSI CWP Lead free bronze spring loaded with PTFE seat, solder, screwed or press fit ends.
- B. Over 2 inches: 200 PSI CWP Cast iron body, bronze trim, spring loaded, renewable composition disc, wafer, flanged ends.
- C. Over 2 Inches: Direct operated water pressure reducing valve shall be constructed using Lead Free materials. Cast iron body, stainless steel internal parts with diaphragm rated to 200 PSI maximum working pressure. Watts Regulator Series 2300 or approved equal.

### 2.20 PRESSURE AND TEMPERATURE RELIEF VALVES

A. Provided with equipment.

## 2.21 BALANCE VALVE

A. NSF 61 compliant lead-free brass body rated for 300 PSIG working pressure, temperature range shall be from -4°F to 250°F, type 304 Stainless Steel ball valve. Valve body shall include two

pressure/temperature ports, a drain valve port and a calibrated nameplate with a memory stop. NPT or sweat end connections.

## 2.22 STRAINERS

- A. Wye Strainers: A wye-pattern Lead Free cast copper silicon alloy strainer to be installed as indicated on the plans. The strainer must have a retainer cap with gasket and plug. Strainer shall be rated to 400psi (27.6 bar) WOG @ 210°F (99°C); 125psi (8.6 bar) WSP @ 353°F (178°C). Wye-Pattern cast copper silicon alloy Strainers shall be constructed using Lead Free\* materials. Strainer shall be a Watts Series LF777SI or LFS777SI or approved equal.
- B. Water Meter Strainer: NSF 61 and 372 compliant. Rated to 150 PSI working pressure. Removable basket, flanged connections, constructed of lead free, high copper alloy. Strainer and bolts shall be stainless steel. Neptune or approved equal.

### 2.23 ACCEPTABLE MANUFACTURERS - BACKFLOW PREVENTERS

- A. Watts Regulator.
- B. Febco.
- C. Colt.
- D. Substitutions: Under provisions of Division 01.

### 2.24 BACKFLOW PREVENTERS

- A. General: Backflow preventers shall conform to the applicable requirements of AWWA C510. Furnish a certificate of Full Approval or a current Certificate of Approval for each design, size, and make of backflow preventer being provided for the project. The certificate shall be from the Foundation for Cross- Connection Control and Hydraulic Research, University of Southern California, and shall attest that this design, size, and make of backflow preventer has satisfactorily passed the complete sequence of performance testing and evaluation for the respective level of approval. A Certificate of Provisional Approval is not acceptable in lieu of the above. IAPMO (UPC) approved.
- B. Reduced Pressure Backflow Preventers: ANSI/ASSE 1013; FDA approved epoxy coated cast iron (4" or larger) or bronze body (3" and smaller) with bronze and stainless steel internal parts and stainless steel springs; two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve which opens under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks; Watts Regulator Series 909 or approved equal.
- C. Vending Machine Backflow Preventer: NSF Standard No. 25 double check valve design with stainless steel body and heavy duty rubber parts designed to prevent backflow of carbon dioxide gas and carbonated water into the potable water supply system serving vending machines. Integral vent to discharge C02 gas to atmosphere in the event of fouling or malfunction. Temperature Range: 33ºF-140ºF, Maximum Working Pressure; 150psi. Watts Regulator 9BD or approved equal.
- D. Coffee Machine Backflow preventer: Body and adapters are of 316 stainless steel construction and all rubber components comply with FDA food additive regulations. All materials in contact with the potable water are in compliance with the requirements of the Safe Drinking Water Act, Public Law. Watts SD2 or approved equal.
- E. Combination Boiler Fill Valve and Backflow Preventer: T 93-523, National Interim Primary Drinking Water Regulations. The combination valve shall contain a Boiler Dual Check Valve with Atmospheric Vent and a High Capacity Feed Water Pressure Regulators shall be constructed of an iron and bronze body construction with NPT threaded inlet and outlet connections, a tight seating check valve, purge lever for manual purging, and a stainless steel strainer. Maximum Pressure: 100 psi. Watts Regulator Series 1156F or approved equal.

## 2.25 ACCEPTABLE MANUFACTURERS - WATER HAMMER ARRESTORS

A. J.R. Smith.

- B. Zurn.
- C. Mifab.
- D. Substitutions: Under provisions of Division 01.

### 2.26 WATER HAMMER ARRESTORS

A. ANSI A112.26.1; sized in accordance with PDI WH-201, pre-charged suitable for operation in temperature range -100°F to 300°F and maximum 250 psig working pressure; Series 5000 manufactured by J.R. Smith or approved equal.

#### 2.27 DRAIN VALVES

A. Bronze body, chrome plated brass ball, RPTFE seals and stuffing box ring, stainless steel handle with vinyl cover. 3/4" NPT x 3/4" Hose thread, with duct cover and chain, sweat ends. Apollo 78-100 Series or approved equal.

### 2.28 ACCEPTABLE MANUFACTURERS - CLEANOUTS

- A. J.R. Smith.
- B. Zurn.
- C. Mifab.
- D. Substitutions: Under provisions of Division 01.

### 2.29 CLEANOUTS

- A. Exterior Surfaced Areas: Round cast iron access frame and non-skid cover, bronze plug, vandal resistant screws. J.R. Smith Model 4251 or approved equal.
- B. Interior Finished Wall Areas: Line type with lacquered cast iron body and round epoxy coated gasketed cover, bronze plug, and round stainless steel access cover secured with machine screw. J.R. Smith Model 4022 or approved equal.
- C. Interior Unfinished Accessible Areas: Caulked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.

### 2.30 ACCEPTABLE MANUFACTURERS – TRAP PRIMER VALVES

- A. Precision Plumbing Products, Inc.
- B. Mifab.
- C. Zurn.
- D. Substitutions: Under provisions of Division 01.

### 2.31 ELECTRONIC TRAP PRIMER VALVE

A. Electronic Trap Primer: Prime-time Trap Primer as manufactured by Precision Plumbing Products or equal. Recessed mounted in NEMA-1 cabinet with cover plate. UL listed. Provide manifold with number of connections as indicated on the drawings.

### 2.32 MANUAL TRAP PRIMER VALVE

A. Valve: Machined of brass, containing no springs or diaphragms. "O" rings acceptable for -40°F to +450°F operation. Distribution Unit: Brass fitting with copper water reservoir. Clear plastic cover. Tapping's for up to four drain taps.

### 2.33 ACCEPTABLE MANUFACTURERS - MIXING VALVES

- A. Cash Acme.
- B. Powers.
- C. PVI.
- D. Watts Regulator.
- E. Lawler Manufacturing Company.

- F. Symmons Industries Inc.
- G. Webstone.
- H. Substitutions: Under provisions of Division 01.

### 2.34 MASTER TEMPERING VALVE

- A. Master water tempering valve shall be of the thermostatic type with liquid-filled motor. It shall have lead free bronze body construction with replaceable corrosion-resistant components. Valve construction shall employ sliding piston control mechanism. Piston and liner shall be of stainless steel material. Valve shall come equipped with removable union end stop and check inlets with stainless steel strainers. Valve shall control temperature from a low flow to the maximum flow rate for a given pressure differential. Valve shall provide protection against hot or cold supply line failure and thermostat failure.
- B. Temperature control system shall be controlled digitally via integrated circuit board technology designed to deliver blended water economically at accurate temperature selected by user as safe and appropriate for sanitary use in facility's recirculated hot water system.
- C. Construction shall be lead free design and in compliance with lead free laws. Digital water temperature control and monitoring system shall feature full-color 3.5" touchscreen interface capable of displaying 196 combinations of critical system data in standard or metric measurements. Unit shall be user-configurable on location and shall not require factory preprogramming prior to shipment. Temperature adjustment shall be made locally by user at the control module and shall not require a laptop computer or special software to initiate.
- D. System shall control water temperature to +/- 2°F in accordance with ASSE 1017 and during periods of low and zero demand, and maintain a consistent system "idling" temperature to mitigate "temperature creep" without the use of a manual throttling device/balancing valve. The high-speed actuator shall be located external to mixing chamber where water from valve cannot affect performance as a result of faulty orings or seals.
- E. System shall feature Feed Forward or Predictive Control which anticipates changes in system demand and adjusts valve pre-emptively to maintain mixed set point. Control module shall be password protected to help prevent unauthorized adjustment or tampering with settings.
- F. Control module shall integrate with building automation systems through Bacnet and Modbus protocols without the use of a separate module, and feature local and remote temperature alarms. System will also feature a password protected, user-selected high-temperature sanitization mode for operation as part of a user's safe and properly designed thermal bacteria eradication protocol.
- G. In the event of a power failure or loss of cold water, system will close the hot water supply via an internally charged capacitor and is not reliant on batteries which must be replaced. Actuator shall also feature a manual override which can be used to set mixed outlet temperature in the event of a power loss.
- H. System shall be listed/approved to ASSE 1017, cUPC, NSF and CSA 24/UL873, and should be mounted on a heavy-duty welded strut with corrosion resistance coating and factory-tested as a complete unit. System shall come with a standard 5-year limited warranty.
- I. Other specifications include:
  - 1. Maximum Operating Pressure.....200psi (1379kPa)
  - 2. Maximum Hot Water Temperature......200°F (93°C)
  - 3. Minimum Hot Water Supply Temperature\*\*......2°F (1°C) above set point
  - 4. Hot Water Inlet Temperature Range......120-180°F (49-82°C)

- 6. Minimum Flow \*\*\* .....0.5gpm (1.89lpm)
- 7. Temperature Adjustment Range\*\*\*\*.....80-180°F (27-82°C)
- 8. Listing /Compliance......ASSE 1017<sup>^</sup>, cUPC<sup>^</sup>, NSF372<sup>^</sup>, CSA 24/UL873
- 9. Pump relay......16A @ 250 VAC
- J. Unit includes a dial thermometer and ball valve on tempered water outlet. Unit shall be provided assembled and tested with necessary fittings and nipples.

### 2.35 LAVATORY TEMPERING VALVE

- A. Lead free brass construction and chrome finish, adjustable temperature selection with threaded cap and adjustment tool, thermal actuator, corrosion resistant internal components, integral checks. Mounting bracket for secure installation. Provide with tee fitting for cold and hot water faucet connections.
- B. Construction
  - 1. Body: DZR Brass.
  - 2. Springs: Stainless Steel.
  - 3. Internal Cap: Brass.
  - 4. Piston: Engineered Polymer.
  - 5. Inlet Strainer Screens: Stainless Steel.
- C. Performance:
  - 1. Factory set to 105°F.
  - 2. Maximum Operating Pressure: 230 psi.
  - 3. Hot Water Inlet Temperature Range: 120°F 180°F.
  - 4. Cold Water Inlet Temperature Range: 40°F 80°F.
  - 5. Temperature Adjustment Range: 100°F 120°F.
  - 6. Minimum Flow: 0.25 GPM.
  - 7. Listing: ASSE 1070, CSA, IAPMO.
  - 8. Approval: ASSE 1070, CSA B125.7, NSF 61 Certified.
- D. CASH ACME Heatguard 135 Series, Webstone Figure# H-77211W or approved equal.

## PART 3 EXECUTION

## 3.01 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

## 3.02 INSTALLATION

- A. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- B. Route piping in orderly manner and maintain gradient.
- C. Install piping to conserve building space and not interfere with use of space.
- D. Group piping whenever practical at common elevations.
- E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

- F. Provide clearance for installation of insulation and access to valves and fittings.
- G. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors.
- H. Establish elevations of buried piping outside the building to ensure not less than 10 ft. of cover.
- I. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- J. Prepare pipe, fittings, supports, and accessories not prefinished, ready for finish painting. Refer to Division 09.
- K. Establish invert elevations, slopes for drainage to 1/4" per foot, 1/8" per foot if 4" or over, minimum. Maintain gradients.
- L. Install valves with stems upright or horizontal, not inverted.
- M. Provide properly sized handles for valve operation. Handles shall not be cut or bent to make fit where installed.
- N. Extend cleanouts to wall surface. Floor cleanouts are not permitted. Lubricate threaded cleanout plugs with Teflon<sup>™</sup> based thread lubricate. Ensure clearance at cleanout for rodding of drainage system.
- O. Encase exterior cleanouts in concrete flush with grade.
- P. Install water hammer arrestors complete with accessible isolation valve.
- Q. Install strainers with valve as indicated on plans to allow for simple debris removal.
- R. Press Fittings shall be installed in accordance with the manufacturer's installation instructions.
- S. Extend drain lines from vending machine backflow preventer to water receptor.
- T. Support all piping in accordance with Uniform Plumbing Code and Manufacturer installation instructions. Where there is a conflict between requirements of the Uniform Plumbing Code and Manufacturer installation instructions, the more restrictive requirement shall apply.
- U. Epoxy coated cast iron piping shall be installed per the piping manufacturer's instructions.
- V. Foundation drain piping from the building perimeter shall be extended around the Aquatherapy pool. Routing shown on mechanical, see civil for connection outside of building.

# 3.03 APPLICATION

- A. Install unions downstream of valves and at equipment connections.
- B. Install ball or butterfly valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- C. Install ball or balance valve valves for throttling, bypass, or manual flow control services. (No globe valves permitted.)
- D. Provide spring loaded check valves on discharge of water pumps.

### 3.04 TESTING

- A. Test all water piping in accordance with Section 609 of the UPC. Submit a signed statement to the Engineer stating testing dates, procedure and initials of tester. The test pressure for a hydrostatic test shall be 1.5 times the design pressure or 150 psi, whichever is greater, and for an air test shall be 1.1 times the design pressure or 150 psi, whichever is greater.
- B. Test all sanitary sewer and vent piping in accordance with Section 712 of the UPC. Submit a signed statement to the Engineer stating testing dates, procedure and initials of tester.
- C. Test all storm drainage piping in accordance with Section 1109 of the UPC. Submit a signed statement to the Engineer stating testing dates, procedure and initials of tester.

D. Plastic piping tests are to be performed hydrostatically in accordance with manufacturer installation manuals. For polypropylene piping submit all testing results and documentation to manufacturer as required for manufacturer Warranty.

# 3.05 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Flush, clean and disinfect the potable water system in accordance with Section 609 of the UPC. Submit a signed statement to the Engineer stating disinfection dates, procedure and initials of tester.

# 3.06 INTERIOR TRENCH EXCAVATION AND BACKFILL

- A. Excavation
  - 1. Place all excavated material suitable for back-fill in an orderly manner, and in conformance with safety codes.
  - 2. Dispose of all material not suitable for back filling.
  - 3. Form bell holes so pipelines rest on continuous undisturbed soil. If larger rocks or boulders are encountered, remove them. If trenches are below specified grade, backfill to required depth with select granular materials free from debris, rock, or frozen material, and compact to proper grade before installing piping.
- B. Location
  - 1. Locate trenches to accommodate utilities shown on the drawings.
  - 2. Excavate trench with adequate width to allow compaction equipment to be used at the sides of pipes.
  - 3. Make trench side slopes conform to prevailing safety code requirements.
- C. Dewatering
  - 1. Perform whatever work is necessary to prevent the flow and accumulation of surface or ground water in the excavation.
- D. Timing
  - 1. Do not back-fill until underground mechanical system has been properly tested, inspected and approved.
  - 2. Coordinate with the work of others, and complete all trench work in a timely manner.
- E. Bedding
  - 1. Place bedding material under, around, and over the pipe in lifts not exceeding six inch in depth.
  - 2. Work material around pipe by hand methods, taking care to keep any oversize or sharp stones out of contact with the pipe, and to provide uniform support for the pipe.
  - 3. Cover pipe with bedding material to building sub-grade or to a minimum 12 inch depth before adding other backfill.
- F. Backfilling
  - 1. Continue placing backfill material until trench is completely filled to building sub-grade, or as shown on the drawings.
  - 2. Place backfill material in lifts not to exceed 12 inches in depth.
- G. Compaction
  - 1. Compact bedding material to at least 95 percent of maximum density, taking care not to damage the pipe.
  - 2. Compact backfill under footings, slabs, and other structures to 95% of maximum density or more, if required by the Owner. Where 95% compaction cannot be achieved, fill remaining voids with concrete.

- 3. Compact other areas to preclude future settlement, or at least to 85% of maximum density.
- H. Finishing
  - 1. After completion of backfilling, dispose of excess material and smooth the surface to grade.
  - 2. Do not allow heavy equipment to be used over backfilled work that does not have sufficient cover to prevent pipe damage.
- I. Special Precautions
  - 1. Avoid unauthorized and unnecessary excavations.
  - 2. Minimize number and size of excavations under footings or bearing walls.
  - 3. Support footings, foundations, and walls with timbers and jacks if there appears to be any possible change of damage, and keep such precautions in place until work is completed and sufficient backfill is in place to eliminate possible damage.
  - 4. Avoid damage to all existing underground services, cables, conduit lines or foundations. Repair any existing underground work damaged at no additional cost to the Owner.
  - 5. Protect excavated materials from moisture during the period prior to reinstallation.

### 3.07 SERVICE CONNECTIONS

- A. Provide new sanitary sewer and storm drain services, as required. Before commencing work check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.
- B. Provide new water service complete with reduced pressure backflow preventor and water meter with by-pass valves. Provide 18 gauge galvanized sheet metal sleeve around service main to 6 inch above floor. Size for minimum of 2 inches of loose batt insulation stuffing. Provide close fitting galvanized sheet metal escutcheon.

# END OF SECTION 22 1000

# SECTION 22 3000 PLUMBING EQUIPMENT

## PART 1 GENERAL

## 1.01 WORK INCLUDED

- A. Water Heaters.
- B. Water Softener.
- C. Expansion Tanks.
- D. Pressure Tanks.
- E. Pumps.
- F. Pressure Booster System.
- G. Sump Pumps.
- H. Elevator Sump Pumps.
- I. Interceptors.
- J. Trench Drains.

# 1.02 RELATED WORK

- A. Division 02 Excavating, Backfilling, Trenching.
- B. Section 22 0500 Common Work Results for Plumbing.
- C. Section 22 0516 Expansion Fittings and Loops for Plumbing Piping.
- D. Section 22 0519 Meters and Gages for Plumbing Piping.
- E. Section 22 0529 Hangers and Supports for Plumbing Piping and Equipment.
- F. Section 22 0553 Identification for Plumbing Piping and Equipment.
- G. Section 22 0700 Plumbing Insulation.
- H. Section 22 4000 Plumbing Fixtures.
- I. Section 22 4500 Emergency Plumbing Fixtures

## **1.03 QUALITY ASSURANCE**

- A. Provide pumps with manufacturer's name, model number, and rating/capacity identified.
- B. Ensure products and installation of specified products are in conformance with recommendations and requirements of the following organizations:
  - 1. American Gas Association (AGA).
  - 2. National Sanitation Foundation (NSF).
  - 3. American Society of Mechanical Engineers (ASME).
  - 4. National Board of Boiler and Pressure Vessel Inspectors (NBBPVI).
  - 5. National Electrical Manufacturers' Association (NEMA).
  - 6. Underwriters Laboratories (UL).
- C. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, operate within 25 percent of midpoint of published maximum efficiency curve.

## 1.04 REGULATORY REQUIREMENTS

- A. Conform to AGA, NSF, NBBPVI, ANSI/NFPA 54, ANSI/NFPA 58, requirements for water heaters.
- B. Conform to ANSI/ASME Section 8D for manufacture of pressure vessels for heat exchangers.

C. All materials utilized in domestic water system shall be certified by an ANSI accredited organization to conform to ANSI/NSF Standard 61.

### 1.05 SUBMITTALS

- A. Submit product data under provisions of Division 01.
- B. Include dimension drawings of water heaters indicating components and connections to other equipment and piping.
- C. Include heat exchanger dimensions, size of tappings, and performance data.
- D. Include dimensions of tanks, tank lining methods, anchors, attachments, lifting points, tappings, and drains.
- E. Indicate pump type, capacity, materials of construction, power requirements, and affected adjacent construction.
- F. Submit certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
- G. Submit manufacturer's installation instructions under provisions of Division 01.

### 1.06 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data under provisions of Division 01.
- B. Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

### 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site under provisions of Division 01.
- B. Store and protect products under provisions of Division 01.
- C. Provide temporary inlet and outlet caps. Maintain caps in Place until installation.

### 1.08 WARRANTY

- A. Provide manufacturer's warranty under provisions of Division 01.
- B. Storage tank, heating surfaces, and combustion chamber will have a manufacturer's 15-year warranty (8 years non-prorated, 7 years prorated) covering manufacturing or material defects, waterside or fire side corrosion, leaks, and/or the production of rusty water. Warranties must be directly provided from the water heater manufacturer. Warranties provided by distributors, contractors, sales representatives or third party insurers will not be accepted

## PART 2 PRODUCTS

## 2.01 ACCEPTABLE MANUFACTURERS - WATER HEATERS

- A. PVI.
- B. AO Smith.
- C. Boch.
- D. Substitutions: Under provisions of Division 01.

### 2.02 COMMERCIAL GAS FIRED WATER HEATER

- A. Available Manufacturers: Manufacturer shall be a company specializing in manufacturing the products specified in this section with minimum twenty years' experience.
- B. The water heaters shall be ETL listed as a complete unit. The heater shall satisfy current Federal Energy Policy Act standards for both thermal efficiency and stand-by heat losses as established for gas fired water heaters.
- C. The water heater will be a vertical fire tube, design that is constructed and stamped in accordance with Section IV, Part HLW of the ASME code. Water heater will be National Board

Registered for a working pressure of 150 psi and will be pressure tested at 1-1/2 times working pressure.

- D. Water heater will be a single-pass, down-fired, fire tube design contained within an integral storage tank.
- E. Tank, combustion chamber and fire tubes will be unlined. Lined or plated water heaters will not be acceptable.
- F. Tank, combustion chamber and fire tubes will be constructed from phase-balanced austenitic and ferritic duplex steel with a chemical structure containing a minimum of 21% chromium to prevent corrosion and mill certified per ASTM A 923Methods A to ensure that the product is free of detrimental chemical precipitation that affects corrosion resistance. The material selected shall be tested and certified to pass stress chloride cracking test protocols as defined in ISO 3651-2and ASTM G123 - 00(2005) "Standard Test Method for Evaluating Stress-Corrosion Cracking of Stainless Alloys with Different Nickel Content in Boiling Acidified Sodium Chloride Solution."
- G. Tank will be welded utilizing joint designs to minimize volume of weld deposit and heat input. All heat affected zones (HAZ) shall be processed after welding to ensure the HAZ corrosion resistance is consistent with the mill condition base metal chemical composition. Weld procedures (amperage, volts, welding speed, filler metals and shielding gases) utilized shall result in a narrow range of austenite-ferrite microstructure content consistent with phase balanced objectives for welds, HAZ and the base metal.
- H. All internal and external tank surfaces shall undergo full immersion passivation and pickling processing to meet critical temperature, duration and chemical concentration controls required to complete corrosion resistance restoration of pressure vessel surfaces. Other passivation and pickling methods are not accepted. Immersion passivation and pickling certification documents are required and shall be provided with each product.
- I. Materials shall meet ASME Section II material requirements and be accepted by NSF 61 for municipal potable water systems. Storage tank materials shall contain more than 80% post-consumer recycled materials and be 100% recyclable.
- J. All water contacting tank surfaces will be non-porous and exhibit 0% water absorption.
- K. All tank connections/fittings will be non-ferrous or stainless steel.
- L. To preserve thermal efficiency, the water heater will not use or require a circulator piped from the hot water outlet to the cold water inlet of the heater for the purpose of temperature control during normal operation. Connection for a building return circulation line will be made to a dedicated hot return fitting at the center of the storage vessel and not the cold inlet piping. Connection to a sidearm tank, if used, will be made to a dedicated hot return fitting at the center of the storage vessel and not the cold inlet piping.
- M. Finished vessel will not require sacrificial or impressed current anodes and none will be used. Water heaters or sidearm storage tanks that employ anode rods of any type will not be acceptable.
- N. Combustion will be provided by a premix, fan-assisted surface burner with a gas train meeting UL, ANSI and FM standards for the input specified.
- O. Burner will be stainless steel.
- P. Gas train components will capable of self-proportionating gas and air to maintain optimum combustion in response to varying vent pressures.
- Q. The burner will employ pulse-width modulation.
- R. Burner NOx emissions will be less than 20 ppm when corrected to 3% oxygen.
- S. Water heater will be a category IV, condensing appliance and vent through PVC, CPVC, Polypropylene, or stainless steel. Water heater will satisfy requirements for sealed combustion. Vents for inlet air and exhaust can terminate in different pressure zones.

# 2.03 ACCEPTABLE MANUFACTURERS – DOMESTIC WATER THERMAL EXPANSION TANKS

- A. Amtrol.
- B. Taco.
- C. Armstrong.
- D. Bell & Gossett.
- E. Substitutions: Under provisions of Division 01.

# 2.04 DOMESTIC WATER THERMAL EXPANSION TANKS

- A. Construction: Welded steel, constructed, tested and stamped in accordance with Section VIII, Division 1 of the ASME Code for a working pressure of 150 PSIG; factory air pre-charged and field adjustable. All welds conforming to ASME Section IX. All internal parts must comply with FDA regulations and approvals.
- B. The tank shall be supported by steel legs or a base (integral ring mount) for a vertical installation.
- C. Each tank shall have a steel shell and an internal butyl/EPDM diaphragm or butyl bladder to isolate the air charge from fluid.
- D. Accessories: Pressure gauge and air-charging fitting, tank drain; precharge to incoming domestic water supply pressure.

## 2.05 ACCEPTABLE MANUFACTURERS – WATER SOFTENER SYSTEMS

- A. Watts.
- B. Substitutions: Under provisions of Division 01.

## 2.06 WATER SOFTENER SYSTEMS

- A. Mineral Tank
  - 1. The mineral tank shall be constructed of a polyethylene liner with a continuous roving outer fiberglass reinforced wrapping. The tank shall be non-ASME code with a 150 psi maximum pressure rating and a 120 deg. F (48 deg. C) maximum temperature rating, and certified to NSF/ANSI Standard 44 or 61. 14" diameter tanks and larger shall have a bottom base permanently installed with industrial grade adhesive. Tank shall be supplied with a 6" top flange or a 4" or 2.5" top threaded port for loading media and connection of the control valve. The tank shall be designed with a safety factor of 4:1 for minimum burst pressure.
- B. Ion Exchange Resin
  - 1. The ion exchange resin shall be a high quality, premium grade, strongly acidic gel-type cation exchange resin specially designed for drinking water treatment and certified to NSF/ANSI Standard 61 and 372. The ion exchange resin shall be composed of polystyrene with 8% divinylbenzene crosslinking that offers excellent bead integrity, high resistance to bead fracture or osmotic shock, and very low extractables. The resin shall have a light amber color and shall be specially pretreated to remove taste, odor and color throw. Resin bead size shall be 16X40 mesh. The resin shall meet the requirements of FDA regulation CFR section 21, §173.25. Maximum grain capacity per cubic foot of resin shall be 30,000 grains as CaCO3 when regenerated with 15 lbs of sodium chloride and 20,000 grains as CaCO3 when regenerated with 6 lbs of sodium chloride. PH stability of the resin must be 0-14. Temperature stability of the resin must be up to 250 deg. F (121 deg. C). The resin shall be Watts Model # A4000.
- C. Gravel Under-bedding
  - 1. The gravel under-bedding shall be a flint media. This media shall be washed to rid it of fines to prevent clogging of the lower distributor system. Enough gravel must be furnished to completely cover the lower distributor in the mineral tank(s).

- D. Internal Distributor System
  - 1. The internal distributor system shall come already installed in the water softener mineral tank(s). The screens/laterals of the internal distribution system shall be a slotted screen type diffuser. The slot cross section shall be a V shape to promote a self-cleaning characteristic of the slot. Slot size shall be .008" and not allow the resin to pass through and become present in the systems effluent water. The lower distributor shall be a hub and lateral design for mineral tanks over 24" in diameter and a single point design for mineral tanks 24" in diameter and below. Lateral type screen will have an internal perforated pipe core to evenly distribute water flow across the entire lateral to prevent resin bed channeling. The internal distributor system screens shall be made of abrasion resistant 20% glass filled polypropylene. The distributor tube connecting the internal distribution system to the system control valve shall be made of polyvinyl chloride.
- E. System Control Valve
  - 1. The system control valve shall control all functions of the water softener regeneration and service cycles. The control valve shall be a multi-port type constructed of lead free brass as defined in the US EPA Safe Drinking Water Act and be tested and certified to NSF/ANSI STD. 61 Section 8 Material Safety Only and NSF/ANSI STD. 372 for Lead Free compliance. Cycle positioning shall be motor driven, slow in actuation, and not cause pressure surges or water hammer. The system control valve shall be furnished with a fully programmable microprocessor based controller with an LCD screen. Operating data from the system shall be stored within the controller and displayed on the screen. Operating data shall be peak flow rate, totalizing meter, gallons remaining in softening cycle, use since last regeneration, regeneration interval, and error history log. In service, regeneration, standby position, and error conditions will be indicated on the valve. The valve will be supplied with a normally open and normally open wet contact for interface with the building control system. The controller, related wiring, and positioning motors shall be housed within a water resistant gasket sealed enclosure. The control valve shall be supplied with a meter capable of tracking gallons higher and lower than the system is capable of processing so that it is not a flow restriction at high flow rates or not sensitive to low flow rates. A drain line flow controller shall be provided to regulate the flow of water to drain during a regeneration cycle. The flow controller shall be constructed of a sch. 80 PVC nipple or brass coupling with an orifice plate in the middle. Pressure sensitive rubber flow restrictors shall be installed in the orifice plate. These flow restrictors shall not be able to wash out of the plate and shall allow the consistent passage of water with pressure fluctuations between 30 to 100 psi.
- F. Brine Tank
  - 1. Provide a brine tank made of high density polyethylene for making a brine solution for the water softener to use during a regeneration cycle and for salt storage. The brine tank shall be furnished with an over flow connection, lid, aircheck, and brine well. The brine tank shall be sized to hold enough salt for 12 regenerations at 6 lbs of salt per cubic foot of resin.
- G. Test Kit
  - 1. Provide a Watts model T10460 hardness test kit to the owner upon start up of the system.
- H. 4.0 SERVICES
- I. 4.1 Warranty

# 2.07 ACCEPTABLE MANUFACTURERS – DOMESTIC WATER PRESSURE TANKS

- A. Amtrol.
- B. Taco.
- C. Armstrong.

- D. Bell & Gossett.
- E. Substitutions: Under provisions of Division 01.

### 2.08 DOMESTIC WATER PRESSURE TANKS

- A. Construction: Welded steel, rated for working pressure of 150 psig, 200°F maximum working temperature, flexible butyl rubber diaphragm, polypropylene liner sealed into tank, and steel legs or saddles. NSF 61 listed. Tank shall comply with low lead plumbing law.
- B. Accessories: Air-charging fitting, tank drain; pre-charge to incoming water pressure.

## 2.09 ACCEPTABLE MANUFACTURERS - IN-LINE CIRCULATOR PUMPS

- A. Grundfos.
- B. Wilo.
- C. Taco.
- D. Substitutions: Under provisions of Division 01.

### 2.10 IN-LINE CIRCULATOR PUMPS

- A. Casing: Bronze, rated for 125 psig working pressure.
- B. Impeller: Bronze.
- C. Shaft: Alloy steel with integral thrust collar and two oil lubricated bronze sleeve bearings.
- D. Seal: Carbon rotating against a stationary ceramic seat.
- E. Drive: Flexible coupling.

## 2.11 ACCEPTABLE MANUFACTURERS - WATER BOOSTER SYSTEMS

- A. Grundfos.
- B. Substitutions: Under provisions of Division 01.

### 2.12 WATER BOOSTER SYSTEMS

- A. Furnish and install a pre-fabricated and tested variable speed packaged pumping system to maintain constant water delivery pressure. Water Booster system shall consists of Grundfos CRE series pumps and an integral control package.
- B. The complete packaged water booster pump system shall be certified and listed by UL (Category QCZJ Packaged Pumping Systems) for conformance to U.S. Standards.
- C. The unit shall be rated for a total system noted on the drawings, the individual pumps in the system shall be sized and sequenced to deliver portions of the total flow as demand varies.
- D. The system manufacturer shall submit individual pump curves and system curves for the Engineer's approval.
- E. Piping:
  - 1. The unit shall be completely factory assembled and tested, and shall use stainless steel for the discharge manifold and interconnecting piping.
  - 2. Discharge and suction connections shall be ANSI flanges.
- F. Valves:
  - 1. The discharge and suction lines of each pump shall be complete with ball valves, such that individual pumps may be serviced while the system is in operation.
  - 2. The discharge of each pump shall be furnished with spring-loaded, resilient-seated check valves.
- G. Appurtenances:
  - 1. Pressure Gauges: Liquid-filled suction and discharge.
  - 2. Pressure gauge shall be mounted on ball valves.
- 3. The system shall be provided with a pre-pressurized hydropneumatic tank, sized to operate properly without short cycling of pumps. The hydropneumatic tank will be provided with a relief valve preset to 95 psig, if pump discharge is capable of exceeding 120 psig.
- H. Pumps:
  - 1. All pumps shall be ANSI/NSF 61 approved for drinking water.
  - 2. The pumps shall be of the in-line vertical multi-stage design.
  - 3. The head-capacity curve shall have a steady rise in head from maximum to minimum flow within the preferred operating region. The shut-off head shall be a minimum of 20% higher than the head at the best efficiency point.
  - 4. Vertical In-Line Multi-Stage Pumps shall have the following features:
    - a. The pump impellers shall be secured directly to the pump shaft by means of a splined shaft arrangement.
    - b. The suction/discharge base shall have ANSI Class 250 flange connections.
    - c. Pump Construction.
      - 1) Suction/discharge base, pump head, motor stool: Cast iron (Class 30)
      - 2) Impellers, diffuser chambers, outer sleeve: 304 Stainless Steel
      - 3) Shaft 316 or 431 Stainless Steel
      - 4) Impeller wear rings: 304 Stainless Steel
      - 5) Shaft journals and chamber bearings: Silicon Carbide
      - 6) O-rings: EPDM
  - 5. Motors:
    - a. Integral VFD in NEM 3R enclosure with thermal protection.
    - b. Totally Enclosed Fan Cooled with Class F insulation and a maximum class B temperature rise.
    - c. Nameplate shall have, as a minimum, all information as described in NEMA Standard MG 1-20.40.1.
    - d. Motors shall have a NEMA C-Flange for vertical mounting.
    - e. Drive end bearings shall be adequately sized so that the minimum L10 bearing life is 17,500 hours at the minimum allowable continuous flow rate for the pump at full rated speed.
- I. Skid:
  - 1. Materials of Construction: Stainless steel.
  - 2. Pump Isolation valves shall be provided on the suction and discharge of each pump. Isolation valve sizes 2 inch and smaller shall be nickel plated brass full port ball valves. Isolation valve sizes 3 inch and larger shall be a full lug style butterfly valve. The valve disk shall be of stainless steel. The valve seat material shall be EPDM and the body shall be cast iron, coated internally and externally with fusion-bonded epoxy.
  - 3. A spring-loaded non-slam type check valve shall be installed on the discharge of each pump. The valve shall be a wafer style type fitted between two flanges. The head loss through the valve shall not exceed 5 psi at the pump design capacity. Check valves 2" and larger shall have a body material of stainless steel or epoxy coated iron (fusion-bonded) with an EPDM or NBR resilient seat. Spring material shall be stainless steel. Disk shall be of stainless steel or leadless bronze.
  - 4. For systems that require a diaphragm tank, a diaphragm tank connection of no smaller than <sup>3</sup>/<sub>4</sub>"shall be provided on the discharge manifold.

- 5. A pressure transducer shall be factory installed on the discharge manifold (or field installed as specified on plans). Systems with positive inlet gauge pressure shall have a factory installed pressure transducer on the suction manifold for water shortage protection.
- 6. A bourdon tube pressure gauge, 2.5 inch diameter, shall be placed on the suction and discharge manifolds. The gauge shall be liquid filled and have copper alloy internal parts in a stainless steel case. Gauge accuracy shall be 2/1/2 %. The gauge shall be ca-pable of a pressure of 30% above its maximum span without requiring recalibration.
- 7. Systems with a flooded suction inlet or suction lift configuration shall have a factory installed water shortage protection device on the suction manifold.
- 8. The base frame shall be constructed of corrosion resistant 304 stainless steel. Rubber vibration dampers shall be fitted between each pumps and baseframe to minimize vibration.
- 9. The control panel shall be mounted on a 304 stainless steel fabricated control cabinet stand attached to the system skid.
- J. Testing:
  - 1. The entire pump station shall be factory performance tested as a complete unit prior to shipment. Job-site programming shall be entered into the controller prior to shipment (details of installation requirements shall be communicated to the pump system manufacturer). A verified performance test report shall be made available from the system manufacturer.
  - 2. The system shall undergo a hydrostatic test of 250 psig for a minimum of 15 minutes prior to shipment.

## 2.13 ACCEPTABLE MANUFACTURERS - SUMP PUMPS

- A. ITT Flygt.
- B. Liberty.
- C. Zoeller.
- D. Substitutions: Under provisions of Division 01.

## 2.14 SUMP PUMPS

- A. Type: Vertical centrifugal, direct connected, simplex arrangement.
- B. Casing: Cast iron volute with radial clearance around impeller.
- C. Impeller: Cast iron or Bronze, keyed to stainless steel shaft.
- D. Support: Cast iron pedestal motor support on steel floor plate with gas tight gaskets.
- E. Bearings: lubricated bronze sleeve spaced maximum 48 inches and grease lubricated ball thrust at floor plate.
- F. Drive: Flexible coupling to vertical, solid shaft ball bearing electric motor.
- G. Sump: Steel cover plate [with steel curb frame for grouting into concrete sump] [on steel sump basin] with inspection opening and cover, and alarm fittings.
- H. Controls (Simplex): Float switch with float rod, stops, and corrosion resistant float, and separate pressure switch high level alarm with transformer, alarm bell and standpipe.

## 2.15 ACCEPTABLE MANUFACTURERS – ELEVATOR SUMP PUMPS

- A. Liberty.
- B. Zoeller.
- C. Xylem.
- D. Substitutions: Under provisions of Division 01.

## 2.16 ELEVATOR SUMP PUMPS

- A. Operating Conditions: The manual pump is connected to a control which has the ability to prevent oil from being pumped from the elevator sump. This same control unit will activate an alarm when an oil "film" is detected or when a high water condition exits. The system will continue to monitor and remove water from the vault even if an oil condition is detected.
- B. Construction: The centrifugal sump pump shall be constructed of class 25 cast iron. The motor housing shall be oil filled to dissipate heat. All mating parts shall be machined and sealed with a Buna-N o-ring. All fasteners exposed to the liquid shall be stainless steel. The motor shall be protected on the top side with sealed cord entry plate with molded pins to conduct electricity eliminating the ability of water to enter internally through the cord. The motor shall be protected on the lower side with a unitized ceramic/carbon seal with stainless steel housings and spring or engineered double lip seal with stainless steel springs. The pump shall be furnished with stainless steel handle.
- C. Electrical Power Cord: The submersible pump shall be supplied with a 6 foot of multiconductor power cord. It shall be cord type YELLOW UL 16-3 SJEOOW 300V 105°C, capable of continued exposure to the pumped liquid. The power cord shall be sized for the rated full load amps of the pump in accordance with the National Electric Code. The power cable shall not enter the motor housing directly but will conduct electricity to the motor by means of a water tight compression fitting cord plate assembly, with molded pins to conduct electricity. This will eliminate the ability of water to enter internally through the cord, by means of a damaged or wicking cord.
- D. Motors: Single phase motors shall be oil filled, permanent split capacitor, Class B insulated NEMA B design, rated for continuous duty. At maximum load the winding temperature shall not exceed 130 degrees C unsubmerged. The pump motor shall have an integral thermal overload switch in the windings for protecting the motor. The capacitor circuit shall be mounted internally in the pump.
- E. Bearings and Shaft: An upper sleeve and lower ball bearing shall be required. The lower ball bearing shall be a single ball / race type bearing. Both bearings shall be permanently lubricated by the oil, which fills the motor housing. The motor shaft shall be made of 300 or 400 series stainless steel.
- F. Seals: The pump shall have a unitized carbon / ceramic seal with stainless steel housings and spring, or engineered double lip seal with stainless steel springs. The motor plate / housing interface shall be sealed with a Buna-N o-ring.
- G. Impeller: The impeller shall be vortex style made of an engineered polymer, with pump out vanes on the back shroud to keep debris away from the seal area. It shall be threaded to the motor shaft.
- H. Controls: The control unit has three probes and a float ball switch. The pump will activate when the middle probe contacts water, and will remain on until the first, longest probe no longer is in contact with water. A high water alarm is activated when third or shortest probe contacts water. The system will ignore a small film of oil, however larger volumes of oil will be detected when the alarm probe does not detect water and the float ball activates. The system will continue to operates, removing water not oil from the sump even when oil has been detected.
- I. Paint: The exterior of the casting shall be protected with powder coat paint.
- J. Testing: The pump shall have a ground continuity check and the motor chamber shall be Hipotted to test for electrical integrity, moisture content and insulation defects. The motor and volute housing shall be pressurized, and an air leak decay test is performed to ensure integrity of the motor housing. The pump shall be run, voltage current monitored, and the tester checks for noise or other malfunction.

#### 2.17 ACCEPTABLE MANUFACTURERS – PRECAST TRENCH DRAINS

A. MEA-Josam.

- B. ACO.
- C. Mifab.
- D. Zurn.
- E. Wade.
- F. Substitutions: Under provisions of Division 01.

#### 2.18 PRECAST TRENCH DRAINS

- A. Trench drain, catch basin and grate to be a complete system provided by a single manufacturer.
- B. Trench Drain: Modular system of precast and pre-sloped polymer concrete. 6" wide trench, radiused bottom, 0.5 percent continuous slope.
- C. Grates: Cast iron grating and ductile iron frame rated for 25-ton wheel load with lock down bolts.
- D. Catch Basin: Polymer concrete construction, cast iron grating, galvanized steel sediment bucket, preformed knockout panels for connection to channels and drain pipe.

#### 2.19 ACCEPTABLE MANUFACTURERS – POOL TRENCH DRAINS

- A. Stegmeier.
- B. Substitutions: Under provisions of Division 01.

#### 2.20 PRECAST TRENCH DRAINS

- A. Trench drain, catch basin and grate to be a complete system provided by a single manufacturer.
- B. Trench Drain: Modular system of precast and pre-sloped plastic body with stainless steel grate. 3" wide trench, radiused bottom, 0.5 percent continuous slope.

## PART 3 EXECUTION

#### 3.01 WATER HEATER INSTALLATION

- A. Install water heaters in accordance with manufacturer's instructions and to AGA and UL requirements.
- B. Coordinate with plumbing piping and related gas venting and electrical work to achieve operating system.
- C. Pipe relief valves and drains to nearest floor drain or six inches above finished floor.
- D. The contractor shall supply all water heaters and flue condensate drains with "P-traps" and unions before the PH neutralizers. All condensate drain piping shall be PVC and supplied/installed by the contractor. All PVC joints shall be glued in place and all barbed fittings shall be secured with tie wraps.
- E. The water heaters and flue condensate drains shall not be combined into one neutralizer. All piping shall be per manufactures piping diagrams and directions. PH neutralizers shall be secured to the floor or wall so as not to be exposed to damage or within a normal walkway. The contractor shall fill all "P-traps" and PH neutralizers with tap water before the firing of any water heater.

## 3.02 WATER SOFTENER INSTALLATION

A. The Contractor providing the equipment shall provide start up of the water softener system, ten 50 lb bags of pellet form sodium chloride for the brine tank, and perform a training for the owner upon completion of start up.

## 3.03 PUMP INSTALLATION

A. Install in accordance with manufacturer's instructions.

- B. Provide line sized ball valve and strainer on suction and line sized soft seated check valve and globe valve on discharge.
- C. Ensure shaft length allows sump pumps to be located minimum 24 inches below lowest invert into sump pit and minimum 6 inches (150) clearance from bottom of sump pit.

## END OF SECTION 22 3000

## SECTION 22 4000 PLUMBING FIXTURES

## PART 1 GENERAL

## 1.01 WORK INCLUDED

- A. Water Closets.
- B. Urinals.
- C. Lavatories.
- D. Sinks.
- E. Wash Fountains.
- F. Janitor, Service and Laundry Sinks.
- G. Showers.
- H. Drinking Fountains.
- I. Electric Water Coolers.
- J. Washer Rough-In Boxes.
- K. Ice Machine Rough-In Boxes.
- L. Roof and Floor Drains.
- M. Interceptors.
- N. Hose Bibbs.

## 1.02 RELATED WORK

- A. Section 22 0500 Common Work Results for Plumbing.
- B. Section 22 0529 Hangers and Supports for Plumbing Piping and Equipment.
- C. Section 22 0800 Commissioning of Plumbing.
- D. Section 22 1000 Plumbing Piping.
- E. Section 22 3000 Plumbing Equipment.

#### 1.03 REFERENCES

- A. ANSI/ASSE 1012 Backflow Preventers with Immediate Atmospheric Vent.
- B. ANSI/ASSE 1011 Hose Connection Vacuum Breakers.
- C. ANSI/ASSE 1019 Wall Hydrants, Frost Proof Automatic Draining Anti-Backflow Types.
- D. ANSI A112.21.1 Floor Drains.
- E. ANSI A112.21.2 Roof Drains.

## 1.04 QUALITY ASSURANCE

- A. Manufacturer: For each product specified, provide components by same manufacturer throughout.
- B. Trim: By same manufacturer for each product specified throughout.

#### 1.05 SUBMITTALS

- A. Submit product data under provisions of Division 01.
- B. Include sizes, rough-in requirements, service sizes, and finishes.

#### **1.06 OPERATION AND MAINTENANCE DATA**

- A. Submit operation and maintenance data under provisions of Division 01.
- B. Include fixture trim exploded view and replacement parts lists.

C. Provide Manufacturer's parts list and maintenance information on specialties.

## 1.07 WARRANTY

A. Provide manufacturer's warranty under provisions of Division 01.

## PART 2 PRODUCTS

# 2.01 ACCEPTABLE MANUFACTURERS – FIXTURES

- A. Kohler.
- B. American Standard.
- C. Just.
- D. Elkay.
- E. Fiat.
- F. Substitutions: Under provisions of Division 01.

# 2.02 ACCEPTABLE MANUFACTURERS - FLUSH VALVES

- A. Sloan.
- B. Zurn.
- C. Delaney.
- D. Substitutions: Under provisions of Division 01.

## 2.03 ACCEPTABLE MANUFACTURERS - WATER CLOSET SEATS

- A. Kohler.
- B. American Standard.
- C. Bemis.
- D. Substitutions: Under provisions of Division 01.

# 2.04 ACCEPTABLE MANUFACTURERS - FIXTURE CARRIERS

- A. J.R. Smith.
- B. Zurn.
- C. Mifab.
- D. Wade.
- E. Substitutions: Under provisions of Division 01.

# 2.05 ACCEPTABLE MANUFACTURERS -FIXTURE TRIM

- A. Delta.
- B. Moen.
- C. Chicago.
- D. Just.
- E. Fiat.
- F. Substitutions: Under provisions of Division 01.

# 2.06 ACCEPTABLE MANUFACTURERS - WASH FOUNTAINS

- A. Bradley.
- B. Halsey Taylor.
- C. Acorn.
- D. Substitutions: Under provisions of Division 01.

## 2.07 ACCEPTABLE MANUFACTURERS - ELECTRIC WATER COOLERS

- A. Haws.
- B. Oasis.
- C. Halsey Taylor.
- D. Substitutions: Under provisions of Division 01.

## 2.08 P-TRAP

A. P-trap shall be chrome plated cast brass body, with 17 gauge seamless tubular wall bend, cast brass slip nuts. Reducing washers shall be used with reducing cast brass nut, chrome plated brass escutcheons.

## 2.09 ANGLE STOPS AND SUPPLY RISERS

A. Quarter-turn lead free brass ball valve with convertible loose key handle, chrome plated copper, or braided stainless supply risers and chrome plated brass escutcheons.

# 2.10 ACCEPTABLE MANUFACTURERS - ROOF DRAINS, FLOOR DRAINS, FLOOR SINKS, DRAINS, INTERCEPTORS AND ACCESSORIES

- A. J.R. Smith.
- B. Zurn.
- C. Josam.
- D. Mifab.
- E. Wade.
- F. Substitutions: Under provisions of Division 01.

## 2.11 ACCEPTABLE MANUFACTURERS - HOSE BIBBS/HYDRANTS

- A. Woodford.
- B. J.R. Smith.
- C. Zurn.
- D. Josam.
- E. Mifab.
- F. Wade.
- G. Substitutions: Under provisions of Division 01.

## PART 3 EXECUTION

#### 3.01 PREPARATION

A. Coordinate areas with others trades in preparation to receive drains to required invert elevations.

#### 3.02 INSPECTION

- A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.
- B. Verify adjacent construction is ready to receive rough-in work of this Section.

## 3.03 INSTALLATION

- A. Install each fixture with removable p-trap for servicing and cleaning.
- B. Provide angle stop and supply risers at each fixture. Provide chrome plated escutcheons for both hot and cold water supplies and waste piping.
- C. Install components level and plumb.

- D. Install and secure fixtures in place with wall or floor carriers, supports as per the manufacturer's instructions.
- E. Solidly attach floor mounted water closets to toilet flange with non-corroding t-bolts, washers and acorn nuts.
- F. Seal fixtures to wall and floor surfaces with silicone sealant, color to match fixture.
- G. Mount fixtures above finished floor in accordance with Architectural.
- H. Install specialties in accordance with manufacturer's instructions to permit intended performance.

## 3.04 ADJUSTING AND CLEANING

- A. Adjust stops, valves or flow control valves for intended water flow rate to fixtures without splashing, noise, or overflow.
- B. Remove and clean all aerators and filters from faucets and other plumbing fixtures after the domestic water system has been tested, flushed and disinfected as per Section 22 1000.
- C. At completion remove all visible stickers and tags not intended to be left in place, thoroughly clean all surfaces of plumbing fixtures.

## END OF SECTION 22 4000

## SECTION 22 4500 EMERGENCY PLUMBING FIXTURES

## PART 1 GENERAL

## **1.01 SECTION INCLUDES**

- A. Emergency Showers.
- B. Eye / Face Washes.
- C. Eye Washes.
- D. Safety Stations.
- E. Emergency Mixing Valve.
- F. Alarms.

## 1.02 RELATED WORK

- A. Section 22 0500 Common Work Results for Plumbing.
- B. Section 22 0529 Hangers and Supports for Plumbing Piping and Equipment.
- C. Section 22 0800 Commissioning of Plumbing.
- D. Section 22 1000 Plumbing Piping.
- E. Section 22 3000 Plumbing Equipment.

#### 1.03 REFERENCES

- A. ANSI Z358.1 Emergency Eyewash and Shower Equipment.
- B. ANSI 117.1 Accessible and Usable Buildings and Facilities.
- C. OSHA Act 1910-151.C.

#### 1.04 SUBMITTAL

- A. Submit under provisions of Division 01.
- B. Product Data: Provide catalog illustrations of fixtures, sizes, rough in dimensions, utility sizes, capacities, materials, trim, and finishes.
- C. Manufacturer's installation instructions and performance limitations.

#### **1.05 OPERATION AND MAINTENANCE DATA**

- A. Submit under provisions of Division 01.
- B. Maintenance Data: include fixture trim exploded view and replacement parts lists.

## 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of Division 01.
- B. Accept fixtures on site in factory packaging. Inspect for damage.
- C. Protect installed fixtures and equipment from damage by securing areas and by leaving factory packaging in place to protect fixtures and equipment from damage.

#### **1.07 FIELD MEASUREMENTS**

A. Verify all rough-in and finishing measurements in the field.

#### PART 2 PRODUCTS

## 2.01 ACCEPTABLE MANUFACTURERS: EMERGENCY SHOWER & EYE WASH EQUIPMENT

- A. Bradley.
- B. Guardian.
- C. Haws.

- D. Speakman.
- E. Substitutions: Under provisions of Division 01.

## 2.02 EYE WASHES (ONLY)

- A. Deck mounted, hand-held eyewash/drench hose with ½" IPS U.S. made chrome-plated brass squeeze valve with replaceable stainless steel seat and locking clip, stainless steel squeeze handle with plastic cover, nylon handle, nylon deck flange with locator guide, and 8ft. PVC hose. Unit shall have (2) polypropylene GS-Plus<sup>™</sup> spray heads with integral "flip-top" dust covers, filters and 1.6 GPM flow control orifices mounted on a chrome-plated brass eyewash assembly. Unit shall include ANSI compliant sign.
- B. Performance: Unit shall be fully factory assembled and hydrostatically tested to meet or exceed ANSI Z358.1, and come with a full 2-year warranty.

## 2.03 SAFETY STATIONS - COMBINATION EYE WASH & SHOWER

- A. Eyewash and Shower Station
  - 1. Barrier free, wall mounted, fully recessed shower and eye/facewash. 18 gauge recessed wall cabinet constructed of stainless steel. Polished chrome-plated brass pull-down eye/facewash, shower head constructed of stainless steel. Configure shower head for wall mounted installation. 1" inlet water connection. Front access maintenance panel. Combination unit shall be ANSI Z358.1 and CSA certified.
  - 2. Performance: Unit shall be hydrostatically tested to meet or exceed ANSI Z358.1 and come with a full 2-year warranty.

#### 2.04 RECESSED EMERGENCY SHOWER

- A. Horizontally mounted emergency shower with recessed, stainless steel, flanged shower head, internal 20 GPM flow control, 1" IPS Schedule 40 hot dipped galvanized pipe and fittings, polished stainless steel pull rod, 1" IPS brass stay-open valve, stainless steel actuating arm, and stainless steel ceiling guide plate. Unit shall include ANSI compliant sign.
- B. Performance: Unit shall be hydrostatically tested to meet or exceed ANSI Z358.1, and come with a full 2-year warranty.

#### 2.05 EMERGENCY MIXING VALVES

- A. Eye Wash Temperature Valve
  - 1. Thermostatic mixing valve set for 85 degrees valve for emergency eyewash. Unit shall include: built-in cold water by-pass, rough bronze finish, solid bimetal thermostat, locking temperature regulator with limit stop factory set for 90 degrees, integral check stops, dial thermometer, and recessed stainless steel cabinet with door and lock.
  - 2. Performance: Unit shall have a flow range of .5-GPM to 5-GPM with a maximum pressure loss of 20-PSI and come with a full 1-year warranty.
- B. Eye/Face Wash Temperature Valve
  - 1. Thermostatic mixing valve set for 85 degrees valve for emergency eye / face wash. Unit shall include: built-in cold water by-pass, rough bronze finish, solid bimetal thermostat, locking temperature regulator with limit stop factory set for 90 degrees, integral check stops, dial thermometer, and recessed stainless steel cabinet with door and lock.
  - 2. Performance: Unit shall have a flow range of 3-GPM to 13-GPM with a maximum pressure loss of 20-PSI and come with a full 1-year warranty.
- C. Eye/Face/Shower Temperature Valve
  - 1. Thermostatic mixing valve set for 85 degrees valve for emergency eyewash. Unit shall include: built-in cold water by-pass, rough bronze finish, solid bimetal thermostat, locking temperature regulator with limit stop factory set for 90 degrees, integral check stops, dial thermometer, and recessed stainless steel cabinet with door and lock.

2. Performance: Unit shall have a flow range of 3-GPM to 44-GPM with a maximum pressure loss of 20-PSI and come with a full 1-year warranty.

## PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Verify that mounting pads are prepared and ready for fixtures and equipment.
- B. Verify that electric power is available and of the correct characteristics.

#### 3.02 PREPARATION

A. Rough-in emergency fixtures and equipment piping connections in accordance with code requirements and manufacturers recommendations.

## 3.03 INSTALLATION

- A. Install emergency shower equipment in accordance with ANSI Z358.1 and manufacturer's instructions. Set level and plumb. Secure in place to solid mounting surface.
- B. Install emergency fixture tempering valve with thermometers on inlets and outlet.
- C. Adjust shower and eye/face temperature to comply with the tepid water requirements of ANSI Z358.1 standard.
- D. Adjust controls and valves to insure the most remote safety station receives a minimum flow of 20GPM at 30PSI dynamic.
- E. Test emergency shower equipment to demonstrate proper operation. Replace malfunctioning units or components. Adjust controls, and valves for intended water flow rate to emergency fixtures.
- F. Protect fixtures and equipment during construction. At completion, thoroughly clean emergency showers and equipment.

#### END OF SECTION 22 4500

#### SECTION 23 0500 COMMON WORK RESULTS FOR HVAC

## PART 1 GENERAL

## 1.01 SCOPE

A. All provisions of the Contract including the General and Supplementary Conditions and the General Requirements apply to this work.

## 1.02 WORK INCLUDED

- A. The work to be included in these and all other mechanical subsections shall consist of providing, installing, adjusting and setting into proper operation complete and workable systems for all items shown on the drawings, described in the specifications or reasonably implied. This shall include the planning and supervision to coordinate the work with other crafts and to maintain a proper time schedule for delivery of materials and installation of the work.
- B. Division 01 of the specifications is to be specifically included as well as all related drawings.

## 1.03 RELATED WORK

- A. Related Work Specified Elsewhere:
  - 1. Fire Suppression Specifications: Division 21.
  - 2. Plumbing Specifications: Division 22.
  - 3. Electrical Specifications: Division 26.
  - 4. Motors and Connections: Division 26.
  - 5. Starters and Disconnects: Division 26.
- B. Unless otherwise indicated on the electrical drawings or the electrical schedules, provide all mechanical equipment motors, motor starters, thermal overload switches, control relays, time clocks, thermostats, motor operated valves, float controls, damper motors, electric switches, electrical components, wiring and any other miscellaneous Division 23 controls. Disconnect switches are included in the electrical work, unless specifically called out on mechanical plans.
- C. Carefully coordinate all work with the electrical work shown and specified elsewhere.

## 1.04 REFERENCED CODES - LATEST ADOPTED EDITION

- A. NFPA 13 Installation of Sprinkler Systems.
- B. NFPA 70 National Electrical Code (NEC).
- C. IMC International Mechanical Code.
- D. UPC Uniform Plumbing Code.
- E. IECC International Energy Conservation Code.
- F. IFC International Fire Code.
- G. IFGC International Fuel Gas Code.
- H. IBC International Building Code.

#### 1.05 PROJECT RECORD DRAWINGS

- A. In addition to other requirements of Division 01, mark up a clean set of drawings as the work progresses to show the dimensioned location and routing of all mechanical work which will become permanently concealed. Show routing of work in concealed blind spaces within the building. Show exact dimensions of buried piping off of columns or exterior walls.
- B. Maintain record documents at job site in a clean, dry and legible condition. Keep record documents available for inspection by the Project Manager.
- C. Show the location of all valves and their appropriate tag identification.

D. At completion of project, deliver these drawings to the Owner and obtain a written receipt.

## 1.06 SUBMITTALS

- A. See General Conditions and the General Requirements in Division 01 regarding submittals.
- B. Submit by specification section complete and all at one time; partial submittals will not be considered. Submittals shall be provided in electronic PDF Format. The data in the electronic file shall be arranged and indexed under basic categories in order of the Specification Sections. An index shall be included with bookmarks and identifying tabs between sections and references to sections of specifications.
- C. Catalog sheets shall be complete and the item or model to be used shall be clearly marked, and identified as to which item in the specifications or on the drawings is being submitted and with drawing fixture number where applicable.
- D. Only submit on items specifically required by each specification section. If a submittal has not been requested, it will not be reviewed.

## 1.07 OPERATING AND MAINTENANCE MANUALS

- A. See General Conditions and the General Requirements in Division 01 regarding Operating and Maintenance Manuals.
- B. Submit maintenance manuals to the Engineer covering all equipment, fixtures, devices, etc. installed by the Contractor.
- C. The operation and maintenance manuals shall be submitted by specification section complete and all at one time; partial operations and maintenance manual submittals will not be considered. The Operation and maintenance manuals shall be provided in electronic PDF Format. The data in the electronic file shall be arranged and indexed under basic categories. An index shall be included with bookmarks and identifying tabs between sections and references to sections of specifications. The manual shall contain, but not limited to, the following types of information:
  - 1. Cover sheet with name, address, telephone number of Contractor, General Contractor and major equipment suppliers.
  - 2. Catalog cuts of all equipment, fixtures, etc. installed (Marked to identify the specific items used).
  - 3. Manufacturer's maintenance and overhaul instruction booklets including exploded views.
  - 4. Identification numbers of all parts and nearest sources for obtaining parts and services.
  - 5. Reduced scale drawings of the control system and a verbal description of how these controls operate.
  - 6. A copy of the final test and balance report.
  - 7. A copy of valve schedule and reduced scale drawings showing valve locations.
  - 8. Written summary of instructions to Owner.
  - 9. All manufacturers' warranties and guarantees.
  - 10. Contractors Warranty Letter.
- D. A periodic maintenance form that includes all of the equipment shall be provided with the maintenance manual. The form shall list each piece of equipment with a list of manufacturers recommended inspection and maintenance tasks, and how often maintenance is required (daily, weekly, monthly, annually). Opposite each task shall be squares for check-off for a full year (initials) to verify that the tasks are being done.

#### 1.08 HANDLING

- A. See General Conditions and the General Requirements in Division 01 regarding material handling.
- B. Deliver packaged materials to job site in unbroken packages with manufacturer's label, and store to facilitate inspection and installation sequence. All items must be labeled and identified as to make, size and quality.

#### 1.09 SUBSTITUTIONS

- A. See General Conditions and the General Requirements in Division 01 for substitution request procedures.
- B. In accordance with the General Conditions and the General Requirements in Division 01, Substitution and Product Options, all substitute items must fit in the available space, and be of equal or better quality including efficiency performance, size, and weight, and must be compatible with existing equipment. The Owner shall be the final authority regarding acceptability of substitutes.

## 1.10 DIMENSIONS

- A. Before ordering any material or doing any work, the Contractor shall verify all dimensions, including elevations, and shall be responsible for the correctness of the same. No extra charge or compensation will be allowed on account of differences between actual dimensions and measurements indicated on the drawings.
- B. Any differences, which may be found, shall be submitted to the Owner for consideration before proceeding with the work.

## 1.11 MANUFACTURER'S DIRECTIONS

A. All manufactured articles shall be applied, installed and handled as recommended by the manufacturer, unless specifically called out otherwise. Advise the Architect/Engineer of any such conflicts before installation.

#### 1.12 PERMITS, FEES, ETC.

A. The Contractor under each Division of these specifications shall arrange for a permit from the local authority. The Contractor shall pay for any inspection fees or other fees and charges required by ordinance, law, codes and these specifications.

# 1.13 TESTING

A. The Contractor under each section shall perform the various tests as specified and required by the Architect, Engineer and as required by applicable code, the State and local authorities. The Contractor shall furnish all labor, fuel and materials necessary for making tests.

#### 1.14 TERMINOLOGY

- A. Whenever the words "furnish", "provide", "furnish and install", "provide and install", and/or similar phrases occur, it is the intent that the materials and equipment described be furnished, installed and connected under this Division of the Specifications, complete for operation unless specifically noted to the contrary.
- B. Where a material is described in detail, listed by catalogue number or otherwise called for, it shall be the Contractor's responsibility to furnish and install the material.
- C. The use of the word "shall" conveys a mandatory condition to the contract.
- D. "This section" refers to the section in which the statement occurs.
- E. "The project" includes all work in progress during the construction period.
- F. In describing the various items of equipment, in general, each item will be described singularly, even though there may be a multiplicity of identical or similar items.

## 1.15 SCHEDULE OF WORK

A. The work under the various sections must be expedited and close coordination will be required in executing the work. The various trades shall perform their portion of the work at such times as directed so as to meeting scheduled completion dates, and to avoid delaying any other trade. The Architect will set up completion dates. Each contractor shall cooperate in establishing these times and locations and shall process work so as to ensure the proper execution of it.

## 1.16 COOPERATION AND CLEANING UP

- A. The Contractor for the work under each section of the specifications shall coordinate the Contractors work with the work described in all other sections of the specifications to the end that, as a whole, the job shall be a finished one of its kind, and shall carry on the work in such a manner that none of the work under any section of these specifications shall be handicapped, hindered or delayed at any time.
- B. At all times during the progress of the work, the Contractor shall keep the premises clean and free of unnecessary materials and debris. The Contractor shall, on direction at any time from the Architect, clear any designated areas or area of materials and debris. On completion of any portion of the work, the Contractor shall remove from the premises all tools and machinery and all debris occasioned by the work, leaving the premises free of all obstructions and hindrances.

#### 1.17 WARRANTY

A. Unless a longer warranty is hereinafter called for, all work, materials and equipment items shall be warrantied for a period of one year after acceptance by the Owner. All defects in labor and materials occurring during this period, as determined by the Architect/Engineer, shall be repaired and/or replaced to the complete satisfaction of the Architect/Engineer. Guarantee shall be in accordance with Division 01.

#### 1.18 COMPLETION REQUIREMENTS

- A. In accordance with the General Conditions and the General Requirements in Division 01, Project Closeout; before acceptance and final payment, the Contractor shall furnish:
  - 1. Accurate project record drawings, shown in red ink on prints, showing all changes from the original plans made during installation of the work.
  - 2. Contractors One Year Warranty.
  - 3. All Manufacturers' Guarantees.
  - 4. Test and Balance Reports.
  - 5. Operation and Maintenance Manuals.

#### 1.19 INSPECTION OF SITE - REMODEL PROJECTS

A. The accompanying plans do not indicate completely the existing plumbing and mechanical installations. The bidders for the work under these sections of the specifications shall inspect the existing installations and thoroughly acquaint themselves with conditions to be met and the work to be accomplished in removing and modifying the existing work, and in installing the new work in the present building and underground serving to and from that structure. Failure to comply with this shall not constitute grounds for any additional payments in connection with removing or modifying any part of the existing installations and/or installing any new work.

## **1.20 RELOCATION OF EXISTING INSTALLATIONS**

A. There are portions of the existing plumbing, mechanical and electrical systems, which shall remain in use to serve the finished building in conjunction with the indicated new installations. By actual examination at the site, each bidder shall determine those portions of the remaining present installations, which must be relocated to avoid interference with the installations of new work of the Contractors particular trade and that of all other trades. All such existing installations, which interfere with new installations, shall be relocated by the Contractor.

## 1.21 SALVAGE MATERIALS

- A. The Contractor shall remove existing equipment, duct, grilles and other items associated with the mechanical systems where no longer required for the project. Where such items are exposed to view or uncovered by any cutting or removal of general construction and has no continuing function (as determined by the Architect/Engineer), they shall be removed.
- B. All items or materials removed from the project shall be made available for the Owner's inspection. The Owner retains the option to claim any item or material. Contractor shall deliver any claimed item or material in good condition to the place designated by the Owner. All items not claimed become the property of the contractor and shall be removed from the site.

## PART 2 PRODUCTS

## 2.01 MATERIALS

- A. All equipment shall be regularly cataloged items of the manufacturer and shall be supplied as a complete unit in accordance with the manufacturer's standard specifications along with any optional items required for proper installation unless otherwise noted. Maintain manufacturer's identification, model number, etc. on all equipment at all times.
- B. Where more than one of an item is to be provided, all of the items shall be identical manufacture, make, model, color, etc.

#### 2.02 RESTRICTED MATERIALS

- A. No materials containing asbestos in any form shall be allowed.
- B. No solder or flux containing lead shall be used on this project.
- C. Where materials or equipment provided by this Contractor are found to contain restricted materials, such items shall be removed and replaced with non-restricted materials items. Entire cost of restricted materials removal and disposal and cost of installing new items shall be the responsibility of the Contractor for those restricted materials containing items installed by the Contractor.

#### 2.03 ELECTRICAL MOTORS

- A. Motors: Furnish electric motors designed for the specific application and duty applied, and to deliver rated horsepower without exceeding temperature ratings when operated on power systems with a combined variation in voltage and frequency not more than + 10% of rated voltage. Motors for pumps and fans shall be selected to be non-overloading.
- B. Verify from the drawings and specifications the available electrical supply characteristics and furnish equipment that will perform satisfactorily under the conditions shown and specified.
- C. All motors for use with equipment with variable frequency drives shall be inverter ready motors. Verify compatibility and sizing of motor with variable frequency drive.
- D. Size motors for 1.15 service factor and not to exceed 40° C temperature rise above ambient.
- E. Fractional horsepower motors to have self-resetting thermal overload switch.
- F. Provide Premium Efficiency, motors for all three phase motors one horsepower and larger. Standard efficiency motors will not be acceptable.

#### PART 3 EXECUTION

#### 3.01 DRAWINGS

A. The drawings are partly diagrammatic, not necessarily showing all offsets or exact locations of piping and ducts, unless specifically dimensioned. The contractor shall provide all materials and labor necessary for a complete and operable system. Complete details of the building which affect the mechanical installation may not be shown. For additional details, see Architectural, [Structural], [Civil] and Electrical Drawings. Coordinate work under this section with that of all related trades.

## 3.02 INSTALLATION

- A. All work shall comply with the latest adopted applicable codes and ordinances including, but not limited to, the IMC, UPC, IBC, NFPA, IECC, IFGC and IFC Standards; all local and state amendments to all codes and standards.
- B. Obtain and pay for all inspection fees, connection charges and permits as a part of the Contract.
- C. Compliance with codes and ordinances shall be at the Contractor's expense.

## 3.03 MEASUREMENTS

- A. Verify all measurements on the job site.
- B. Locate all equipment and fixtures on the centers of walls, openings, spaces, etc., unless specified otherwise.
- C. Check all piping, ducts, etc. to clear openings.
- D. Rough-in dimensions shall be per manufacturer's recommendations and in compliance with current ADA and ANSI 117.1 standards.

## 3.04 OPERATING INSTRUCTIONS

- A. Before the facility is turned over to the Owner, instruct the Owner or Owner's personnel in the operation, care and maintenance of all systems and equipment under the jurisdiction of the Mechanical Division. These instructions shall also be included in a written summary in the Operating Maintenance Manuals.
- B. The Operation and Maintenance Manuals shall be utilized for the basis of the instruction. Provide a minimum of eight hours of onsite instruction to the owner designated personnel.
- C. When required by individual specification sections provide additional training on HVAC systems and equipment as indicated in the respective specification section.

#### 3.05 SYSTEM ADJUSTING

- A. Each part of each system shall be adjusted and readjusted as necessary to ensure proper functioning of all controls, proper air distribution, elimination of drafts, noise and vibration.
- B. Balance air and water systems for volume quantities shown and as required to ensure even temperature and the elimination of drafts. Balancing shall be done by a qualified firm acceptable to the Engineer. Provide balancing log to the Engineer before substantial completion.

## 3.06 CUTTING, FITTING, REPAIRING, PATCHING AND FINISHING

- A. Arrange and pay for all cutting, fitting, repairing, patching and finishing of work by other trades where it is necessary to disturb such work to permit installation of mechanical work. Perform work only with craftsmen skilled in their respective trades.
- B. Avoid cutting, insofar as possible, by setting sleeves, frames, etc. and by requesting openings in advance. Assist other trades in securing correct location and placement of rough-frames, sleeves, openings, etc. for ducts and piping.
- C. Cut all holes neatly and as small as possible to admit work. Include cutting where sleeves or openings have been omitted. Perform cutting in a manner so as not to weaken walls, partitions or floors. Drill holes required to be cut in floors without breaking out around holes.

## 3.07 PAINTING

- A. Perform all of the following painting in accordance with provisions of Division 09 with colors as selected by the Architect. Provide the following items as a part of mechanical work:
  - 1. Factory applied prime and finish coats on mechanical equipment.
  - 2. Factory applied prime and finish coat on all air registers, grilles and diffusers, unless otherwise specified.

- 3. Factory applied prime coat on access doors.
- 4. Pipe identification where specified.
- B. If factory finish on any equipment furnished is damaged in shipment or during construction, refinish to equal original factory finish.

## 3.08 INSTALLATION OF EQUIPMENT

- A. Unless otherwise indicated, mount all equipment and install in accordance with manufacturer's recommendations and approved submittals.
- B. Maintain manufacture recommended minimum clearances for access and maintenance.
- C. Where equipment is to be anchored to structure, furnish and locate necessary anchoring and vibration isolation devices.
- D. Furnish all structural steel, such as angles, channels, beams, etc. required to support all piping, ductwork, equipment and accessories installed under this Division. Use structural supports suitable for equipment specified or as indicated. In all cases, support design will be based upon data contained in manufacturer's catalog. Provide Seismic Restraint in Accordance with Specification Section 23 0548.
- E. Openings: Arrange for necessary openings in buildings to allow for admittance and reasonable maintenance or replacement of all equipment furnished under this Contract.
- F. Access Doors: Provide as necessary for reasonable maintenance of all equipment valves, controls, etc. Coordinate with general contractor for location and finish. For additional details, see Architectural, Structural, Civil and Electrical Drawings. Coordinate work under this section with that of all related trades.

## END OF SECTION 23 0500

#### **SECTION 23 0505**

## SELECTIVE DEMOLITION FOR HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)

#### PART 1 GENERAL

#### 1.01 DESCRIPTION

- A. Work specified in this Section includes the demolition, removal, and disposition of certain mechanical work.
- B. Drawings, the provisions of the Agreement, and Administrative Specification Sections apply to all work of this Section.

#### PART 2 PRODUCTS (Not Used)

#### PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence. Notify the Architect in writing of conditions detrimental to the proper and timely completion of the work.
- B. Do not begin installation until all unsatisfactory conditions are resolved. Beginning work constitutes acceptance of conditions as satisfactory.

#### 3.02 DEMOLITION, REMOVAL AND DISPOSITION

- A. Saw-cut concrete as shown or required.
- B. Piping, Ductwork, And Equipment To Be Removed: Remove all piping, ductwork, and equipment as indicated on the Drawings.
- C. Piping, Ductwork, Equipment, Control Wiring and Tubing To Be Removed: Remove all piping, ductwork, equipment, control wiring and tubing as indicated. Drawings do not show all existing piping, ductwork, equipment, control wiring and tubing which is to be removed. Unless indicated otherwise, where existing equipment has been removed, or its use replaced by new equipment, remove connecting piping and ductwork back to the branch in the main so that there will be no dead ends or unused pipe lines in mechanical spaces at completion.
  - 1. Where components are reused and have controls, the existing Siemens controls shall be removed and the equipment shall be fitted with controls as specified under 23 0923.
- D. Materials To Owner: All items or materials removed from the project shall be made available for the Owner's inspection. The Owner retains the option to claim any item or material. The Contractor shall deliver any claimed item or material in good condition to the place designated by the Owner. All items not claimed become the property of the Contractor and shall be removed from the site by the Contractor.
- E. Re-use Of Materials: Only where indicated on Drawings.
- F. Materials To Contractor: Materials shown or specified to be removed, other than the materials indicated to be turned over to Owner.
- G. Protect any active piping and/or wiring encountered; remove, plug or cap utilities to be abandoned. Notify the Architect of utilities encountered whose service is not known.
- H. Debris Removal: Existing materials removed and not reinstalled or turned over to the Owner shall be immediately removed from the site and disposed of by the Contractor.
- I. Repairs: Any portion of the facility damaged, cut back or made inoperable by this Contractor shall be repaired with similar materials as the existing structure and/or damaged item as instructed by the Architect.

## END OF SECTION 23 0505

## SECTION 23 0516 EXPANSION FITTINGS AND LOOPS FOR HVAC PIPING

## PART 1 GENERAL

## 1.01 SECTION INCLUDES

- A. Flexible Pipe Connectors.
- B. Expansion Joints.
- C. Expansion Compensators.
- D. Pipe Alignment Guides.
- E. Pipe Anchors.

## 1.02 RELATED SECTIONS

- A. Section 23 0500 Common Work Results for HVAC.
- B. Section 23 0548 Vibration and Seismic Controls for HVAC: Product and installation requirements for vibration isolators used in piping systems.
- C. Section 23 2113 Hydronic Piping: Product and installation requirements for piping used in hydronic heating and cooling systems.

## 1.03 REFERENCES

- A. AMSE B31.1 Power Piping.
- B. ASME B31.5 Refrigeration Piping.
- C. ASME B31.9 Building Services Piping
- D. ASME Section IX Boiler and Pressure Vessel Code Welding and Brazing Qualifications.
- E. AWS D1.1 Structural Welding Code Steel.

#### 1.04 PERFORMANCE REQUIREMENTS

- A. Provide structural work and equipment required to control expansion and contraction of piping. Verify that anchors, guides, and expansion joints provided, adequately protect system.
- B. Expansion Compensation Design Criteria: As indicated on the drawings.

#### 1.05 SUBMITTALS

- A. Submit product data under provisions of Division 01.
- B. Product Data:
  - 1. Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-toface length, live length, hose wall thickness, hose convolutions per foot and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.
  - 2. Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.
- C. Manufacturer's Installation Instructions: Indicate special procedures, and external controls.
- D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- E. Welders' Certificate: Include welders' certification of compliance with ASME Section IX.
- F. Manufacturer's Field Reports: Indicate results of inspection by manufacturer's representative.

#### 1.06 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 01.
- B. Record actual locations of flexible pipe connectors, expansion joints, anchors, and guides.

## 1.07 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Division 01.
- B. Maintenance Data: Include adjustment instructions.

#### 1.08 QUALITY ASSURANCE

A. Perform Work in accordance with ASME B31.1 code for installation of piping systems and ASME Section IX for welding materials and procedures.

## 1.09 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.

## 1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of Division 01.
- B. Accept expansion joints on site in factory packing with shipping bars and positioning devices intact. Inspect for damage.
- C. Protect equipment from exposure by leaving factory coverings, pipe end protection, and packaging in place until installation.

## 1.11 WARRANTY

- A. Provide five year warranty under provisions of Division 01.
- B. Warranty: Include coverage for leak free performance of packed expansion joints.

## PART 2 PRODUCTS

## 2.01 FLEXIBLE PIPE CONNECTORS

- A. Steel Piping:
  - 1. Manufacturers:
    - a. Mercer Rubber Co., Model BSS.
    - b. Hyspan, series 4500.
  - 2. Inner Hose: Stainless Steel.
  - 3. Exterior Sleeve: Single braided stainless steel.
  - 4. Pressure Rating: 125 psig WSP and 450° F, 200 psig WOG and 250° F psig at 70° F.
  - 5. Joint: As specified for pipe joints.
  - 6. Size: Use pipe sized units.
  - 7. Maximum offset: <sup>3</sup>/<sub>4</sub> inch on each side of installed center line.
- B. Copper Piping:
  - 1. Manufacturers:
    - a. Mercer Rubber Co., Model BBF.
    - b. Hyspan, series 4500.
  - 2. Inner Hose: Bronze
  - 3. Exterior Sleeve: Braided bronze.
  - 4. Pressure Rating: 125 psig WSP and 450° F, 200 psig WOG and 250° F and 70° F.
  - 5. Joint: As specified for pipe joints.
  - 6. Size: Use pipe sized units
  - 7. Maximum offset: <sup>3</sup>/<sub>4</sub> inch on each side of installed center line.

## 2.02 EXPANSION JOINTS

- A. Flexible Expansion Loop (Thermal or Seismic Applications):
  - 1. Flexible loops shall consist of two flexible sections of hose and braid, two 90° elbows, and a 180° return assembled in such a way that the piping does not change direction, but maintains its course along a single axis.
  - 2. Flexible loops shall have a factory supplied, center support nut located at the bottom of the 180° return, and a drain/air release plug.
  - 3. Flexible loops shall impart no thrust loads to system support anchors or building structure. Loops shall be installed in a neutral, pre-compressed or pre-extended condition as required for the application.
  - 4. Install and guide per manufacturer's recommendations. Materials of construction and end fitting type shall be consistent with pipe material and equipment/ pipe connection fittings.
  - 5. For potable water service, connectors shall be UL classified in accordance with ANSI/NSF 61-1977 standards.
  - 6. Metraflex Model Metraloop or approved equal.

## 2.03 ACCESSORIES

- A. Pipe Alignment Guides:
  - Primary and intermediate guides shall be of the radial type employing a heavy wall guide cylinder with weld down or bolt down anchor base. A two section guide spider, having 1/8" maximum diametrical clearance with guide cylinder inside diameter, bolted or welded tight to the carrier pipe which slides through the guide cylinder I.D. Cylinder shall be of sufficient size to clear 1 inch thick pipe insulation and long enough to prevent over travel of the spider.
  - 2. Metraflex Model PGIV or approved equal.
- B. Pipe Anchors:
  - 1. Pipe Alignment Guide (Spider Type):
    - a. Primary and intermediate guides shall be of the radial type employing a heavy wall guide cylinder with weld down or bolt down anchor base. A two section guide spider, having 1/8" maximum diametrical clearance with guide cylinder inside diameter, bolted or welded tight to the carrier pipe which slides through the guide cylinder I.D. Cylinder shall be of sufficient size to clear pipe insulation and long enough to prevent over travel of the spider.
  - 2. Metraflex Model PGIV or approved equal.
    - a. Pipe Alignment Guide (Slide Type):
    - b. Primary and intermediate guides shall be of the sliding type. Two piece construction employing a sliding member to be welded to the carrier pipe and a weld down or bolt down anchor base. Sliding member shall be of sufficient height to clear pipe insulation and long enough to prevent over travel of the slide. Load bearing surfaces shall be Teflon to Teflon (T/T-standard), Teflon to Stainless (T/S), or Graphite to Graphite (G/G) as required for the application.
    - c. Metraflex Model SG or approved equal.

## PART 3 EXECUTION

## 3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Construct spool pieces to exact size of flexible connection for future insertion.

- C. Install flexible pipe connectors on pipes connected to equipment supported by vibration isolation. Provide line size flexible connectors.
- D. Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end. Install in horizontal plane unless indicated otherwise.
- E. Rigidly anchor pipe to building structure where necessary. Provide pipe guides so movement is directed along axis of pipe only. Erect piping such that strain and weight is not on cast connections or apparatus.
- F. Provide support and equipment required to control expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where [required] [indicated].
- G. Provide expansion loops as indicated on drawings.

## END OF SECTION 23 0516

## SECTION 23 0519 METERS AND GAUGES FOR HVAC PIPING

## PART 1 GENERAL

#### 1.01 SUMMARY

- A. Section Includes:
  - 1. Pressure Gauges.
  - 2. Pressure Gauge Taps.
  - 3. Thermometers.
  - 4. Flow Meters.
  - 5. BTU Meters.
- B. PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THE SECTION
  - 1. Section 23 2113 Hydronic Piping: Installation of thermometer wells, pressure gauge tappings.
  - 2. Section 23 3100 HVAC Ducts and Casings: Installation of thermometers and static pressure gauges.

## 1.02 RELATED WORK

- A. Section 23 0500 Common Work Results for HVAC.
- B. Section 23 0923 Direct Digital Control System for HVAC.
- C. Section 23 0993 Sequence of Operations for HVAC Controls.
- D. Section 23 2116 Hydronic Piping Specialties.
- E. Section 23 3300 Air Duct Accessories.

## 1.03 REFERENCE STANDARDS

- A. ASTM E1 Specification for ASTM Thermometers.
- B. ASTM E77 Verification and Calibration of Liquid-in-Glass Thermometers.
- C. AWWA C700 Cold Water Meters Displacement Type.
- D. AWWA C706 Direct Reading Remote Registration Systems for Cold Water Meters.
- E. ASTM E1 Standard Specification for ASTM Thermometers.

#### 1.04 SUBMITTALS

- A. Product Data: Submit engineering data for each component, include list which indicates use, operating range, total range and location for manufactured components.
- B. Submit manufacturer's installation instructions under provisions of Division 01.

#### 1.05 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Accurately record actual location of all instrumentation and gauges.
- B. Operation and Maintenance Data.

## 1.06 WARRANTY

A. Furnish one year manufacturer warranty for HVAC instrumentation.

## PART 2 PRODUCTS

## 2.01 INSTRUMENTATION FOR HVAC

- A. Manufacturers:
  - 1. Dwyer
  - 2. Trerice.

- 3. Weiss.
- 4. Marshaltown.
- 5. Ashcroft.
- 6. Enerpac.
- 7. Peterson.
- 8. Winters.
- 9. Substitutions: In accordance with Division 01.

#### 2.02 PRESSURE GAUGES

A. 3½" diameter diameter dial size with a flangeless cast aluminum case, stainless steel friction ring and glass window. Movement will be brass with a bronze bourdon tube and brass socket. Dial face will be white with black figures; pointer will be friction adjustable type. Accuracy will be ±1% of scale range, ASME B40.1 Grade 1A. Model 600C as manufactured by Trerice.

#### 2.03 PRESSURE GAUGE TAPS

- A. Gauge Isolation Valve: Lever handle ball valve, forged brass body, chrome plated brass ball, viton o-rings for maximum 150 psig. Model Mini T-82-M as manufactured by Jomar or equal.
- B. Needle Valve: Brass for maximum 150 psig. Model 735 as manufactured by Trerice or equal.
- C. Pulsation Damper: Pressure snubber, brass with 1/4 inch connections. Series 870 as manufactured by Trerice.
- D. Coil Siphon: Brass, ¼", male pipe thread each end. 885 series.

## 2.04 STEM TYPE THERMOMETERS

A. Analog Thermometers: 9 inch scale, universal adjustable angle, organic spirits, lens front tube, cast aluminum case with blue/black metallic finish and clear Lexan window, extended brass stem, cast aluminum adjustable joint with positive locking device, 2 percent of scale accuracy to ASTM E77, scale calibrated in both degrees F and degrees C, range per schedule. BX9 series as manufactured by Trerice or approved equal.

#### 2.05 BTU METERS

- A. Manufacturers:
  - 1. Onicon.
  - 2. Substitutions: Under provisions of Division 01.
- B. Unit mounted microprocessor based calculator, unit mounted or remote mounted LCD display. Native BACnet compatible. Matched RTD temperature sensors, pre calibrated for accuracy of less than +/-0.25 deg F. Ultrasonic flow meter with accuracy of less than +/- 1% over the standard operating range.
- C. Pre-calibrated and certified to N.I.S.T. standards.

## PART 3 EXECUTION

#### 3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide two pressure gauges per pump, installing taps on suction and discharge of pump. Pipe to gauge with isolation valve to each tapping.
- C. Thermometers for measuring fluid temperatures shall have stems with insertion lengths of roughly half of the pipe diameter; minimum insertion length will be 2". Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inch for installation of thermometer sockets. Select bulb length to reach centerline of pipe. Thermometers installed on tanks will have a minimum insertion length of 5".

- D. Where insulation thickness exceeds 2", provide a longer stem thermometer with an extension neck, stainless steel separable thermowell. The extension neck shall be at least 2" long.
- E. Coat thermometer stem with heat transfer paste prior to installing into the thermowell.
- F. Install thermometer sockets and flanges adjacent to controls system thermostat, transmitter, or sensors.
- G. Provide instruments with scale ranges selected according to service with largest appropriate scale and range selected so that the operating temperature or pressure of the material being measured will fall approximately in the middle of the scale.
- H. Install gauges and thermometers in locations where they are easily read from normal operating level.
- I. Thermometers for measuring air temperatures shall have a perforated guard stem and a mounting flange.

## 3.02 PRESSURE GAUGE SCHEDULE

| LOCATION              | SCALE RANGE   |  |  |
|-----------------------|---------------|--|--|
| Pumps                 | 0 - 60 PSIG   |  |  |
| Heating water system  | 0 - 30 PSIG   |  |  |
| Heating Gycol system  | 0 - 30 PSIG   |  |  |
| Chilled water system  | 0 - 30 PSIG   |  |  |
| Chilled Glycol system | 0 - 30 PSIG   |  |  |
| Others                | As applicable |  |  |

#### 3.03 THERMOMETER SCHEDULE

| LOCATION                      | SCALE RANGE   |  |  |
|-------------------------------|---------------|--|--|
| Heating water system          | 0 - 200° F    |  |  |
| Chilled water system          | 0 - 100° F    |  |  |
| Glycol Heating/Cooling system | 0 - 200° F    |  |  |
| Others                        | As applicable |  |  |

#### 3.04 DIAL THERMOMETER SCHEDULE

| LOCATION        | SCALE RANGE   |  |  |
|-----------------|---------------|--|--|
| Each VAV plenum | 0 - 100° F    |  |  |
| Outside air     | -40 - 120° F  |  |  |
| Return air      | 0 - 100° F    |  |  |
| Mixed air       | 0 - 100° F    |  |  |
| Others          | As applicable |  |  |

## 3.05 STATIC PRESSURE AND FILTER GAUGE SCHEDULE

| LOCATION             | SCALE RANGE                      |  |  |
|----------------------|----------------------------------|--|--|
| Filter banks         | 0 - 1 IN H <sub>2</sub> O        |  |  |
| Supply fan discharge | 0 - 2 IN H <sub>2</sub> O        |  |  |
| Building static      | -0.25 - 0.25 IN H <sub>2</sub> O |  |  |

## END OF SECTION 23 0519

## SECTION 23 0529 HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

## PART 1 GENERAL

## 1.01 WORK INCLUDED

- A. Pipe, Duct, and Equipment Hangers, Supports, and Associated Anchors.
- B. Hanger Rods.
- C. Inserts.
- D. Equipment Curbs.
- E. Equipment Bases and Supports.
- F. Formed Steel Channel.
- G. Sleeves and Seals.

## 1.02 PRODUCTS FURNISHED BUT INSTALLED UNDER OTHER SECTIONS

- A. Furnish hanger and support sleeves for placement into formwork.
- B. Placement of equipment roof support curbs.

## 1.03 RELATED WORK

- A. Division 03 Cast in Place Concrete: Equipment Bases.
- B. Division 07 Fire Stopping: Joint Seals for Piping and Duct Penetration of Fire Rated Assemblies.
- C. Division 09 Painting.
- D. Section 23 0500 Common Work Results for HVAC.
- E. Section 23 0548 Vibration and Seismic Controls for HVAC.
- F. Section 23 0700 HVAC Insulation.
- G. Section 23 3116 Hydronic Piping.

## 1.04 REFERENCES

- A. ASME B31.1 Power Piping.
- B. ASME B31.2 Fuel Gas Piping.
- C. ASME B31.5 Refrigeration Piping.
- D. ASME B31.9 Building Services Piping.
- E. ASTM E84 Test Method for Surface Burning Characteristics of Building Materials.
- F. ASTM E119 Method for Fire Tests of Building Construction and Materials.
- G. ASTM A 194 Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High Pressure and/or High Temperature Service.
- H. ASTM A 307 Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength.
- I. ASTM A 575 Steel Bars, Carbon, Merchant Quality, M-Grades.
- J. ASTM A 653 Steel Sheet, Zinc-Coated (Galvanized).
- K. ASTM A 675 Steel Bars, Carbon, Hot-Wrought, Special Quality.
- L. ASTM E814 Test Method of Fire Tests of Through Penetration Firestops.
- M. ASTM F708 Standard Practice for Design and Installation of Rigid Pipe Hangers.
- N. ASTM E1966 Standard Test Method for Fire-Resistive Joint Systems.
- O. ANSI/MSS SP58 Pipe Hangers and Supports Materials, Design and Manufacturer.

- P. ANSI/MSS SP69 Pipe Hangers and Supports Selection and Application.
- Q. AWS D1.1 Structural Welding Code Steel.
- R. MSS SP 58 Pipe Hangers and Supports Materials, Design and Manufacturer.
- S. MSS SP 69 Pipe Hangers and Supports Selection and Application.
- T. MSS SP89 Pipe Hangers and Supports Fabrication and Installation Practices.
- U. UL 1479 Fire Tests of Penetration Firestops.

## 1.05 REGULATORY REQUIREMENTS

A. Conform to applicable code for support of [hydronic] [steam and steam condensate] piping.

## 1.06 SUBMITTALS

- A. Submit under provisions of Division 01.
- B. Shop Drawings: Indicate system layout with location and detail of trapeze hangers.
- C. Product Data: Provide manufacturers catalog data including load capacity.
- D. Design Data: Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.
- E. Manufacturer's Installation Instructions: Indicate special procedures and assembly of components.

## 1.07 QUALITY ASSURANCE

A. Perform Work in accordance with AWS D1.1 for welding hanger and support attachments to building structure.

## 1.08 DELIVERY, STORAGE AND HANDLING

- A. Delivery, storage and handle products under provisions of the Supplementary Conditions.
- B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.
- C. Protect from weather and construction traffic, dirt, water, chemical, and damage, by storing in original packaging.

## PART 2 PRODUCTS

## 2.01 PIPE HANGERS AND SUPPORTS

- A. Acceptable Manufacturers:
  - 1. Anvil.
  - 2. Eaton.
  - 3. Erico.
  - 4. Holdrite.
  - 5. PHD Manufacturing, Inc.
- B. Hydronic Piping:
  - 1. Conform to ANSI/MSS SP58.
  - 2. Hangers for Pipe Sizes <sup>1</sup>/<sub>2</sub> to 1-<sup>1</sup>/<sub>2</sub> Inch: Malleable iron, adjustable swivel, split ring for steel pipe, copper swivel for copper pipe.
  - 3. Hangers for Hot Pipe Sizes 2 to 4 Inches and Cold Pipe Sizes 2 Inches and Larger: Carbon steel, adjustable, clevis.
  - 4. Hangers for Hot Pipe Sizes 6 Inches and Over: Adjustable steel yoke, cast iron roll, double hanger.
  - 5. Multiple or Trapeze Hangers: Steel channels or strut with hanger rods. Cast iron roll and stand for hot pipe sizes 6 inches and over.

- 6. Wall Support for Pipe Sizes to 3 Inches: Strut triangular bracket with pipe clamp and cushion insulator.
- 7. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp; adjustable steel yoke and cast iron roll for hot pipe sizes 6 inches and over.
- 8. Vertical Support: Steel riser clamp.
- 9. Floor Support for Pipe Sizes to 4 Inches and All Cold Pipe Sizes: Cast iron adjustable pipe saddle, locknut nipple, floor flange or steel support.
- 10. Floor Support for Hot Pipe Sizes 6 Inches and Over: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
- 11. Copper Pipe Support: Carbon steel ring, adjustable, copper plated with felt isolation pad or all copper ring or swivel.
- C. Shield for Insulated Piping 1-1/2 Inches and Smaller: 18 gauge galvanized steel shield over insulation in 180° segments, minimum 12 inches long at pipe support.
- D. Shield for Insulated Piping 2 Inches and Larger: Hard block, calcium silicate insert, 180° segment, 12 inch minimum length, block thickness same as insulation thickness, flame resistant vapor barrier covering and 18 gauge galvanized shield.
- E. Shields for Vertical Copper Pipe Risers: Galvanized steel pipe.
- F. Design hangers to allow installation without disengagement of supported pipe.
- G. Copper Plating: All hanger elements in metal-to-metal contact with copper pipe shall have copper plating, hanger rings with factory-applied 1/16 inch minimum thick plastic, or tape cushion strip over all contact surfaces.
- H. Strut Type Pipe Hanging System: Unistrut P-1000 series; framing members shall be No. 12 gage formed steel channels, 1-5/8 inch square, conforming to ASTM A653 GR33, one side of channel shall have a continuous slot with inturned lips; framing nut with grooves and spring 1/2 inch size, conforming to ASTM 675 GR60; screws conforming to ASTM A 307; fittings conforming to ASTM A 575; all parts enamel painted or electro-galvanized.
- I. Fixed Strut Rooftop Pipe Supports: Foam bottom, UV stabilized thermoplastic base, with hot dip galvanized strut support. Size as required for pipe. Minimum 6" Height, utilize adjustable height as required. Erico Caddy Pyramid ST or approved equal.

## 2.02 HANGER RODS

A. Steel Hanger Rods: Mild steel, threaded both ends, threaded one end, or continuous threaded.

## 2.03 ANCHOR BOLTS

A. Anchor (Expansion) Bolts: Shall be carbon steel to ASTM A 307; nut shall conform to ASTM A194; shall be drilled-in type. Design values for shear and tension shall be not more than 80 percent of the allowable load.

## 2.04 INSERTS

A. Inserts: Malleable iron case of [galvanized] steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

#### 2.05 FLASHING

- A. Metal Flashing: 26 gauge minimum galvanized steel.
- B. Metal Counter Flashing: 22 gauge minimum galvanized steel.
- C. Lead Flashing: 5 lb./sq. ft. sheet lead for waterproofing; one lb./sq. ft. sheet lead for soundproofing.
- D. Flexible Flashing: 47 mil thick sheet butyl; compatible with roofing.
- E. Caps: Steel, 22 gauge minimum; 16 gauge at fire resistant elements.

## 2.06 EQUIPMENT CURBS

A. Fabricate curbs of concrete, unless specifically called out otherwise.

## 2.07 SLEEVES

- A. Sleeves for Pipes Through Non-fire Rated Floors: Form with 18 gauge galvanized steel for 4 inch diameter and larger, 22 gauge up to 3" diameter.
- B. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Form with steel pipe or 18 gauge galvanized steel for 4 inch diameter and larger, 22 gauge up to 3" diameter.
- C. Sleeves for Pipes Through Fire Rated and Fire Resistive Floors and Walls, and Fireproofing: Prefabricated fire rated sleeves including seals, UL listed caulking system.
- D. Fire Stopping Insulation: Mineral fiber type, non- combustible.
- E. Caulk: Fire stop sealant in compliance with ASTM E814, UL 1479 and Division 07.
- F. Mechanical Sleeve Seals: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

## 2.08 FORMED STEEL CHANNEL

- A. Manufacturers:
  - 1. Atkore Allied Tube & Conduit Corp.
  - 2. Eaton B-Line Series.
  - 3. PHD Manufacturing, Inc.
  - 4. Substitutions under provisions of Division 01.
- B. Product Description: Galvanized 12 gauge (2.8 mm) thick steel. With holes 1-1/2 inches (38 mm) on center.

## PART 3 EXECUTION

#### 3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install pipe hangers in accordance with ANSI/MSS-SP-69.

## 3.02 PIPE HANGERS AND SUPPORTS

A. Support piping as follows:

| Pipe Size         | Max. Hanger<br>Spacing | Hanger<br>Diameter |
|-------------------|------------------------|--------------------|
| 1/2 to 1-1/4 inch | 6'-0"                  | 3/8"               |
| 1-1/2 to 2 inch   | 10'-0"                 | 3/8"               |
| 2-1/2 to 3 inch   | 10'-0"                 | 1⁄2"               |
| 4 to 6 inch       | 10'-0"                 | 5/8"               |
| 8 to 12 inch      | 14'-0"                 | 7/8"               |
| 14 inch and Over  | 20'-0"                 | 1"                 |

#### Notes:

<sup>a</sup> See piping manufacturer installation instructions for additional requirements.

- B. Install hangers to provide minimum ½ inch space between finished covering and adjacent work.
- C. Place a hanger within 12 inches of each horizontal elbow.
- D. Use hangers with  $1-\frac{1}{2}$  inch minimum vertical adjustment.
- E. Support vertical piping at every floor.

- F. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- G. Support riser piping independently of connected horizontal piping.
- H. Design hangers for pipe movement without disengagement of supported pipe.
- I. Provide copper plated hangers and supports for copper piping.
- J. Prime coat exposed steel hangers and supports. Refer to Division 09. Hangers and supports located in crawlspace, pipe shafts, and suspended ceiling spaces are not considered exposed.
- K. Provide transverse seismic restraint for all piping systems.
- L. Support all piping on flat roofs using rooftop pipe supports. Install per manufacturer's instructions. Install piping minimum 6" above roof surface.

## 3.03 INSERTS

- A. Provide inserts for placement in concrete formwork.
- B. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
- C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
- D. Where concrete slabs form finished ceiling, provide inserts to be flush with slab surface.
- E. Where inserts are omitted, drill through concrete slab from below and provide thru-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.

#### 3.04 EQUIPMENT BASES AND SUPPORTS

- A. Provide equipment bases of where shown on plans and where required by equipment manufacturer installation instructions.
- B. Provide templates, anchor bolts, and accessories for mounting and anchoring equipment.
- C. Construct support of steel members. Brace and fasten with flanges bolted to structure.
- D. Provide housekeeping pads of concrete, minimum 4 inches thick and extending 6 inches beyond supported equipment anchors. Provide 6" curbs for air handling units and boilers. Refer to Division 03.
- E. Provide rigid anchors for pipes after vibration isolation components are installed.
- F. Anchor (Expansion) Bolts: Install anchor bolts for all mechanical equipment, piping and ductwork as required. Tightly fit and clamp base-supported equipment anchor bolts at all equipment support points. Provide locknuts where equipment, piping, and ductwork is hung. Install anchor (expansion) bolts in holes drilled in concrete where necessary to hang piping or ductwork, or to anchor stationary equipment from existing concrete slabs.

#### 3.05 FLASHING

- A. Provide flexible flashing and metal counter-flashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.
- B. Provide acoustical flashing around ducts and pipes penetrating equipment and exam rooms, installed in accordance with manufacturer's instructions for sound control.
- C. Provide curbs for mechanical roof installations 24 inches minimum high above roofing surface. Flexible sheet flash and counter-flash with sheet metal; seal watertight.
- D. Adjust storm collars tight to pipe with bolts; caulk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.

#### 3.06 SLEEVES

- A. Set sleeves in position in construction. Provide reinforcing around sleeves.
- B. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

- C. Extend sleeves through floors one inch above finished floor level. Pack and caulk sleeves full depth and provide floor plate.
- D. Where piping or ductwork penetrates floor, ceiling, or wall, install sleeve, close off space between pipe or duct and adjacent work with fire stopping insulation and caulk seal. Use fire rated caulking where area or occupancy separation walls are penetrated. Provide close fitting metal collar or escutcheon covers at both sides of penetration.
- E. Install chrome plated steel escutcheons at finished surfaces.

## 3.07 INSTALLATION OF EQUIPMENT

- A. Unless otherwise indicated, mount all equipment and install in accordance with manufacturer's recommendations and approved submittals.
- B. Maintain manufacture recommended minimum clearances for access and maintenance.
- C. Where equipment is to be anchored to structure, furnish and locate necessary anchoring and vibration isolation devices.
- D. Furnish all structural steel, such as angles, channels, beams, etc. required to support all piping, ductwork, equipment and accessories installed under this Division. Use structural supports suitable for equipment specified or as indicated. In all cases, support design will be based upon data contained in manufacturer's catalog.
- E. Openings: Arrange for necessary openings in buildings to allow for admittance and reasonable maintenance or replacement of all equipment furnished under this Contract.
- F. Access Doors: Provide as necessary for reasonable maintenance of all equipment valves, controls, etc.

## END OF SECTION 23 0529

#### SECTION 23 0548 VIBRATION AND SEISMIC CONTROLS FOR HVAC

#### PART 1 GENERAL

#### 1.01 WORK INCLUDED

A. This section provides minimum acceptance requirements for vibration isolation and seismic/wind restraints for all HVAC piping, ductwork equipment and piping.

#### 1.02 GENERAL

A. The requirements for seismic protection measures to be applied to plumbing equipment and systems specified herein are in addition to any other items called for in other sections of these specifications.

## 1.03 HVAC PIPING, DUCTWORK AND EQUIPMENT

- A. This section provides minimum acceptance requirements for vibration isolation and seismic/wind restraints for all HVAC equipment, piping and ductwork. HVAC equipment shall include all items on mechanical plans or in other sections of the Division 23 specifications. Equipment shall include but not be limited to:
  - 1. Boilers.
  - 2. Air Separators.
  - 3. Expansion tanks.
  - 4. Buffer Tanks.
  - 5. Glycol Tanks.
  - 6. Pumps.
  - 7. Hydronic Piping.
  - 8. Fuel Oil Piping.
  - 9. Natural Gas Piping.
  - 10. Ductwork.
  - 11. Unit Heaters.
  - 12. Cabinet Unit Heaters.
  - 13. Air handling units.
  - 14. Chillers.
  - 15. Dry cooling Units.
  - 16. Condensing Units.
  - 17. Heat Exchangers.
  - 18. Fans.
  - 19. Hoods.
  - 20. Heating Coils.
  - 21. Control Panels.

## 1.04 RELATED WORK SPECIFIED ELSEWHERE

- A. Concrete work is provided in Division 03.
- B. Vibration isolation and seismic/wind restraints for plumbing systems are specified elsewhere in Division 22.
- C. Vibration isolation and seismic restraints for electrical systems are provided in Division 26.

## 1.05 QUALITY ASSURANCE

- A. The following codes and standards will apply:
  - 1. International Building Code.
  - 2. American Society of Civil Engineers (ASCE) 7-16.
- B. Manufacturer's Qualifications: Firms regularly engaged in manufacture of vibration control and wind restraint products of type, size, and capacity required, whose products have been in satisfactory use in similar service for not less than 5 years.
- C. The following guides may be used for supplemental information on typical seismic installation practices:
  - 1. Federal Emergency Management Agency (FEMA) manuals 412, Installing Seismic Restraints for Mechanical Equipment and 414, Installing Seismic Restraints for Ductwork and Pipe.
  - 2. Sheet Metal and Air-conditioning Contractors' National Association's (SMACNA) Seismic Restraint Manual Guidelines for Mechanical Systems.
  - 3. American Society for Heating, Refrigerating and Air-conditioning Engineers' (ASHRAE) A Practical Guide to Seismic Restraint.
  - 4. Manufacturers Standardization Society of the Valve and Fittings Industry MSS SP-127-2014a, Bracing for Piping Systems, Seismic - Wind - Dynamic, Design, Selection, Application.

## 1.06 COMPONENT IMPORTANCE FACTOR

- A. In order to identify systems requiring seismic restraint and to define those from which restraints may be excluded, utility components are assigned an ASCE 7 Importance Factor (Ip) on the basis of the following:
  - Ip = 1.5 [All piping and equipment serving systems required for the continued operation of an essential facility (Occupancy Category IV). Occupancy Category IV, essential facilities required for post earthquake recovery - all "Designated Seismic Systems" per IBC Chapter 17 required for the continued operation of the facility.]

[All piping, or equipment associated with Life-safety systems which are required to function after a seismic event including fire protection sprinkler systems.]

[Components that contain hazardous or flammable materials.]

[Natural gas piping, fuel oil piping, medical gas piping, vacuum piping, petroleum based liquid piping, compressed air piping and any other piping carrying hazardous materials: lp=1.5.]

Ip = 1.0 All other components.

## 1.07 SUBMITTALS

- A. Submit shop drawings and manufacturer's data in accordance with Division 01.
- B. Provide calculations for selection of seismic/wind restraints in accordance with IBC and ASCE 7, certified by a qualified professional engineer, licensed in the state of the project.
- C. Provide Seismic Restraint plans and calculations for FM Global (Factory Mutual) review. Design parameters for these installations, may be obtained from FM Global prior to system design.

FM Global – Plan Review 601 – 108<sup>th</sup> Avenue NE, Suite 1400 P.O. Box 96077 Bellevue, WA 98004 Tel. (425) 455-5333

- D. Provide Vibration isolation shop drawings shall include isolator locations, load on each isolator, and include installation instructions.
- E. All outdoor mounted equipment shall be restrained for the highest wind speed as specified by the project's structural engineer, the governing building code(s) or the authority having jurisdiction.
- F. Submit shop drawings for all devices specified herein and as indicated and scheduled on the drawings. Submittals shall indicate full compliance with the device specification in Part 2. Any deviation shall be specifically noted and subject to engineer approval. Submittals shall include device dimensions, placement, attachment and anchorage requirements.
- G. Provide Finite Element Analysis (FEA) of all customized restraints, snubbers, and support structures such as equipment bases and roof curbs. A summary report from the analyses shall be made available to the Engineer and shall indicate compliance with the design forces for the project including all gravity, wind and seismic loads. The report shall show locations of maximum stress and explain any allowances given for localized yielding along with safety factors.
- H. Provide Shop drawings along with catalog cuts, templates and erection and installation details, as appropriate, for the items listed. Submittals shall be complete in detail; shall indicate thickness, type, grade, class of metal; and dimensions; and shall show construction details, reinforcement, anchorage, and installation with relation to the building construction.
  - 1. Sway Braces.
  - 2. Vibration Isolators.
  - 3. Seismic Cable Restraint.

## PART 2 PRODUCTS

## 2.01 ACCEPTABLE MANUFACTURERS

- A. Vibration isolators and Seismic Restraint shall be manufactured by:
  - 1. Amber/Booth.
  - 2. Cooper Industries.
  - 3. International Seismic Application Technology.
  - 4. Kinetics Noise Control.
  - 5. Mason Industries.
  - 6. Vibro-Acoustics.
  - 7. Substitutions: Items of same function and performance are acceptable in conformance with Division 01.

## 2.02 SEISMIC BRACING AND SUPPORT OF SYSTEMS AND COMPONENTS

- A. General:
  - 1. Seismic restraint designer shall coordinate all attachments with the structural engineer of record.
  - 2. Design analysis shall include calculated dead loads, static seismic loads, and capacity of materials utilized for the connection of the equipment or system to the structure.
  - 3. Analysis shall detail anchoring methods, bolt diameter, and embedment depth.
  - 4. All seismic restraint devices shall be designed to accept without failure the forces calculated per the applicable building code and as summarized in installation requirements.
  - 5. The total height of the structure (h) and the height of the system to be restrained within the structure (z) shall be determined in coordination with architectural plans and the General Contractor.
B. Friction from gravity loads shall not be considered resistance to seismic forces.

#### 2.03 SEISMIC BRACING COMPONENTS

- A. Steel strut shall be 1-5/8 wide in varying heights and mig-welded combinations as required to meet load capacities and designs indicated. A material heat code, part number, and manufacturer's name shall be stamped on all strut and fittings to maintain traceability to material test reports.
  - 1. Material for epoxy painted strut: ASTM A1011, SS, Grade 33.
  - 2. Material for pre-galvanized strut: ASTM A653, SS, Gr. 33.
  - 3. Material for Hot-Dip Galvanized strut: ASTM A1011, SS, Grade 33 and hot-dip galvanized after fabrication in accordance with ASTM A123.
  - 4. Material for fittings and accessories: ASTM A907 Gr. 33, Structural Quality or ASTM A1011, SS. Gr.33.
  - 5. Fittings and accessories: Products shall be of the same manufacturer as strut and designed for use with that product.

#### 2.04 VIBRATION ISOLATION AND RESTRAINTS

- A. Provide positive attachment for seismic and wind restraints on those systems and components required by the applicable building code and by the local authority having jurisdiction.
- B. Provide restraint devices as required, specified, and as scheduled for isolated and non-isolated systems and equipment. Provide calculations to determine restraint loadings for all restrained systems and equipment resulting from seismic forces.
- C. Springs: All springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. All springs except internal nested springs shall have an outside diameter not less than 0.8 of the compressed height of the spring. Ends of springs shall be square and ground for stability. Laterally stable springs shall have kx/ky ratios of at least 0.9. All springs shall be fully color-coded to indicate capacity color striping is not considered adequate.
- D. Corrosion Protection: All springs shall be powder-coated enamel. Housings shall be hot dipped galvanized, powder-coated enamel, or painted with rust-resistant paint.
- E. See the vibration isolation and seismic restraint schedule on the drawings for equipment specific values to be used in calculating the seismic restraint forces, including component importance factor, lp.
- F. Bases:
  - Steel Equipment Base: Bases shall be constructed of structural steel members with cross members to form an integral support platform. Steel deflection shall be limited to I/360 the longest span but not to exceed 1/4". Bases for exterior use shall be painted or hot-dipped galvanized for complete corrosion resistance. Minimum clearance under steel equipment bases shall be 1" (25 mm).
    - a. Type IFB Integral fan base with structural angle main support beams and cross beams. Bases for fans shall have adjustable motor slide rails as indicated on the Schedule and shall accommodate motor overhang where required.
    - b. Type CTB Cooling tower bases consisting of W-shaped structural steel beam main supports and cross bracing to create a full-perimeter base.
- G. Isolators:
  - Vibration Isolation Pads: Type N Neoprene pad type isolators, 3/8" (10 mm) minimum thick, ribbed on both sides. Type NSN - Sandwich neoprene pad type isolators, with 3/8" (10 mm) minimum thick ribbed neoprene pads bonded to each side of a 10 ga (3.5 mm) minimum galvanized metal plate. Isolator pads shall be selected to ensure that deflection does not exceed 20% of isolator free height.

- 2. Grommet Washers: Type GW Neoprene grommet washers of sufficient size to accommodate USS standard washers, long enough to sleeve through 1/4" (6 mm) plate material, and with at least 1/8" (3 mm) thick material around the bolt hole.
- 3. Rubber-in-Shear Floor Mounts: Type RD "Double-deflection" neoprene isolators, with neoprene-coated metal surfaces, and top and bottom surfaces ribbed. Isolators shall have bolt holes in the base.
- 4. Seismically Rated Rubber-in-Shear Floor Mounts: Type SRD- "Double-deflection" neoprene isolators, with mounting bracket and all-directional snubber for seismic restraint. Snubber shall include elastomeric components to prevent metal-to-metal contact under normal operation and during a seismic event. Datasheets shall include load/deflection curves based on manufacturer testing; test reports shall be available on request. Neoprene Element shall be color-coded to identify load capacity.
- 5. Free Spring Floor Mounted Isolators: Type FS Free-standing, laterally stable, unhoused spring isolators with components for leveling and securing equipment. Springs shall be supported either with a neoprene cup or a metal base plate complete with a ribbed neoprene pad, minimum 1/4" (6 mm) thick, bonded to the base plate. Type FST same as Type FS with the addition of an equipment support top plate.
- 6. Restrained Spring Floor Mounted Isolators: Type CSR Laterally stable, vertically restrained spring isolators with welded steel housings and heavy top plates for supporting equipment. Springs shall be supported either with a neoprene cup or a metal base plate complete with a ribbed neoprene pad, minimum 1/4" (6 mm) thick, bonded to the base plate. Housings shall include vertically restraining limit stops. Minimum clearance around the restraining bolts and between the housing and the spring shall be 1/2" (13mm). Top plate and restraining bolts shall be out of contact with the housing during normal operation and neoprene grommets shall be incorporated to minimize short-circuiting of restraining bolts. For outdoor applications, housing must be hot-dip galvanized. For indoor applications, powder-coated finish for the housing is acceptable.
- 7. Closed Mount Spring Isolators: Type CM Floor mounted spring isolators with telescoping housings and bolts for leveling and securing equipment. Springs shall be supported either with a neoprene cup or a metal base plate complete with a neoprene noise isolation pad, minimum 1/4" (6 mm) thick, bonded to the base plate. Housings shall be fabricated or welded steel telescoping housings that incorporate neoprene stabilizers to minimize short circuiting and provide vertical damping.
- 8. Neoprene Hangers: Type NH "Double-deflection" neoprene hanger isolators, each with an integral neoprene sleeve between hanger rod and housing. The neoprene element shall be color-coded to help identify load capacity and should include either an internal metal washer or external as a fail-safe to prevent pull-out failure. For the capacities above 300 lb, the neoprene elements shall include 12 extrusions to be able to provide the desired deflection at the rated load. Manufacturers must be able to provide performance test reports showing deflection at rated load. Provide vertical uplift stopwasher on neoprene hangers for seismically restrained equipment or piping.
- 9. Spring Hangers: Vibration isolator hanger supports with steel springs and welded steel housings. Hangers shall be designed for a minimum of 15 degree angular misalignment from vertical before support rod contacts housing; hangers serving lightweight loads 0.90 kN (200 lbs) and less may be exempt from this requirement. Provide a vertical uplift stopwasher on spring hangers for seismically restrained equipment or piping.
  - a. Type SH Spring hanger isolators complete with spring, compression cup, and neoprene acoustic washer.
  - b. Type SHR Spring hanger with neoprene isolators complete with spring, compression cup, and neoprene "double-deflection" element at top of hanger.

- c. Type SHB Spring hanger with bottom cup isolators complete with spring, compression cup, and neoprene cup under spring.
- d. Type SHRB Spring hanger with neoprene and bottom cup isolators complete with spring, compression cup, neoprene "double-deflection" element at top of hanger, and neoprene cup under the spring.
- e. Type PSH Pre-compressed spring hanger isolators complete with spring, compression cup, neoprene acoustic washer, and hardware to compress spring. Springs shall be pre-compressed to 2/3 rated load.
- f. Type PSHR Pre-compressed spring hanger with neoprene isolators complete with spring, compression cup, neoprene "double-deflection" element at top of hanger, and hardware to compress spring. Springs shall be pre-compressed to 2/3 rated load.
- g. Type PSHB Pre-compressed spring hanger with bottom cup isolators complete with spring, compression cup, neoprene cup under spring, and hardware to compress spring. Springs shall be pre-compressed to 2/3 rated load.
- h. Type PSHRB Pre-compressed spring hanger with neoprene and bottom cup isolators complete with spring, compression cup, neoprene "double-deflection" element at top of hanger, neoprene cup under the spring, and hardware to compress spring. Springs shall be pre-compressed to 2/3 rated load.

### H. Curbs:

- 1. Curb-mounted Spring Rail: Type RTR Full-perimeter rail type isolator, minimum 16 ga (1.6 mm) formed galvanized steel construction with integral spring isolators designed to fit over a roof curb and under the isolated equipment. Wind resistance shall be provided by means of resilient snubbers with a minimum clearance of 1/4" (6 mm) so as not to interfere with the spring action except in high winds. The weather seal shall consist of continuous closed cell sponge materials both above and below the base and a waterproof, flexible EPDM connection joining the outside perimeter of the upper and lower members. The rail shall be manufactured, shipped and installed as a single piece unless its size exceeds standard shipping dimensions. Shipping splits and lifting points shall be provided as scheduled.
- 2. Acoustic Barrier System: provide as scheduled to ensure a noise criteria of NC in the adjacent space below. Provide duct silencers, absorptive lining, and high-transmission loss panels as required to meet background noise criteria. Manufacturer shall guarantee acoustic performance.
- Flexible connectors Piping: Twin-sphere type, made of nylon cord fabric and neoprene or EPDM rubber as required for service. Connectors shall be line size and shall be designed for the pressures and temperatures encountered in the system, minimum 115 psig (6.83 MPa) and 125° F (52° C).
- I. Vibration isolators with integral seismic restraint: Isolator housings shall be capable of withstanding the applicable design forces for the specific installation.
  - Seismic/Wind Spring Floor Mounts: Laterally stable, restrained spring type with support for bolting to the equipment. Springs shall be supported either with a neoprene cup or a metal base plate complete with a neoprene noise isolation pad, minimum 1/4" (6 mm) thick, bonded to the base plate. Mount shall include integral all-directional limit stops with elastomeric grommets preventing metal-to-metal contact and with minimum 1/4" clearance under normal operation. Vibro-Acoustics type SFS or approved equal.
  - 2. Seismic/Wind Restrained Spring Isolator: Type SCSR Laterally stable, restrained spring type with housings and heavy top plates for supporting the equipment and resisting seismic and wind loading. Housings shall be of welded steel construction and include vertically restraining limit stops. Maximum clearance around the restraining bolts shall be

1/4" (6 mm). Top plate and restraining bolts shall be out of contact with the housing during normal operation and neoprene grommets shall be incorporated to minimize short-circuiting of restraining bolts. Housing must be hot-dip galvanized for outdoor applications. For indoor applications, powder-coated finish is acceptable for the housing.

- 3. Seismically Rated Rubber-in-Shear Floor Mounts: Type SRD- "Double-deflection" neoprene isolators, with mounting bracket and all-directional snubber for seismic restraint. Snubber shall include elastomeric components to prevent metal-to-metal contact under normal operation and during a seismic event. Datasheets shall include load/deflection curves based on manufacturer testing; test reports shall be available on request. Neoprene Element shall be color-coded to identify load capacity.
- 4. Seismic Cable Restraints: Type BulletBrace <sup>™</sup> Preassembled Adjustable Seismic cable sway bracing restraints shall consist of 7x19 galvanized steel aircraft cable sized to resist seismic loads. Cable restraint system shall be completely preassembled to eliminate onsite assembly of restraint components and must allow quick and easy adjustment on the length of the cable after the installation to remove excessive sag on the cable. Cable end connections shall use heavy brackets, thimbles, and wire rope clips or compression sleeves.
- 5. Rigid Restraints: Type RRK-V Seismic rigid sway bracing restraints shall include heavy duty brackets made of high-strength, low alloy steel designed to provide enough strength to withstand seismic load. To prevent any confusion, brackets should be universal to be used for both structure and equipment attachments and should accommodate post-installation of seismic restraints without the requirement of disassembling the hanger rod or any component of the equipment. No drilling should be required to secure rigid restraint brackets to the rigid brace, and rigid restraint system must include special grade hardware for attachments. Rigid restraint brackets must be color-coded for capacity identification.
- 6. Hanger Rod Stiffener: Structural steel angle attached with a formed steel clamp (Type VAC) to threaded rod support. Steel angle to be provided by contractor; steel clamp to be provided by seismic restraint manufacturer.
- 7. Seismic Inline Pump Stands: Type SIPS trapezoidal-shaped rigid support stands made of high strength, low alloy steel designed to connect to pipe flanges which support vertical inline pumps. Stands shall include neoprene grommet washers for anchor bolts and be designed to provide adequate restraint for connected equipment to resist seismic loads. Provide vibration isolation pads under pump stands as shown on the schedule or details.
- 8. Seismic Pipe Stand: Type SPS-6 and SPSA-6 (Adjustable Height) rigid support pipe stands made of high-strength steel rigid restraints, low alloy designed to support the dead load, and provide enough strength to withstand at least 1 g of lateral seismic force. In addition to providing allowance for roof slopes, the adjustable height stands shall be used to accommodate changing pipe sizes.
- 9. Seismic Restraint Brackets: Type SRB Formed steel brackets for securing floor-mounted equipment complete with pre-drilled holes. Brackets shall be galvanized or powder coated enamel for corrosion protection.
- 10. Seismic Snubber: Structural steel angle(s) with surfaces covered with ribbed neoprene pads to cushion contact with snubber. Customized snubber designs may use other structural shapes and configurations as required. Snubbers shall be designed to limit equipment motion to no more than 6 mm (1/4") in any direction.
- 11. Concrete Anchors: Post-installed anchors in concrete shall be qualified for seismic/wind restraint application.
  - a. Mechanical anchor bolts: Drilled-in and stud-wedge or female-wedge type in zinccoated steel for interior applications and stainless steel for exterior applications. (In accordance with ACI 355.2 and ICC-ES AC193)

b. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. (In accordance with ACI 355.4 and ICC-ES AC308)

## PART 3 EXECUTION

#### 3.01 GENERAL

- A. Coordinate size, doweling, and reinforcing of concrete equipment housekeeping pads and piers with vibration isolation and seismic restraint device manufacturer to ensure adequate space and prevent edge breakout failures. Pads and piers must be adequately doweled in to structural slab.
- B. Coordinate locations and sizes of structural supports with locations of vibration isolators and seismic/wind restraints (e.g., roof curbs, cooling towers, air-cooled chillers, etc.).
- C. Isolated and restrained equipment and piping located on roofs must be attached to the structure. Intermediate supports between the restraint and structure that are not attached to the structure must be approved by the restraint manufacturer.

### 3.02 SEISMIC/WIND RESTRAINTS

- A. General:
  - 1. All equipment and piping shall be restrained to resist seismic/wind forces per the applicable building code(s) as a minimum. Restraint attachments shall be made by bolts, welds or a positive fastening method. Friction shall not be considered. All attachments shall be proven capable of accepting the required wind load by calculations. Additional requirements specified herein are included specifically for this project.
  - 2. Install seismic and wind restraint devices per the manufacturer's submittals. Any deviation from the manufacturer's instructions shall be reviewed and approved by the manufacturer.
  - 3. Attachment to structure for suspended equipment and pipe: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
  - 4. Wall penetrations may be used as bracing locations provided the wall can provide adequate resistance without significant damage.
  - 5. Coordinate sizes and locations of cast-in-place inserts for post-tensioned slabs with seismic restraint manufacturer.
  - 6. Provide hanger rod stiffeners where indicated or as required to prevent buckling of rods due to seismic forces.
  - 7. Where rigid restraints are used on equipment or piping, support rods for the equipment or piping at restraint locations must be supported by anchors rated for seismic use. Post-installed concrete anchors must be in accordance with ACI 355.2.
  - 8. Ensure housekeeping pads have adequate space to mount equipment and seismic restraint devices and shall also be large enough to ensure adequate edge distance for restraint anchor bolts to avoid housekeeping pad breakout failure.
- B. Concrete Anchor Bolts:
  - Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid pre- or post-tensioned tendons, electrical and telecommunications conduit, and gas lines.
  - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.

- 3. Mechanical Anchors: Protect threads from damage during anchor installation. Heavyduty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
- 4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
- 5. Set anchors to manufacturer's recommended torque, using a torque wrench.
- C. Equipment Restraints:
  - 1. Seismically restrain equipment as indicated on the schedule. Install fasteners, straps and brackets as required to secure the equipment.
  - 2. As indicated on the schedule, install seismic snubbers on HVAC equipment supported by floor-mounted, non-seismic vibration isolators. Locate snubbers as close as possible to vibration isolators and attach to equipment base and supporting structure as required.
  - 3. Install neoprene grommet washers on equipment anchor bolts where clearance between anchor and equipment support hole exceeds 1/8" (3.2 mm).
  - 4. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- D. Duct Systems:
  - 1. Seismically restrain all ductwork listed below, using seismic cable restraints:
    - a. All ducts with cross-sectional area equal to or greater than 6 ft2 (0.55 m2).
    - b. Any ductwork which if it were to fail would result in damage to a piece of equipment or building function that has a component importance factor of 1.5.
    - c. All ductwork weighing more than 17 lbs/ft (25 kg/m).
  - 2. "12-inch rule", where duct can be exempted from seismic restraint based on the length of the support rods, is accepted if one of the following conditions are met:
    - a. The hangers shall be detailed to avoid significant bending of the hangers and their attachments. The maximum stress due to combined loading including bending in the hangers must be less than 21.6 ksi.
    - b. Isolation hangers are added to hanger rod to provide swivel joint and to prevent bending moment in hanger.
  - 3. Space lateral supports a maximum of 30' o.c. (9 m), and longitudinal supports a maximum of 60' (18 m) o.c.
  - 4. Duct risers shall be restrained at floor penetrations every 30' (9 m) maximum spacing.
  - 5. Fire damper locations may be used as restraint locations for all directions except away from the damper.
  - 6. Brace a change of direction longer than 12' (3.7 m).
  - 7. Install restraint cables so they do not bend across edges of adjacent equipment or building structure.
- E. Piping Systems:
  - 1. For projects with a Seismic Design Category of D, provide seismic cable restraints on the following:
    - a. All piping greater than 3" (75 mm) nominal diameter.

- b. All piping systems assigned a component importance factor, lp, of 1.5 with a nominal pipe diameter greater than 1" (25 mm) or trapeze-supported piping with combined operating weight over 10 lbs/ft (15 kg/m).
- 2. "12-inch rule", where pipe can be exempted from seismic restraint based on the length of the support rods, is accepted if one of the following conditions are met:
  - a. Hangers are detailed to avoid bending of the hangers and their attachment; and provisions are made for piping to accommodate expected deflections. The maximum stress due to combined loading including bending in the hangers must be less than 21.6 ksi.
  - b. Isolation hangers are added to hanger rod to provide swivel joint and to prevent bending moment in hanger.
- 3. Restraint spacing:
  - a. For ductile piping, space lateral supports a maximum of 40' (12 m) o.c., and longitudinal supports a maximum of 80' (24 m) o.c.
  - b. For non-ductile piping (e.g., cast iron, PVC) space lateral supports a maximum of 20' (6 m) o.c., and longitudinal supports a maximum of 40' (12 m) o.c.
  - c. For piping with hazardous material inside (e.g., natural gas, medical gas) space lateral supports a maximum of 20' (6 m) o.c., and longitudinal supports a maximum of 40' (12 m) o.c.
  - d. For pipe risers, restrain the piping at floor penetrations using the same spacing requirements as above.
- 4. Brace a change of direction longer than 12' (3.7 m).
- 5. Longitudinal restraints for single pipe supports shall be attached directly to the pipe, not to the pipe hanger.
- 6. For supports with multiple pipes (trapezes), secure pipes to trapeze member with clamps approved for application.
- 7. Install restraint cables so they do not bend across edges of adjacent equipment or building structure.
- 8. Install flexible metal hose loops in piping which crosses building seismic joints, sized for the anticipated amount of movement.
- 9. Install flexible piping connectors where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment.
- 10. Coordinate seismic restraints with thermal expansion compensators, guides and anchor points. Thermal expansion anchor points shall be designed to accommodate seismic forces.

### 3.03 VIBRATION ISOLATION

- A. Block and shim all bases level so that all piping and electrical connections can be made to a rigid system at the proper operating level, before isolators are adjusted. Ensure that there are no rigid connections or incidental physical contacts between isolated equipment and the building structure or nearby systems.
- B. Ensure housekeeping pads have adequate space to mount equipment and isolator housings and shall also be large enough to ensure adequate edge distance for isolator anchors.
- C. Select and locate vibration isolation equipment to give uniform loading and deflection, according to weight distribution of equipment.

- D. Mount fans, as indicated on the drawings, on structural steel vibration bases common to both fan and motor. There shall be a minimum operating clearance of 1" (25 mm) between steel bases and the structure.
- E. Mount pumps and equipment, as indicated on the drawings, on housekeeping pads.
- F. Extent of Piping Isolation:
  - 1. Isolate all piping larger than 1" (25 mm) dia. rigidly connected to vibration isolated equipment with 1" (25 mm) static deflection spring hangers at spacing intervals in accordance with the following:

| Distance from Vibrating Equipment |
|-----------------------------------|
| 50'                               |
| 60'                               |
| 70'                               |
|                                   |

- a. Chilled Glycol/Water Piping:
  - Horizontal: Pipe stand floor supports shall be supported on Type CSR isolators. Suspended piping shall be supported with Type SHR isolators. The first 3 isolators shall have the same minimum static deflection as the equipment isolators, with a maximum of 2" (50 mm). The remaining isolators shall have a minimum 1" (25 mm) static deflection.
  - 2) Vertical: Piping shall be isolated from the supporting members or structure with Type FS or SHR isolators with a minimum 1" (25 mm) static deflection.
- 2. Piping attached to isolated equipment with flexible connections or to air handling units with internal vibration isolators meeting the requirements of these specifications is exempt from these requirements.

|                    |                        |               |              |                   |                       | Floor Span   |                   |                       |              |                  |                       |              |                   |                       |
|--------------------|------------------------|---------------|--------------|-------------------|-----------------------|--------------|-------------------|-----------------------|--------------|------------------|-----------------------|--------------|-------------------|-----------------------|
|                    |                        |               |              | Slab on Grade     | e                     |              | Up to 20 ft.      |                       |              | 20 to 30 ft.     |                       |              | 30 to 40 ft.      |                       |
| Equipment Type     | HP<br>and<br>Other     | RPM           | Base<br>Type | lsolator<br>Type  | Min.<br>Defl.,<br>in. | Base<br>Type | lsolator<br>Type  | Min.<br>Defl.,<br>in. | Base<br>Type | lsolator<br>Type | Min.<br>Defl.,<br>in. | Base<br>Type | lsolator<br>Type  | Min.<br>Defl.,<br>in. |
| Chillers           | Chillers               |               |              |                   |                       |              |                   |                       |              |                  |                       |              |                   |                       |
| Air -cooled screw  | All                    | All           | N/A          | CSR-1A<br>SCSR-1A | 1.00                  | N/A          | CSR-2A<br>SCSR-2A | 1.50                  | SEF          | CSR/SCSR         | 2.50                  | SEF          | CSR-3A<br>SCSR-3A | 2.50                  |
| Pumps              |                        |               |              |                   |                       |              |                   |                       |              |                  |                       |              |                   |                       |
| Close-coupled      | ≤ 7.5                  | All           | N/A          | NSN               | 0.12                  | CIB          | FS-1A<br>SFS-1A   | 0.75                  | CIB          | FS-1A<br>SFS-1A  | 0.75                  | CIB          | FS-1A<br>SFS-1A   | 0.75                  |
|                    | ≥ 10                   | All           | CIB          | FS-1A<br>SFS-1A   | 0.75                  | CIB          | FS-1A<br>SFS-1A   | 0.75                  | CIB          | FS-2A<br>SFS-2A  | 1.50                  | CIB          | FS/SFS            | 1.50                  |
| Inline (suspended) | ≤ 25                   | All           | N/A          | SHRB              | 0.75                  | N/A          | SHRB              | 1.50                  | N/A          | SHRB             | 1.50                  | N/A          | SHRB              | 1.50                  |
|                    | ≥ 30                   | All           | N/A          | SHRB              | 1.50                  | N/A          | SHRB              | 1.50                  | N/A          | SHRB             | 1.50                  | N/A          | SHRB              | 2.50                  |
| Packaged AH, AC,   | H, and V u             | nits          |              |                   |                       |              |                   |                       |              |                  |                       |              |                   |                       |
| All                | ≤ 10                   | All           | N/A          | FS-1A<br>SFS-1A   | 0.75                  | N/A          | FS-1A<br>SFS-1A   | 0.75                  | N/A          | FS-1A<br>SFS-1A  | 0.75                  | N/A          | FS-1A<br>SFS-1A   | 0.75                  |
|                    | ≤ 15,<br>≤ 4 in.<br>SP | Up to<br>300  | N/A          | FS-1A<br>SFS-1A   | 0.75                  | N/A          | FS-4A<br>SFS-4A   | 3.50                  | N/A          | FS-4A<br>SFS-4A  | 3.50                  | CIB          | FS-4A<br>SFS-4A   | 3.50                  |
|                    |                        | 301 to<br>500 | N/A          | FS-1A<br>SFS-1A   | 0.75                  | N/A          | FS-3A<br>SFS-3A   | 2.50                  | N/A          | FS-3A<br>SFS-3A  | 2.50                  | N/A          | FS-3A<br>SFS-3A   | 2.50                  |
|                    |                        | 501 and<br>up | N/A          | FS-1A<br>SFS-1A   | 0.75                  | N/A          | FS-2A<br>SFS-2A   | 1.50                  | N/A          | FS-2A<br>SFS-2A  | 1.50                  | N/A          | FS-2A<br>SFS-2A   | 1.50                  |
|                    | > 15,<br>> 4 in.<br>SP | Up to<br>300  | SB           | FS-1A<br>SFS-1A   | 0.75                  | SB           | FS-4A<br>SFS-4A   | 3.50                  | CIB          | FS-4A<br>SFS-4A  | 3.50                  | CIB          | FS-4A<br>SFS-4A   | 3.50                  |

G. Equipment Isolation:

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|                           |                                                                                                                                                                                                                                                    | 301 to<br>500<br>501 and<br>up | SB<br>SB | FS-1A<br>SFS-1A<br>FS-1A<br>SFS-1A | 0.75<br>0.75 | SB<br>SB | FS-2A<br>SFS-2A<br>FS-2A<br>SFS-2A | 1.50<br>1.50 | CIB<br>CIB | FS-3A<br>SFS-3A<br>FS-2A<br>SF-2A | 2.50<br>1.50 | CIB | FS-3A<br>SFS-3A<br>FS-3A<br>SFS-3A | 2.50<br>2.50 |
|---------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|----------|------------------------------------|--------------|----------|------------------------------------|--------------|------------|-----------------------------------|--------------|-----|------------------------------------|--------------|
| Ducted Rotating Equipment |                                                                                                                                                                                                                                                    |                                |          |                                    |              |          |                                    |              |            |                                   |              |     |                                    |              |
| Small fans, fan-          | ≤ 600<br>cfm                                                                                                                                                                                                                                       |                                | N/A      | NH                                 | 0.25         | N/A      | NH                                 | 0.25         | N/A        | SHRB                              | 0.75         | N/A | SHRB                               | 0.75         |
| powered boxes             | > 600<br>cfm                                                                                                                                                                                                                                       |                                | N/A      | SHRB                               | 0.75         | N/A      | SHRB                               | 0.75         | N/A        | SHRB                              | 0.75         | N/A | SHRB                               | 0.75         |
| Notes:                    | Notes: (1) Units that are suspended overhead shall use isolation hangers in place of floor mounted isolators with equal or greater deflection.                                                                                                     |                                |          |                                    |              |          |                                    |              |            |                                   |              |     |                                    |              |
|                           | (2) Use flexible duct connectors as specified in Section entitled "Ductwork".                                                                                                                                                                      |                                |          |                                    |              |          |                                    |              |            |                                   |              |     |                                    |              |
|                           | (3) Floor spans are defined as the distance between structural support columns or walls.                                                                                                                                                           |                                |          |                                    |              |          |                                    |              |            |                                   |              |     |                                    |              |
|                           | (4) Seismic snubbers or isolators with integral restraint (i.e. Type SFS or SCSR) may be required if seismic or wind restraints are required by building code(s). Restraint types and sizes shall be determined by seismic restraint manufacturer. |                                |          |                                    |              |          |                                    |              |            |                                   |              |     |                                    |              |

- H. There shall be no rigid contact of isolated piping or equipment with shaft walls, floor slabs, partitions, or conduits.
- I. Provide height-saving brackets where recommended by the manufacturer for equipment stability, or operating height requirements.
- J. Where recommended by the manufacturer, isolator base plates shall be bolted to the structure or foundation. Bolting shall incorporate neoprene bushings and washers.
- K. Provide spring-loaded thrust restraints for fans and air handling units where movement under any operating condition will exceed 3/8" (10 mm).
- L. Isolator hangers shall be installed with the housing a minimum of 1/4" (6 mm) below but as close to the structure as possible. Where isolator hangers would be concealed by non-accessible acoustical sub ceiling, install the hangers immediately below the sub ceiling for access.

#### 3.04 INSPECTION AND CERTIFICATION

- A. After installation, arrange and pay for the vibration isolation product manufacturer, or representative, to visit the site to verify that the vibration isolation systems are installed and operating properly, and shall submit a certificate so stating. Verify that isolators are adjusted, with springs perpendicular to bases or housing, adjustment bolts are tightened up on equipment mountings, and hangers are not cocked.
- B. After installation, arrange and pay for the seismic restraint product manufacturer, or representative, to visit the site to verify that the seismic and wind restraint systems are installed properly, and shall submit a certificate so stating.

### END OF SECTION 23 0548

#### **SECTION 23 0553**

#### IDENTIFICATION FOR HVAC PIPING, DUCTWORK AND EQUIPMENT

#### PART 1 GENERAL

#### 1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this section.

#### 1.02 SUMMARY

- A. Section Includes identification of HVAC piping, ductwork and equipment installed under Division 23.
- B. Related Sections:
  - 1. Division 09 Painting and Coating: Execution requirements for painting specified by this section.

#### 1.03 REFERENCES

A. ANSI/ASME A13.1 - Scheme for the Identification of Piping Systems.

#### 1.04 SUBMITTALS

- A. Submit product data under provisions of Division 01.
- B. Include product data on: Nameplates, tags, stencil and paint, and pipe markers.

#### 1.05 QUALITY ASSURANCE

A. Conform to ANSI/ASME A13.1 for color scheme for identification of piping systems and accessories.

#### PART 2 PRODUCTS

#### 2.01 ACCEPTABLE MANUFACTURERS

- A. Seton.
- B. Marking Services Inc.
- C. Craftmark Identification Systems.
- D. Substitutions: Under provisions of Division 01.

#### 2.02 MATERIALS

- A. Color: Unless specified otherwise, conform with ANSI/ASME A13.1.
- B. Plastic Nameplates: Laminated three-layer plastic with engraved black or white letters on contrasting background color. Plate size minimum <sup>3</sup>/<sub>4</sub>" X 2-<sup>1</sup>/<sub>2</sub>".
- C. Plastic Tags: Laminated three-layer plastic with engraved black or white letters on contrasting background color. Tag size minimum 1-1/2 inch square.
- D. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.
- E. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and fluid being conveyed. Larger sizes may have maximum sheet size with spring fastener.
- F. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.
- G. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape of not less than 6 inch wide by 4 mil thick, manufactured for direct burial service.
- H. Ceiling Labels: 3/4" x 2" vinyl label, 3.0 Mil self-adhesive vinyl similar to DuraLabel Pro. Label color shall be black text on a white background.

I. Valve Chart Frame: Aluminum frame with plastic windows.

### PART 3 EXECUTION

### 3.01 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.
- B. Prepare surfaces in accordance with Division 09 for stencil painting.

### 3.02 INSTALLATION

- A. Apply stencil painting in accordance with Division 09.
- B. Install identifying devices after completion of coverings and painting.
- C. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.
- D. Install labels with sufficient adhesive for permanent adhesion and seal with clear lacquer. For unfinished canvas covering, apply paint primer before applying labels.
- E. Install tags using corrosion resistant chain. Number tags consecutively by location.
- F. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.
- G. Equipment: Identify air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates. Small devices, such as in-line pumps, may be identified with plastic or metal tags.
- H. Identify control panels and major control components outside panels with plastic nameplates.
- I. Identify valves in main and branch piping with tags showing service and valve number.
- J. Identify piping, concealed or exposed, with plastic pipe markers. Tags may be used on small diameter piping. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.
- K. Ductwork: Identify ductwork with plastic nameplates or stencil. Identify as to air handling unit number, and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.
- L. Provide ceiling labels to locate equipment above T-bar type panel ceilings. Locate in corner of panel closest to equipment.
- M. Locations: Nameplates shall be located so as to be readily visible to maintenance personnel. Motor nameplates shall be readily visible on accessible, three phase motors, otherwise a duplicate motor nameplate shall be permanently affixed to the driven machinery in a visible locations.

### 3.03 VALVE CHART AND SCHEDULE

A. Provide valve chart and schedule at location as directed. Chart shall show valve number, service and normal position. Provide a reduced scale copy of drawings showing valves and valve number. Provide copies of valve chart and drawings for inclusion in operation and maintenance manuals in accordance with Section 23 0500.

### END OF SECTION 23 0553

### SECTION 23 0593 TESTING, ADJUSTING, AND BALANCING FOR HVAC

### PART 1 GENERAL

## 1.01 WORK INCLUDED

- A. Air Systems:
  - 1. Constant Volume Air Systems.
  - 2. Variable Air Volume Systems.
  - 3. Fume Hoods and Bio-Safety Cabinet Systems.
  - 4. Exhaust Hood Systems.
  - 5. Space Pressurization.
  - 6. Shaft Pressurization Systems.
  - 7. Existing HVAC Systems.
- B. Hydronic Systems:
  - 1. Constant Flow Systems.
  - 2. Variable Flow Systems.
  - 3. Primary-secondary Systems.

### 1.02 SCOPE

- A. Furnish the professional services of a qualified and approved balancing and testing firm to perform the work of this specification section.
- B. The work of this section includes but is not necessarily limited to:
  - 1. Testing and balancing existing hydronic heating and ventilation systems as indicated on drawings.
  - 2. Testing and balancing fans and air handling systems.
  - 3. Testing and balancing new variable air volume terminal units.
  - 4. Testing and balancing new liquid heat transfer systems.
  - 5. Working directly with the control subcontractor to obtain proper system adjustments.
  - 6. Domestic water distribution system adjustment.
- C. The work of this section does not include:
  - 1. Adjusting burners for proper combustion operation.
  - 2. Liquid waste transfer system adjustment.
  - 3. Fire protection systems.

### 1.03 APPLICABLE CODES AND STANDARDS

- A. SMACNA Manual for the Balancing and Adjustment of Air Distribution Systems.
- B. AMCA Publication 203, Field Performance Measurements.
- C. American Air Balancing Council (AABC) Recommended Procedures
- D. National Environmental Balancing Bureau (NEBB) Recommended Procedures

## 1.04 QUALIFICATION OF THE BALANCING FIRM OR COMPANY

A. Subcontractor minimum qualifications include:

1. NEBB Certified in Testing, Adjusting and Balancing of Air and Hydronic Systems or Demonstration of satisfactory completion of five projects of similar scope in the State of Alaska during the past five years. Provide references if requested.

### 1.05 TIMING OF WORK

- A. Do not begin balancing and testing until the systems, including controls, are completed and in full working order.
- B. Schedule the testing and balancing work in cooperation with other trades.
- C. Complete the testing and balancing at least one week before the date of substantial completion and before any occupancy occurs

## 1.06 CONTRACTOR RESPONSIBILITY TO BALANCING AGENCY

- A. Award the test and balance contract to an approved firm or company upon receipt of contract to allow the Balance and Testing Agency to schedule this work in cooperation with other trades involved and comply with completion date.
- B. Put all heating, ventilating and air conditioning systems, equipment and controls into full operation for the Balancing Agency and continue the operation of same during each working day of testing balancing.
- C. Provide scaffolding, ladders and access to each system for proper testing balancing.
- D. Ensure that the building enclosure is complete, including but not limited to, structural components, windows and doors installed, door hardware complete, ceilings complete, stair, elevator and mechanical shafts complete, roof systems complete, all plenums sealed, etc.
- E. Make any changes in pulleys, belts and dampers, or add any dampers as required for correct balance as recommended by the Balance and Testing Agency at no additional cost to the Owner.
- F. Complete installation, programming (including design parameters and graphics), calibration, and startup of all building control systems.
- G. Require that the building control system firm provide access to hardware and software, or onsite technical support required to assist the TAB effort. The hardware and software or the onsite technical support shall be provided at no cost to the TAB firm.

### 1.07 REPORT

- A. Certified Reports shall be included in project O & M manuals. Reports shall include: testing, adjusting, and balancing reports bearing the signature of the Test and Balance Agency Representative. The reports shall be certified proof that the systems have been tested, adjusted, and balanced in accordance with the referenced standards; are an accurate representation of how the systems have been installed; are a true representation of how the systems are operating at the completion of the testing, adjusting and balancing procedures; and are an accurate record of all final quantities measured, to establish normal operating values of the system. Follow the procedures and format specified below:
  - 1. Draft Reports: Upon completion of testing, adjusting and balancing procedures, prepare draft reports on the approved forms. Draft reports may be hand written, but must be complete, factual, accurate, and legible. Organize and format draft reports in the same manner specified for the final reports.
  - 2. Final Reports: Upon verification and approval of the draft report; prepare final reports,

typewritten, organized and formatted as specified below.

- 3. Report Format: Report forms shall be those standard forms prepared by the referenced standard for each respective item and system to be tested, adjusted and balanced. Report shall be provided in electronic PDF Format. The data in the electronic file shall be arranged and indexed. Divide the contents into the below listed sections, with bookmarks for each section:
  - a. General Information and Summary.
  - b. Air Systems.
  - c. Hydronic Systems.
  - d. Temperature Control Systems.
  - e. Special Systems.
  - f. System Deficiency Reports and Corrective Actions.
- 4. Report Contents: Provide the following minimum information, forms and data:
  - a. General Information and Summary: Inside cover sheet to identify testing, adjusting, and balancing agency; contractor; owner, architect, engineer and project. Include addresses, contact names and telephone numbers. Also, include a certification sheet containing the name, address, telephone number and signature of the Certified Test and Balance Personnel. Include in this division a listing of the instrumentation used for the procedures along with the proof of calibration.
  - b. The remainder of the report shall contain the appropriate forms containing as a minimum, the information indicated on the standard report forms prepared by the AABC for each respective item and system. Prepare a schematic diagram for each item of equipment and system to accompany each respective report form.
  - c. Calibration Reports: Submit proof that all required instrumentation has been calibrated to tolerances specified in the referenced standards, within a period of six months prior to starting the project.

### 1.08 SUBMITTALS

- A. Submit in accordance with Division 01.
- B. Submit balancing agency qualifications and sample balancing forms.
- C. Provide list of equipment to be used and date of last calibration.
- D. Submit preliminary balance report a minimum of one week prior to substantial completion inspection.

## PART 2 PRODUCTS

## 2.01 INSTRUMENTS

- A. Maintain all instruments accurately calibrated and in good working order. Use instruments with the following minimum performance characteristics.
  - 1. Air Velocity Instruments: Direct reading in feet per minute, 2% accuracy.
  - 2. Static Pressure Instruments: Direct reading in inches' water gauge, 2% accuracy.
  - 3. RPM Instruments: Direct reading in revolutions per minute, .5% accuracy; or revolution counter accurate within 2 counts per 1,000.

- 4. Pressure Readout: Direct reading in feet of water or PSI, .5% accuracy.
- 5. Temperature Instruments Direct reading in degrees F, +.5% accuracy.
- 6. Water Flow Instruments: Differential pressure type; direct reading in feet of water or PSI, accuracy, suitable for readout balancing valve provided.
- 7. Sound Measuring Instrument: Octave Band Analyzer which essentially complies to AASA Standards SI.6 1960 with a range of 24DB to 150 DB sound pressure level ref. .0002 microbar. Calibrate sound test instrument before use to a closed coupler and a driving loudspeaker that produces a know-sound pressure level at the microphone of the analyzer.

## PART 3 EXECUTION

## 3.01 GENERAL PROCEDURES FOR ALL SYSTEMS

- A. Start with new, clean filters.
- B. In cooperation with the control manufacturer's representative, coordinate adjustments of automatically operated dampers and valves to operate as specified, indicated and/or noted.
- C. Use manufacturer's ratings on all equipment to make required calculations.
- D. Make final adjustments for each space per heating or cooling comfort requirement. State reason for variance from design CFM, i.e., "too noisy", "drafty", etc.
- E. Mark equipment and balancing device settings (including damper-control positions, valve position indicators, fan-speed-controls, and similar controls and devices) with paint or other suitable permanent identification material to show final settings.

### 3.02 REQUIREMENTS FOR ALL AIR HANDLING SYSTEMS

- A. Identify each diffuser, grille and register as to location and area.
- B. Identify and list size, type and manufacturer of diffusers, grilles, registers and all testing equipment.
- C. In readings and tests of diffusers, grilles and registers, include required FPM velocity and required CFM and test CFM after adjustments. If test apparatus is designed to read CFM directly, velocity reading may be omitted. Identify test apparatus used. Identify wide open (W.O.) runs.
- D. Check and record the following items:
  - 1. Air temperatures; mixed air, after coils, outside air, return air and supply air.
  - 2. Pressure drop at each coil, filter bank, etc.
  - 3. Operating suction and discharge pressure.
  - 4. Full nameplate data of all equipment.
  - 5. Rated and actual running amperage and voltage of all motors.
  - 6. Drive data including sheaves and belts and adjustments.
  - 7. Electrical overloads/heaters sizes and ranges of motors.

## 3.03 BALANCING LOW VELOCITY CONSTANT VOLUME DUCTWORK

- A. Analyze system and identify major branches. Tabulate design CFM for each branch.
- B. Select the branch which appears to be the longest run from the fan or to have the highest static

pressure requirements.

- C. Adjust other branch dampers or the fan to establish 110% design air flow through the selected branch.
- D. Adjust the air flow through each air inlet (exhaust systems) or outlet (supply systems) on the selected branch to within +5% of the requirements so that at least one branch damper serving an inlet (or outlet) is wide open.
- E. Proceed to another branch and set up 110% design airflow. Balance each inlet or outlet to within +5% of requirements, again leaving at least one wide open run. Repeat this process until all branches are balanced 110% airflow.
- F. Once each branch has been balanced at 110% flow with one wide open run on each branch, balance with branches together, leaving at least one branch damper wide open. At this point, adjust the fan delivery so that each branch is at about 110% design airflow. Adjust the branch dampers so that each inlet (or outlet) in the system is within 10% of the required airflow.
- G. Adjust the fan for design airflow.
- H. Read and record the airflow at each inlet and outlet.
- I. Secure each branch damper and mark the balanced position of the damper quadrant.
- J. Test and record entering and leaving air temperatures of coils.
- K. Test and record entering and leaving water temperatures of coils.
- L. Test and record static pressure drop across each filter and coil bank.

### 3.04 BALANCING VAV AIR SYSTEMS

- A. The high velocity ductwork of the Variable Air Volume (VAV) systems are computer designed and in general should not require special balancing. The balancer must, however, check the CFM's and adjust as necessary and work with the Control Contractor to set up the fans and controls for proper operation through the range of system operation. The balancing essentially consists of the following:
  - 1. Set up and adjust each fan.
  - 2. Set up duct static pressure control.
  - 3. Balance ductwork and mixing boxes, air outlets, terminal units, etc.
  - 4. Set up building static pressure control.
- B. Step 1: Adjust all thermostats set points to call for full airflow. Adjust supply air temperature so that terminal units will stay in full airflow position. If system diversity exceeds 80%, some boxes may have to be temporarily closed.
- C. Step 2: Adjust variable speed drive controller to provide 100% fan CFM volume. Check current draw on motor. Do not exceed nameplate full load current rating. Adjust fan RPM accordingly.
- D. Step 3: Proceed with the adjustment of diffusers downstream of each terminal box. Proceed as though each box were a branch on a constant volume system. Adjust thermostats of nearby boxes or adjust fan delivery to bring the total terminal box airflow to within + 10% of design box airflow. Record data. Establish a wide-open run and balance the diffusers to within +5% of percentage of total box airflow to design box airflow.
- E. Step 4: At each terminal box, adjust the high-volume limiter to the CFM scheduled on the computer run to the total air flow scheduled through the box. Coordinate with the control

subcontractor and adjust the low volume limit. Record correction factor for each box.

- F. Step 5: Upon completion of all the diffuser adjustments at each terminal box in all zones, place enough thermostats to the no flow position to compensate for diversity. These should be randomly selected based on judgment as to how diversity applies to the particular air distribution system, considering building use. The object is to create 100% airflow at the fan.
- G. Step 6: Adjust the static pressure sensor controlling the variable speed drive to the specified setting for its location in the duct system and adjust fan for 100% CFM at wide open RPM. Record fan suction and discharge static pressure, fan CFM, RPM, motor amperage and voltage, filter and coil pressure drops and static pressure at control sensor location. Refer to procedure for constant volume fan adjustment.
- H. Step 7: Work with control subcontractor to set up all fan system controls and building static pressure control. Readjust space thermostats set points.

### 3.05 FLUID SYSTEM TESTING AND BALANCING

- A. Preparation of system Phase I:
  - 1. Complete air balance before beginning fluid balance.
  - 2. Clean all strainers.
  - 3. Examine fluid in system to determine if treated and clean.
  - 4. Check pump rotation.
  - 5. Verify expansion tanks are not air bound and system full of fluid.
  - 6. Verify all air vents at high points of fluid systems are installed properly and are operating freely. Make certain all air is removed from circuiting system.
  - 7. Open all valves to full flow position including coil and heater stop valves, close bypass valves and open return line balancing cocks. Set temperature controls so that automatic valves are open to full flow through apparatus.
  - 8. Check and set operating temperature of boilers and heat exchangers to design requirements when balancing by temperature drop.
  - 9. Adjust all flows to 110% of design flows as shown.
- B. Test and Balance Procedure Phase II:
  - 1. Set pumps to proper GPM delivery and set proper GPM delivery in main piping runs from boiler room. Note flow variations for additive alternates.
  - 2. Adjust flow of fluid through primary equipment.
  - 3. Check leaving fluid temperatures and return fluid temperatures and pressure drop through major equipment. Reset to correct design temperatures.
  - 4. Check fluid temperature at inlet side of coils and other heat transfer equipment. Note rise or drop of temperatures from source.
  - 5. Balance each coil and all other heat transfer apparatus in system.
  - 6. Upon completion of flow readings and adjustments, mark all settings and record all data.
- C. Test and Balance Procedure Phase III:
  - 1. After making adjustments to coils and apparatus, recheck settings at pumps and major equipment. Readjust if required.

- 2. Attach pressure gauges on each coil, then read pressure drop through coil at set flow rate on call for full flow through coil. Set pressure drop across bypass valve to match coil full flow pressure drop. This prevents unbalanced flow conditions when coils are on full bypass.
- 3. Check and record the following items with flows set at 100% of design.
  - a. Inlet and leaving fluid and air temperatures at coils and major equipment.
  - b. GPM flow of each coil and major equipment.
  - c. Pressure drop of each coil and major equipment.
  - d. Pressure drop across bypass valve.
  - e. Pump operating suction and discharge pressures and final total developed head.
  - f. Pump GPM.
  - g. Rated and actual running amperage and voltage of pump motor.
  - h. Full nameplate data of all pumps and equipment.
  - i. Electrical overloads/heaters sizes and ranges of motors.
- 4. Permanently mark adjusted position of all balancing valves. Stamp indicator plate of circuit setters and other balancing valves without memory stop.

## END OF SECTION 23 0593

### SECTION 23 0700 HVAC INSULATION

#### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Piping Insulation.
- B. Equipment Insulation.
- C. Ductwork Insulation.
- D. Jackets and Accessories.

### 1.02 REFERENCES

- A. ASTM B209 Aluminum and Aluminum-alloy Sheet and Plate.
- B. ASTM C195 Mineral Fiber Thermal Insulating Cement.
- C. ASTM C450 Standard Practice for Fabrication of Thermal Insulating Fitting Covers for NPS Piping, and Vessel Lagging.
- D. ASTM C518 Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
- E. ANSI/ASTM C533 Calcium Silicate Block and Pipe Thermal Insulation.
- F. ANSI/ASTM C534 Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
- G. ANSI/ASTM C547 Mineral Fiber Pipe Insulation (Preformed).
- H. ANSI/ASTM C552 Cellular Glass Thermal Insulation.
- I. ANSI/ASTM C553 Mineral Fiber Blanket Insulation.
- J. ANSI/ASTM C578 Preformed, Block Type Cellular Polystyrene Thermal Insulation.
- K. ASTM C585 Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).
- L. ASTM C612 Mineral Fiber Block and Board Thermal Insulation.
- M. ASTM C449 Mineral Fiber Hydraulic-setting Thermal Insulating and Finishing Cement.
- N. ASTM C610 Expanded Perlite Block and Pipe Thermal Insulation.
- O. ASTM C1071 Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material).
- P. ASTM C1136 Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
- Q. ASTM C1427 Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
- R. ASTM D774 Standard Test Method for Bursting Strength of Paper.
- S. ASTM D1000 Standard Test Methods for Pressure-Sensitive Adhesive-Coated Tapes Used for Electrical and Electronic Applications.
- T. ASTM E84 Surface Burning Characteristics of Building Materials.
- U. ASTM E96 Standard Test Methods for Water Vapor Transmission of Materials.
- V. UL 723 Surface Burning Characteristics of Building Materials.

### 1.03 SUBMITTALS

- A. Submit product data under provisions of Division 01.
- B. Include product description, thickness for each service, and locations.

C. Submit manufacturer's installation instructions.

## 1.04 QUALITY ASSURANCE

- A. Applicator: Company specializing in piping insulation application with three years minimum experience.
- B. Pipe insulation manufactured in accordance with ASTM C585 for inner and outer diameters.
- C. Materials: Flame spread/smoke developed rating of 25/50 in accordance with UL 723, ASTM E84.
- D. Factory fabricated fitting covers manufactured in accordance with ASTM C450.

### 1.05 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- C. Shipment of materials from manufacturer to installation location shall be in weather tight transportation.
- D. Protect from weather and construction traffic, dirt, water, chemical, and damage, by storing in original packaging.

### 1.06 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesive, mastics, and insulation cements.

#### 1.07 FIELD MEASURMENTS

A. Verify field measurements prior to fabrication.

### 1.08 WARRANTY

A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.

### PART 2 PRODUCTS

### 2.01 ACCEPTABLE MANUFACTURERS

- A. Armacell.
- B. Certain-Teed.
- C. IMCOA.
- D. Johns Manville.
- E. Knauf.
- F. Owens-Corning.
- G. Manson.
- H. Pittsburgh Corning.
- I. K-Flex USA.
- J. Armstrong.
- K. Substitutions: Under provisions of Division 01.

### 2.02 INSULATION - PIPING

- A. Type A: Glass fiber, rigid, molded, non-combustible insulation; ANSI/ASTM C547; 'k' value of 0.23 at 75° F, rated from 0° F to 850° F, vapor retarder jacket of Kraft paper bonded to aluminum foil, self-sealing lap and butt strips; Johns Manville "Micro-Lok" or approved equal.
- B. Type B: Cellular glass; ANSI/ASTM C552; 'k' value of 0.29 at 75° F; 7.3 lbs./cu. ft. density; Pittsburgh Corning "Foamglass ONE" or approved equal.

- C. Type D: Flexible unicellular polyolefin; ASTM C1427; 'k' value of 0.25 at 75° F ASTM C518; moisture vapor transmission of zero perm-inch ASTM E96; rated to 210° F; IMCOA "Imcolock" or approved equal.
- D. Type E: Elastomeric foam; EPDM-based closed-cell flexible foam, ASTM C534; flexible cellular elastomeric in sheet or pre-formed tube, 'k' value of 0.26 at 75° F, max. service temp 300° F, ASTM C534; max. flame spread = 50, max. smoke developed = 50, ASTM E84; UV-resistant coating/jacketing if exposed to sunlight; K-FLEX USA "Insul-Tube", "Insul-Sheet", or approved equal.
- E. Type F: Hydrous calcium silicate; ANSI/ASTM C533; rigid white; asbestos free; 'k' value of 0.44 at 300° F, rated to 1,200° F; Johns Manville "Thermo 12 Gold" or approved equal.

### 2.03 FIELD APPLIED PIPING JACKET

- A. Vapor Barrier Jackets: Kraft reinforced foil vapor barrier with self-sealing adhesive joints.
- B. PVC Jackets and solvent welding adhesive: One piece, pre-molded type, Johns Manville "Zeston 2000", fitting covers and jacketing material. Johns Manville "Perma-Weld" solvent welding adhesive.
- C. Aluminum Jackets: ASTM B209; 0.016 inch thick; corrugated or textured finish, longitudinal slip joints.
- D. Stainless Steel Jackets: Type 304 stainless steel; 0.010 inch thick; corrugated finish.

### 2.04 INSULATION - EQUIPMENT

- A. Type G: Rigid fiberglass board with FSK outer facing. Johns Manville 814 FSK, 3.0 lbs./cu. ft. density, ASTM C612, K= .23 @ 75<sup>o</sup> F, 450<sup>o</sup> F maximum service temperature, Johns Manville 1000 series "Spin-Glas" or approved equal.
- B. Type H: Reusable Thermal Insulation Covers, HVAC Equipment: 2" thermal insulating wool, 2.4 lb./cu.ft. density, maximum temperature rating of 1000 Deg. F; Interior/Exterior Fabric: 17 oz./sq. yd. silicone coated fiberglass cloth, maximum temperature range of -80 to 500 Deg F; Securement: Lacing Anchors, fourteen gauge stainless steel with 1.5" diameter stainless steel speed washers; Sewing Thread: Kevlar/Stainless Steel S-110 Natural with stainless steel core, all blanket seems to be single sewn lock stitch interior seams, six to nine stitches per inch; Drawcord: 0.125" diameter #4 ultra-strength polyester. Thermal Energy Products "Energy-Wrap EW.2T.NM.SH.SC" or approved equal.
- C. Type I: Reusable Valve Wrap Insulation Covers: Removable and reusable wraps packaged with a 1" thick fiberglass blanket insert to completely cover the insulated equipment. The outer cover of the shall be made of DuPont Tychem® QC that is secured with a Velcro closure. Tychem® QC consists of a durable Tyvek® substrate quality coated with polyethylene that is impermeable to water. K= .28 @ 100° F; Temperature Limits 0°F to 450°F; Water Vapor Transmission ASTM E 96 0.01 Perms at 37.8C/100F-RH/100%; Breaking Strength Grab (md/cd) ASTM D5034-90 43/49 lbs; Tearing Strength Trapezoid (md/cd) ASTM D1117-80 7/5 lbs; Weatherable Grade; UV resistant; White/gloss finish; UL25/50 rating and are non-combustible per ASTM E 136. NOSWEAT Reusable Valve Wraps or approved equal.

### 2.05 INSULATION - DUCTWORK

- A. Type K: Exterior FSK Duct Wrap: Flexible glass fiber; ASTM C553; commercial grade; 'k' value of 0.27 at 75° F, 0.6 lb./cu. ft. density. 0.00035 inch vinyl scrim facing with 2" stapling tab. Johns Manville "Microlite Standard Duct Wrap" or equal.
- B. Type L: Exterior FSK Rigid Fiber Board Duct Insulation; ASTM C612, 'k' value of 0.23 at 75° F, 3.0 lb./cu. ft. density. 0.00035 inch foil scrim facing. Johns Manville "814 Spin-Glas" or equal.
- C. Type N: Duct Liner: Close cell, CFC- and HCFC-free flexible elastomeric acoustical insulation with scrim-reinforced acrylic adhesive on one side; ASTM C534 type 2 (sheet) grade 1, ASTM E84 25/50 at 2" and below; 'k' value of 0.25 at 75° F; R-4.2 and noise reduction coefficient (NRC) of 0.5 at 1" thick; recommended for -40 to 200° F temperature applications; install metal

nosing for air velocities greater than 4,000 ft./min., UL listed adhesive galvanized steel pins. K-flex USA "K-flex duct liner gray" or approved equal.

D. Type O: Service temperature of -297° F to 300° F. 3 lb/ft^2 density, K value of 0.19 @ 75° F. John Mansville Trymer 3000 or approved equal.

### 2.06 FIELD APPLIED EQUIPMENT AND DUCTWORK JACKETS

A. Re-Wettable Canvas Jacketing: Fiberglass cloth made from texturized yarns, impregnated throughout with an inorganic fire retardant asbestos free adhesive; 20x14 thread count, 14.5 oz./sq.yd, 0.04 inch thickness, 1,000<sup>o</sup> F upper temperature limit; GLT Products "Style 1989" or approved equal.

#### 2.07 INSULATION ACCESSORIES

- A. Adhesives: Waterproof and fire-retardant type.
- B. Lagging Adhesive: Fire resistive to ASTM E84 and UL 723.
- C. Impale Anchors: Galvanized steel, 12 gauge, self-adhesive pad.
- D. Joint Tape: Glass fiber cloth, open mesh.
- E. FSK Joint Tape; ASTM C1136 Foil-Scrim-Kraft (FSK) lamination coated with solvent acrylic pressure sensitive adhesive; capable of adhering to fibrous and sheet metal surfaces; tridirectionally reinforced 2x3 squares per inch fiberglass scrim; 9.5 mils thick, -40 to 240° F service temperatures; Venture Tape "1525CW" or approved equal.
- F. Tie Wire: Annealed steel, 16 gauge.
- G. Insulated pipe supports: Calcium silicate with galvanized steel jacket (min. 24 gauge); ANSI/ASTM C533; rigid white; 'k' value of 0.37 at 100° F, rated to 1,200° F; Thermal Pipe Shields "T-2000 Calsil" or equal.

## PART 3 EXECUTION

### 3.01 PREPARATION

- A. Install materials after piping, equipment and ductwork has been tested and approved.
- B. Clean surfaces for adhesives.
- C. Prepare surfaces in accordance with manufacturer's recommendations.

### 3.02 INSTALLATION – PIPING INSULATION

- A. Install materials in accordance with manufacturer's recommendations, building codes and industry standards.
- B. Continue insulation vapor barrier through penetrations except where prohibited by code.
- C. Locate insulation and cover seams in least visible locations.
- D. Neatly finish insulation at supports, protrusions, and interruptions.
- E. Provide insulated cold or dual temperature pipes conveying fluids below ambient temperature with vapor retardant jackets with self-sealing laps. Insulate complete system, including under fitting jackets.
- F. For insulated pipes conveying fluids above ambient temperature, secure jackets with selfsealing lap or outward clinched, expanded staples. Bevel and seal ends of insulation at equipment, flanges, and unions. Insulate complete system, including under fitting jackets.
- G. Provide insert fabricated of Johns Manville Thermo-12 Gold or other heavy density insulating material suitable for temperature between support shield and piping on piping 1-1/2" inch diameter larger. Insulation inserts shall not be less than the following lengths:

| 1-1⁄2" to 2-1⁄2" pipe size | 10" long |
|----------------------------|----------|
| 3" to 6" pipe size         | 12" long |

H. For exterior applications, provide aluminum pipe jacketing.

- I. Insulated pipe, fittings, joints, and valves shall be covered with PVC or metal jacket. Jacket seams shall be located on bottom side of horizontal piping.
- J. Fully insulate all piping including all spaces under jacketing.
- K. Jackets:
  - 1. Indoor, Concealed Applications: Insulated pipes shall have vapor barrier jackets, factoryapplied. Vapor barrier PVC fittings may also be used provided joints are sealed with solvent welding adhesive approved by the jacket manufacturer.
  - 2. Provide PVC jacketing on all pipe exposed in mechanical equipment rooms.
  - 3. Where piping is exposed in finished spaces below 10 feet above finished floor, finish with PVC jacket and fitting covers.

#### 3.03 SCHEDULE – PIPING

| PIPING                                      | TYPE    | PIPE SIZE          | MINIMUM<br>INSULATION<br>THICKNESS |
|---------------------------------------------|---------|--------------------|------------------------------------|
| Heating Glycol/Water Supply and Re-<br>turn | A, E    | 1-1/4" and Smaller | 1"                                 |
| Heating Glycol/Water Supply and Re-<br>turn | A, E    | 1-1/2" and Larger  | 1"                                 |
| Cooling Glycol/Water Supply and Re-<br>turn | A, E    | All Sizes          | 1"                                 |
| Heat Recovery Water                         | А       | All Sizes          | 1"                                 |
| Cold Condensate Drains                      | A, E    | All Sizes          | 1"                                 |
| Refrigerant Suction Piping                  | E       | All Sizes          | 1"                                 |
| Refrigerant Liquid Piping                   | E       | All Sizes          | 1"                                 |
| Humidifier Piping                           | А       | All Sizes          | 1"                                 |
| Piping Exposed to Freezing                  | A, D, E | All Sizes          | 2"                                 |
| Buried Piping – Under building              | E       | All Sizes          | 1"                                 |

#### 3.04 INSTALLATION - EQUIPMENT

- A. Install materials in accordance with manufacturer's instructions.
- B. Do not insulate factory insulated equipment.
- C. Apply insulation as close as possible to equipment by grooving, scoring, and beveling insulation, if necessary. Secure insulation to equipment with studs, pins, clips, adhesive, wires, or bands. Minimum 2" overlap on blanket material.
- D. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor barrier cement.
- E. Cover insulation with metal mesh and finish with heavy coat of insulating cement.
- F. Do not insulate over nameplate or ASME stamps. Bevel and seal insulation around such.
- G. When equipment with insulation requires periodical opening for maintenance, repair, or cleaning, install insulation in such a manner that it can be easily removed and replaced without damage.
- H. Where canvas jacketing is indicated, apply mastic in sufficient thickness to completely cover the texture of the canvas material.

#### 3.05 SCHEDULE - EQUIPMENT

| EQUIPMENT                  | INSULATION<br>TYPE | THICKNESS |
|----------------------------|--------------------|-----------|
| Air Separator              | G, H               | 2"        |
| Heat Exchangers/Converters | G, H               | 2"        |

| EQUIPMENT                     | INSULATION<br>TYPE | THICKNESS |
|-------------------------------|--------------------|-----------|
| Valves 2" and larger          | 1                  | 1"        |
| Applications below -15 deg. F | В                  | 2"        |

### 3.06 INSTALLATION – DUCTWORK INSULATION

- A. Install materials in accordance with manufacturer's instructions.
- B. Provide insulation with vapor barrier when air conveyed may be below ambient temperature. Continue insulation with vapor barrier through penetration.
- C. Duct Exterior Insulation (Type K,L) Application:
  - 1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
  - 2. Secure insulation without vapor barrier with staples, tape, or wires.
  - 3. Install without sag on underside of ductwork. Use mechanical fasteners to prevent sagging. Secure insulation with mechanical fasteners on 15 inch centers maximum, on bottom and side of ductwork with dimension exceeding 20 inches. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.
  - 4. Maximum 25% compression.
- D. Fiber-Free Duct Liner (Type N) Application:
  - 1. Adhere insulation with approved adhesive for 100 percent coverage. Secure insulation with mechanical fasteners on 15 inch centers maximum on top and side of ductwork with dimension exceeding 20 inches. Butt joints together tightly then seal and smooth. Thoroughly coat ends of liner with adhesive. Do not use nail-type fasteners. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
  - 2. Ductwork dimensions indicated are net inside dimensions required for air flow. Increase ductwork to allow for insulation thickness.
  - 3. Install liner as indicated on plans.
- E. Where ductwork is scheduled for exterior insulation and is shown on the plans to be internally lined, the exterior insulation thickness may be reduced by the thickness of the lining. Where exterior insulation can be eliminated or reduced due to thickness of lining, overlap exterior insulation a minimum 24 inches over lined ductwork.
- F. Where canvas jacketing is indicated, apply mastic in sufficient thickness to completely cover the texture of the canvas material.
- G. Fully insulate all quench vent piping within the building envelope.

### 3.07 SCHEDULE - DUCTWORK

| DUCTWORK                                | TYPE | INSULATION<br>THICKNESS | FINISH |
|-----------------------------------------|------|-------------------------|--------|
| Combustion Air Duct                     | L    | 2" Rigid                | CANVAS |
| Quench Vent                             | 0    | 2"                      | CANVAS |
| Exhaust & Relief Ducts Within 10 ft. of | K,L  | 1"                      | CANVAS |
| Exterior Openings                       |      |                         |        |
| Outside Air Intake Ducts                | L    | 2° Rigid                | CANVAS |
| Supply Ducts                            | K    | 1"                      | FSK    |
| Return and Relief Ducts in Mechanical   | K, L | 1"                      | FSK    |
| Rooms                                   |      |                         |        |
| Internal Acoustic Lining                | M,N  | 1"                      |        |

| DUCTWORK                        | TYPE | INSULATION<br>THICKNESS | FINISH |
|---------------------------------|------|-------------------------|--------|
| Internal Lining in Supply Ducts | M,N  | 1"                      |        |

END OF SECTION 23 0700

### SECTION 23 0800 COMMISSIONING OF HVAC

### PART 1 GENERAL

#### 1.01 SUMMARY

- A. Section includes Cx process requirements for the following HVAC systems, assemblies, and equipment:
  - 1. Energy supply systems.
  - 2. Heat generation systems.
  - 3. Cooling generation systems.
  - 4. Central-station air-handling systems.
  - 5. Air, and hydronic distribution systems.
  - 6. Heating and cooling terminal and unitary equipment.
  - 7. HVAC controls.
  - 8. TAB verification.
- B. Related Requirements:
  - 1. Section <u>01 9113 General Commissioning Requirements</u> for general Cx process requirements and CxA responsibilities.
  - 2. For prefunctional checklists, comply with requirements in various Division 23 Sections specifying HVAC systems, system components, equipment, and products.

### 1.02 DEFINITIONS

- A. Cx: Commissioning, as defined in Section <u>01 9113 General Commissioning Requirements</u>.
- B. CxA: Commissioning Authority, as defined in Section <u>01 9113 General Commissioning</u> <u>Requirements</u>.
- C. DDC: Direct digital controls.
- D. HVAC: Heating, ventilating, and air conditioning.
- E. "Systems," "Assemblies," "Subsystems," "Equipment," and "Components": Where these terms are used together or separately, they shall mean "as-built" systems, assemblies, subsystems, equipment, and components.
- F. TAB: Testing, adjusting, and balancing.

### PART 2 PRODUCTS (Not Used)

### PART 3 EXECUTION

### 3.01 CONSTRUCTION CHECKLIST REVIEW

- A. Review and provide written comments on draft prefunctional checklists. CxA will create required draft prefunctional checklists and provide them to Contractor.
- B. Return draft prefunctional checklist review comments within [10] < Insert number> days of receipt.
- C. When review comments have been resolved, the CxA will provide final prefunctional checklists, marked "Approved for Use, (date)."
- D. Use only prefunctional checklists, marked "Approved for Use, (date)."

### 3.02 Cx TESTING PREPARATION

- A. Certify that HVAC systems, subsystems, and equipment have been installed, calibrated, and started and that they are operating according to the Contract Documents and approved submittals.
- B. Certify that HVAC instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents and approved submittals, and that pretest set points have been recorded.

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- C. Certify that TAB procedures have been completed and that TAB reports have been submitted, discrepancies corrected, and corrective work approved.
- D. Set systems, subsystems, and equipment into operating mode to be tested according to approved test procedures (for example, normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).

## 3.03 Cx TEST CONDITIONS

- A. Perform tests using design conditions, whenever possible.
  - 1. Simulated conditions may, with approval of Architect, be imposed using an artificial load when it is impractical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by CxA and document simulated conditions and methods of simulation. After tests, return configurations and settings to normal operating conditions.
  - 2. Cx test procedures may direct that set points be altered when simulating conditions is impractical.
  - 3. Cx test procedures may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are impractical.
- B. If tests cannot be completed because of a deficiency outside the scope of the HVAC system, document the deficiency and report it to Architect. After deficiencies are resolved, reschedule tests.
- C. If seasonal testing is specified, complete appropriate initial performance tests and documentation and schedule seasonal tests.

## 3.04 Cx TESTS COMMON TO HVAC SYSTEMS

- A. Measure capacities and effectiveness of systems, assemblies, subsystems, equipment, and components, including operational and control functions, to verify compliance with acceptance criteria.
- B. Test systems, assemblies, subsystems, equipment, and components operating modes, interlocks, control responses, responses to abnormal or emergency conditions, and response according to acceptance criteria.
- C. Coordinate schedule with, and perform Cx activities at the direction of, CxA.
- D. Comply with prefunctional checklist requirements, including material verification, installation checks, startup, and performance tests requirements specified in Division 23 Sections specifying HVAC systems and equipment.
- E. Provide technicians, instrumentation, tools, and equipment to perform and document the following:
  - 1. Prefunctional checklist verification tests.
  - 2. Prefunctional checklist verification test demonstrations.
  - 3. Cx tests.
  - 4. Cx test demonstrations.
- F. Vibration Isolation in HVAC Systems:
  - 1. Prerequisites: Acceptance of results of prefunctional checklists for vibration and seismic control devices specified in Section 23 0548 Vibration and Seismic Controls for HVAC Piping and Equipment.
  - 2. Components to Be Tested:
    - a. Vibration isolation and seismic control devices in HVAC systems.
    - b. Structural systems.
  - 3. Test Purpose: Evaluate effectiveness of vibration isolation and seismic control devices.
  - 4. Test Conditions: Measure vibration of the facility structure at [three] < Insert number> locations designated by Owner's witness while the isolated equipment operates.
  - 5. Test Conditions: Measure vibration of the facility structure at [three] < Insert number> locations designated by Owner's witness at the following operating conditions:

- a. Maximum speed.
- b. Minimum speed.
- c. Critical speed.
- 6. Acceptance Criteria: Structure-borne vibration not to exceed specified performance.
- G. Heat Tracing in HVAC Systems:
  - 1. Prerequisites: Acceptance of results of prefunctional checklists for heat tracing specified in HVAC systems. Comply with requirements listed in Section <u>26 0580 Heating Cables</u>.
  - 2. Equipment and Systems to Be Tested:
    - a. Self-regulating, parallel-resistance heating cables.
    - b. Heater trace circuit controller.
  - 3. Test Purpose:
    - a. Evaluate response to ambient temperature below freeze-protection set point.
    - b. Evaluate heating cable fault alarm.
  - 4. Test Conditions:
    - a. Subject temperature sensor to temperature approximately [3 deg F] <Insert value> above freeze-protection set point (initial set point [41 deg F] <Insert value>). Monitor sensed temperature with a calibration-grade thermometer. Gradually change set point or sensed temperature until freeze-protection circuit is energized.
    - b. Subject temperature sensor to temperature approximately [3 deg F] <Insert value> below freeze-protection set point (initial set point [41 deg F] <Insert value>). Monitor sensed temperature with a calibration-grade thermometer. Gradually change set point or sensed temperature until freeze-protection circuit is de-energized.
    - c. Simulate an electrical fault on the heating cable.
  - 5. Acceptance Criteria:
    - a. Freeze-protection circuit is energized at set-point temperature minus 2 deg F.
    - b. Freeze-protection circuit is de-energized at set-point temperature plus 2 deg F.
    - c. Heater trace circuit controller initiates an alarm of cable fault. Alarm is correctly reported at the fire-alarm control panel.

#### 3.05 TAB VERIFICATION

- A. Prerequisites: Completion of "Examination" Article requirements and correction of deficiencies, as specified in Section <u>23 0593 Testing, Adjusting, and Balancing for HVAC</u>.
- B. Completion of "Preparation" Article requirements for preparation of a TAB plan that includes strategies and step-by-step procedures, and system-readiness checks and reports, as specified in Section <u>23 0593 Testing, Adjusting, and Balancing for HVAC</u>.
- C. Scope: HVAC air systems and hydronic piping systems.
- D. Purpose: Differential flow relationships intended to maintain air pressurization differentials between the various areas of Project.
- E. Conditions of the Test:
  - 1. Cx Test Demonstration Sampling Rate: As specified in "Inspections" Article in Section 23 0593 Testing, Adjusting, and Balancing for HVAC.
  - 2. Systems operating in full heating mode[ with minimum outside-air volume].
  - 3. Systems operating in full cooling mode[ with minimum outside-air volume].
  - 4. For measurements at air-handling units with economizer controls; systems operating in economizer mode with 100 percent outside air.
- F. Acceptance Criteria:
  - 1. Under all conditions, rechecked measurements comply with "Inspections" Article in Section 23 0593 Testing, Adjusting, and Balancing for HVAC.
  - 2. Additionally, no rechecked measurement shall differ from measurements documented in the final report by more than two times the tolerances allowed.

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3. Under all conditions, where the Contract Documents indicate a differential in airflow between supply and exhaust and/or return in a space, the differential relationship shall be maintained.

## 3.06 BUILDING HEATING CONTROL SYSTEM Cx TESTS

- A. Heating-Water Supply Temperature Control:
  - 1. Prerequisites: Installation verification of the following:
    - a. Startup of boilers B2-1 and B2-2.
    - b. Startup of heating-water pump(s) < Insert pump designation(s) >.
    - c. TAB of heating-water flow and pressure.
    - d. Input Device: Heating-water supply temperature; [thermostat] [thermistor temperature sensor] [resistance temperature sensor] <Insert device designation>.
    - e. Output Device: Control valve < Insert device designation>.
      - Display the following at the operator's workstation:
        - 1) Heating-water supply temperature.
        - 2) Heating-water supply temperature set point.
      - 3) Control-valve position.
  - 2. Scope: Heating-water system.
  - 3. Purpose: Control of heating-water supply temperature at input device <**Insert device designation**>.
  - 4. Conditions of the Test:

f.

- a. Minimum heating-water flow.
- b. Midrange Heating-Water Flow: [50 to 60] < Insert number(s) > percent of maximum.
- c. Maximum heating-water flow.
- Acceptance Criteria: Under all conditions, heating-water supply temperature is within plus or minus [2.0 deg F] < Insert temperature> of set point.
- B. Heating-Water Supply Temperature Reset:
  - 1. Prerequisites: Installation verification of the following:
    - a. Startup of Boilers B2-1 and B2-2.
    - b. Startup of heating-water pump(s) < Insert pump designation(s) >.
    - c. TAB of heating-water flow and pressure.
    - d. Input Device: Heating-water supply temperature; [thermostat] [thermistor temperature sensor] [resistance temperature sensor] <Insert device designation>.
    - e. Input Device: Outdoor-air temperature; [electric, outdoor-air-reset controller] [outdoor-air sensor].
    - f. Output Device: Control valve < Insert device designation>.
    - g. Display the following at the operator's workstation:
      - 1) Outdoor-air temperature.
      - 2) Heating-water supply temperature.
      - 3) Heating-water supply temperature set point.
      - 4) Control-valve position.
  - 2. Scope: Heating-water system.
  - 3. Purpose: Control of heating-water supply temperature at heating-water supply temperature input device <**Insert device designation**> in response to variable outdoor-air temperature input; [electric, outdoor-air-reset controller] [outdoor-air sensor].
  - 4. Conditions of the Test: Outdoor-air temperature input value may be overridden for this test.
    - a. Low Temperature: Outdoor-air temperature between [minus 30 and 0 deg F] <Insert temperature range>.
    - b. Midrange Temperature: Outdoor-air temperature between [30 and 45 deg F] <Insert temperature range>.

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- c. High Temperature: Outdoor-air temperature above [65 deg F] < Insert temperature>.
- Acceptance Criteria: Heating-water supply temperature resets in straight-line relationship with outdoor-air temperature for the following reset schedule. Under all conditions, heatingwater supply temperature is within [2.0 deg F] < Insert temperature> of set point.
  - a. [195 deg F] <Insert temperature> heating water when outdoor-air temperature is [minus 30 deg F] <Insert temperature>.
  - b. [130 deg F] <Insert temperature> heating water when outdoor-air temperature is [65 deg F] <Insert temperature>.
  - Under all conditions, heating-water supply temperature is within plus or minus [2.0 deg F] <Insert temperature> of set point.
- C. Control Primary Circulating Pump(s):
  - 1. Prerequisites: Installation verification of the following:
    - a. Startup of heating-water pump(s) < Insert pump designation(s) >.
    - b. Input Device: Outdoor-air temperature; [electric, outdoor-air-reset controller] [outdoor-air sensor].
    - c. Output Device: Heating-water pump; [starter] [DDC system command to starter] relay.
    - d. Display the following at the operator's workstation:
      - 1) Outdoor-air temperature.
      - 2) Operating status of primary circulating pump(s).
  - 2. Scope: Heating-water pump(s) < Insert pump designation(s) > and associated controls.
  - 3. Purpose: On-off control of heating-water pump(s) in response to variable outdoor-air temperature input; [electric, outdoor-air-reset controller] [outdoor-air sensor].
  - 4. Conditions of the Test:
    - a. High Temperature: Outdoor-air temperature above [65 deg F] < Insert temperature>.
    - b. Low Temperature: Outdoor-air temperature below [65 deg F] < Insert temperature >.
  - 5. Acceptance Criteria:
    - a. High Temperature: Pump(s) are off when outside-air temperature is above [65 deg F] <Insert temperature>.
    - b. Low Temperature: Pump(s) are on when outside-air temperature is below [65 deg F] </br><Insert temperature>.

## 3.07 SNOWMELT HEATING CONTROL SYSTEM Cx TESTS

- A. Snowmelt Heating-Water Supply Temperature Control:
  - 1. Prerequisites: Installation verification of the following:
    - a. Startup of boiler B2-3 and B2-4.
    - b. Startup of heating-water pump(s) SMCP2-1A and SMCP2-1B.
    - c. TAB of heating-water flow and pressure.
    - d. Input Device: Heating-water supply temperature; [thermostat] [thermistor temperature sensor] [resistance temperature sensor] <Insert device designation>.
    - e. Output Device: Control valve < Insert device designation>.
    - f. Display the following at the operator's workstation:
      - 1) Heating-water supply temperature.
      - 2) Heating-water supply temperature set point.
      - 3) Control-valve position.
  - 2. Scope: Heating-water system.
  - 3. Purpose: Control of heating-water supply temperature at input device <**Insert device designation**>.
  - 4. Conditions of the Test:
    - a. Minimum heating-water flow.
    - b. Midrange Heating-Water Flow: [50 to 60] < Insert number(s) > percent of maximum.
    - c. Maximum heating-water flow.

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- Acceptance Criteria: Under all conditions, heating-water supply temperature is within plus or minus [2.0 deg F] < Insert temperature > of set point.
- B. Snowmelt Heating-Water Supply Temperature Reset:
  - 1. Prerequisites: Installation verification of the following:
    - a. Startup of boilers B2-3 and B2-4.
    - b. Startup of heating-water pump(s) SMCP2-1A and SMCP2-1B.
    - c. TAB of heating-water flow and pressure.
    - d. Input Device: Heating-water supply temperature; [thermostat] [thermistor temperature sensor] [resistance temperature sensor] <Insert device designation>.
    - e. Input Device: Outdoor-air temperature; [electric, outdoor-air-reset controller] [outdoor-air sensor].
    - f. Output Device: Control valve < Insert device designation>.
    - g. Display the following at the operator's workstation:
      - 1) Outdoor-air temperature.
      - 2) Heating-water supply temperature.
      - 3) Heating-water supply temperature set point.
      - 4) Control-valve position.
  - 2. Scope: Heating-water system.
  - 3. Purpose: Control of heating-water supply temperature at heating-water supply temperature input device <**Insert device designation**> in response to variable outdoor-air temperature input; [electric, outdoor-air-reset controller] [outdoor-air sensor].
  - 4. Conditions of the Test: Outdoor-air temperature input value may be overridden for this test.
    - a. Low Temperature: Outdoor-air temperature between [minus 30 and 0 deg F] <Insert temperature range>.
    - b. Midrange Temperature: Outdoor-air temperature between [30 and 45 deg F] <Insert temperature range>.
    - c. High Temperature: Outdoor-air temperature above [65 deg F] < Insert temperature >.
  - Acceptance Criteria: Heating-water supply temperature resets in straight-line relationship with outdoor-air temperature for the following reset schedule. Under all conditions, heatingwater supply temperature is within [2.0 deg F] < Insert temperature> of set point.
    - a. [195 deg F] <Insert temperature> heating water when outdoor-air temperature is [minus 30 deg F] <Insert temperature>.
    - b. [130 deg F] <Insert temperature> heating water when outdoor-air temperature is [65 deg F] <Insert temperature>.
    - Under all conditions, heating-water supply temperature is within plus or minus [2.0 deg F] <Insert temperature> of set point.
- C. Control Primary Circulating Pump(s):
  - 1. Prerequisites: Installation verification of the following:
    - a. Startup of heating-water pump(s) < Insert pump designation(s) >.
    - b. Input Device: Outdoor-air temperature; [electric, outdoor-air-reset controller] [outdoor-air sensor].
    - c. Output Device: Heating-water pump; [starter] [DDC system command to starter] relay.
    - d. Display the following at the operator's workstation:
      - 1) Outdoor-air temperature.
      - 2) Operating status of primary circulating pump(s).
  - 2. Scope: Heating-water pump(s) < Insert pump designation(s) > and associated controls.
  - 3. Purpose: On-off control of heating-water pump(s) in response to variable outdoor-air temperature input; [electric, outdoor-air-reset controller] [outdoor-air sensor].
  - 4. Conditions of the Test:
    - a. High Temperature: Outdoor-air temperature above [65 deg F] < Insert temperature >.

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- b. Low Temperature: Outdoor-air temperature below [65 deg F] < Insert temperature>.
- Acceptance Criteria:
  - a. High Temperature: Pump(s) are off when outside-air temperature is above [65 deg F] </br><Insert temperature>.
  - b. Low Temperature: Pump(s) are on when outside-air temperature is below [65 deg F] </br><Insert temperature>.

## 3.08 CENTRAL REFRIGERATION SYSTEM Cx TESTS

- A. Start and Stop Condenser-Water Pump(s):
  - 1. Prerequisites: Installation verification of the following:
    - a. Startup of condenser-water pump(s) < Insert pump designation(s) >.
    - b. Startup of cooling tower <**Insert cooling tower designation**>.
    - c. Input Device: Water pressure transducer < Insert device designation>.
    - d. Input Device: [Space thermostat] [DDC system outdoor-air temperature] <Insert device designation>.
    - e. Input Device: [Time clock] [DDC system time schedule] <Insert device designation>.
    - f. Output Device: Hard wired through motor starter; [DDC system binary output] <Insert device designation>.
    - g. Output Device: [Time clock] [Binary output] < Insert device designation>.
    - h. Display the following at the operator's workstation:
      - 1) Low-level cooling-tower sump alarm.
      - 2) Outdoor-air temperature.
      - 3) Cooling (software) demand indication.
      - 4) Time and time schedule.
      - 5) Condenser-water pump(s) on-off status.
      - 6) Condenser-water pump(s) on-off indication.
      - 7) Condenser-water flow indication.
  - 2. Scope:
    - a. Condenser-water system, including condenser-water pump(s), cooling towers, and associated controls.
  - 3. Purpose:
    - a. Condenser-water pump(s) lockout.
    - b. Condenser-water pump(s) start.
    - c. Condenser-water pump(s) shutdown.
    - d. Low-level cooling-tower sump alarm.
    - e. Condenser-water pump(s) time-of-day schedule.
  - 4. Conditions of the Test:
    - a. Verify Lockout: Start with condenser-water pump enable-input devices in the "disable" state to prevent pump start. One by one, place the enable-input devices in the "enable" state, and then return each to the "disable" state before placing the next enable-input device to the "enable" state.
    - b. Verify Start: Start with condenser-water pump enable-input devices in the "disable" state to prevent pump start. One by one, place the enable-input devices in the "enable" state.
    - c. Verify Shutdown: Place all enable-input devices in the "enable" state to allow the pump(s) to start. One by one, place the enable-input devices in the "disable" state, and then return each to the "enable" state before placing the next enable-input device to the "disable" state.
    - d. Verify Schedule: Compare condenser-water pump start and stop schedule times with Owner-approved time-of-day schedule.
  - 5. Acceptance Criteria:
    - a. Lockout: No single enable-input device starts the pump(s) when released to the "enable" state.

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- b. Start: Condenser-water pump(s) start when, and only when, all enable-input devices are in the "enable" state.
- c. Shutdown: Each enable-input device stops the condenser-water pump(s) when placed in the "disable" state, regardless of the state of other enable-input devices.
- d. Schedule: Condenser-water pump start and stop schedule times agree with Ownerapproved time-of-day schedule.
- B. Start and Stop Chilled-Water Pump(s):
  - 1. Prerequisites: Installation verification of the following:
    - a. Startup of chilled-water pump(s) < Insert pump designation(s) >.
    - b. Startup of condenser-water pump(s) < Insert pump designation(s) >.
    - c. Startup of cooling tower < Insert cooling tower designation>.
    - d. Input Device: Flow switch in condenser-water circuit<Insert device designation>.
    - e. Output Device: [Starter] [DDC system command to starter] relay.
    - f. Display of the following at the operator's workstation:
      - 1) Chilled-water flow indication.
      - 2) Condenser-water flow indication.
      - 3) Chilled-water pump(s) on-off status.
      - 4) Chilled-water pump(s) on-off indication.
  - 2. Scope: Chilled-water system, including chilled-water pump(s), associated controls, and condenser-water system controls.
  - 3. Purpose:
    - a. Chilled-water pump(s) start.
    - b. Chilled-water pump(s) shutdown.
  - 4. Conditions of the Test:
    - a. Verify Start: Start with chilled-water pump enable-input device in the "disable" state to prevent pump start. Place the enable-input device in the "enable" state.
    - b. Verify Shutdown: Start with the enable-input device in the "enable" state to allow the pump(s) to run. Then place the enable-input device in the "disable" state.
  - 5. Acceptance Criteria:
    - a. Start: Chilled-water pump(s) start when, and only when, the enable-input device is in the "enable" state.
    - b. Shutdown: The enable-input device stops the chilled-water pump(s) when placed in the "disable" state.
- C. Alternative Chiller(s):
  - 1. Prerequisites: Installation verification of the following:
    - a. Input Device: [Electric alternator] [DDC system software] <Insert device designation>.
    - b. Output Device: [Chiller] [DDC system command to chiller] <Insert device designation> terminal strip.
    - c. Display:
      - 1) Chiller(s) on-off indication.
      - 2) Chiller failure alarm.
  - 2. Scope:
    - a. Chilled-water system and associated controls.
    - b. Condenser-water system and associated controls.
  - 3. Purpose:
    - a. Lead-lag rotation of chillers.
    - b. Replacement of failed chiller in rotation.
    - c. Adding and dropping chillers as follows: < Insert sequence and parameters>.
    - d. Replacement of failed chiller in add/drop sequence.
    - e. Chiller failure alarm initiation.
  - 4. Conditions of the Test:

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- a. Lead-Lag Rotation Chiller Start: Create a number of chilled-water system start-stop cycles equal to the number of chillers plus one.
- b. Lead-Lag Rotation Lead Chiller Fail: Disable the lead chiller while it is running.
- c. Lead-Lag Rotation Lag Chiller Fail: Disable a lag chiller while it is running.
- d. Lead-Lag Rotation Chiller Start Fail: Disable a chiller while it is in standby mode. Initiate a lead-lag rotation call for the disabled chiller to start.
- e. Add/Drop Sequence Increasing Demand: Increase chilled-water demand incrementally to observe the corresponding addition of chillers. Increase demand gradually as the load approaches the set point for adding the next chiller, to permit observation of the actual load at the time the next chiller is enabled.
- f. Add/Drop Sequence Decreasing Demand: Decrease chilled-water demand incrementally to observe the corresponding dropping of chillers. Decrease demand gradually as the load approaches the set point for dropping the next chiller, to permit observation of the actual load at the time the next chiller is disabled.
- 5. Acceptance Criteria:
  - a. Lead-Lag Rotation Chiller Start: On each chilled-water system start event, the [other] [next] chiller in rotation starts as the lead chiller, and the previous lead chiller is designated as the [last ]lag chiller.
  - b. Lead-Lag Rotation Lead Chiller Fail: When the lead chiller fails, the [**other**] [**next**] chiller in rotation starts as the lead chiller, and a chiller failure alarm is initiated for the failed chiller.
  - c. Lead-Lag Rotation Lag Chiller Fail: When the lag chiller fails, [the next chiller in rotation starts as the lead chiller, and ]a chiller failure alarm is initiated for the failed chiller.
  - d. Lead-Lag Rotation Chiller Start Fail: When a chiller fails to start, [the next chiller in rotation starts in its place, and ]a chiller failure alarm is initiated for the failed chiller.
  - Add/Drop Sequence Increasing Demand: Chillers are added at the specified load set point, plus or minus [5] <Insert number> percent. Chilled-water supply temperature remains stable within plus or minus [2.0 deg F] <Insert temperature> of set point.
  - f. Add/Drop Sequence Decreasing Demand: Chillers are dropped at the specified load set point, plus or minus [5] <Insert number> percent. Chilled-water supply temperature remains stable within plus or minus [2.0 deg F] <Insert temperature> of set point.
  - g. Add/Drop Sequence Operating Chiller Fail: When an operating chiller fails, the next chiller in sequence starts and a chiller failure alarm is initiated for the failed chiller.
  - h. Add/Drop Sequence Chiller Start Fail: When a chiller fails to start, the next chiller in sequence starts in its place and a chiller failure alarm is initiated for the failed chiller.

## 3.09 TERMINAL UNIT EQUIPMENT Cx TESTS

- A. VAV Terminal Air Units with Coils:
  - 1. Prerequisites: Installation verification of the following:
    - a. Occupancy Input Device: Occupancy sensor.
    - b. Occupancy Output Device: DDC system binary output.
    - c. Room Temperature Input Device: [Room thermostat] [Electronic temperature sensor].
    - d. Room Temperature Output Device: [**Pneumatic**] [**Electronic**] damper actuators and control-valve operators.
    - e. Display the following at the operator's workstation:
      - 1) Room/area served.
      - 2) Room occupied/unoccupied.
      - 3) Room temperature indication.
      - 4) Room temperature set point.

- 5) Room temperature set point, occupied.
- 6) Room temperature set point, unoccupied.
- 7) Air-damper position as percentage open.
- 8) Control-valve position as percentage open.
- 2. Scope: VAV terminal air units with hydronic coils in supply-air systems, and associated controls.
- 3. Purpose:
  - a. Occupancy-dependent room temperature set-point reset.
  - b. Room temperature control.
- 4. Conditions of the Test:
  - a. Cx Test Demonstration Sampling Rate: [10] < Insert number> percent of each model/size unit.
  - Temperature Control Occupied: Start with the room unoccupied. Occupy the room and observe the change to occupied status. Observe temperature control until room temperature is stable at occupied set point, plus or minus [1.0 deg F] < Insert temperature>.
  - c. Temperature Control Unoccupied: Start with the room occupied. Vacate the room and observe the change to unoccupied status. Observe temperature control until room temperature is stable at unoccupied set point, plus or minus [1.0 deg F] < Insert temperature>.
- 5. Acceptance Criteria:
  - a. Temperature Control Occupied:
    - 1) Control system status changes from "occupied" to "unoccupied" after the specified time.
    - Room temperature is stable at occupied set point, plus or minus [1.0 deg F]
      <Insert temperature> within [10] <Insert number> minutes of occupancy.
      Room temperature does not overshoot or undershoot set point by more than
      [2.0 deg F] <Insert temperature> during transition.
  - b. Temperature Control Unoccupied:
    - 1) Control system status changes from "unoccupied" to "occupied" [immediately] [after five minutes of continuous occupancy].
    - Room temperature is stable at unoccupied set point, plus or minus [1.0 deg F]
      <Insert temperature> within [30] <Insert number> minutes of occupancy.
- B. Finned Tube
- C. Radiant Panel

### 3.10 AIR-HANDLING SYSTEM Cx TESTS

- A. Supply Fan(s) Variable-Volume Control:
  - 1. Prerequisites: Installation verification of the following:
    - a. Volume Control Input Device: [Static-pressure transmitter] [Differential-pressure switch] sensing supply-duct static pressure referenced to conditioned-space static pressure.
    - b. Volume Control Output Device: [Receiver controller] [DDC system analog output] [DDC system analog output to digital-to-pneumatic transducer] to modulating damper actuator. Set inlet guide vanes to [minimum] [closed] position when fan is stopped.
    - volume Control Input Device: [Static-pressure transmitter] [Differential-pressure switch] sensing supply-duct static pressure referenced to conditioned-space static pressure.
    - d. Volume Control Output Device: [Receiver controller] [DDC system analog output] to motor speed controller. Set variable-speed drive to minimum speed when fan is stopped.
    - e. High-Pressure Input Device: Static-pressure transmitter sensing supply-duct static pressure referenced to static pressure outside the duct.

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- f. High-Pressure Output Device: [Receiver controller] [DDC system binary output] to [alarm panel] [motor starter].
- g. Display the following at the operator's workstation:
  - 1) Supply-fan-discharge static-pressure indication.
  - 2) Supply-fan-discharge static-pressure set point.
  - 3) Supply-fan airflow rate.
  - 4) Supply-fan [inlet vane position] [speed].
- 2. Scope: VAV supply fan units and associated controls.
- 3. Purpose:
  - a. Supply-air discharge static pressure control.
  - b. Response to excess supply-air discharge static pressure condition.
- 4. Conditions of the Test:
  - a. Minimum supply-air flow.
  - b. Midrange Supply-Air Flow: [50 to 60] < Insert number(s) > percent of maximum.
  - c. Maximum supply-air flow.
  - d. Excess supply-air discharge static pressure.
- 5. Acceptance Criteria:
  - a. At all supply-air flow rates, and during changes in supply-air flow, discharge air static pressure is at set point plus or minus [2] < Insert number > percent.
  - b. Fan stops and an alarm is initiated at the operator's workstation when supply-air discharge static pressure is at the excess static pressure, plus or minus [2] < Insert number> percent.
- B. Air-Handler Mixed-Air Control:
  - 1. Prerequisites: Installation verification of the following:
    - a. Minimum Position Input Device: [Time clock] [DDC system time schedule].
    - b. Output Device: [Receiver controller] [DDC system analog output] [DDC system analog output to digital-to-pneumatic transducer] to modulating damper actuator(s).
    - c. Heating Reset Input Device: [Room thermostat] [DDC system software].
    - d. [Supply] [Mixed]-Air Temperature Input Device: [Duct-mounted thermostat] [Electronic temperature sensor].
    - e. Cooling Reset Input Device: Outdoor- and return-air, duct-mounted [thermostats] [electronic temperature sensors].
    - f. Display the following at the operator's workstation:
      - 1) Mixed-air-temperature indication.
      - 2) Mixed-air-temperature set point.
      - 3) Mixed-air damper position.
  - 2. Scope: Air handler with mixed-air control and associated controls.
  - 3. Purpose:
    - a. Occupied time control.
    - b. Minimum damper position control.
    - c. Heating reset control.
    - d. [Supply] [Mixed]-air temperature control.
    - e. Cooling reset control.
    - f. Unoccupied time control.
  - 4. Conditions of the Test:
    - a. Occupied Time Control: Start in unoccupied schedule. Advance to occupied schedule time.
    - b. Minimum Damper Position Control: Command system to mode in which minimum damper position is required.
    - c. Heating Reset Control: Create a call for heating.
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- d. [Supply] [Mixed]-Air Temperature Control: Override [supply] [mixed]-air temperature set point to a value [2.0 deg F] <Insert temperature> above current [supply] [mixed]-air temperature.
- e. Cooling Reset Control: Override outdoor-air [temperature to a value that exceeds return-air temperature] [enthalpy to a value that exceeds return-air enthalpy].
- f. Unoccupied Time Control: Advance to unoccupied schedule time.
- g. Control Data Trend Log: Set up a data trend log of the following input device values and output device commands. Record data at [hourly] <Insert alternative recording frequency> intervals. Submit trend data for [24-hour] <Insert time> periods in which natural conditions require heating reset control, [supply] [mixed]-air temperature control, and cooling reset control.
  - 1) Minimum position input device.
  - 2) Heating reset input device.
  - 3) [**Supply**] [**Mixed**]-air temperature input device.
  - 4) Cooling reset input device.
- 5. Acceptance Criteria:
  - a. Occupied Time Control: Mixed-air control is active in occupied mode.
  - b. Minimum Damper Position Control: Controller [opens minimum outdoor-air dampers] [positions outdoor-air dampers to minimum position].
  - c. Heating Reset Control: Controller [closes minimum outdoor-air dampers] [sets outdoor-air dampers to minimum position].
  - d. [Supply] [Mixed]-Air Temperature Control: Controller modulates outdoor-, return-, and relief-air dampers to maintain temporary [supply] [mixed]-air temperature set point, plus or minus [1.0 deg F] < Insert temperature>.
  - e. Cooling Reset Control: Controller sets outdoor-air dampers to minimum position when outdoor-air [temperature exceeds return-air temperature] [enthalpy exceeds return-air enthalpy].
  - f. Unoccupied Time Control: Controller positions outdoor- and relief-air dampers closed and return-air dampers open.
  - g. Control Data Trend Log: Data verify control according to sequence of control.

# END OF SECTION 23 0800

## SECTION 23 0900 INSTRUMENTATION AND CONTROL FOR HVAC

# PART 1 GENERAL

# 1.01 SECTION INCLUDES

- A. Pressure Gauges.
- B. Pressure Gauge Taps.
- C. Thermometers.
- D. Thermometer Wells.

# 1.02 REFERENCES

- A. Air Movement and Control Association International, Inc.:
  - 1. AMCA 500 Test Methods for Louvers, Dampers, and Shutters.
- B. American Society of Mechanical Engineers:
  - 1. ASME B16.22 Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
- C. ASTM International:
  - 1. ASTM B32 Standard Specification for Solder Metal.
  - 2. ASTM B280 Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
  - 3. ASTM D1693 Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics.
- D. National Electrical Manufacturers Association:
  - 1. NEMA DC 3 Residential Controls Electrical Wall Mounted Room Thermostats.
- E. Underwriters Laboratory:
  - 1. UL 508A Standard for Industrial Control Panels.

## 1.03 SUBMITTALS

- A. Submit shop drawings under provisions of Division 01.
- B. Submit product data under provisions of Division 01.
- C. Product Data: Include list which indicates use, operating range, total range and location for manufactured components.
- D. Submit manufacturer's installation instructions under provisions of Division 01.

## 1.04 PROJECT RECORD DOCUMENTS

- A. Submit documents under provisions of Division 01.
- B. Accurately record actual locations of instrumentation.

## 1.05 ENVIRONMENTAL REQUIREMENTS

A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

# 1.06 QUALITY ASSURANCE

A. Control panels intended for general industrial use, operating from a voltage of 1000 volts or less shall be listed to UL 508A. This equipment is intended for installation in ordinary locations, in accordance with the National Electrical Code, ANSI/NFPA 70, where the ambient temperature does not exceed 40°C (104°F) maximum.

# PART 2 PRODUCTS

#### 2.01 ACCEPTABLE MANUFACTURERS - INSTUMENTATION

- A. Trerice.
- B. Weiss.
- C. Dwyer.
- D. Substitutions: Under provisions of Section Division 01.

#### 2.02 PRESSURE GAUGES

A. 3½" diameter diameter dial size with a flangeless cast aluminum case, stainless steel friction ring and glass window. Movement will be brass with a bronze bourdon tube and brass socket. Dial face will be white with black figures; pointer will be friction adjustable type. Accuracy will be ±1% of scale range, ASME B40.1 Grade 1A. Model 600C as manufactured by Trerice.

#### 2.03 PRESSURE GAUGE TAPS

A. Gauge Isolation Valve: Lever handle ball valve, forged brass body, chrome plated brass ball, viton o-rings for maximum 150 psig. Model Mini T-82-M as manufactured by Jomar.

#### 2.04 SOLAR POWERED DIGITAL THERMOMETER

A. Hi-impact ABS case; -50/ 300°F (-45/150° C) swtichable range; 1/2" LCD digits, wide ambient formula display; 1% accuracy; 1/10° between -19.9/199.9 °F (-28/93°C) resolution; 10 Lux (one foot-candle) LUX rating; 10 second update rate; -30/140°F (-35/60°C) ambient operating range; Glass passivated thermistor – NTC sensor. Model Digital Vari-angle as manufactured by Weiss Products.

#### 2.05 THERMOMETER SUPPORTS

- A. Socket: Brass separable sockets for thermometer stems with or without extensions as required, and with cap and chain.
- B. Flange: 3 inch outside diameter reversible flange, designed to fasten to sheet metal air ducts, with brass perforated stem.

#### 2.06 TEST PLUGS

A. Test Plug: 1/4 inch or 1/2 inch brass fitting and cap for receiving 1/8 inch outside diameter pressure or temperature probe with Nordel or Viton core for temperatures up to 350 degrees F.

#### PART 3 EXECUTION

#### 3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide proper grounding of all control wiring.
- C. Provide two pressure gauges per pump, installing taps on suction and discharge of pump. Pipe to gauge with isolation valve to each tapping.
- D. Thermometers for measuring fluid temperatures shall have stems with insertion lengths of roughly half of the pipe diameter; minimum insertion length will be 2". Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inch for installation of thermometer sockets. Select bulb length to reach centerline of pipe. Thermometers installed on tanks will have a minimum insertion length of 5".
- E. Where insulation thickness exceeds 2", provide a longer stem thermometer with an extension neck, stainless steel separable thermowell. The extension neck shall be at least 2" long.
- F. Coat thermometer stem with heat transfer paste prior to installing into the thermowell.
- G. Install thermometer sockets and flanges adjacent to controls system thermostat, transmitter, or sensors.

- H. Provide instruments with scale ranges selected according to service with largest appropriate scale and range selected so that the operating temperature or pressure of the material being measured will fall approximately in the middle of the scale.
- I. Install gauges and thermometers in locations where they are easily read from normal operating level.
- J. Thermometers for measuring air temperatures shall have a perforated guard stem and a mounting flange.
- K. Install solar thermometers in locations where solar cells are activated by fixed interior lighting.

## 3.02 IDENTIFICATION

- A. All controllers, transmitters, switches, thermostats, gauges, and devices with adjustable setpoints shall be permanently tagged for identification.
- B. The tagging scheme shall be reflected on the control drawings. Also, include plain language label.

### 3.03 POWER AND INTERFACE CONNECTIONS

- A. Coordinate fully with other Divisions of this specification to provide all necessary power connections and interface connections for a complete and fully operable control system.
- B. Electric wiring and wiring connection required for the installation of the control system as herein specified shall be provided by the Controls Contractor.
- C. Line voltage wiring shall be installed in raceways.
- D. Low voltage wiring shall be physically protected and installed in raceways.
- E. All wiring shall comply with the requirements of local and national electrical codes and with Division 26.
- F. All wiring and conduit shall be installed by qualified personnel with electrical certificate of fitness.

#### 3.04 WARRANTY

A. Upon completion of the project, as defined either by acceptance of the building by the Owner or use of the equipment by the Owner for its intended purposes - whichever occurs first, a warranty period of one (1) year shall commence. The warranty shall consist of a commitment by the controls contractor to provide, at no cost to the Owner, parts and labor as required to repair or replace such parts of the control system that prove inoperative due to defective materials or installation practices. This warranty expressly excludes routine service, such as instrument calibration.

### 3.05 PRESSURE GAUGE SCHEDULE

| LOCATION                | SCALE RANGE   |
|-------------------------|---------------|
| Pumps less than 40' TDH | 0 - 30 PSIG   |
| Pumps more than 40' TDH | 0 - 60 PSIG   |
| Heating Water System    | 0 - 30 PSIG   |
| Others                  | As applicable |

#### 3.06 DIGITAL THERMOMETER SCHEDULE

| LOCATION                                     | SCALE RANGE   |
|----------------------------------------------|---------------|
| Heating /Water System                        | 0 - 200° F    |
| Domestic Hot Water Supply and Recirculating. | 0 - 200° F    |
| Others                                       | As applicable |

## END OF SECTION 23 0900

#### SECTION 23 0923 DIRECT DIGITAL CONTROL SYSTEM FOR HVAC

#### PART 1 GENERAL

#### **1.01 SECTION INCLUDES**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Furnish a totally native BACnet-based system, including an operator's workstation using Microsoft Windows 10 as the operating system and shall be based on a distributed control system in accordance with this specification. The operator's workstation, all building controllers, application controllers, and all input/output devices shall communicate using the protocols and network standards as defined by ANSI/ASHRAE Standard 135–2016, BACnet.
- C. Provide all necessary BACnet-compliant hardware and software to meet the system's functional specifications. Provide Protocol Implementation Conformance Statement (PICS) for Windows-based control software and every controller in system, including unitary controllers.
- D. Prepare individual hardware layouts, interconnection drawings, and software configuration from project design data.
- E. Implement the detailed design for all analog and binary objects, system databases, graphic displays, logs, and management reports based on control descriptions, logic drawings, configuration data, and bid documents.
- F. Design, provide, and install all equipment cabinets, panels, data communication network cables needed, and all associated hardware.
- G. Provide and install all interconnecting cables between supplied cabinets, application controllers, and input/output devices.
- H. Provide and install all interconnecting cables between all operator's terminals and peripheral devices (such as printers, etc.) supplied under this section.
- I. Provide complete manufacturer's specifications for all items that are supplied. Include vendor name of every item supplied.
- J. Provide supervisory specialists and technicians at the job site to assist in system startup, and commissioning.
- K. Provide a comprehensive operator and technician training program as described herein.
- L. Provide as-built documentation, operator's terminal software, diagrams, and all other associated project operational documentation (such as technical manuals) on approved media, the sum total of which accurately represents the final system.
- M. Provide new sensors, dampers, valves, and install only new electronic actuators. No used components shall be used as any part or piece of installed system.
- N. The system shall be monitored on the existing Central Server at YKSD facilities office in Bethel. Coordinate with Owner for integration, networking connections and hosting requirements on existing central server.

#### 1.02 SYSTEM DESCRIPTION

- A. Distributed logic control systems complete with all software and hardware functions shall be provided and installed. System shall be completely based on ANSI/ASHRAE Standard 135-2016, BACnet. This system is to control all mechanical equipment, including all unitary equipment such as pumps, air handlers, heat exchangers, etc. and any other listed equipment using native BACnet-compliant components.
- B. Operator's workstation software shall be Microsoft Windows 10 as the computer operating system. The Energy Management and Control System (EMCS) application program shall be written to communicate specifically utilizing BACnet protocols. Software shall include password

protection, scheduling (including optimum start), alarming, logging of historical data, full graphics including animation, after-hours billing program, demand limiting, full suite of field engineering tools including graphical programming and applications.

- C. Building controllers shall include complete energy management software, including scheduling building control strategies with optimum start and logging routines. All energy management software and firmware shall be resident in field hardware and shall not be dependent on the operator's terminal. Operator's terminal software is to be used for access to field-based energy management functions only. Provide zone-by-zone direct digital logic control of space temperature, scheduling, runtime accumulation, equipment alarm reporting, and override timers for after-hours usage. All application controllers all equipment and any other piece of controlled equipment shall be fully programmable. Application controllers shall be mounted next to controlled equipment and communicate with building controller via BACnet LAN.
- D. Room sensors shall allow room setpoint adjustment within preset limits.
- E. Provide all alarms, manual control, and status indication functions at local CRT and central host as indicated under the sequence of operation, Specification Section 230993.

## 1.03 QUALITY ASSURANCE

- A. Responsibility: The supplier of the EMCS shall be responsible for inspection and Quality Assurance (QA) for all materials furnished.
- B. Manufacturer Qualifications: Company specializing in manufacturing products specified. Five years documented experience.
  - 1. BAS System: Designed, installed, commissioned, and serviced by manufacturer authorized and trained personnel. Support facility within Alaska with technical staff, spare parts, and test and diagnostic equipment.
  - 2. Contractor: Full-time, on-site, experienced project manager responsible for supervision of design, installation, start-up and commissioning or BAS.
  - 3. Materials and Equipment: Latest standard design complying with requirements.
  - 4. UL Listed under Standard UL 916, category PAZX: BAS peer-to-peer network controllers, central system controllers and local user displays.
  - 5. Electronic Equipment: Conform to requirements of FCC Regulation, Part 15, Governing Radio Frequency Electromagnetic Interference and be so labeled.
  - 6. Control System: Engineered, programmed and supported by representative's local office/ No less than four hour response, 24 hours a day, 7 days a week.
- C. Installer Qualifications: Two years documented experience with projects of similar scope and complexity.
- D. Source Limitations: Each product type to be from a single manufacturing source

## **1.04 SPECIFICATION NOMENCLATURE AND DEFINITIONS**

- A. Acronyms Used in this Specification:
  - 1. ACM: Ascent Control Module.
  - 2. Actuator: Device that opens or closes valve or damper in response to control signal.
  - 3. AI: Analog Input.
  - 4. AO: Analog Output.
  - 5. Analog: Continuously variable state over stated range of values.
  - 6. BAS: Building Automation System.
  - 7. BMS: Building Management System
  - 8. Compass: Alerton Workstation Software.

- 9. DDC: Direct Digital Control.
- 10. FC: Fail closed position of control device or actuator. Device moves to closed position on loss of control signal or energy source.
- 11. FO: Fail open position of control device or actuator. Device moves to open position on loss of control signal or energy source.
- 12. GUI: Graphical User Interface.
- 13. HMI: Human Machine Interface.
- 14. HVAC: Heating, Ventilating and Air Conditioning.
- 15. LAN: Local Area Network.
- 16. MSDB Microsoft SQL Database
- 17. Modulating: Movement of control device through an range of values, proportional to an infinitely variable input value.
- 18. Motorized: Control device with actuator.
- 19. NC: Normally closed position of switch after control signal is removed or normally closed position of manually operated valves or dampers.
- 20. NO: Normally open position of switch after control signal is removed; or the open position of a controlled valve or damper after the control signal is removed; or the usual position of a manually operated valve.
- 21. Operator Workstation: PC running Compass software and any required software tools applicable for day to day operation of the BMS.
- 22. P: Proportional control; control mode with continuous linear relationship between observed input signal and final controlled output element.
- 23. PI: Proportional-Integral control, control mode with continuous proportional output plus additional change in output based on both amount and duration of change in controller variable (reset control).
- 24. PICS: BACnet Product Interoperability Compliance Statement.
- 25. PID: Proportional-Integral-Derivative control, control mode with continuous correction of final controller output element versus input signal based on proportional error, its time history (reset) and rate at which it's changing (derivative).
- 26. Point: Analog or discrete instrument with addressable database value.
- 27. VLC: VisuaLogic® Controller.
- 28. WAN: Wide Area Network.

## 1.05 REFERENCE STANDARDS LATEST ADOPTED EDITION

- A. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE).
- B. ANSI/ASHRAE Standard 135-2016, BACnet.
- C. International Building Code (IBC), including local amendments.
- D. UL 916 Underwriters Laboratories Standard for Energy Management Equipment. Canada and the US.
- E. National Electrical Code (NEC).
- F. FCC Part 15, Subpart J, Class A.

#### 1.06 SUBMITTALS

- A. Submit under the provisions of Division 01.
- B. Drawings:

- 1. The system supplier shall submit engineered drawings, control sequence, and bill of materials for approval.
- 2. Drawings shall be submitted in the following standard sizes: 11" x 17" (ANSI B).
- C. System Documentation. Include the following in submittal package:
  - 1. System configuration diagrams in simplified block format.
  - 2. All input/output object listings and an alarm point summary listing.
  - 3. Electrical drawings that show all system internal and external connection points, terminal block layouts, and terminal identification.
  - 4. Complete bill of materials, valve schedule and damper schedule.
  - 5. Manufacturer's instructions and drawings for installation, maintenance, and operation of all purchased items.
  - 6. Overall system operation and maintenance instructions including preventive maintenance and troubleshooting instructions.
  - 7. For all system elements operator's workstation(s), building controller(s), application controllers, routers, and repeaters, provide BACnet Protocol Implementation Conformance Statements (PICS) as per ANSI/ASHRAE Standard 135-2016.
  - 8. Provide complete description and documentation of any proprietary (non-BACnet) services and/or objects used in the system.
  - 9. A list of all functions available and a sample of function block programming that shall be part of delivered system.
  - 10. Submit manufactures warranty and ensure forms have been filled out in the Government's name and registered with the manufacturer.

### 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store and handle in strict compliance with manufacturer's written instructions and recommendations.
- B. Protect from damage due to weather, excessive temperature, and construction operations.

#### **1.08 PROJECT CONDITIONS**

A. Maintain environmental conditions within limits recommended by manufacturer for optimum results. Do not install products in environmental conditions outside recommended limits.

#### 1.09 WARRANTY

- A. Provide under the provisions of Division 01.
- B. Provide one (1) year manufacturer's warranty for field programmable micro-processor based units from the time of completion

#### PART 2 PRODUCTS

#### 2.01 APPROVED MANUFACTURERS

- A. Alerton Technologies, Inc.
- B. Substitutions: No substitutions permitted.

#### 2.02 SYSTEM DESCRIPTION

- A. Except as indicated, system supplier to secure and pay for all permits, inspections, and certifications required for his work, and arrange for necessary approvals by the governing authorities.
- B. BAS: Network of interoperable, stand-alone building controllers, field controllers on logical networks, graphics and programming for complete system.
  - 1. Password access to features, functions and data contained in BAS.

- 2. Software for complete operating system, as specified, as integral part of supervisory controller. Not dependent upon higher level computer for execution.
- 3. System Backup: Electronic copies of software, project graphics, setpoints, and system parameters. Backups will allow Owner to restore system if necessary.
- C. Distributed Logic Control System: Software and hardware per ANSI/ASHRAE Standard 135.
  - 1. System controls mechanical equipment, including unitary equipment and generators using native BACnet-compliant components.
  - 2. Operator's Workstation Software: BAS/BMS application written utilizing BACnet protocols. Software functions to include password protection, scheduling, alarming, logging of historical data, full graphics including animation, after-hours billing, demand limiting, and full suite of field engineering tools including graphical programming applications.
  - 3. Programming to make future changes to e system, controllers, field level devices, system changes, scheduling, and trending.
  - 4. Field engineering tools, graphical programming, graphical displays, and applications.
  - 5. Building Controllers: Building management software, with scheduling building control strategies and optimum start and logging.
  - 6. Energy Management Software/Firmware: Resident in field hardware.
  - 7. Operator's Terminal Software: Used to access field-based building management functions. Zone-by-zone direct digital logic control of space temperature, scheduling, runtime accumulation, equipment alarm reporting, and override timers for after-hours usage.
  - 8. Room Sensors: Viewable digital readout of room temperature, and outside air. Adjustable room setpoint within preset limits and set desired override time. Start and stop unit from digital sensor. Include wiring and firmware for field service mode allowing technicians to balance VAV zones and access parameters in zone controller directly from room sensor. Field service mode must have ability to be locked out.
  - 9. Application Controllers: Terminal units and other controlled equipment to be programmable. Mount next to controlled equipment. Communicate with building controller through BACnet LAN.

## 2.03 OPERATOR'S WORKSTATION

- A. Alterton Ascent Compass Software.
- B. General structure of workstation interaction shall be a standard client/server relationship. Server shall be used to archive data and store system database. Clients shall access server for all archived data. Each client shall include flexibility to access graphics from server or local drive.
- C. BACnet Conformance:
  - 1. Operator's workstation shall as a minimum support Point-to-Point (PTP) and Ethernet BACnet LAN types. It shall communicate directly via these BACnet LANs as a native BACnet device. Operator's terminal shall comply with the requirements of a BACnet conformance class 3 device and support all BACnet services necessary to provide the following BACnet functional groups: a. Clock Functional Group.
    - a. Event Response Functional Group.
    - b. Time Master Functional Group.
    - c. Device Communications.
  - 2. Please refer BACnet Functional Groups, in the BACnet standard for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All proprietary services, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.

- 3. Standard BACnet object types accessed by the workstation shall include as a minimum: Analog Value, Analog Input, Analog Output, Binary Value, Binary Input, Binary Output, Calendar, Device, Event Enrollment, File, Notification Class, Program and Schedule object types. All proprietary object types, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.
- 4. The Operator Workstation shall comply with Annex J of the BACnet specification for IP connections. This device shall use Ethernet to connect to the IP internetwork, while using the same Ethernet LAN for non-IP communications to other BACnet devices on the LAN. Must support interoperability on wide area networks (WANs) and campus area networks (CANs). Workstation shall support Foreign Device Registration to allow temporary workstation connection to IP network.
- 5. Displays:
  - a. Operator's workstation shall display all data associated with project as called out on drawings and/or object type list supplied. Graphic files shall be created using digital, full color photographs of system installation, AutoCAD ™ or Visio ™ drawing files of field installation drawings and wiring diagrams from as-built drawings. Operator's workstation shall display all data using three-dimensional graphic representations of all mechanical equipment. System shall be capable of displaying graphic file, text, and dynamic object data together on each display and shall include animation. Information shall be labeled with descriptors and shall be dynamically updated without any action by the user. Workstation shall allow user to change all field-resident EMCS functions associated with the project, such as setpoints, weekly schedules, exception schedules, etc. from any screen no matter if that screen shows all text or a complete graphic display. This shall be done without any reference to object addresses or other numeric/mnemonic indications.
  - b. All displays and programming shall be generated and customized by the local EMCS supplier and installer.
  - Binary objects shall be displayed as ACTIVE/INACTIVE/NULL or with customized text. C. Text shall be justified left, right or center as selected by the user. Also, allow binary objects to be displayed as individual change-of-state graphic objects on the display screen such that they overlay the system graphic. Each binary object displayed in this manner shall be assigned up to three graphic files for display when the point is ON. OFF or in alarm. For binary outputs, toggle the object's commanded status when the graphic item is selected with the system mouse. Similarly, allow the workstation operator to toggle the binary object's status by selecting with the mouse a graphic of a switch or light, for example, which then displays a different graphic (such as an "ON" switch or lighted lamp). Additionally, allow binary objects to be displayed as an animated graphic. Animated graphic objects shall be displayed as a sequence of multiple graphics to simulate motion. For example: when a pump is in the OFF condition, display a stationary graphic of the pump. When the operator selects the pump graphic with the mouse, the represented object's status is toggled and the graphic of the pump's impeller rotates in a time-based animation. The operator shall be able to click on an animated graphical object or switch it from the OFF position to ON, or ON to OFF. Allow operator to change graphic file assignment and also create new and original graphics online. System shall be supplied with a library of standard graphics, which may be used unaltered or modified by the operator. Systems that do not allow customization or creation of new graphic objects by the operator (or with thirdparty software) shall not be allowed.
  - d. Analog objects shall be displayed with operator modifiable units. Analog input objects may also be displayed as individual graphic items on the display screen as an overlay

to the system graphic. Each analog input object may be assigned a minimum of five graphic files, each with high/low limits for automatic selection and display of these graphics. As an example, a graphic representation of a thermometer would rise and fall in response to either the room temperature or its deviation from the controlling setpoint. Analog output objects, when selected with the mouse, shall be displayed as a prompted dialog (text only) box. Selection for display type shall be individual for each object. Analog object values may be changed by selecting either the "increase" or "decrease" arrow in the analog object spinner box without using the keypad. Pressing the button on the right side of the analog object spinner box allows direct entry of an analog value and accesses various menus where the analog value may be used, such as trendlogs.

- e. Analog objects may also be assigned to an area of a system graphic, where the color of the defined area changes based on the analog object's value. For example, an area of a floor-plan graphic served by a single control zone would change color with respect to the temperature of the zone or its deviation from setpoint. All editing and area assignment shall be created or modified online using simple icon tools.
- f. A customized menu label (push-button) shall be used for display selection. Menu items on a display shall allow penetration to lower level displays or additional menus. Dynamic point information and menu label push buttons may be mixed on the same display to allow sub-displays to exist for each item. Each display may be protected from viewing unless operator has appropriate security level. A security level may be assigned to each display and system object. The menu label shall not appear on the graphic if the operator does not have the appropriate security level.
- g. A mouse shall be used to move the pointer arrow to the desired item for selection of new display or to allow the operator to make changes to object data.
- 6. Password Protection:
  - a. Provide security system that prevents unauthorized use unless operator is logged on. Access shall be limited to operator's assigned functions when user is logged on. This includes displays as outlined above.
  - b. Each operator's terminal shall provide security for 200 users minimum. Each user shall have an individual User ID, User Name and Password. Entries are alphanumeric characters only and are case sensitive (except for User ID). User ID shall be 0–8 characters, User Name shall be 0–29 characters, and Password shall be 4–8 characters long. Each system user shall be allowed individual assignment of only those control functions and menu items to which that user requires access. All passwords, user names, and access assignments shall be adjustable online at the operator's terminal. Each user shall also have a set security level, which defines access to displays and individual objects the user may control. System shall include 10 separate and distinct security levels for assignment to users.
  - c. System shall include an Auto Logout Feature that shall automatically logout user when there has been no keyboard or mouse activity for a set period of time. Time period shall be adjustable by system administrator. Auto Logout may be enabled and disabled by system administrator. Operator terminal shall display message on screen that user is logged out after Auto Logout occurs.
- 7. Operator Activity Log:
  - a. Operator Activity Log shall be included with system that tracks all operator changes and activities. System shall track what is changed in the system, who performed this change, date and time of system activity and value of the change before and after operator activity. Operator shall be able to display all activity, sort the changes by user and also by operation.

- b. Log shall be gathered and archived to hard drive on operator workstation as needed. Operator shall be able to export data for display and sorting in a spreadsheet.
- c. Any displayed data, that is changeable by the operator, may be selected using the right mouse button and the operator activity log shall then be selectable on the screen. Selection of the operator activity log using this method shall show all operator changes of just that displayed data.
- 8. Scheduling:
  - a. Operator's workstation shall show all information in easy-to-read daily format including calendar of this month and next. All schedules shall show actual ON/OFF times for day based on scheduling priority. Priority for scheduling shall be events, holidays and daily with events being the highest.
  - b. Operator shall be able to change all information for a given weekly or exception schedule if logged on with the appropriate security access.
  - c. System shall include a Schedule Wizard for set up of schedules. Wizard shall walk user through all steps necessary for schedule generation. Wizard shall have its own pull-down selection for startup or may be started by right clicking on value displayed on graphic and then selecting Schedule.
  - d. Scheduling shall include optimum start based on outside air temperature, current heating/cooling setpoints, indoor temperature and history of previous starts. Each and every individual zone shall have optimum start time independently calculated based on all parameters listed. User shall input schedules to set time that occupied setpoint is to be attained. Optimum start feature shall calculate the startup time needed to match zone temperature to setpoint. User shall be able to set a limit for the maximum startup time allowed.
- 9. Alarm Indication and Handling:
  - a. Operator's workstation shall provide audible, visual, and printed means of alarm indication. The alarm dialog box shall always become the top dialog box regardless of the application(s), currently running. Printout of alarms shall be sent to the assigned terminal and port.
  - b. System shall provide log of alarm messages. Alarm log shall be archived to the hard disk of the system operator's terminal. Each entry shall include a description of the event-initiating object generating the alarm. Description shall be an alarm message of at least 256 characters in length. Entry shall include time and date of alarm occurrence, time and date of object state return to normal, time and date of alarm acknowledgment and identification of operator acknowledging alarm.
  - c. Alarm messages shall be in user-definable text (English or other specified language) and shall be entered either at the operator's terminal or via remote communication.
  - d. System shall include an Alarm Wizard for set up of alarms. Wizard shall walk user through all steps necessary for alarm generation. Wizard shall have its own pull-down selection for startup or may be started by right clicking on value displayed on graphic and then selecting alarm setup.
- 10. Trendlog Information:
  - a. System server shall periodically gather historically recorded data stored in the building controllers and archive the information Archived files shall be appended with new sample data, allowing samples to be accumulated. Systems that write over archived data shall not be allowed, unless limited file size is specified. Samples may be viewed at the operator's workstation. Operator shall be able to scroll through all trended data. All trendlog information shall be displayed in standard engineering units.

- b. Software shall be included that is capable of graphing the trend logged object data. Software shall be capable of creating two-axis (x,y) graphs that display up to ten object types at the same time in different colors. Graphs shall show object values relative to time.
- c. Operator shall be able to change trend log setup information. This includes the information to be logged as well as the interval at which it is to be logged. All input, output, and value object types in the system may be logged. All operations shall be password protected. Setup and viewing may be accessed directly from any and all graphics on which object is displayed.
- d. System shall include a trend Wizard for setup of logs. Wizard shall walk user through all necessary steps. Wizard shall have its own pull-down selection for startup, or may be started by right clicking on value displayed on graphic, and then selecting Trendlogs from the displayed menu.
- 11. Energy Log Information:
  - a. System server shall be capable of periodically gathering energy log data stored in the field equipment and archive the information. Archive files shall be appended with new data, allowing data to be accumulated. Systems that write over archived data shall not be allowed unless limited file size is specified. Display all energy log information in standard engineering units.
  - b. All data shall be stored in data base file format for direct use by third-party programs. Operation of system shall stay completely online during all graphing operations.
  - c. Operator shall be able to change the energy log setup information as well. This includes the meters to be logged, meter pulse value, and the type of energy units to be logged. All meters monitored by the system may be logged. System shall support using flow and temperature sensors for BTU monitoring.
  - d. System shall display archived data in tabular format form for both consumption and peak values. Data shall be shown in hourly, daily, weekly, monthly and yearly formats. In each format the user shall be able to select a specific period of data to view.
- 12. Demand Limiting:
  - a. System shall include demand limiting program that includes two types of load shedding. One type of load shedding shall shed/restore equipment in binary fashion based on energy usage when compared to shed and restore settings. The other type of shedding shall adjust operator selected control setpoints in an analog fashion based on energy usage when compared to shed and restore settings. Shedding may be implemented independently on each and every zone or piece of equipment connected to system.
  - b. Binary shedding shall include minimum of 5 priority levels of equipment shedding. All loads in a given priority level shall be shed before any loads in a higher priority level are shed. Load shedding within a given priority level shall include two methods. In one the loads shall be shed/restored in a "first off-first on" mode and in the other the loads are just shed/restored in a linear fashion.
  - c. Analog shed program shall generate a ramp that is independently used by each individual zone or individual control algorithm to raise the appropriate cooling setting and lower appropriate heating setting to reduce energy usage.
  - d. Status of each and every load shed program shall be capable of being displayed on every operator terminal connected to system. Status of each load assigned to an individual shed program shall be displayed along with English description of each load.
- 13. Configuration/Setup:
  - a. Provide means for operator to display and change system configuration. This shall include, but not be limited to, system time, day of the week, date of daylight savings

set forward/set back, printer termination, port addresses, modem port and speed, etc. Items shall be modified using understandable terminology with simple mouse/cursor key movements.

- 14. Field Engineering Tools:
  - a. Operator's workstation software shall include field-engineering tools for programming all controllers supplied. All controllers shall be programmed using graphical tools that allow the user to connect function blocks on screen that provide sequencing of all control logic. Function blocks shall be represented by graphical displays that are easily identified and distinct from other types of blocks. Graphical programming that uses simple rectangles and squares is not acceptable.
  - b. User shall be able to pick graphical function block from menu and place on screen. Provide zoom in and zoom out capabilities. Function blocks shall be downloaded to controller without any reentry of data.
  - c. Programming tools shall include a real time operation mode. Function blocks shall display real time data and be animated to show status of data inputs and outputs when in real time operation. Animation shall show change of status on logic devices and countdown of timer devices in graphical format.
  - d. Field engineering tools shall also include a database manager of applications that include logic files for controllers and associated graphics. Operator shall be able to select unit type, input/output configuration and other items that define unit to be controlled. Supply minimum of 250 applications as part of workstation software.
  - e. Field engineering tool shall include Device Manager for automatic detection of devices connected anywhere on the BACnet network by scanning of the entire network. This function shall display device instance, network identification, model number and description of connected devices. It shall record and display software file loaded into each controller. A copy of each file shall be stored on the computer's hard drive. If needed, this file shall be downloaded to the appropriate controller by selection using the mouse.
  - f. System shall include backup/restore function that will back up entire system to selected medium and then restore system from that media.
- 15. Workstation Hardware:
  - a. Provide operator's workstation(s) at location(s) noted on the plans.
  - b. Workstation/Server Computer Minimum Requirements:
    - 1) 2.5 Ghz (or better), one or more dual-core or quad-core processors.
    - 2) 8 MB RAM or better.
    - 3) 1 TB hard disk or better.
    - 4) High-performance graphics adapter.
    - 5) Ethernet 100/100 network interface card.
    - 6) Keyboard, monitor, mouse,
    - 7) Windows 10.
    - 8) Software:
      - a) At the conclusion of project, contractor shall update the School District Server with database, programming and graphics for this project. A complete backup will be made of the entire school district DDC system and stored per School Districts instructions. This backup shall allow the owner to completely restore the system in the case of a computer malfunction.

# 2.04 BUILDING CONTROLLER

- A. General:
  - 1. All communication with operator workstation and all application controllers shall be via BACnet. Building controller shall incorporate as a minimum, the functions of a 2-way BACnet router. Controller shall route BACnet messages between the highspeed LAN (Ethernet 10/100/1000MHz) and master slave token passing (MS/TP)

LANs,

- a. Each MS/TP LAN must be software configurable from 9.6 to 115.4Kbps.
- b. Controller shall support two gigabit speed Ethernet (10/100/1000) ports.
- c. The direct access port must be a female DB-9 connector supporting BACnet temporary PTP connection of a portable BACnet operator terminal at 9.6 to 115.2 Kbps over RS-232 null modem cable.
- 2. Building controller shall be capable of providing global control strategies for the system based on information from any objects in the system regardless if the object is directly monitored by the controller or by another controller. The program that implements these strategies shall be completely flexible and user definable. Any systems utilizing factory pre-programmed global strategies that cannot be modified by field personnel on-site or downloaded via remote communications are not acceptable. Changing global strategies via firmware changes is also unacceptable.
- 3. Programming shall be object-oriented using control function blocks, supporting DDC functions, 1000 Analog Values and 1000 Binary Values. All flowcharts shall be generated and automatically downloaded to controller. Programming tool shall be resident on workstation and the same tool used for all controllers.
- 4. Provide means to graphically view inputs and outputs to each program block in realtime as program is executing. This function may be performed via the operator's workstation or field computer.
- 5. Building controller shall provide battery-backed real-time (hardware) clock functions.
- 6. Controller shall have a memory needed to ensure high performance and data reliability. Battery shall retain static RAM memory and real-time clock functions for a minimum of 1.5 years (cumulative).
- 7. Global control algorithms and automated control functions should execute via 32-bit processor.
- 8. Controller installation shall include memory-free gel-cell battery providing ongoing power conditioning and noise filtering for operation data integrity. It shall provide up to 5 minutes of powerless operation for orderly shutdown and data backup.
- B. BACnet Conformance:
  - Building Controller shall as a minimum support Point-to-Point (PTP), MS/TP and Ethernet BACnet LAN types. It shall communicate directly via these BACnet LANs as a native BACnet device and shall support simultaneous routing functions between all supported LAN types. Global controller shall be a BACnet conformance class 3 device and support all BACnet services necessary to provide the following BACnet functional groups:
    - a. Clock Functional Group.
    - b. Files Functional Group.
    - c. Reinitialize Functional Group.
    - d. Device Communications Functional Group.
    - e. Event Initiation Functional Group.

- 2. Please refer to section 22.2, BACnet Functional Groups, in the BACnet standard for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All proprietary services, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.
- 3. Standard BACnet object types supported shall include as a minimum: Analog Value, Binary Value, Calendar, Device, File, Group, Notification Class, Program and Schedule object types. All proprietary object types, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.
- 4. The Building Controller shall comply with Annex J of the BACnet specification for IP connections. This device shall use Ethernet to connect to the IP internetwork, while using the same Ethernet LAN for non-IP communications to other BACnet devices on the LAN. Must support interoperability on wide area networks (WANs) and campus area networks (CANs) and function as a BACnet Broadcast Management Device (BBMD).
- C. Schedules:
  - 1. Each building controller shall support a minimum of 250 BACnet Schedule Objects and 250 BACnet Calendar Objects.
- D. Logging Capabilities:
  - 1. Each building controller shall log as minimum 1000 trendlogs. Any object in the system (real or calculated) may be logged. Sample time interval shall be adjustable at the operator's workstation.
  - 2. Logs may be viewed both on-site or off-site via remote communication.
  - 3. Building controller shall periodically upload trended data to networked operator's workstation for long term archiving if desired.
  - 4. Archived data stored in database format shall be available for use in third-party spreadsheet or database programs. E. Alarm Generation:
  - 5. Alarms may be generated within the system for any object change of value or state either real or calculated. This includes things such as analog object value changes, binary object state changes, and various controller communication failures.
  - 6. Each alarm may be dialed out as noted in paragraph 2 above.
  - 7. Alarm log shall be provided for alarm viewing. Log may be viewed on-site at the operator's terminal or off-site via remote communications.
  - 8. Controller must be able to handle up to 1500 alarm setups stored as BACnet event enrollment objects system destination and actions individually configurable.

## 2.05 APPLICATION CONTROLLERS

- A. Provide one or more native BACnet application controllers for each air handler and provide native BACnet application controllers as needed for control that adequately cover all objects listed in object list. All controllers shall interface to building controller via MS/TP LAN using BACnet protocol. No gateways shall be used. Controllers shall include input, output and self-contained logic program as needed for complete control of units. Controllers shall be fully programmable using graphical programming blocks. Programming tool shall be resident on operator workstation and be the same tool as used for the building controller. No auxiliary or non-BACnet controllers shall be used.
- B. BACnet Conformance
  - 1. Application controllers shall as a minimum support MS/TP BACnet LAN types. They shall communicate directly via this BACnet LAN at 9.6, 19.2, 38.4 and 76.8 Kbps, as native

BACnet devices. Application controllers shall be of BACnet conformance class 3 and support all BACnet services necessary to provide the following BACnet functional groups:

- a. Files Functional Group.
- b. Reinitialize Functional Group.
- c. Device Communications Functional Group.
- 2. Please refer to BACnet Functional Groups, in the BACnet standard, for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All proprietary services, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.
- 3. Standard BACnet object types supported shall include as a minimum—Analog Input, Analog Output, Analog Value, Binary Input, Binary Output, Binary Value, Device, File, and Program object types. All proprietary object types, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.
- 4. Application controllers shall include universal inputs with 10-bit resolution that accept 3K and 10K thermistors, 0–10VDC, 0–5 VDC, 4–20 mA and dry contact signals. Any input on a controller may be either analog or digital with a minimum of 3 inputs that accept pulses. Controller shall also include support and modifiable programming for interface to intelligent room sensor with digital display. Controller shall include binary and analog outputs on board. Analog outputs shall be switch selectable as either 0–10VDC or 0–20mA. Software shall include scaling features for analog outputs. Application controller shall include 24VDC voltage supply for use as power supply to external sensors.
- 5. All program sequences shall be stored on board application controller in nonvolatile flash memory. No batteries shall be needed to retain logic program. All program sequences shall be executed by controller 10 times per second and capable of multiple PID loops for control of multiple devices. All calculations shall be completed using floating-point math and system shall support display of all information in floatingpoint nomenclature at operator's terminal. Programming of application controller shall be completely modifiable in the field over installed BACnet LANs or remotely via modem interface. Operator shall program logic sequences by graphically moving function blocks on screen and tying blocks together on screen. Application controller shall be programmed using programming tools as described in operator's terminal section.
- 6. Application controller shall include support for intelligent room sensor. Display on intelligent room sensor shall be programmable at application controller and include an operating mode and a field service mode. All button functions and display data shall be programmable to show specific controller data in each mode based on which button is pressed on the sensor. See sequence of operation for specific display requirements at intelligent room sensor.

# 2.06 EXPANDABLE APPLICATION CONTROLLERS

- A. General:
  - 1. Expandable application controller shall be capable of providing control strategies for the system based on information from any or all connected inputs. The program that implements these strategies shall be completely flexible and user definable. Any systems utilizing factory pre-programmed global strategies that cannot be modified by field personnel on-site via simple download are not acceptable. Changing global strategies via firmware changes is also unacceptable. Program execution of controller shall be a minimum of once per second.
  - 2. Programming shall be object-oriented using control program blocks. Controller shall support a minimum of 500 Analog Values and 500 Binary Values. Each and every analog and binary value shall support standard BACnet priority arrays. Programming tool shall be provided

with system and shall be the same tool that is used to program the Building Controller. All flowcharts shall be generated and automatically downloaded to controller. No re-entry of database information shall be necessary.

- 3. Provide means to graphically view inputs and outputs to each program block in realtime as program is executing. This function may be performed via the operator's terminal or field computer.
- 4. Controller shall have adequate data storage to ensure high performance and data reliability. Battery shall retain static RAM memory and real-time clock functions for a minimum of 1.5 years (cumulative). Battery shall be a field-replaceable (nonrechargeable) lithium type. Unused battery life shall be 10 years.
- 5. The onboard, battery-backed real time clock must support schedule operations and trend logs.
- 6. Global control algorithms and automated control functions should execute via 32-bit processor.
- 7. Controller shall include both on-board 10BASE-T/100BASE-TX Ethernet BACnet communication over twisted pair cable (UTP) and shall include BACnet IP communication. In addition, controller shall include BACnet PTP connection port.
- 8. The base unit of the controller shall host up to 8 expansion modules with various I/O combinations. These inputs and outputs shall include universal 12-bit inputs, binary triac outputs, and 8-bit switch selectable analog outputs (0-10V or 0-20 mA). Inputs shall support 3K and 10K thermistors, 0-5VDC, 0-10VDC, 4-20mA, dry contacts and pulse inputs directly.
- 9. All outputs must have onboard Hand-Off-Auto switches and a status indicator light. HOA switch position shall be monitored. Each analog output shall include a potentiometer for manually adjusting the output when the HOA switch is in the Hand position.
- 10. The position of each and every HOA switch shall be available system wide as a BACnet object. Expandable Controller shall provide up to 176 discreet inputs/outputs per base unit.
- B. BACnet Conformance:
  - 1. Controller shall as a minimum support Point-to-Point (PTP), MS/TP and Ethernet BACnet LAN types. It shall communicate directly via these BACnet LANs as a native BACnet device and shall support simultaneous routing functions between all supported LAN types. Building controller shall be a BACnet conformance class 3 device and support all BACnet services necessary to provide the following BACnet functional groups:
    - a. Clock Functional Group.
    - b. Files Functional Group.
    - c. Reinitialize Functional Group.
    - d. Device Communications Functional Group.
    - e. Event Initiation Functional Group.
  - 2. Please refer to section 22.2, BACnet Functional Groups, in the BACnet standard for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All necessary tools shall be supplied for working with proprietary information.
  - 3. Standard BACnet object types supported shall include as a minimum: Analog Input, Binary Input, Analog Output, Binary Output, Analog Value, Binary Value, Device, File, Group, Event Enrollment, Notification Class, Program and Schedule object types. All necessary tools shall be supplied for working with proprietary information.
  - 4. The Controller shall comply with Annex J of the BACnet specification for IP connections. This device shall use Ethernet to connect to the IP internet work, while using the same Ethernet LAN for non-IP communications to other BACnet devices on the LAN. Must

support interoperability on wide area networks (WANs) and campus area networks (CANs) and function as a BACnet Broadcast Management Device (BBMD).

- C. Schedules:
  - 1. Each controller shall support a minimum of 50 BACnet Schedule Objects.
- D. Logging Capabilities:
  - 1. Each controller shall support a minimum of 200 trend logs. Any object in the system (real or calculated) may be logged. Sample time interval shall be adjustable at the operator's workstation.
  - 2. Controller shall periodically upload trended data to system server for long term archiving if desired.
  - 3. Archived data stored in database format shall be available for use in third-party spreadsheet or database programs.
- E. Alarm Generation:
  - 1. Alarms may be generated within the system for any object change of value or state either real or calculated. This includes things such as analog object value changes, binary object state changes, and various controller communication failures.
  - 2. Alarm log shall be provided for alarm viewing. Log may be viewed on-site at the operator's terminal or off-site via remote communications.
  - 3. Controller must be able to handle up to 200 alarm setups stored as BACnet event enrollment objects system destination and actions individually configurable.

### 2.07 TERMINAL UNIT APPLICATION CONTROLLERS

- A. Provide one native BACnet application controller for each piece of unitary mechanical equipment that adequately covers all objects listed in object list for unit. All controllers shall interface to building controller via MS/TP LAN using BACnet protocol. No gateways shall be used. Controllers shall include input, output and self-contained logic program as needed for complete control of unit. B. BACnet Conformance:
  - 1. Application controllers shall as a minimum support MS/TP BACnet LAN types. They shall communicate directly via this BACnet LAN at 9.6, 19.2, 38.4 and 76.8 Kbps, as a native BACnet device. Application controllers shall be of BACnet conformance class 3 and support all BACnet services necessary to provide the following BACnet functional groups:
    - a. Files Functional Group.
    - b. Reinitialize Functional Group.
    - c. Device Communications Functional Group.
  - 2. Please refer to section 22.2, BACnet Functional Groups in the BACnet standard for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All proprietary services, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.
  - 3. Standard BACnet object types supported shall include as a minimum–Analog Input, Analog Output, Analog Value, Binary Input, Binary Output, Binary Value, Device, File and Program Object Types. All proprietary object types, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.
- B. Application controllers shall include universal inputs with 10-bit resolution that can accept 3K and 10K thermistors, 0–10 VDC, 4–20 mA, dry contact signals and a minimum of 3 pulse inputs. Any input on controller may be either analog or digital. Controller shall also include support and

modifiable programming for interface to intelligent room sensor. Controller shall include binary outputs on board with analog outputs as needed.

- C. All program sequences shall be stored on board controller in nonvolatile flash memory. No batteries shall be needed to retain logic program. All program sequences shall be executed by controller 10 times per second and shall be capable of multiple PID loops for control of multiple devices. Programming of application controller shall be completely modifiable in the field over installed BACnet LANs or remotely via modem interface. Operator shall program logic sequences by graphically moving function blocks on screen and tying blocks together on screen. Application controller shall be programmed using same programming tools as building controller and as described in operator workstation section. All programming tools shall be provided and installed as part of system.
- D. Application controller shall include support for intelligent room sensor (see Section 2.9.B.) Display on room sensor shall be programmable at controller and include an operating mode and a field service mode. All button functions and display data shall be programmable to show specific controller data in each mode based on which button is pressed on the sensor. See sequence of operation for specific display requirements at intelligent room sensor.

## 2.08 SENSORS AND MISCELLANEOUS DEVICES

- A. Temperature Sensors:
  - 1. All temperature sensors to be solid state electronic, factory-calibrated to within 0.5°F, totally interchangeable with housing appropriate for application. Wall sensors to be installed as indicated on drawings. Mount 48 inches about finished floor. Duct sensors to be installed such that the sensing element is in the main air stream. Immersion sensors to be installed in wells provided by control contractor, but installed by mechanical contractor. Immersion wells shall be filled with thermal compound before installation of immersion sensors. Outside air sensors shall be installed away from exhaust or relief vents, not in an outside air intake and in a location that is in the shade most of the day.
- B. Intelligent Room Sensor with LCD Readout:
  - 1. Sensor shall contain a backlit LCD digital display and user function keys along with temperature sensor. Controller shall function as room control unit, and shall allow occupant to raise and lower setpoint, and activate terminal unit for override use—all within limits as programmed by building operator. Sensor shall also allow service technician access to hidden functions as described in sequence of operation.
  - 2. The Intelligent Room Sensor shall simultaneously display room setpoint, room temperature, outside temperature, and fan status (if applicable) at each controller. This unit shall be programmable, allowing site developers the flexibility to configure the display to match their application. The site developer should be able to program the unit to display time-of-day, room humidity and outdoor humidity. Unit must have the capability to show temperatures in Fahrenheit or Centigrade.
  - 3. Override time may be set and viewed in half-hour increments. Override time count down shall be automatic, but may be reset to zero by occupant from the sensor. Time remaining shall be displayed. Display shall show the word "OFF" in unoccupied mode unless a function button is pressed.
  - 4. See sequence of operation for specific operation of LCD displays and function keys in field service mode and in normal occupant mode. Provide intelligent room sensors as specified in point list.
  - 5. Field service mode shall be customizable to fit different applications.
- C. Wall Sensor:
  - 1. In areas where setpoint adjustment and/or after hours override are not needed such as restrooms, entry ways, corridors, etc., standard wall sensor shall use solid-state sensor

identical to intelligent room sensor and shall be packaged in aesthetically pleasing enclosure.

- D. Ceiling Sensor
  - 1. Composite temperature sensor with 1oF accuracy. Integral humidity, motion, sound, and light sensing devise. Infrared temperature measurement. Two universal outputs. 24 VDC power supply.
  - 2. Provide a space mounted wall sensor for room setpoint adjustment.
- E. Guards:
  - 1. In areas where setpoint adjustment and/or after hours override are not needed such as restrooms, entry ways, corridors, etc., standard wall sensor shall use solid-state sensor identical to intelligent room sensor and shall be packaged in aesthetically pleasing enclosure.
  - 2. Provide metal tamper proof protective guards for all sensors installed in gymnasiums. Concealed sensors can be used in lieu of protective guards if approved by Engineer.

#### 2.09 ELECTRONIC DATA INPUTS AND OUTPUTS

A. Differential and Static Pressure Sensors and Switches:

- 1. Air flow and duct static pressure analog sensors will be high accuracy suitable for the low pressures to be encountered, be selected for approximately 50% overrange, and have a 4 to 20 ma output. These differential pressure sensors will be provided with valved lines for testing and calibration, and will have adjustments for zero and span.
- 2. Kilowatt transducers will be the integrated electronic type with accuracy of .2% of scale. For balanced (such as motors) three phase loads, two current transformers (CT's) will be provided and for unbalanced loads, three CT's will be provided. Two or three potential transformers (PT's) will be provided as recommended by the manufacturer for the application. Output will be 4 to 20 ma. Suitable CT's and PT's will be provided and installed unless specifically specified with other equipment. B. Current Sensing Relays:
- 3. Provide solid-state, adjustable, current operated relay. Provide a relay that changes switch contact state in response to an adjustable set point value of current in the monitored A/C circuit.
- 4. Adjust the relay switch point so that the relay responds to motor operation under load as an "on" state and so that the relay responds to an unloaded running motor as an "off" state. A motor with a broken belt is considered an unloaded motor.
- 5. Provide relay for status monitoring on fans, motors and pumps.
- B. Control Outputs:
  - 1. On/Off Outputs: Control panel shall internally provide test points for the circuit driving the equipment contactor, for the purpose of troubleshooting whether the 120 VAC circuit to the contactor is active. All such relays or digital output modules shall provide a pilot light or LED display of this same status.
- C. Modulating Outputs: Modulating outputs shall be industry standard 0-5 VDC, or 0-10 VDC. Milliamp outputs of 0-20 mA or 4-20 mA are also acceptable. Drive open/Drive closed type modulating outputs are acceptable provided that they also comply with the following requirements.
- D. All modulating outputs shall provide within the control panel, a metric gauge, or display indication via on board display or portable operators terminal of the commanded position signal to the actuating device. This meter, gauge, or display must provide either a 0-100 percent position indication, or readout directly in the engineering units of the signal being used. Drive open/drive closed type controllers shall include sufficient components and control algorithms to comply with this requirement.

## 2.10 CONTROL VALVES

A. Control valves shall be two-way, three-way, or six-way pattern as shown, constructed for tight shutoff and shall operate satisfactorily against system pressures and differentials. Two-way control valves shall exhibit equal percentage characteristics. Non-equal percentage valve characteristics shall not be acceptable. Valves with size up to and including 3" shall be "screwed" with 250 psi ANSI pressure body rating; 4" and larger valves shall be 'flanged' configuration. Proportional control valves shall be sized for a pressure drop of 3.0 psig at rated flow (except as noted). Two-position line size and shall be provided with a 250 psi static pressure body rating.

#### 2.11 DAMPER ACTUATORS

- A. Electric damper actuators shall be properly sized to provide sufficient torque to position the damper throughout its operating range. Outside air, exhaust air and recicculation dampers shall be spring return type.
- B. One electronic actuator direct shaft-mounted per damper section. No connecting rods or jackshafts. Small outside and return economizer dampers may be mechanically linked if one actuator has sufficient torque to drive both horizontal drive shafts.
- C. Multi-section dampers with electric actuators shall be arranged so that each damper section operates individually. One electronic actuator shall be direct shaft-mounted per damper section.

#### 2.12 MOTORIZED CONTROL DAMPERS

A. See Section 23 3300.

#### 2.13 ENCLOSURES

- A. All controllers, power supplies and relays shall be mounted in enclosures.
- B. Enclosures may be NEMA 1 when located in a clean, dry, indoor environment. Indoor enclosures shall be NEMA 12 when installed in other than a clean environment. C. Enclosures shall have hinged, locking doors.
- C. Provide laminated plastic nameplates for all enclosures in any mechanical room or electrical room. Include location and unit served on nameplate. Laminated plastic shall be 1/8" thick sized appropriately to make label easy to read.

# 2.14 UNINTERRUPTIBLE POWER SUPPLY (UPS)

- A. Provide uninterruptible power supply (UPS) on power supply to all control panels and control transformers.
- B. Provide electric power to control devices from control system power circuit or from device or equipment being controlled.
- C. Carry a dedicated ground wire to controllers from the associated breaker panel. Do not use the conduit system for grounding purposes.
- D. Generator DDC Panel UPS: Size UPS for a minimum of 90 minutes power supply.
- E. Size all other DDC Panel UPS for a minimum of 5 minutes power supply.

## 2.15 HUMIDITY SENSORS

- A. All controllers Humidity Sensors:
  - 1. Range 0 to 100% RH
  - 2. Sensing Element Bulk Polymer
  - 3. Output Signal 4 20 mA DC
  - 4. Accuracy At 77°F (25⁰C) + 2% RH

## 2.16 WATER DETECTOR

A. Water detector features gold-plated probes and microchip technology for dependable detection of conductive liquids. SPDT contacts are provided to connect to a monitoring system. A height-

adjustable, cast-aluminum, weatherproof enclosure is standard. A green LED visible outside the box indicates power. A red LED indicates water detected. Kele Model WD-1B or equal.

### 2.17 BTU METER

- A. Description: Provide complete BTU Measurement System including micro-processor based BTU meter, flowmeter, matched set of temperature sensors and mechanical installation hardware and cabling required for a complete system installation. BTU measurement system shall be configured for the specific application prior to delivery.
- B. Application: The contractor shall be responsible for selecting the BTU meter options submitted based on the application. BTU meter shall be constructed, calibrated and scaled for the intended application in terms of pipe size, pipe material, installation requirements, expected energy rate, ambient conditions and fluid characteristics which include but are not limited to pressure, temperature and viscosity.
- C. Design: Total thermal energy measurement (BTU) system to be provided by a single manufacturer, including flowmeter, temperature sensors and BTU meter.
  - 1. BTU Calculator: Computation error </= 0.09% @ 30-degree F delta T.
  - 2. Enclosure: NEMA 12K enclosure minimum, designed for wall or DIN rail mounting. Nonmetallic enclosure materials of construction must meet UL 94 V-0 flammability requirements and be suitable for use in plenum spaces.
  - 3. Connections: Provide three (3)  $\frac{1}{2}$ " conduit access holes minimum.
  - 4. Temperature Rating: -13 F to 140 F ambient
- D. Flow Meter Accuracy: See accuracy statement provided with the flow meter.
- E. Temperature Sensor Accuracy:
  - Current (mA) based sensors: Provide a matched pair of loop powered, current (mA) based temperature sensors, wet calibrated over the intended application range against NIST traceable standards. Current (mA) signal shall be unaffected by wire length. Differential temperature measurement uncertainty within calibrated range shall be </= to +/- 0.15-degree F.
  - 2. Resistance Temperature Device (RTD): Provide a matched pair of 1000 Ohm platinum RTDs, wet calibrated to a differential measurement uncertainty of +/- 0.18-degree F over the stated range. RTD's must meet EN1434/C900 accuracy requirements for 3K sensors.
- F. Calibration and Configuration: Each thermal energy (BTU) metering system shall be factory programmed for the specific application and each metering system component, including temperature sensors and flow meter, shall receive a certificate of calibration, directly traceable to N.I.S.T.
- G. Transmitter and Display: Provide an operator interface consisting of four push-buttons and graphical interface. Display shall visually indicate total fluid volume in gallons, instantaneous flow rate, supply temperature, return temperature, thermal energy flow rate and thermal-energy flow total in kilowatts per hour or British thermal units (BTU). Output signals shall be RS485 serial network protocol, native BACnet MS/TP or MODBUS RTU, three (3) programmable pulse outputs and one (1) analog output signal. Meter shall have the capability to receive and totalize three (3) auxiliary input pulses which can be viewed locally and communicated over the RS485 network.
- H. Listings and Certifications:
  - 1. Meter shall have FCC: Part 15, Subpart B
  - 2. Meter shall have CE approval
  - 3. Meter shall be UL listed
  - 4. Meters selected with BACnet shall have BTL Certification to ASHRAE 135:2009

- I. Flow Meter Description: Provide an insertion turbine flowmeter complete with NIST traceable, wet calibrated flow-measuring element, integral transmitter, installation valves, depth gage and calibration certificate. Flowmeter shall be wet tappable, allowing insertion and removal from the flow stream without system shutdown.
  - 1. Application: Flowmeter shall be constructed, calibrated, and scaled for the intended application in terms of pipe size, pipe material, installation requirements, expected flow rate, ambient conditions and fluid characteristics which include but are not limited to pressure, temperature, conductivity, and viscosity
  - 2. Sensing Technology: Axial Turbine flow-measuring element; either single or dual turbine based on application requirements.
  - 3. Construction: Plated brass or 316L stainless steel with attached tag indicating calibration information. Maximum Pressure Rating: 400 psig; Maximum Temperature Rating: 280 deg F.
  - 4. End Connections: 1" Male NPT for use with 1" full port Isolation Valve, Minimum.
  - 5. Flow Range: Flow-measuring element and transmitter shall cover operating range of equipment or system served.
  - 6. Accuracy: Flowmeter shall provide calibrated outputs, directly from the integral transmitter, throughout the operating range with the accuracy stated as follows:
    - a. Plus or minus 0.5% of rate at calibrated velocity
    - b. Plus or minus 1.0% of rate from 3.0 to 30.0 ft/sec velocity (10:1 turndown).
    - c. Plus or minus 2.0% of rate from 0.4 to 20 ft/sec velocity (50:1 turndown).
  - 7. Calibration: Each flowmeter shall receive a wet calibration, within the expected operating range, against a primary volumetric standard that is traceable to NIST.
  - 8. Local Display: Local display shall provide instantaneous flow rate information, totalized flow information and shall be factory configured for connection to a specific flowmeter.
  - 9. Onicon Model F-1000 or approved equal.

## 2.18 INTERCONNECTING WIRE AND CABLE

- A. Wiring regardless of service or voltage will comply with Contract Document Division 26 Project Electrical System Specifications, the National Electric Code (NEC), and any/all applicable local codes and/or Authorities Having Jurisdiction (AHJ).
- B. Where required, wiring, regardless of service or voltage, to be in conduit per Division 26 and routed parallel to or at right angles with the structure. Properly support every 6 ft (1829 mm).
- C. Where permitted by local guides, NEC and AHJ; use plenum-rated control cabling where final application will be concealed but accessible. Where plenum-rated cable is allowed, route parallel to or at right angles with the structure. Support every 6 ft (1829 mm).
- D. The BAS Wiring:
  - 1. 24 VAC Power: Red/Black jacketed conductors; black jacketed sheath over the pair.
  - 2. Input/Output White/Black jacketed conductors; white jacketed sheath over the pair.
  - 3. Communication: White/Black jacketed conductors; blue jacketed sheath over the pair.

## 2.19 FIRESTOPPING

- A. Capable of maintaining an effective barrier against flame, heat, and smoke. Metalines, Dow, 3M, or equal.
- B. Provide installations classified in Underwriter's Laboratories (UL) Building Materials Directory or listed in the Warnock Hersey International Directory.
- C. Paintable where exposed to view.

- D. Waterproof in plumbing chases.
- E. Provide the product of more than one manufacturer if required to provide listed installations throughout.

# 2.20 ACCEPTABLE MANUFACTURERS - VARIABLE FREQUENCY DRIVES

- A. Danfoss.
- B. ABB.
- C. Square-D (Telemecanique® brand Altivar Panel)
- D. Yaskawa (Magnetec)
- E. Substitutions: Under provisions of Section 016000.

## 2.21 VARIABLE FREQUENCY DRIVES (VFDS)

- A. Description:
  - 1. This specification covers a complete Variable Frequency Drive (VFD) consisting of a pulse width modulated (PWM) inverter designed for use on a standard NEMA Design B induction motor or better.
  - 2. The drive manufacturer shall supply the drive and all necessary controls as herein specified. The manufacturer shall have been engaged in the production of this type of equipment for a minimum of fifteen years. B. Quality Assurance:
  - 3. Referenced Standards:
    - a. Institute of Electrical and Electronic Engineers (IEEE) Standard 519-1992, IEEE Guide for Harmonic Content and Control.
    - b. Underwriters laboratories UL508C.
    - c. National Electrical Manufacturer's Association (NEMA) ICS 7.0, AC Adjustable Speed Drives.
- B. Testing: All printed circuit boards shall be completely tested and burned-in before being assembled into the completed VFD. The VFD shall then be subjected to a computerized systems test (cold), burn-in, and computerized systems test (hot). The burn-in shall be at 104°F (4 °C), at full-rated load. All testing and manufacturing procedures shall be ISO 9001 certified.
- C. Qualifications: VFDs and options shall be UL listed as a complete assembly. VFDs and options shall be cUL listed as a complete assembly. VFDs and options shall be CE labeled as a component. VFDs shall be listed for use at remote locations from devices.
- D. Warranty: Warranty shall be 24 months from the date of shipment (with certified startup).
- E. Products: The Variable Frequency Drives (VFDs) shall be solid state, with a Pulse Width Modulated (PWM) output. The VFD package as specified herein shall be enclosed in a NEMA 1 enclosure, completely assembled and tested by the manufacturer. The VFD shall employ a full wave rectifier (to prevent input line notching), Capacitors, and Insulated Gate Bipolar Transistors (IGBT's) as the output-switching device. The drive efficiency shall be 97% or better at full speed and full load. Fundamental power factor shall be no less than 0.98 at all speeds and loads.
- F. Harmonic Distortion Control:
  - The VFD shall limit harmonic distortion reflected onto the utility system to a voltage and current level as defined by IEEE 519 for general systems applications. This shall be accomplished by using drive components specifically designed to reduce harmonic distortion. AC line reactors are required where their use will assist in reducing harmonic distortion.
  - 2. Any harmonic calculations shall be done based on kVA capacity X/R ratio and the impedance of the utility transformer feeding the installation and the total system load. The calculations shall be made with the point of the common coupling being the utility feeder.

- 3. The system containing the VFD shall comply with the 5% level of total harmonic distortion on line voltage and the line current limits as defined in IEEE 519-1992.
- G. Specifications:
  - 1. Input voltage 208-240, 380-480, 575-600 VAC +/- 10%, 3 phase, 48-63 Hz.
  - 2. Undervoltage trip @ rated input -35%, Overvoltage trip @ rated input +30%.
  - 3. Interrupt rating 65 kAIC, suitable for use on a circuit capable of delivering not more than 10,000 RMS symmetrical amps, 480 V maximum.
  - 4. Output Frequency 0 to 150 Hz. Operation above 60 Hz shall require programming changes to prevent inadvertent high-speed operation.
  - 5. Environmental operating conditions: 0 to 4 Degrees°C, 0 to 3300 feet above sea level, less than 95% humidity, non-condensing.
  - 6. Provide line side filter.
  - 7. Enclosure shall be rated NEMA 1 or as specifically mentioned elsewhere.
  - 8. All VFDs shall have the same customer interface, including digital display, and keypad, regardless of horsepower rating. The keypad is to be used for local control, for setting all parameters, and for stepping through the displays and menus. The keypad shall be removable, capable of remote mounting, and shall have its own non-volatile memory. An optional keypad shall allow for uploading and downloading of parameter settings as an aid for start-up of multiple VFDs.
  - 9. VFD shall be rated for use in remote located setups.
- H. Input/Output Features:
  - 1. Four (4) programmable critical frequency lockout ranges to prevent the VFD from operating the load continuously at an unstable speed.
  - 2. A custom PID preset for HVAC & fluid systems, allow a pressure or flow signal to be connected to the VFD, using the microprocessor in the VFD for the closed loop control. The VFD shall have 250 mA of 24 VDC auxiliary power and be capable of loop powering a transmitter supplied by others. The auxiliary power supply shall have overload and over current protection. The PID setpoint shall be adjustable from the VFD keypad, analog inputs, digital inputs, or over the communications bus.
  - 3. Two (2) programmable analog inputs shall accept a current, voltage, or Ni 1000 sensor level input signal for speed reference, or for reference and actual (feedback) signals for PID controller.
  - 4. Six (6) programmable digital inputs for maximum flexibility in interfacing with external devices. One digital input is to be utilized as a customer safety connection point for fire, freeze, and smoke interlocks (Enable). Upon customer reset (reclosure of interlock) drive is to resume normal operation. These inputs can also be used to activate the setpoints of individual control loops.
  - 5. Two (2) programmable analog output proportional to Frequency, Motor Speed, Output Voltage, Output Current, Motor Torque, Motor Power (kW), DC Bus voltage, Active Reference, and other data.
  - 6. Two (2) programmable digital relay outputs. The relays shall be rated for maximum switching current 8 amps at 24 VDC and 0.4 A at 250 VAC.
  - 7. The VFD shall Ramp or Coast to a stop, as selected by the user.
- J. Operator Display: The following operating information displays shall be standard using an optional VFD digital display. All applicable operating values shall be capable of being displayed in engineering (user) units. All parameters viewed from the list below shall be capable of being

displayed at all times. The display shall be in complete English words (alpha-numeric codes are not acceptable).

- 1. Output frequency.
- 2. Motor speed (RPM, %, or engineering units).
- 3. Motor current.
- 4. Calculated motor torque.
- 5. Calculated motor power (kW).
- 6. DC bus voltage.
- 7. Output voltage.
- 8. Heatsink temperature (0 F).
- 9. Analog input values.
- 10. Analog output value.
- 11. Keypad reference values.
- 12. Elapsed time meter (resetable).
- 13. kWh meter (resetable).
- 14. mWh meter.
- 15. Digital input status.
- 16. Digital output status.
- K. Safeties: The VFD shall have the following protection circuits. In the case of a protective trip, the drive shall stop and announce the fault condition in complete words (alphanumeric codes are not acceptable):
  - 1. Overcurrent trip 350% instantaneous (170% RMS) of the VFD's variable torque current rating.
  - 2. Overvoltage trip 130% of the VFD's rated voltage.
  - 3. Undervoltage trip 65% of the VFD's rated voltage.
  - 4. Overtemperature +90° C, Heatsink Temperature.
  - 5. Ground Fault either running or at start.
  - 6. Adaptable Electronic Motor Overload (I 2 t). The Electronic Motor Overload protection shall protect the motor based on speed, load curve, and external fan parameter. Circuits, which are not speed dependent, are unacceptable. The electronic motor overload protection shall be UL Listed for this function.
- L. Communications:
  - 1. The VFD shall have an RS-485 port as standard. The standard protocol shall BACnet protocol.
  - 2. Serial communication capabilities shall include, but not be limited to, run-stop control; speed set adjustment, proportional/integral/derivative PID control (Set Point) adjustments, current limit, and accel/decel time adjustments. The drive shall have the capability of allowing the DDC to monitor feedback such as process variable feedback, output speed/frequency, current (in amps), % torque, power (kW), kilowatt hours (resettable), operating hours (resettable), relay outputs, digital inputs and diagnostic warning and fault information. Additionally, remote (LAN) VFD fault reset shall be possible. A minimum of 15 field parameters shall be capable of being monitored.
  - 3. The VFD shall allow the DDC to control the drive's digital and analog outputs via the serial interface. The serial communications interface shall allow for DO (relay) con-

trol and AO (analog) control without being tied to a VFD function. In addition, all drive digital and analog inputs shall be capable of being monitored by the DDC system.

- M. Installation:
  - 1. Installation shall be the responsibility of the Division 26 electrical contractor. The contractor shall install the drive in accordance with the recommendations of the VFD manufacturer as outlined in the installation manual.
  - 2. Power wiring shall be the responsibility of the Division 26 electrical contractor. The contractor shall complete all wiring in accordance with the recommendations of the VFD manufacturer as outlined in the installation manual.
- N. Start-up: Certified factory start-up shall be provided for each drive by a factory authorized service center. A certified start-up form shall be filled out for each drive with a copy provided to the owner, and a copy kept on file at the manufacturer.
- O. Product Support: Factory trained application engineering and service personnel that are thoroughly familiar with the drive products offered shall be locally available at both the specifying and installation locations.

## 2.22 AIRFLOW MEASURING STATIONS

- A. Acceptable Manufacturers:
  - 1. EBTRON, Inc.
  - 2. No Substitutions.
- B. Provide airflow sensor measurement devices as indicated in the sequence of operations. Fan inlet measurement devices shall not be substituted for duct or plenum measurement devices indicated on the plans.
- C. Each measurement device shall consist of one or more sensor probe assemblies and a single microprocessor-based transmitter. Each sensor probe assembly will contain one or more independent sensor housings. Multiple sensor housings shall be equally weighted and averaged by the transmitter prior to output Vortex shedding flow meters are not acceptable.
- D. All Sensor Probe Assemblies:
  - 1. Each electronic sensor housing shall utilize two hermetically sealed thermistor probes to determine airflow rate and ambient temperature. Devices that do not have 2 thermistors in each sensor housing are not acceptable.
  - 2. Each sensor housing shall be calibrated at a minimum of 16 airflow rates and have an accuracy of +/-2% of reading over the entire operating airflow range. Each sensor assembly shall be calibrated to standards that are traceable to the National Institute of Standards and Technology (NIST).
  - 3. Devices whose accuracy is the combined accuracy of the transmitter and sensor probes must demonstrate that the total accuracy meets the performance requirements of this specification throughout the measurement range.
  - 4. Each sensor probe assembly shall have an integral, U.L. listed, plenum rated cable and terminal plug for connection to a remotely mounted transmitter. All terminal plug interconnecting pins shall be gold plated.
  - 5. Each sensor assembly shall not require matching to the transmitter in the field.
  - 6. A single manufacturer shall provide both the airflow measuring probe(s) and transmitter at a given measurement location.
- E. Duct and Plenum Sensor Probe Assemblies:
  - 1. Sensor housings shall be mounted in an extruded, 6063 aluminum tube probe assembly.
  - 2. The number of sensor housings provided for each location shall be as follows:

| Area (sq. ft.) | Sensors |
|----------------|---------|
| <=1            | 2       |
| >1 to <4       | 4       |
| 4 to <8        | 6       |
| 8 to <12       | 8       |
| 12 to <16      | 12      |
| >=16           | 16      |

- 3. Probe assembly mounting brackets shall be constructed of 304 stainless steel. Probe assemblies shall be mounted using one of the following options:
  - a. Insertion mounted through the side or top of the duct.
  - b. Internally mounted inside the duct or plenum.
  - c. Standoff mounted inside the plenum.
- 4. The operating airflow range shall be 0 to 5,000 CFM unless otherwise indicated on the plans.
- F. Fan Inlet Sensor Probe Assemblies (Allowed only at roof mounted relief fans upon written permission from the engineer).
  - 1. Sensor housings shall be mounted on 304 stainless steel blocks.
  - 2. Mounting rods shall be field adjustable to fit the fan inlet and constructed of nickel plated steel.
  - 3. Mounting feet shall be constructed of 304 stainless steel.
  - 4. The operating airflow range shall be 0 to 10,000 CFM unless otherwise indicated on the plans.
- G. Transmitters:
  - 1. The transmitter shall have an LCD display capable of displaying airflow and temperature. Airflow shall be field configurable to be displayed as a velocity or a volumetric rate.
  - 2. The transmitter shall be capable of displaying the individual airflow and temperature readings of each sensor on the LCD display.
  - 3. The transmitter shall operate on 24 VAC. The transmitter shall be protected from weather and water.
  - 4. The transmitter shall be capable of communicating with the host controls using one of the following interface options:
    - a. Linear analog output signal: Field selectable, fuse protected and isolated, 0-10VDC and 4-20mA (4-wire).
    - b. BACnet-MS/TP.
    - c. 10 Base-T Ethernet: Field selectable BACnet Ethernet, BACnet-IP, The measuring device shall be UL listed as an entire assembly.
- H. The manufacturer's authorized representative shall review and approve placement and operating airflow rates for each measurement location indicated on the plans. A written report shall be submitted to the mechanical engineer if any measurement locations do not meet the manufacturer's placement requirements.
- I. Install in accordance with manufacturer's instructions at the locations indicated on the contract drawings. Duct and plenum devices shall not be adjusted without approval from the mechanical engineer.

# PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence.
- B. Notify the owners' representative in writing of conditions detrimental to the proper and timely completion of the work.
- C. Do not begin work until all unsatisfactory conditions are resolved.
- D. All existing DDC equipment to be salvaged including but not limited to panel boxes, controller cards, valve actuators and bodies, damper actuators, temperature sensors, thermostats, etc. Refer to section 02 4000 for salvage instructions.

#### 3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide all miscellaneous devices, hardware, software, interconnections installation and programming required to ensure a complete operating system in accordance with the sequences of operation and point schedules.

#### 3.03 LOCATION AND INSTALLATION OF COMPONENTS

- A. Locate and install components for easy accessibility; in general, mount 48 inches above floor with minimum 3'-0" clear access space in front of units. Obtain approval on locations from owner's representative prior to installation.
- B. All instruments, switches, transmitters, etc., shall be suitably wired and mounted to protect them from vibration, moisture and high or low temperatures.
- C. Identify all equipment and panels. Provide permanently mounted tags for all panels.
- D. Provide stainless steel or brass thermowells suitable for respective application and for installation under other sections, sized to suit pipe diameter without restricting flow.

#### **3.04 CONTROL WIRING**

- A. Provide all interlock and control wiring. All wiring shall be installed neatly and professionally, in accordance with Specification Division 26 and all national, state and local electrical codes.
- B. Provide wiring as required by functions as specified and as recommended by equipment manufacturers, to serve specified control functions. Provide shielded low capacitance wire for all communications trunks.
- C. Control wiring shall not be installed in power circuit raceways. Magnetic starters and disconnect switches shall not be used as junction boxes. Provide auxiliary junction boxes as required. Coordinate location and arrangement of all control equipment with the owner's representative prior to rough-in.
- D. Provide auxiliary pilot duty relays on motor starters as required for control function.
- E. Provide power for all control components from circuits as indicated on the electrical drawings coordinate with Division 26 electrical contractor prior to rough in. All 120V connections to direct digital control panels and peripheral devices shall be connected to electrical branch circuit panelboards that start with an "S" designation (i.e. Panel 'S1', 'S2', 'SM', etc.)
- F. All control wiring in the mechanical, electrical, telephone and boiler rooms to be installed in raceways. All other wiring to be installed neatly and inconspicuously per local code requirements. Control wiring above accessible ceiling spaces may be run with plenum rated cable (without conduit). Control wiring shall not be installed in the below floor space. All wiring in non-accessible spaces shall be in conduit (example wiring routed down wall shall be in conduit).

#### 3.05 SOFTWARE

A. Load and debug software for BAS. Operate to prove functionality of each system.

- 1. Provide database generation.
- 2. System displays: Show analog and binary object types within system; logically laid out for easy use by Owner. Provide outside air temperature indication on system displays associated with economizer cycles.
- 3. At a minimum, run time totalization shall be incorporated for each monitored supply fan, return fan, exhaust fan, hot water and chilled water pumps. Warning limits for each point shall be entered for alarm and or maintenance purposes.
- 4. Binary and analog object types (including zones) shall have the capability to be automatically trended.
- 5. Analog inputs (High/Low Limits) and selected binary input alarm points to be prioritized and routed (locally or remotely) with alarm message per Owner's requirements.
- B. BAS Contractor: Review programs with Engineer in the programming stage. Make sure programmer understands Engineer's intent and that program will carry out that intent.
- C. Bound copy of the complete information on the equipment and components.
- D. Spare parts list. Identify equipment critical to maintaining integrity of operating system.
- E. Trendlog:
  - 1. All binary and analog object types (including zones) shall have the capability to be automatically trended. At the owner or engineer's discretion all points shall be trend logged.
- F. Alarm:
  - 1. All analog inputs (High/Low Limits) and selected binary input alarm points shall be prioritized and routed (locally or remotely) with alarm message per owner's requirements.
- G. Database Save:
  - 1. Provide back-up database for all stand-alone application controllers on disk.

#### 3.06 FIELD SERVICES

- A. Prepare and start logic control system under provisions of this section.
- B. Start-up and commission systems. Allow sufficient time for start-up and commissioning prior to placing control systems in permanent operation. See Section 23 0800 and 01 8100 for additional commissioning requirements.
- C. Provide the capability for off-site monitoring at control contractor's local or main office. At a minimum, off-site facility shall be capable of system diagnostics and software download. Owner shall provide phone line for this service for 1 year or as specified.
- D. Provide Owner's Representative with spare parts list. Identify equipment critical to maintaining the integrity of the operating system.

## 3.07 TRAINING

- A. Provide application engineer to instruct owner in operation of systems and equipment.
- B. Provide system operator's training to include (but not limited to) such items as the following: modification of data displays, alarm and status descriptors, requesting data, execution of commands and request of logs.
- C. Provide on-site training above as required, up to 16 hours as part of this contract.

#### 3.08 DEMONSTRATION

- A. Demonstrate complete operating system to owner's representative.
- B. Provide certificate stating that control system has been tested and adjusted for proper operation prior to the commissioning Functional Testing process.

# END OF SECTION 23 0923

### SECTION 23 0993 SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

### PART 1 GENERAL

### 1.01 SECTION INCLUDES

- A. Boiler Water.
- B. Heating Water Pumps.
- C. Glycol Water.
- D. Glycol Water Pumps.
- E. Chilled Water System.
- F. Chilled Water Pumps.
- G. Domestic Hot Water Heaters.
- H. Air Handling Unit.
- I. Ventilation Fans.
- J. Exhaust Fans.
- K. Baseboard Convectors.
- L. Cabinet Heaters.
- M. Unit Heaters.

#### 1.02 RELATED SECTIONS

- A. Section 23 0500 Common Work Results for HVAC.
- B. Section 23 0800 Commissioning of HVAC.
- C. Section 23 0923 Direct Digital Control System for HVAC.
- D. Section 23 2123 Hydronic Pumps.
- E. Section 23 5216 Condensing Boilers.
- F. Section 23 7300 Indoor Central Air-Handling Units.

#### **1.03 SYSTEM DESCRIPTION**

A. This Section defines the manner and method by which controls function. Requirements for each type of control system operation are specified. Equipment, devices, and system components required for control systems are specified in other Sections.

#### 1.04 SUBMITTALS

- A. Submit under provisions of Division 01.
- B. Submit diagrams indicating mechanical system controlled and control system components. Label with settings, adjustable range of control and limits. Include written description of control sequence.
- C. Include flow diagrams for each control system, graphically depicting control logic.
- D. Include draft copies of graphic displays indicating mechanical system components, control system components, and controlled function status and value.

#### 1.05 PROJECT RECORD DOCUMENTS

- A. Submit documents under provisions of Division 01.
- B. Accurately record actual setpoints and settings of controls, including changes to sequences made after submission of shop drawings.

## PART 2 PRODUCTS - Not Used

PART 3 EXECUTION

- 3.01 BOILER WATER CONTROL (B2-1,2)
- 3.02 HYDRONIC PUMP (HCP2-1A,1B)
- 3.03 SNOWMELT BOILER CONTROL (B2-3,4)
- 3.04 SNOWMELT PUMP (SMCP2-1A,1B)
- 3.05 HEATING COIL SYSTEM (HX2-1, HCCP2-1A,1B)
- 3.06 CHILLED GLYCOL SYSTEM (CH2-1,2, SWP2-1,2, CWP-3A,3B)
- 3.07 CHILLED WATER SYSTEM (HX2-2, CWP2-5A,5B)
- 3.08 DRYCOOLER SYSTEM (DC2-1,2, CWP2-4A,4B)
- 3.09 COMPUTER ROOM TERMINAL UNITS (CRAC1-1 THRU 4)
- 3.10 COMPUTER ROOM TERMINAL UNITS (CRAC2-1 THRU 4)
- 3.11 AQUATHERAPY EQUIPMENT (PPK2-1, EF2-2)
- 3.12 DOMESTIC WATER HEATERS (WH2-1,2, TV2-1)
- 3.13 DOMESTIC HW CIRCULATING PUMPS (PCP2-1A,1B)
- 3.14 DIMESTIC WATER BOOSTER PUMP (DBP2-1)
- 3.15 HEAT RECOVERY VENTILATORS (HRV2-3 THRU 6)
- 3.16 HEAT RECOVERY VENTILATORS (HRV2-1,2)
- 3.17 AIR HANDLING UNIT (AHU2-1,2)
- 3.18 VAV TERMINAL UNITS
- 3.19 FAN COIL UNITS
- 3.20 BUILDING RELIEF AIR
- 3.21 MED GAS EXHAUST FAN (EF2-1)
- 3.22 HOUSEKEEPING SUPPLIES EXHAUST FAN (EF2-3)
- 3.23 BOILER ROOM VENTILATION FAN (VF2-1)
- 3.24 RADIANT ZONE (RZP2-1 THRU 12)
- 3.25 FINTUBE TERMINAL UNITS
- 3.26 HEATING/COOLING TERMINAL UNITS
- 3.27 COOLING ONLY TERMINAL UNITS
- 3.28 CABINET UNIT HEATERS
- 3.29 UNIT HEATERS
- 3.30 SUMP PUMPS (SP2-1,2,3)
- 3.31 AQUATHERAPY SUMP PUMPS (SP2-4,5)

END OF SECTION 23 0993

### SECTION 23 1123 FACILITY NATURAL-GAS PIPING

### PART 1 GENERAL

#### 1.01 WORK INCLUDED

- A. Pipe and pipe fittings.
- B. Valves.

## 1.02 QUALITY ASSURANCE

A. Valves: Manufacturer's name and pressure rating marked on valve body.

#### 1.03 SUBMITTALS

- A. Submit product data under provisions of Division 01.
- B. Include data on pipe materials, pipe fittings, valves and accessories.

#### 1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site under provisions of Division 01.
- B. Store and protect products under provisions of Division 01.
- C. Deliver and store valves in shipping containers with labeling in place.

#### PART 2 PRODUCTS

## 2.01 NATURAL GAS PIPING, ABOVE GRADE

- A. Piping: Steel Pipe ASTM A53, Schedule 40 black. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, forged steel welding type.
- B. Joints:
  - 1. Low pressure, 2" and under: Screwed or Viega MegaPressG Cold Press Mechanical Joint. Press fittings are acceptable to last tee for connection to the appliance. Utilize threaded piping at the last tee.
  - 2. Medium pressure or larger than 2": ANSI/AWS D1.1, welded.

### 2.02 FLANGES, UNIONS, AND COUPLINGS

- A. Pipe Size 2 Inches and Under: 150 psig malleable iron unions for threaded ferrous piping; bronze unions for copper pipe, soldered joints.
- B. Pipe Size Over 2 Inches: 150 psig forged steel slip-on flanges for ferrous piping; bronze flanges for copper piping: 1/16 inch thick preformed neoprene bonded to fiber.
- C. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

## 2.03 ACCEPTABLE MANUFACTURERS – GAS COCKS AND BALL VALVES

- A. Apollo.
- B. Hammond.
- C. Milwaukee.
- D. Nibco.
- E. Substitutions: Under provisions of Division 01

#### 2.04 GAS COCKS

- A. Up to 2 Inches: Bronze body, bronze tapered plug. non-lubricated, Teflon packing, threaded ends.
- B. Over 2 Inches: Cast iron body and plug, non- lubricated, Teflon packing, flanged ends.

### 2.05 BALL VALVES

- A. Up to 2 Inches: Bronze two piece body, full port, forged brass, chrome plated ball, Teflon seats and stuffing box ring, lever handle, solder, threaded or press-fit ends.
- B. Over 2 Inches: Cast steel, two piece body, full port chrome plated steel ball, Teflon seat and stuffing box seals, lever handle, flanged, solder, threaded or press-fit ends.

#### 2.06 ACCEPTABLE MANUFACTURERS – SEISMIC VALVES

- A. Pacific Seismic Products, PSP.
- B. Substitutions: Under provisions of Division 01.

#### 2.07 SEISMIC VALVES

A. Swing check valve arrangement with an acceleration-sensitive triggering steel ball mechanism. Sight glass indicator, flanged connections. UL listed to Standard ASCE/ANSI/SEI 25-16, maximum pressure 60 psi, -40 Deg F to 150 Deg F ambient temperature. Horizontal or Vertical orientation, Flanged connections, Provide with monitoring switch for remote monitoring connection.

#### PART 3 EXECUTION

#### 3.01 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

#### 3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- D. Install piping to maintain headroom to conserve building space and not interfere with use of space.
- E. Group piping whenever practical at common elevations.
- F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- G. Provide clearance for installation of insulation and access to valves and fittings.
- H. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors.
- I. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- J. Install valves with stems upright or horizontal, not inverted.
- K. Provide properly sized handles for valve operation. Handles shall not be cut or bent to make fit where installed.

#### 3.03 APPLICATION

- A. Install unions downstream of valves and at equipment or apparatus connections.
- B. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

#### 3.04 TESTING

A. Test all piping in accordance with IFGC and UPC requirements. The test pressure used shall be no less than 10 times the proposed maximum working pressure, but not less than 10 psig

for low pressure gas systems (7 inch WC) or 60 psig for medium pressures gas systems (2 psig or 5 psig). All welded pipe shall be tested with not less than 60 psig test pressures.

# END OF SECTION 23 1123
## SECTION 23 2113 HYDRONIC PIPING

# PART 1 GENERAL

## 1.01 WORK INCLUDED

- A. Pipe and Pipe Fittings.
- B. Valves.
- C. Heating Water and Glycol Piping.
- D. Chilled Water and Glycol Piping.

## 1.02 REGULATORY REQUIREMENTS

A. Conform to ANSI/ASME B31.9.

## 1.03 QUALITY ASSURANCE

- A. Valves: Manufacturer's name and pressure rating marked on valve body.
- B. Welding Materials and Procedures: Conform to ANSI/ASME SEC 9, and applicable state labor regulations.
- C. Welders Certification: In accordance with ANSI/ASME SEC 9.

# 1.04 SUBMITTALS

- A. Submit product data under provisions of Division 01.
- B. Include data on pipe materials, pipe fittings, valves, and accessories.
- C. Include welders certification of compliance with ANSI/ ASME SEC 9.

## 1.05 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of piping, valves, and components.
- B. Hydronic System Cleaning and Test reports: Submit to owner for approval. Include all cleaning and testing reports in final O&M manuals.

#### 1.06 WARRANTY

A. PEX pipe and fittings shall be covered by a manufacturer warranty for a duration of 25 years.

# 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site under provisions of Division 01.
- B. Store and protect products under provisions of Division 01.
- C. Deliver and store valves in shipping containers with labeling in place.

# PART 2 PRODUCTS

# 2.01 HEATING WATER AND GLYCOL PIPING

- A. Steel Pipe: ASTM A53, Schedule 40, for sizes 4 inch and over, black.
  - 1. Fittings: ANSI/ASTM B16.3, malleable iron or ASTM A234, steel welding type fittings.
  - 2. Joints: Screwed, or ANSI/AWS D1.1, welded.
- B. Copper Tubing: ASTM B88, Type L, hard drawn.
  - 1. Fittings: ANSI/ASME B16.18 Cast Copper Alloy Solder Joint Pressure Fittings or ANSI/ASME B16.22 Wrought Copper and Copper Alloy Solder Joint Pressure Fittings or ANSI/ASME B16.50 Wrought Copper and Copper Alloy Braze-Joint Pressure Fittings.
  - 2. Joints: ASTM B32, solder, Grade 95TA or ANSI/AWS A5.8, BCuP silver braze; Flux: ASTM B813.
  - 3. Press Fittings: The press fittings connections shall be compatible with seamless K, L or M copper tube made to ASTM B 88. Fittings shall have a maximum non-shock working

pressure of 200 PSI between the temperatures of -20°F and +250°F. Elastomeric seals shall be made of EPDM material. Acceptable manufacturers: Viega ProPress or Nibco Press System.

- C. Pre-Insulated Pex
  - 1. Interior tubing:
    - a. PEX-a (Engel-method crosslinked polyethylene) piping: SDR 9, ASTM F876 and F877 with an oxygen barrier meeting DIN 4726.
    - b. Fittings: Elbows, adapters, couplings, plugs, tees and multiport tees (1/2 inch through 3 inch nominal pipe size): ASTM F1960 cold-expansion fittings in brass manufactured by the pipe manufacturer, utilizing cold-expansion PEX-a reinforcing rings made of same material as the pipe. Fittings shall be third-party certified to NSF 14 and ASTM F1960 and shall comply with ASTM F876 and ASTM F877.
    - c. Temperature and Pressure Rating: Tubing shall be rated for not less than 180°F working temperature and 100 psig working pressure.
    - d. Single or Dual piping as required.
  - 2. Jacket and Insulation
    - a. Jacket: Corrugated seamless high density polyethylene (HDPE); UV-protected.
    - b. Insulation: Minimum R value of 4.8.
- D. Below Slab Tubing:
  - 1. PEX-a (Engel-method crosslinked polyethylene) piping: SDR 9, ASTM F876 and F877 with an oxygen barrier meeting DIN 4726.
  - 2. Fittings: Elbows, adapters, couplings, plugs, tees and multiport tees (1/2 inch through 3 inch nominal pipe size): ASTM F1960 cold-expansion fittings in brass manufactured by the pipe manufacturer, utilizing cold-expansion PEX-a reinforcing rings made of same material as the pipe. Fittings shall be third-party certified to NSF 14 and ASTM F1960 and shall comply with ASTM F876 and ASTM F877.
  - 3. Temperature and Pressure Rating: Tubing shall be rated for not less than 180°F working temperature and 100 psig working pressure.
- E. Grooved piping systems are not allowed.

# 2.02 CHILLED GLYCOL PIPING

- A. Steel Pipe: ASTM A53, Schedule 40, black.
  - 1. Fittings: ANSI/ASTM B16.3, malleable iron or ASTM A234, steel welding type.
  - 2. Joints: Screwed for pipe 2 inch and under; ANSI/AWS D1.1 welded for pipe over 2 inch.
- B. Copper Tubing: ASTM B88, Type L hard drawn.
  - 1. Fittings: ANSI/ASME B16.18 Cast Copper Alloy Solder Joint Pressure Fittings or ANSI/ASME B16.22 Wrought Copper and Copper Alloy Solder Joint Pressure Fittings or ANSI/ASME B16.50 Wrought Copper and Copper Alloy Braze-Joint Pressure Fittings.
  - 2. Joints: ASTM B32, solder, Grade 95TA or ANSI/AWS A5.8, BCuP silver braze; Flux: ASTM B813.
  - Press Fittings: The press fittings connections shall be compatible with seamless K, L or M copper tube made to ASTM B 88. Fittings shall have a maximum non-shock working pressure of 200 PSI between the temperatures of -20°F and +250°F. Elastomeric seals shall be made of EPDM material. Acceptable manufacturers: Viega ProPress or Nibco Press System.

#### 2.03 CHILLED WATER PIPING

A. Copper Tubing: ASTM B88, Type L hard drawn.

- 1. Fittings: ANSI/ASME B16.18 Cast Copper Alloy Solder Joint Pressure Fittings or ANSI/ASME B16.22 Wrought Copper and Copper Alloy Solder Joint Pressure Fittings or ANSI/ASME B16.50 Wrought Copper and Copper Alloy Braze-Joint Pressure Fittings.
- 2. Joints: ASTM B32, solder, Grade 95TA or ANSI/AWS A5.8, BCuP silver braze; Flux: ASTM B813.
- 3. Press Fittings: The press fittings connections shall be compatible with seamless K, L or M copper tube made to ASTM B 88. Fittings shall have a maximum non-shock working pressure of 200 PSI between the temperatures of -20°F and +250°F. Elastomeric seals shall be made of EPDM material. Acceptable manufacturers: Viega ProPress or Nibco Press System.

# 2.04 GLYCOOLED PIPING

- A. Copper Tubing: ASTM B88, Type L hard drawn.
  - 1. Fittings: ANSI/ASME B16.18 Cast Copper Alloy Solder Joint Pressure Fittings or ANSI/ASME B16.22 Wrought Copper and Copper Alloy Solder Joint Pressure Fittings or ANSI/ASME B16.50 Wrought Copper and Copper Alloy Braze-Joint Pressure Fittings.
  - 2. Joints: ASTM B32, solder, Grade 95TA or ANSI/AWS A5.8, BCuP silver braze; Flux: ASTM B813.
  - 3. Press Fittings: The press fittings connections shall be compatible with seamless K, L or M copper tube made to ASTM B 88. Fittings shall have a maximum non-shock working pressure of 200 PSI between the temperatures of -20°F and +250°F. Elastomeric seals shall be made of EPDM material. Acceptable manufacturers: Viega ProPress or Nibco Press System.

# 2.05 EQUIPMENT DRAINS AND OVERFLOWS

- A. Steel Pipe: ASTM A53, Schedule 40 galvanized.
  - 1. Fittings: Galvanized cast iron, or ANSI/ASTM B16.3 malleable iron.
  - 2. Joints: Screwed, or grooved mechanical couplings.
- B. Copper Tubing: ASTM B88, Type L, hard drawn.
  - 1. Fittings: ANSI/ASME B16.18 cast bronze, or ANSI/ASME B16.29 solder wrought copper.
  - 2. Joints: ASTM B32, solder, Grade 95TA or ANSI/AWS A5.8, BCuP silver braze; Flux: ASTM B813.
- C. PVC Pipe: ASTM D1785, Schedule 40, and Schedule 80 for sizes 8 inch and larger, or ASTM D2241, SDR 21 or 26.
  - 1. Fittings: ASTM D2466 or D2467, PVC.
  - 2. Joints: ASTM D2855, solvent weld.
- D. ABS Pipe: ASTM D2680 or D2751.
  - 1. Fittings: ASTM D2751.
  - 2. Joints: ASTM D2235, solvent weld.

# 2.06 FLANGES, UNIONS, AND COUPLINGS

- A. Pipe Size 2 Inches and Under: 150 psig malleable iron unions for threaded ferrous piping; bronze unions for copper pipe, soldered joints.
- B. Pipe Size Over 2 Inches: 150 psig forged steel slip-on flanges for ferrous piping; bronze flanges for copper piping.
- C. Grooved and Shouldered Pipe End Couplings: Malleable iron housing clamps to engage and lock, designed to permit some angular deflection, contraction, and expansion; C-shape elastomer composition sealing gasket for operating temperature range from -30° F to 230° F; steel bolts, nuts, and washers; galvanized couplings for galvanized pipe.

# 2.07 GATE VALVES

A. Gate valves will not be permitted. Use ball or butterfly valves for isolation.

# 2.08 GLOBE VALVES

A. Globe valves will not be permitted. Use ball or butterfly valves for throttling.

# 2.09 ACCEPTABLE MANUFACTURERS - ALL VALVE TYPES

- A. Apollo.
- B. Crane.
- C. FNW.
- D. Hammond.
- E. Milwaukee.
- F. NIBCO.
- G. Red-White Valve Corp.
- H. Substitutions: Under provisions of Division 01.

# 2.10 BALL VALVES

- A. Up to 2 Inches: 600 PSI CWP Bronze two piece body, full port, forged brass, chrome plated ball, Teflon seats and stuffing box ring, lever handle, solder or threaded ends Seat material to be compatible with fluid handled.
- B. Over 2 Inches: Cast steel, two piece body, full port chrome plated steel ball, Teflon seat and stuffing box seals, lever handle, flanged. Seat material to be compatible with liquid handled.

# 2.11 PLUG COCKS

- A. Up to 2 Inches: Bronze body, bronze tapered plug, non-lubricated, Teflon packing, threaded ends, with one wrench operator for every ten plug cocks.
- B. Over 2 Inches: 285 CWP Cast iron body and plug, pressure lubricated, Teflon packing, flanged ends, with wrench operator with set screw.

# 2.12 BUTTERFLY VALVES

- A. High Performance (Double Offset) Butterfly Valves:
  - 1. Body: One-piece wafer, lug or double flanged design with extended neck to allow for 2" of piping insulation. ASME 150 Flange. Provided with top and bottom stem bearings consisting of a 316 stainless steel shell with a TFE/glass fabric liner bearing surface. Equipped with an externally adjustable stem packing system that allows packing adjustment without removing the actuator. Internal over-travel stop shall be provided to prevent over-travel of the disc and minimize possible seat damage.
  - 2. Disc: Disc edge shall be hand polished for minimum torque and maximum sealing capability.
  - 3. Stem: One-piece design provided with blow-out proof stem retention system to assure full retention of the stem in the unlikely event of an internal stem failure.
  - 4. Seat: Design shall consist of a resilient energizer totally encapsulated by the seat. Seat retainer shall be full-faced and firmly attached by bolts located outside the sealing area to protect them from corrosion. The seat assembly shall be locked in the body recess by the full-faced retainer. The seat shall be self-adjusting for wear and temperature changes. The seat shall be easily field replaceable.
  - 5. Valve shall be tested for tight shut-off per API 598 requirements.
  - 6. ANSI/NSF 61/372 Certification.
  - 7. Provide with multi position valve operator/lever handle.
  - 8. Bray/McCannalok High Performance Butterfly Valve or Approved Equal.

## 2.13 SWING CHECK VALVES

- A. Up to 2 Inches: Bronze 45<sup>o</sup> swing disc, solder ends.
- B. Over 2 Inches: Iron body, bronze trim, 45° swing disc, renewable disc and seat, flanged ends.

#### 2.14 SPRING LOADED CHECK VALVES

A. Iron body, bronze trim, stainless steel spring, renewable composition disc, screwed, wafer or flanged ends.

## 2.15 RELIEF VALVES

A. Bronze body, Teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labeled.

## 2.16 HYDRONIC SYSTEM CLEANER

- A. Acceptable Products:
  - 1. CH2O Boil Out Liquid
  - 2. Oatey Hercules Boiler and Heating System Cleaner.

## PART 3 EXECUTION

#### 3.01 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare piping connections to equipment with flanges or unions.
- D. After completion, fill, clean, and treat systems.

## 3.02 INSTALLATION

- A. Route piping in orderly manner, plumb and parallel to building structure, and maintain gradient.
- B. Install piping to conserve building space, and not interfere with use of space and other work.
- C. Group piping whenever practical at common elevations.
- D. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 23 0516.
- E. Provide clearance for installation of insulation, and access to valves and fittings.
- F. Provide access where valves and fittings are not exposed.
- G. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.
- H. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- I. Prepare pipe, fittings, supports, and accessories for finish painting. Refer to Division 09.
- J. Install valves with stems upright or horizontal, not inverted.
- K. Provide properly sized handles for valve operation. Handles shall not be cut or bent to make fit where installed.
- L. Press Fittings shall be installed in accordance with the manufacturer's installation instructions.
- M. Support all piping in accordance with International Mechanical Code and Manufacturer installation instructions. Where there is a conflict between requirements of the Mechanical Code and Manufacturer installation instructions, the more restrictive requirement shall apply.
- N. Install pre-insulated pex where noted with PIP-X designators on plans. See schedules for sizing.
- O. Trenching for all pex shall be in accordance with trenching requirements of 22 1000.

# 3.03 APPLICATION

- A. Use grooved mechanical couplings and fasteners only in accessible locations.
- B. Install unions downstream of valves and at equipment or apparatus connections.
- C. Install brass male adapters each side of valves in copper piped system. Sweat solder adapters to pipe.
- D. Install ball or butterfly valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- E. Install ball or butterfly valves for throttling, bypass, or manual flow control services.
- F. Provide spring loaded check valves on discharge of condenser water pumps.
- G. Provide <sup>3</sup>/<sub>4</sub> inch ball drain valves at main shut-off valves, low points of piping, bases of vertical risers, and at equipment.

## 3.04 CLEANING OF THE HYDRONIC SYSTEM

- A. Prior to starting work, verify system is complete. Thoroughly flush and drain the system. Clean all strainer baskets. Re-install strainer baskets and refill system.
- B. Fill the hydronic piping systems with the system cleaner in accordance with cleaning compound directions for use.
- C. Boil out system for a minimum period of four (4) hours or as recommended by system cleaner, boiler, chiller start-up instructions at a system design operating temperature.
- D. Upon completion of boil out, completely flush system and drain all low points. Remove and clean and re-install all strainer baskets.
- E. Fill system with water or glycol as indicated on the plans. Feed water to system through makeup line with pressure regulator, venting system high points. Set to fill at 12 psig. Pressure system cold at 5 psig, adjust when hot to 12 psig. See Specification Section 23 2116 for glycol fill procedures.
- F. Submit a written and signed statement to the Owner that the above referenced cleaning procedures have been completed.

#### 3.05 TESTING

A. Steel Piping and Copper Tubing: Test piping and tubing hydrostatically at 100 psig or 150 percent of working pressure, whichever is greater, for a period of 4 hours. Observe piping during this period and repair all leaks.

#### END OF SECTION 23 2113

## SECTION 23 2116 HYDRONIC SPECIALTIES

# PART 1 GENERAL

# 1.01 WORK INCLUDED

- A. Expansion Tanks.
- B. Air Vents.
- C. Air Separators.
- D. Strainers.
- E. Pump Fittings.
- F. Flow Indicators, Controls, Meters.
- G. Balance Valves.
- H. Flow Control Valves.
- I. Relief Valves.
- J. Glycol Specialties.

# 1.02 REFERENCES

A. ANSI/ASME - Boilers and Pressure Vessels Code.

# **1.03 REGULATORY REQUIREMENTS**

A. Conform to ANSI/ASME Boilers and Pressure Vessels Code Section 8D for manufacture of tanks.

# 1.04 QUALITY ASSURANCE

A. Manufacturer: For each product specified, provide components by same manufacturer throughout.

# 1.05 SUBMITTALS

A. Submit product data under provisions of Division 01 and Section 23 0500.

# 1.06 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data under provisions of Division 01.
- B. Include installation instruction, assembly views, lubrication instructions, and replacement parts list.

# 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site under provisions of Division 01.
- B. Store and protect products under provisions of Division 01.

# 1.08 EXTRA STOCK

A. Provide one 50 gallon drum of propylene glycol.

# PART 2 PRODUCTS

# 2.01 ACCEPTABLE MANUFACTURERS - DIAPHRAGM-TYPE COMPRESSION TANKS

- A. Amtrol.
- B. Taco.
- C. Bell & Gossett.
- D. Substitutions: Under provisions of Division 01.

# 2.02 DIAPHRAGM-TYPE COMPRESSION TANKS

- A. Construction: Welded steel, tested and stamped in accordance with Section 8D of ANSI/ASME Code; supplied with National Board Form U-1, rated for working pressure of 125 psig, with flexible EPDM diaphragm sealed into tank, and steel legs or saddles.
- B. Accessories: Pressure gauge and air-charging fitting, tank drain; precharge to 12 psig.

# 2.03 ACCEPTABLE MANUFACTURERS - AIR VENTS

- A. Taco.
- B. Amtrol.
- C. Bell & Gossett.
- D. Substitutions: Under provisions of Division 01.

## 2.04 AIR VENTS

- A. Manual Type: Disk type vent with built-in check valve for manual or automatic operation, discs replaceable without draining system, 1/8 inch shank, rated at 50 psi; Hoffman No. 508 or equal.
- B. Float Type: Maintenance free solid brass construction, continuous air venting, 150 psig standard working pressure, 240° F maximum temperature, 1/2 inch male tread at vent point for pressure testing or remote venting, 1/2 or <sup>3</sup>/<sub>4</sub> inch female threaded connections. Provide with mini ball valve for isolation. Taco 409, Spirotherm Spirotop VTP or approved equal.
- C. High Capacity Automatic Air Vent: Cast iron body, stainless steel and brass trim, EPDM diaphragm, rated for 250°F, 2 PSIG through 150 PSIG, <sup>3</sup>/<sub>4</sub> inch system connection, 3/8 inch NPT connection to atmosphere with drain piping. Provide with isolation valve and strainer upstream of vent. Armstrong AAE-750 or equal.

## 2.05 ACCEPTABLE MANUFACTURERS - AIR SEPARATORS

- A. Spirotherm.
- B. Caleffi.
- C. Bell & Gossett.
- D. Taco.
- E. Substitutions: Under provisions of Division 01.

# 2.06 AIR SEPARATORS

- A. Coalescing type combination air eliminator and dirt separator fabricated of steel, rated for 150 psig working pressure, stamped and registered in accordance with ASME Section VIII, Division 01 for unfired pressure vessels, and include two equal chambers above and below the inlet / outlet nozzles. Unit shall include internal elements filling the entire vessel to suppress turbulence and provide air elimination efficiency of 100% free air, 100% entrained air, and 99.6% dissolved air at the installed location. Dirt separation efficiency shall be a minimum of 80% of all particles 30 micron and larger within 100 passes. The elements must consist of a copper core tube with continuous wound copper wire medium permanently attached and followed by a separate continuous wound copper wire permanently affixed. Each unit shall have a separate venting chamber to prevent system contaminants from harming the float and venting valve operation. At the top of the venting chamber shall be an integral full port float actuated brass venting mechanism. Units shall include a valved side tap to flush floating dirt or liquids and for quick bleeding of large amounts of air during system fill or refill. Include removable lower head for internal inspection.
- B. Air Elimination Valve: Bronze, float operated, for 125 psig operating pressure.

# 2.07 ACCEPTABLE MANUFACTURERS - STRAINERS

- A. Bell & Gossett.
- B. Taco.

- C. Armstrong.
- D. Substitutions: Under provisions of Division 01.

#### 2.08 STRAINERS

- A. Size 2 inch and Under: Screwed brass or iron body for 175 psig working pressure, Y pattern with 1/32 inch stainless steel perforated screen.
- B. Size 2-½ inch to 4 inch: Flanged iron body for 175 psig working pressure, Y pattern with 3/64 inch stainless steel perforated screen.
- C. Size 5 inch and Larger: Flanged iron body for 175 psig working pressure, basket pattern with 1/8 inch stainless steel perforated screen.

## 2.09 ACCEPTABLE MANUFACTURERS - PUMP SUCTION AND DISCHARGE FITTINGS

- A. Taco.
- B. Bell & Gossett.
- C. Armstrong.
- D. Metraflex.
- E. Substitutions: Under provisions of Division 01.

## 2.10 PUMP FITTINGS WITH FLOW STRAIGHTENING

- A. Flexible hose connectors on suction and discharge side of pump with section of corrugated metal house, and braid, with carbon steel plate flange end connections. Corrugated Hose shall be type 304 Stainless Steel. Braid shall be type 304 Stainless Steel. End fittings shall be carbon steel plate flange with 150 lb. drilling.
- B. Incorporate internal flow straightening vanes on fitting on discharge side of pump to reduce turbulence prior to the balancing valve. Vanes to be capable of reducing discharge turbulence equal to 5-10 pipe diameters of straight pipe, while allowing full rated movement of the connector.
- C. Suction and discharge fitting shall be configured with long radius reducing elbow.
- D. Metraflex CRV Flex and Vane Flex or approved equal.

## 2.11 ACCEPTABLE MANUFACTURERS - COMBINATION PUMP DISCHARGE VALVES

- A. Bell & Gossett.
- B. Taco.
- C. Armstrong.
- D. Substitutions: Under provisions of Division 01.

# 2.12 COMBINATION PUMP DISCHARGE VALVES

A. Valves: Straight or angle pattern, flanged cast-iron valve body with bolt-on bonnet for 175 psig operating pressure, non-slam check valve with spring-loaded bronze disc and seat, stainless steel stem, and calibrated adjustment permitting flow regulation.

## 2.13 ACCEPTABLE MANUFACTURERS - FLOW INDICATORS

- A. Bell & Gossett.
- B. Armstrong.
- C. Taco.
- D. Substitutions: Under provisions of Division 01.

#### 2.14 FLOW INDICATORS

A. Brass construction, threaded for insertion into piping system, packless, with paddle with removable segments, vapor proof electrical compartment with switches.

# 2.15 ACCEPTABLE MANUFACTURERS - FLOW CONTROL VALVES

- A. Griswold.
- B. FlowCon.
- C. Hydronic Components, Inc., HCI
- D. RWV Hydronic Controls.
- E. Substitutions: Under provisions of Division 01.

# 2.16 FLOW CONTROL VALVES

- A. Construction, Valves 2" and Smaller: ASTM B584 Brass body, rated at 300 psig @ 250 °F with union on inlet, and outlet, temperature and pressure test plug on inlet and outlet, blowdown/backflush drain.
- B. Construction, Valves larger than 2": Class 150 Flange End Valves shall consist of steel pipe with flange ends, and stainless steel flow control cartridge assembly; 230 psig @ 250 °F; flange ends compatible with ANSI B 16.5-2017 150 lb. Steel flanges shall be permanently marked to show direction of flow.
- C. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 14 times minimum pressure required for control. Four operating pressure ranges shall be available with the minimum range requiring less than 3 psi differential pressure to actuate the mechanism.
- D. Control Mechanism: Stainless steel one-piece cartridge with segmented port design and full travel linear coil spring.
- E. Accessories:
  - 1. In-line strainer on inlet and ball valve on outlet.
  - 2. Pressure/temperature test valves.
  - 3. Provide Identification tags indelibly marked with flow rate, model number, zone identification. Tags shall be 3" x 3" aluminum.

#### 2.17 ACCEPTABLE MANUFACTURERS - FLOW METERS

- A. Bell & Gossett.
- B. Armstrong.
- C. Taco.
- D. Substitutions: Under provisions of Division 01.

# 2.18 FLOW METERS

- A. Orifice principle by-pass circuit with direct reading gauge, soldered or flanged piping connections for 125 psig working pressure, with shut off valves, and drain and vent connections.
- B. Cast iron, wafer type, orifice insert flow meter for 250 psig working pressure, with read-out valves equipped with integral check valves with gasketed caps.
- C. Calibrated, plug type balance valve with precision machined orifice, readout valves equipped with integral check valves and gasketed caps, calibrated nameplate and indicating pointer.
- D. Cast iron or bronze, globe style, balance valve with handwheel with vernier type ring setting and memory stop, readout valves.
- E. Portable meter consisting of case containing one, 3 percent accuracy pressure gauge with 0-60 feet pressure range for 500 psig maximum working pressure, color coded hoses for low and high pressure connections, and connectors suitable for connection to read-out valves.

# 2.19 ACCEPTABLE MANUFACTURERS - BALANCE VALVES

- A. Armstrong.
- B. Taco.
- C. Bell & Gossett.
- D. Substitutions: Under provisions of Division 01.

## 2.20 BALANCE VALVES

- A. Valves 2" and Smaller: Bronze or brass body rated for 300 PSIG working pressure, temperature range shall be from -4°F to 250°F, type 304 Stainless Steel ball valve. Valve body shall include two pressure/temperature ports, a drain valve port and a calibrated nameplate with a memory stop. NPT or sweat end connections.
- B. Valves Larger then 2": Cast Iron body rated for 175 PSIG working pressure, temperature range shall be from -4°F to 250°F, brass ball valve. Valve body shall include two pressure/temperature ports, a drain valve port and a calibrated nameplate with a memory stop. Flanged end connections.

# 2.21 GLYCOL SYSTEM

- A. HDPE storage/mixing tank with cover; pump suction hose with inlet strainer; pressure pump with thermal cut-out; integral pressure switch; integral check valve; cord and plug; pre-charged accumulator tank with EPDM diaphragm; manual diverter valve for purging air and agitating contents of storage tank; 10 to 25 psi pressure adjustable regulating valve complete with pressure gauge; integral replaceable strainer; built-in check valve; union connection; low level pump cut-out. Pressure pump shall be capable of running dry without damage. Provide unit with RIA10-1, Low pressure alarm panel with Remote monitoring dry contracts. Unit shall be completely pre-assembled and certified by a recognized testing agency to CSA standard C22.2 No 68.
- B. Propylene Glycol Solution: Dow Frost HD, Inhibited propylene glycol and water solution mixed 50-50 suitable for operating temperatures of -29<sup>o</sup> F. The glycol shall be delivered to site in sealed containers, provide with color dye red.
- C. Ethylene Glycol Solution: DOWCAL 100, Inhibited ethylene glycol and water solution mixed 40-60 suitable for operating temperatures of -25° F. The glycol shall be delivered to site in sealed containers, provide with color dye green.

#### PART 3 EXECUTION

#### 3.01 INSTALLATION AND APPLICATION

- A. Install specialties in accordance with manufacturer's instructions to permit intended performance.
- B. Support tanks inside building from building in accordance with manufacturer's instructions.
- C. Where large air quantities can accumulate, provide enlarged air collection standpipes.
- D. Provide manual air vents at system high points and as indicated.
- E. For automatic air vents, provide vent tubing to nearest drain or back to glycol tank if in mechanical room. Where a drain is not available run discharge to a 12"x12"x6" high galvanized, water tight pan located in an accessible location.
- F. Provide air separator on suction side of system circulation pump and connect to expansion tank.
- G. Provide valved drain and hose connection on strainer blow down connection.
- H. Support pump fittings with floor mounted pipe and flange supports.
- I. Provide shutoff valves on water inlet to terminal heating units such as radiation, unit heaters, and fan coil unit.

- J. Provide balancing valves on water outlet from terminal heating units.
- K. Provide relief valves on pressure tanks, low pressure side of reducing valves, and heat exchangers.
- L. Select system relief valve capacity so that it is greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment.
- M. Pipe relief valve outlet on water systems to nearest floor drain. Extend relief valve outlet on glycol systems to associated glycol tank.
- N. Where one line vents several relief valves, make cross sectional area equal to sum of individual vent areas.

## 3.02 GLYCOL APPLICATION

- A. Clean and flush piping system before adding glycol solution. See Specification Section 23 2113 for hydronic system cleaning procedures.
- B. Feed glycol solution to system through make-up line with pressure regulator, venting system high points. Set to fill at 12 psig. Pressure system cold at 5 psig, adjust when hot to 12 psig.
- C. Perform tests determining strength of glycol and water solution and submit written test results.

| System           | Fluid Type           |
|------------------|----------------------|
| Chilled Glycol   | 40% Ethylene Glycol  |
| Drycooler Glycol | 50% Propylene Glycol |
| Heating Glycol   | 50% Propylene Glycol |
| Snowmelt System  | 50% Propylene Glycol |

# 3.03 AIR VENT APPLICATION SCHEDULE

| Location                                | Туре          |
|-----------------------------------------|---------------|
| Terminal heating units, mains below     | Manual        |
| Terminal heating units, mains above     | None          |
| Heating mains, at high points in system | Automatic     |
| Combination air separator/strainers     | High capacity |
|                                         |               |

Note: For terminal heating units, mains above unit, install branch piping connections at bottom of mains or 45° from bottom to allow air migration to mains.

# END OF SECTION 23 2116

## SECTION 23 2123 HYDRONIC PUMPS

## PART 1 GENERAL

#### 1.01 WORK INCLUDED

- A. In-line Circulators.
- B. Vertical In-line Pumps.
- C. Close Coupled Pumps.

# 1.02 REFERENCES

A. ANSI/UL 778 - Motor Operated Water Pumps.

## 1.03 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacture, assembly, and field performance of pumps with minimum three years' experience.
- B. Alignment: Base mounted pumps shall be aligned by qualified millwright and alignment certified.

## 1.04 SUBMITTALS

- A. Submit product data under provisions of Division 01.
- B. Submit manufacturer pump curves showing performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.

## 1.05 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data under provisions of Division 01.
- B. Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

# 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site under provisions of Division 01.
- B. Store and protect products under provisions of Division 01.

#### 1.07 EXTRA PARTS

A. Provide one extra set of mechanical seals for pumps.

# PART 2 PRODUCTS

# 2.01 ACCEPTABLE MANUFACTURERS

- A. Grundfos.
- B. Bell & Gossett.
- C. Taco.
- D. Armstrong.
- E. Substitutions: Under provisions of Division 01.

# 2.02 GENERAL CONSTRUCTION REQUIREMENTS

- A. Balance: Rotating parts, statically and dynamically.
- B. Construction: To permit servicing without breaking piping or motor connections.
- C. Pump Motors: Operate at 1750 rpm unless specified otherwise.
- D. Pump Connections: Flanged.

# 2.03 IN-LINE CIRCULATORS

- A. Type: Maintenance free, self-lubricated, 3 speed industrial/commercial single stage, direct drive circulator.
- B. Casing: Cast iron.
- C. Impeller: Type 304 stainless steel.
- D. Bearings: Upper and lower radial bearings to be aluminum oxide ceramic, tungsten carbide shaft bearing surfaces.
- E. Shaft: Stainless steel with type 430F.

# 2.04 VFD CONTROLLED IN-LINE CIRCULATORS

- A. Type: Maintenance free, self-lubricated, pump mounted VFD controlled industrial/commercial single stage, direct drive circulator.
- B. Differential pressure monitoring.
- C. Casing: Cast iron.
- D. Impeller: Type 304 stainless steel.
- E. Bearings: Upper and lower radial bearings to be aluminum oxide ceramic, tungsten carbide shaft bearing surfaces.
- F. Shaft: Stainless steel with type 430F.

# 2.05 VERTICAL IN-LINE PUMPS

- A. Type: Vertical, single stage, close coupled, for in-line mounting, for 175 psig working pressure.
- B. Casing: Cast iron, with suction and discharge gauge port, casing wear ring, seal flush connection, drain plug, flanged suction and discharge.
- C. Impeller: 304 stainless steel.
- D. Shaft: 431 stainless steel.
- E. Seal: 304 stainless steel with tungsten carbide seal faces and EDPM O-rings.

# 2.06 CLOSE COUPLED PUMPS

- A. Type: Horizontal shaft, single stage, close coupled, radially split casing, for 175 psig maximum working pressure.
- B. Casing: Cast iron, with suction and discharge gauge ports, renewable bronze casing wearing rings, seal flush connection, drain plug, flanged suction and discharge.
- C. Impeller: Bronze, fully enclosed, keyed to motor shaft extension.
- D. Shaft: Stainless steel.
- E. Seal: Packing gland with minimum four rings graphite impregnated packing and bronze lantern rings, 230<sup>o</sup> F maximum continuous operating temperature.

# PART 3 EXECUTION

# 3.01 INSTALLATION

- A. Install pumps in accordance with manufacturer's instructions.
- B. Provide access space around pumps for service. Provide no less than minimum as recommended by manufacturer.
- C. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.
- D. Decrease from line size with long radius reducing elbows or reducers.

- E. Support piping adjacent to pump such that no weight is carried on pump casings. In-line pumps are supported by adjacent piping.
- F. For close coupled pumps, provide supports under elbows on pump suction and discharge line sizes 4 inches and over.
- G. Provide line sized shut-off valve and strainer on pump suction, and line sized check and isolation valve on pump discharge.
- H. Provide flexible, flow straightener on pump suction and vaneflex on pump discharge.
- I. Provide air cock and drain connection on horizontal pump casings.
- J. Lubricate pumps before start-up.
- K. Install vertical inline mounted pumps on concrete base, with anchor bolts, set and level, and grout in place.

# END OF SECTION 23 2123

## SECTION 23 2300 REFRIGERATION PIPING

# PART 1 GENERAL

# 1.01 SECTION INCLUDES

- A. Refrigerant Piping.
- B. Refrigerant Moisture and Liquid Indicators.
- C. Refrigerant Valves.

# 1.02 REFERENCES

- A. Air-Conditioning and Refrigeration Institute:
  - 1. ARI 495 Refrigerant Liquid Receivers.
  - 2. ARI 710 Liquid-Line Driers.
  - 3. ARI 730 Flow-Capacity Rating and Application of Suction-Line Filters and Filter Dryers.
  - 4. ARI 750 Thermostatic Refrigerant Expansion Valves.
  - 5. ARI 760 Solenoid Valves for Use with Volatile Refrigerants.
- B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
  - 1. ASHRAE 15 Safety Code for Mechanical Refrigeration.
- C. American Society of Mechanical Engineers:
  - 1. ASME B16.22 Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
  - 2. ASME B16.26 Cast Copper Alloy Fittings for Flared Copper Tubes.
  - 3. ASME B31.5 Refrigeration Piping.
- D. ASTM International:
  - 1. ASTM B280 Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
  - 2. ASTM F708 Standard Practice for Design and Installation of Rigid Pipe Hangers.
- E. American Welding Society:
  - 1. AWS A5.8 Specification for Filler Metals for Brazing and Braze Welding.
  - 2. AWS D1.1 Structural Welding Code Steel.
- F. Manufacturers Standardization Society of the Valve and Fittings Industry:
  - 1. MSS SP 58 Pipe Hangers and Supports Materials, Design and Manufacturer.
  - 2. MSS SP 69 Pipe Hangers and Supports Selection and Application.
  - 3. MSS SP 89 Pipe Hangers and Supports Fabrication and Installation Practices.

# 1.03 SUBMITTALS

- A. Submit shop data under provisions of Division 01.
- B. Submit product data indicating general assembly of specialties, including manufacturer's catalogue information.
- C. Submit manufacturer's installation instructions under provisions of Division 01.
- D. Submit design data as a submittal under provisions of Division 01.
- E. Submit data indicating pipe sizing.
- F. Submit test reports under provisions of Division 01.
- G. Submit Test reports indicating results of leak test, acid test.

# 1.04 PROJECT RECORD DOCUMENTS

- A. Submit documents under provisions of Division 01.
- B. Accurately record exact locations of equipment and refrigeration accessories on record drawings.

# 1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store, protect and deliver products to site under provisions of Division 01.
- B. Deliver and store piping and specialties in shipping containers with labeling in place.
- C. Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.

## PART 2 PRODUCTS

## 2.01 PIPING

- A. Copper Tubing: ASTM B280, Type ACR hard drawn or annealed.
  - 1. Fittings: ASME B16.22 wrought copper.
  - 2. Joints: AWS A5.8 BCuP silver braze.
- B. Copper Tubing to 7/8 inch OD: ANSI/ASTM B88, Type K, annealed.
  - 1. Fittings: ANSI/ASME B16.26 cast copper.
  - 2. Joints: Flared.

## 2.02 MANUFACTURERS

- A. Alco Controls Div, Emerson Electric Company.
- B. Parker Hannifin Corporation.
- C. Substitutions: Under provisions of Division 01.

# 2.03 MOISTURE AND LIQUID INDICATORS

- A. Indicators:
  - 1. Port: Single, UL listed.
  - 2. Body: Copper or brass, flared or solder ends.
  - 3. Sight glass: Color-coded paper moisture indicator with removable element cartridge and plastic cap.
  - 4. Maximum working pressure: 500 psig.
  - 5. Maximum working temperature: 200 degrees F.

#### 2.04 VALVES

- A. Diaphragm Packless Valves: UL listed, globe or angle pattern, forged brass body and bonnet, phosphor bronze and stainless steel diaphragms, rising stem and handwheel, stainless steel spring, nylon seat disc, solder or flared ends, with positive backseating; for maximum working pressure of 500 psi and maximum temperature of 275 degrees F.
- B. Packed Angle Valves: Forged brass or nickel plated forged steel, forged brass seal caps with copper gasket, rising stem and seat, molded stem packing, solder or flared ends; for maximum working pressure of 500 psi and maximum temperature of 275 degrees F.
- C. Packed Ball Valves: Two piece forged brass Body with Teflon ball seals and copper tube extensions, brass seal cap, chrome plated ball, stem with neoprene ring stem seals; for maximum working pressure of 500 psi and maximum temperature of 300 degrees F.

#### PART 3 EXECUTION

#### 3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

## 3.02 INSTALLATION

- A. Provide refrigerant piping between the remote condensing unit and computer room cooling unit. Locate condensing unit per plans.
- B. Install refrigeration specialties in accordance with manufacturer's instructions.
- C. Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.
- D. Install piping to conserve building space and not interfere with use of space.
- E. Group piping whenever practical at common elevations and locations. Slope piping one percent in direction of oil return.
- F. Provide non-conducting dielectric connections when joining dissimilar metals.
- G. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- H. Provide clearance for installation of insulation and access to valves and fittings.
- I. Provide access to concealed valves and fittings. Coordinate size and location of access doors with Division 01.
- J. Insulate piping, refer to Section 23 0700.
- K. Locate expansion valve sensing bulb immediately downstream or evaporator on suction line.
- L. Provide external equalizer piping on expansion valves with refrigerant distributor connected to evaporator.
- M. Install flexible connectors at right angles to axial movement of compressor.
- N. Fully charge completed system with refrigerant after testing.
- O. Provide electrical connection to solenoid valves. Refer to Section 26 0583.

#### 3.03 APPLICATION

- A. Provide line size liquid indicators in main liquid line leaving condenser, or if receiver is provided, in liquid line leaving receiver.
- B. Provide line size strainer upstream of each automatic valve. Where multiple expansion valves with integral strainers are used install single main liquid line strainer.
- C. Provide shut-off valve on each side of strainer.
- D. Provide permanent filter-driers in low temperature systems and systems utilizing hermetic compressors.
- E. Provide replaceable cartridge filter-driers vertically in liquid line adjacent to receivers with three valve bypass assembly to permit isolation of driers for servicing.
- F. Provide replaceable cartridge filter-driers, with three-valve bypass assembly. Provide filterdriers for each solenoid valve.
- G. Provide solenoid valves in liquid line of systems operating with single pump-out or pump-down compressor control, in liquid line of single or multiple evaporator systems, and in oil bleeder lines from flooded evaporators to stop flow of oil and refrigerant into the suction line when system shuts down.
- H. Provide refrigerant charging (packed angle) valve connections in liquid line between receiver shut-off valve and expansion valve.
- I. Utilize flexible connectors at or near compressors where within piping configuration does not absorb vibration.

# 3.04 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Division 01.
- B. Test refrigeration system in accordance with ASME B31.5
- C. Pressure test system with dry nitrogen to 200 psig. Perform final tests at 27 inches vacuum and 200 psig using halide torch or electronic leak detector. Test to no leakage.

END OF SECTION 23 2300

## SECTION 23 3100 HVAC DUCTS AND CASINGS

## PART 1 GENERAL

#### 1.01 SUMMARY

- A. Section Includes:
  - 1. Duct Materials.
  - 2. Duct Fabrication.
  - 3. Laboratory Fume Hood Exhaust Ducts.
  - 4. Flexible Ducts.
  - 5. Insulated Flexible Ducts.

## 1.02 REFERENCES

- A. ASTM International:
  - 1. ASTM A36/A36M Standard Specification for Carbon Structural Steel.
  - 2. ASTM A90/A90M Standard Test Method for Weight Mass of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.
  - 3. ASTM A167 Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
  - 4. ASTM A653/A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - 5. ASTM A1008/A1008M Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
  - 6. ASTM B209 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
  - 7. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.
- B. National Fire Protection Association:
  - 1. NFPA 96 Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.
- C. Sheet Metal and Air Conditioning Contractors:
  - 1. SMACNA HVAC Duct Construction Standard Metal and Flexible.
- D. Underwriters Laboratories Inc.:
  - 1. UL 181 Factory-Made Air Ducts and Connectors.

# 1.03 PERFORMANCE REQUIREMENTS

- A. Duct Sizes: Inside clear dimensions. For lined ducts, maintain sizes inside lining.
- B. Variation of duct configuration or sizes other than those of equivalent or lower loss coefficient is not permitted except by written permission. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.
- C. Constant Volume Supply Air Ductwork: Ductwork shall be sheet metal ductwork designed for static pressure class of +2"wg.
- D. VAV Supply Air Ductwork Upstream of Terminal Units: Ductwork shall be sheet metal ductwork designed for static pressure class of +4" wg.
- E. Supply Air Ductwork Downstream of Terminal Units: Ductwork shall be sheet metal ductwork designed for static pressure class of +2" wg.

- F. Return Air Ductwork: Ductwork shall be sheet metal ductwork designed for static pressure class of -2" wg upstream of the fan and +2" wg downstream of the fan.
- G. General Exhaust Ductwork: General exhaust ductwork shall include all exhaust ductwork which is not otherwise specified. Ductwork shall be sheet metal ductwork designed for static pressure class of -2" wg upstream of the fan and +2" wg downstream of the fan.
- H. Outside Air Ductwork: Ductwork shall be sheet metal ductwork designed for static pressure class of -2" wg.

## 1.04 SUBMITTALS

- A. See General Conditions and the General Requirements in Division 01 regarding submittals.
- B. Product Data: Submit data for duct materials, duct connectors, fire caulking, and duct sealant.

## 1.05 CLOSEOUT SUBMITTALS

- A. Division 01 Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

## 1.06 QUALITY ASSURANCE

- A. Perform Work in accordance with SMACNA HVAC Duct Construction Standards Metal and flexible.
- B. Maintain one copy of each document on site.

## 1.07 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three] years documented experience.

#### 1.08 ENVIRONMENTAL REQUIREMENTS

- A. Division 01 Product Requirements.
- B. Maintain manufacturers requirements for duct sealant temperatures during and after installation of duct sealant.

#### 1.09 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

# 1.10 WARRANTY

A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.

# PART 2 PRODUCTS

# 2.01 DUCT MATERIALS

- A. Galvanized Steel Ducts: ASTM A653/A653M galvanized steel sheet, lock-forming quality, having G60 zinc coating of in conformance with ASTM A90/A90M.
- B. Steel Ducts: ASTM A1008/A1008M cold-rolled.
- C. Aluminum Ducts: ASTM B209; aluminum sheet, alloy 3003-H14. Aluminum Connectors and Bar Stock: Alloy 6061-T6 or of equivalent strength.
- D. Stainless Steel Ducts: ASTM A167, Type 304 or 316 as listed below application specific specification.
- E. Fasteners: Rivets, bolts, or sheet metal screws.
- F. Sealant: Non-hardening, water resistant, fire resistive, compatible with mating materials; liquid used alone or with tape, or heavy mastic. Maximum VOC content of 75 g/L.

G. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

## 2.02 DUCTWORK FABRICATION

- A. Fabricate and support rectangular ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible and ASHRAE handbooks, except as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
- B. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts. No variation of duct configuration or sizes permitted except by written permission.
- C. Construct T's, bends, and elbows with minimum radius 1-1/2 times centerline duct width. Where not possible and where rectangular elbows are used, provide airfoil turning vanes. Where acoustical lining is indicated, furnish turning vanes of perforated metal with glass fiber insulation.
- D. Increase duct sizes gradually, not exceeding 15 degrees divergence and 30 degrees convergence wherever possible. Maximum 30° divergence upstream of equipment and 45° convergence downstream.
- E. Provide standard 45-degree lateral wye takeoffs. When space does not allow 45-degree lateral wye takeoff, use 90-degree conical tee connections.
- F. Provide easements where low pressure ductwork conflicts with piping and structure. Where easements exceed 10 percent duct area, split into two ducts maintaining original duct area.
- G. Plenum connections: Ensure round duct connections are welded joint bellmouth type.
- H. Use double nuts and lock washers on threaded rod supports.

## 2.03 LABORATORY FUME HOOD EXHAUST DUCTS

- A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards.
- B. Construct of 18 gauge stainless steel, using continuous external welded joints.

## 2.04 INSULATED FLEXIBLE DUCTS

- A. Air duct listed by Underwriters Laboratories, Inc., under UL Standard 181 as a Class 1 flexible air duct and complying with NFPA Standards 90A and 90B. Duct shall be factory made and composed of a resilient calendered film liner duct permanently bonded to a coated spring steel wire helix and supporting a fiberglass insulating blanket. Low permeability outer vapor barrier of fiberglass reinforced film laminate shall complete the composite. R value 6, rated velocity 5000 fpm.
  - 1. Operating Pressure: 10" positive pressure, 1" negative pressure (4-12"ID).
  - 2. Operating Pressure: 6 " positive pressure, 1/2" negative pressure (14-16"ID).
  - 3. Operating Pressure: 4" positive pressure, 1/2" negative pressure (18-20"ID).
- B. Thermaflex Model M-KE or approved equal.

# PART 3 EXECUTION

# 3.01 EXAMINATION

- A. Division 01 Administrative Requirements: Coordination and project conditions.
- B. Verify sizes of equipment connections before fabricating transitions.

#### 3.02 INSTALLATION

A. Install ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

- B. Seal ducts in accordance with SMACNA HVAC Duct Construction Standards Metal and Flexible. Refer to SMACNA standard duct sealing requirements per pressure construction class.
- C. During construction, install temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.
- D. Install duct hangers and supports in accordance with Section 23 0529.
- E. Use double nuts and lock washers on threaded rod supports.
- F. Connect flexible ducts to metal ducts with per SMACNA using adhesive plus sheet metal screws.
- G. Where existing ductwork is reused, clean in accordance with 23 4550.
- H. Re-seal all existing, reused ductwork in the area of work in accordance with SMACNA requirements to ensure leakage is minimalized.
- I. Provide non-ferrous ductwork and accessories in the MRI room.

## 3.03 INTERFACE WITH OTHER PRODUCTS

- A. Install openings in ductwork where required to accommodate thermometers and controllers. Install pitot tube openings for testing of systems. Install pitot tube complete with metal can with spring device or screw to prevent air leakage. Where openings are provided in insulated ductwork, install insulation material inside metal ring.
- B. Connect diffusers or light troffer boots to low pressure ducts with 5 feet maximum length of flexible duct held in place with strap or clamp.
- C. Connect air outlets and inlets to supply ducts directly or with five foot maximum length of flexible duct. Do not use flexible duct to change direction.

## 3.04 SCHEDULES

A. Ductwork Material Schedule:

| Air System                             | Material            |
|----------------------------------------|---------------------|
| Supply                                 | Galvanized Steel    |
| Supply, 5'-0" Downstream of Humidifier | Stainless Steel     |
| Manifolds.                             |                     |
| Return and Relief                      | Galvanized Steel    |
| Outside Air Intake                     | Galvanized Steel    |
| General Exhaust                        | Galvanized Steel    |
| MRI Ductwork                           | Aluminum            |
| Laboratory Fume Hood Exhaust           | Stainless Steel     |
| Combustion Air                         | Galvanized Steel    |
| Buried                                 | Closed Cell Plastic |

END OF SECTION 23 3100

# SECTION 23 3300 AIR DUCT ACCESSORIES

# PART 1 GENERAL

#### 1.01 SUMMARY

- A. Section Includes:
  - 1. Back-draft Dampers.
  - 2. Fire Dampers.
  - 3. Combination Fire-and-Smoke Dampers.
  - 4. Duct Access Doors.
  - 5. Volume Control Dampers.
  - 6. Flexible Duct Connections.
  - 7. Duct Test Holes.
  - 8. Turning Vanes.
  - 9. Flexible Duct Connections.
  - 10. Control Dampers.
  - 11. Insulated Control Dampers.

## 1.02 REFERENCES

- A. Air Movement and Control Association International, Inc.:
  - 1. AMCA 500 Test Methods for Louvers, Dampers, and Shutters.
- B. ASTM International:
  - 1. ASTM E1 Standard Specification for ASTM Thermometers.
- C. National Fire Protection Association:
  - 1. NFPA 90A Standard for the Installation of Air Conditioning and Ventilating Systems.
  - 2. NFPA 92A Recommended Practice for Smoke-Control Systems.
- D. Sheet Metal and Air Conditioning Contractors:
  - 1. SMACNA HVAC Duct Construction Standard Metal and Flexible.
- E. Underwriters Laboratories Inc.:
  - 1. UL 555 Standard for Safety for Fire Dampers.
  - 2. UL 555C Standard for Safety for Ceiling Dampers.
  - 3. UL 555S Standard for Safety for Smoke Dampers.

# 1.03 SUBMITTALS

- A. Division 01 Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate for shop fabricated assemblies including volume control dampers and duct access doors.
- C. Product Data: Submit data for shop fabricated assemblies and hardware used.
- D. Product Data: Submit for the following. Include where applicable electrical characteristics and connection requirements.
  - 1. Fire dampers including locations and ratings.
  - 2. Smoke dampers including locations and ratings.
  - 3. Backdraft dampers.

- 4. Flexible duct connections.
- 5. Volume control dampers.
- 6. Duct access doors.
- 7. Duct test holes.
- E. Product Data: For fire dampers and combination fire and smoke dampers submit the following:
  - 1. Include UL ratings, dynamic ratings, leakage, pressure drop and maximum pressure data.
  - 2. Indicate materials, construction, dimensions, and installation details.
  - 3. Damper pressure drop ratings based on tests and procedures performed in accordance with AMCA 500.
- F. Manufacturer's Installation Instructions: Submit for Fire and Combination Smoke and Fire Dampers.
- G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

## 1.04 CLOSEOUT SUBMITTALS

- A. Division 01 Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of access doors and test holes
- C. Operation and Maintenance Data: Submit for Combination Smoke and Fire Dampers.

## 1.05 QUALITY ASSURANCE

- A. Dampers tested, rated and labeled in accordance with the latest UL requirements.
- B. Damper pressure drop ratings based on tests and procedures performed in accordance with AMCA 500.
- C. Maintain one copy of each document on site.

#### 1.06 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years [documented] experience.

# 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 Product Requirements: Product storage and handling requirements.
- B. Protect dampers from damage to operating linkages and blades.
- C. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly indicating manufacturer and material.
- D. Storage: Store materials in a dry area indoor, protected from damage.
- E. Handling: Handle and lift dampers in accordance with manufacturer's instructions. Protect materials and finishes during handling and installation to prevent damage.

#### **1.08 FIELD MEASUREMENTS**

A. Verify field measurements prior to fabrication.

#### 1.09 COORDINATION

- A. Division 01 Administrative Requirements: Coordination and project conditions.
- B. Coordinate Work where appropriate with building control Work.

#### 1.10 WARRANTY

A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.

# 1.11 EXTRA MATERIALS

- A. Division 01 Execution and Closeout Requirements: Spare parts and maintenance products.
- B. Furnish two of each size and type of fusible link.

# 1.12 COMPLETION REQUIREMENTS

- A. In accordance with the General Conditions and the General Requirements in Division 01, Project Closeout; before acceptance and final payment, the Contractor shall furnish:
  - 1. Accurate project record drawings, shown in red ink on prints, showing all changes from the original plans made during installation of the work.
  - 2. Contractors One Year Warranty.
  - 3. All Manufacturers' Guarantees.
  - 4. Operation and Maintenance Manuals.

# PART 2 PRODUCTS

## 2.01 BACK-DRAFT DAMPERS

- A. Manufacturers:
  - 1. Ruskin.
  - 2. Greenheck.
  - 3. Penn.
  - 4. Substitutions: Division 01 Product Requirements.
- B. Gravity backdraft dampers, size 18 x 18 inches or smaller, furnished with air moving equipment, may be air moving equipment manufacturer's standard construction.
- C. Fabricate multi-blade, parallel action gravity balanced backdraft dampers of 16 gauge galvanized steel, or extruded aluminum, with center pivoted blades of maximum 6" width, with felt of flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

## 2.02 ACCEPTABLE MANUFACTURERS - FIRE DAMPERS, SMOKE DAMPERS AND COMBINATION FIRE AND SMOKE DAMPERS

- A. Greenheck.
- B. Ruskin.
- C. Pottorff.
- D. Substitutions: Under provisions of Division 01.

# 2.03 FIRE DAMPERS

- A. Fabricate in accordance with NFPA 90A and UL 555, and shall be dynamic type.
- B. Fire Resistance: Less than 3 hour rated assemblies: 1-1/2 hour rated; 3 hour or greater rated assembly: 3 hour rated.
- C. Dynamic Closure Rating: Dampers shall be classified for dynamic closure to 2000 fpm and 4 inches w.g. (1 kPa) static pressure.
- D. Fabricate ceiling firestop flaps of galvanized steel, 22 gauge frame and 16 gauge flap, two layers 0.125 inch ceramic fiber on top side , and one layer on bottom side for round flaps, with locking clip.
- E. Fabricate ceiling dampers of galvanized steel, 22 gauge frame, stainless steel closure spring, and light weight, heat retardant non-asbestos fabric blanket closure.
- F. Fabricate curtain type dampers of galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for horizontal installations. Configure with blades out of air stream except for low pressure ducts up to 12 inches in height.
- G. Fabricate multiple blade fire dampers with 16 gauge galvanized steel frame and blades, oilimpregnated bronze or stainless steel sleeve bearings and plated steel axles, 1/8 x 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock.

H. Fusible links, UL 33, shall separate at 212 degrees F. Provide adjustable link straps for combination fire/balancing dampers.

## 2.04 COMBINATION FIRE AND SMOKE DAMPERS

- A. Fabricate in accordance with NFPA 90A, UL 555, and UL 555S, and shall be dynamic type.
- B. Fire Resistance: Less than 3 hour rated assemblies: 1-1/2 hour rated; 3 hour or greater rated assembly: 3 hour rated.
- C. Smoke Leakage Rating: Class II, maximum of 20 CFM at 4" W.G. differential pressure.
- D. Damper Temperature Rating: 250°F.
- E. Air Flow Rating: 4,000 FPM.
- F. Differential Pressure Rating: 6" W.G.
- G. Pressure drop as installed to be 0.1 inches water column or less. Increase damper size as required to meet this condition.
- H. Frame: Multiple-blade type; fabricated with roll-formed, 14-gage thick galvanized steel; with mitered and interlocking corners.
- I. Mounting Sleeve: Factory-installed, galvanized sheet steel; length to suit wall or floor application. Furnish silicone caulk factory applied to sleeve at damper frame to comply with leakage rating requirements.
- J. Blades: Airfoil, horizontal or Vertical interlocking, 14-gauge thick, galvanized sheet steel. In place of interlocking blades, use full-length, 14-gage thick, galvanized-steel blade connectors.
- K. Bearings: Self-lubricating, stainless steel pressed into frame.
- L. Seals:
  - 1. Blade: Inflatable silicone fiberglass material to maintain smoke leakage rating to a minimum of 450°F and galvanized steel for flame seal to 1,900°F. Mechanically attached to blade.
  - 2. Jamb: Stainless steel, flexible metal compression type.
- M. Linkage: Blade linkages shall be non-adjustable and concealed within the jamb of the damper.
- N. Fusible Link Release Temperature: 165 degrees F, Resettable.
- O. Actuator: Two-position action. Mount motor out of air stream. Fail closed type operator, that close damper upon power interruption. Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf. Belimo or approved equal.
- P. Electrical Connection: 115 V, single phase, 60 Hz.
- Q. Accessories:
  - 1. Auxiliary switches: Minimum 1 set one for connection to remote test switch.
  - 2. Remote Test Switch: Test and reset switches, remote mounted, which lights indicating OPEN and CLOSED positions. Switches shall be key operated. Provide wiring harness with sufficient flexibility to allow tile removal in cases where switch is located in ceiling tile. Switch cover plate shall be brushed stainless steel. Locate in ceiling or 7'0" high on wall. Location shall be approved by architect.

# 2.05 DUCT ACCESS DOORS

- A. Manufacturers:
  - 1. Duro-Dyne.
  - 2. Ruskin.
  - 3. Nailor.

- 4. Substitutions: General Conditions of the Contract Product Requirements.
- B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards and as indicated.
- C. Review locations prior to fabrication.
- D. Fabricate rigid and close-fitting doors of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ductwork, install minimum one inch thick insulation with sheet metal cover.
- E. Access doors smaller than 12 inches square may be secured with sash locks.
- F. Provide two hinges and two sash locks for sizes up to 18 inches square, three hinges and two compression latches with outside and inside handles for sizes up to 24 x 48 inches. Provide an additional hinge for larger sizes.
- G. Access doors with sheet metal screw fasteners are not acceptable.

## 2.06 VOLUME CONTROL DAMPERS

- A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards Metal and Flexible, and as indicated.
- B. Fabricate splitter dampers of material same gauge as duct to 24 inches size in either direction, and two gauges heavier for sizes over 24 inches.
- C. Fabricate splitter dampers of single thickness sheet metal to streamline shape. Secure blade with continuous hinge or rod. Operate with minimum 1/4 inch diameter rod in self aligning, universal joint action flanged bushing with set screw.
- D. Fabricate single blade dampers for duct sizes to 9-1/2 x 30 inch.
- E. Fabricate multi-blade damper of opposed blade pattern with maximum blade sizes 12 x 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.
- F. Except in round ductwork 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon or sintered bronze bearings.
- G. Provide locking, indicating quadrant regulators on single and multi-blade dampers. Where rod lengths exceed 30 inches provide regulator at both ends. Where volume dampers are located above gypsum or other non-accessible ceilings, extend damper rods to ceiling and install recessed concealed regulator with adjustable cover for flush installation, with cover. Exposed portions shall be chrome plated. Regulator shall include spring washer, lock nut, coupling, ninety degree screw or gear drive and rod as required, Young Regulator or equal. Coordinate location of access covers with Architect.
- H. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.

# 2.07 FLEXIBLE DUCT CONNECTIONS

- A. Manufacturers:
  - 1. Duro-Dyne.
  - 2. Substitutions: Division 01 Product Requirements.
- B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards, and as indicated.
- C. UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 20 oz. per sq. yd., approximately 3 inches wide, crimped into metal edging strip.
- D. Leaded vinyl sheet, minimum 0.55 inch thick, 0.87 lbs. per sq. ft., 10 dB attenuation in 10 to 10,000 Hz range.

# 2.08 DUCT TEST HOLES

A. Cut or drill temporary test holes in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

B. Permanent test holes shall be factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

## 2.09 TURNING VANES

- A. Double Width: Air foil design double width galvanized turning vanes with 2 inch inside radius.
- B. Single Width: Single galvanized turning vane with 2 inch radius and minimum 1" trailing straight leg.
- C. Acoustical Vanes: Double width vanes with inner vane of perforated galvanized steel with 3/32 inch holes on 5/32 inch spacing. Fill space between vanes with minimum 1.5 lb/cu ft glass fiber duct liner.

## 2.10 CONTROL DAMPERS – ACCEPTABLE MANUFACTURERS

- A. Manufacturers:
  - 1. Ruskin.
  - 2. Greenheck.
  - 3. Tamco.
  - 4. Substitutions: Division 01 Product Requirements.

#### 2.11 CONTROL DAMPERS

- A. Multi-blade, opposed blade action, control dampers of extruded aluminum, with airfoil type blades of maximum six inch width, blades positioned across short air opening dimension, field replaceable extruded vinyl sealed edges, linked together in rattle-free manner, non-corrosive molded synthetic bearings, square or hexagonal axles for positive locking connection to blades and linkage, with documented leakage rate not to exceed 6 CFM/sq. ft. at 4" W.G.
- B. Thermally Broken Control Dampers:
  - 1. Extruded aluminum damper frame shall not be less than .080" in thickness. Damper frame shall be insulated with polystyrofoam on three sides if "Installed in Duct" type and on four sides if "Flanged to Duct" type.
  - 2. Blades to be extruded aluminum profiles, internally insulated with expanded polyurethane foam and shall be thermally broken. Complete blade shall have an insulating factor of R-2.29. All blades shall be symmetrically pivoted.
  - 3. Blade seals shall be of extruded silicone. Frame seals shall be of extruded silicone. Seals to be secured in an integral slot within the aluminum extrusions.
  - 4. Bearings shall be a dual bearing system composed of an inner bearing, rotating within a polycarbonate outer bearing inserted in the frame. Bearings are to be maintenance-free, requiring no lubrication.
  - 5. Control shaft shall have an adjustable length and shall be an integral part of the blade axle.
  - 6. Linkage hardware shall be installed in the frame side and constructed of aluminum and corrosion-resistant, zinc-plated steel, complete with cup-point trunnion screws for a slip-proof grip.
  - 7. Dampers are to be designed for operation in temperatures ranging between -40°F and 185°F.
  - 8. Dampers shall be available with either opposed blade action or parallel blade action. Provide opposed blade dampers for modulating damper applications and parallel blade damper action for open/closed damper applications.
  - 9. Leakage shall not exceed 3 cfm/ft<sup>2</sup> against 1" w.g. differential static pressure.

- 10. Dampers shall be AMCA rated for Leakage Class 1A, not to exceed 3 cfm/ft<sup>2</sup> at 1 in w.g. static pressure differential. Standard air leakage data to be certified under the AMCA Certified Ratings Program.
- 11. Dampers shall be made to size required without blanking off free area.
- 12. Dampers shall be installed in flanged connection.

# PART 3 EXECUTION

# 3.01 EXAMINATION

- A. Division 01 Administrative Requirements: Coordination and project conditions.
- B. Verify rated walls are ready for fire damper installation.
- C. Verify ducts and equipment installations are ready for accessories.
- D. Check location of air outlets and inlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.

# 3.02 INSTALLATION.

- A. Install in accordance with NFPA 90A, and follow SMACNA HVAC Duct Construction Standards Metal and Flexible. Refer to Section 23 3100 for duct construction and pressure class.
- B. Install back-draft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.
- C. Access Doors: Install access doors at the following locations and as indicated:
  - 1. Spaced every 50 feet of straight duct.
  - 2. Upstream of each elbow.
  - 3. Upstream of each reheat coil.
  - 4. Before and after each duct mounted filter.
  - 5. Before and after each duct mounted coil.
  - 6. Before and after each duct mounted fan.
  - 7. Before and after each automatic control damper.
  - 8. Before and after each fire damper and combination fire and smoke damper.
  - 9. Downstream of each VAV box.
- D. Access Door Sizes: Install minimum 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, and as indicated. Install 4 x 4 inch for balancing dampers only. Review locations prior to fabrication.
- E. Install temporary duct test holes as required for testing and balancing purposes. Cut or drill in ducts. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.
- F. Install fire dampers, combination fire and smoke dampers at locations as indicated on Drawings. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.
  - 1. Install smoke dampers and combination smoke and fire dampers in accordance with NFPA 92A.
  - 2. Install dampers square and free from racking with blades running horizontally.
  - 3. Do not compress or stretch damper frame into duct or opening.
  - 4. Handle damper using sleeve or frame. Do not lift damper using blades, actuator, or jack shaft.
  - 5. Install bracing for multiple section assemblies to support assembly weight and to hold against system pressure. Install bracing as needed.

# 3.03 FIELD QUALITY CONTROL

- A. Tests and Inspections:
  - 1. Operate dampers to verify full range of movement.
  - 2. Inspect locations of access doors and verify that purpose of access door can be performed.
  - 3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
  - 4. Inspect turning vanes for proper and secure installation.
  - 5. Operate remote damper operators to verify full range of movement of operator and damper.

# 3.04 DEMONSTRATION

- A. Division 01 Execution and Closeout Requirements: Requirements for demonstration and training.
- B. Demonstrate re-setting of fire dampers to Owner's representative.

END OF SECTION 23 3300

# SECTION 23 3400 HVAC FANS

# PART 1 GENERAL

## 1.01 SUMMARY

- A. Section Includes:
  - 1. Downblast centrifugal roof fans.
  - 2. Upblast centrifugal roof fans.
  - 3. Ceiling cabinet fans.
  - 4. Inline cabinet fans.
  - 5. Centrifugal square inline fans.
  - 6. Roof mounted fume exhaust fan.

# 1.02 REFERENCES

- A. American Bearing Manufacturers Association:
  - 1. ABMA 9 Load Ratings and Fatigue Life for Ball Bearings.
  - 2. ABMA 11 Load Ratings and Fatigue Life for Roller Bearings.
- B. Air Movement and Control Association International, Inc.:
  - 1. AMCA 99 Standards Handbook.
  - 2. AMCA 204 Balance Quality and Vibration Levels for Fans.
  - 3. AMCA 210 Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
  - 4. AMCA 300 Reverberant Room Method for Sound Testing of Fans.
  - 5. AMCA 301 Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
- C. American Refrigeration Institute:
  - 1. ARI 1060 Air-to-Air Energy Recovery Ventilation Equipment Certification Equipment Program.
- D. National Electrical Manufacturers Association:
  - 1. NEMA MG 1 Motors and Generators.
  - 2. NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum).
- E. Underwriters Laboratories Inc.:
  - 1. UL 705 Power Ventilators.

# 1.03 SUBMITTALS

- A. Submit shop drawings and product data under provisions of 23 0500 Common Work Results for HVAC.
- B. Shop Drawings: Indicate size and configuration of fan assembly, mountings, weights, ductwork and accessory connections.
- C. Product Data: Submit data on each type of fan and include accessories, fan curves with specified operating point plotted, power, RPM, sound power levels for both fan inlet and outlet at rated capacity, electrical characteristics and connection requirements.
- D. Manufacturer's Installation Instructions: Submit fan manufacturer's instructions.
- E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

# 1.04 CLOSEOUT SUBMITTALS

A. Submit shop drawings and product data under provisions of Division 01 & 23 0500 Common Work Results for HVAC.

B. Operation and Maintenance Data: Submit instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

# 1.05 QUALITY ASSURANCE

- A. Performance Ratings: Conform to AMCA 210 and bear AMCA Certified Rating Seal.
- B. Sound Ratings: AMCA 301, tested to AMCA 300 and bear AMCA Certified Sound Rating Seal.
- C. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.
- D. Balance Quality: Conform to AMCA 204.
- E. Energy Recovery Unit Wheel Energy Transfer Rating: Meet ARI 1060.

#### 1.06 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

## 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site under provisions of Division 01 in factory-fabricated protective containers, with factory-installed shipping skids and lifting lugs.
- B. Protect motors, shafts, and bearings from weather and construction dust.
- C. Protect motors, shafts, and bearings from weather and construction dust.

#### 1.08 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

## 1.09 WARRANTY

- A. Provide warranty under provisions of Division 01: Product warranties and product bonds.
- B. Furnish three years manufacturer's warranty for fans.

#### PART 2 PRODUCTS

#### 2.01 ACCEPTABLE MANUFACTURERS

- A. Greenheck Corp.
- B. Loren Cook Company.
- C. Twin City.
- D. Substitutions: Under provisions of Division 01.

#### 2.02 GENERAL

- A. Fans used shall not decrease motor size, increase noise level, or increase tip speed by more than 10 percent, or increase inlet air velocity by more than 20 percent, from specified criteria. Fans shall be capable of accommodating static pressure variations of plus or minus 10 percent.
- B. Base performance on sea level conditions unless otherwise noted.
- C. Statically and dynamically balance fans to eliminate vibration or noise transmission to occupied areas.

#### 2.03 DOWNBLAST CENTRIFUGAL ROOF FANS

- A. Fan Unit: Downblast type. direct drive, with galvanized steel with baked-on enamel housing; resilient mounted motor; aluminum wire bird screen; square base to suit roof curb with continuous curb gaskets.
- B. Motor: Electronically commutated variable speed.
- C. Accessories:

- 1. Motor Operated Damper: Aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked and line voltage motor drive, power open, spring return.
- 2. Roof Curb: Per Arch.
- 3. Disconnect Switch: Factory wired, NEMA ICS 2, AC general purpose Class A, manually operated unit with number of poles as required by the load served, full-voltage controller for thermal overload protected fractional horsepower induction motors with thermal overload unit, NEMA 250 Type 3R enclosure.

# 2.04 UPBLAST CENTRIFUGAL ROOF FANS

- A. Fan Unit: Upblast type. direct drive, spun aluminum housing with grease tray; resilient mounted motor; aluminum wire bird screen; square base to suit roof curb with continuous curb gaskets.
- B. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at midposition; fan shaft with self-aligning pre-lubricated ball bearings.
- C. Motor: Electronically commutated variable speed.
- D. Accessories:
  - 1. Motor Operated Damper: Aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked and line voltage motor drive, power open, spring return.
  - 2. Roof Curb: Per Arch.
  - Disconnect Switch: Factory wired, NEMA ICS 2, AC general purpose Class A, manually operated unit with number of poles as required by the load served, full-voltage controller for thermal overload protected fractional horsepower induction motors with thermal overload unit, NEMA 250 Type 3R enclosure.

# 2.05 CENTRIFUGAL SQUARE INLINE FANS

- A. Product Description: Direct drive with galvanized steel housing lined with 1/2 inch acoustic glass fiber insulation], integral inlet cone, removable access doors on 3 sides, inlet and outlet duct collar, gravity backdraft damper in discharge, horizontal hanging brackets.
- B. Fan Wheel: Backward inclined centrifugal type, aluminum construction.
- C. Motor and Drive Mounting: Out of air stream.
- D. Motor: Electronically commutated variable speed.
- E. Bearings: ABMA 9 life at 200,000 hours.
- F. Accessories:
  - 1. Belt guard.
  - 2. Motor cover.
  - 3. Inlet safety screen.
  - 4. Outlet safety screen.
  - 5. Flexible duct connector.
  - 6. Flanged inlet & outlet.
  - Disconnect Switch: Factory wired, NEMA ICS 2, AC general purpose Class A, manually operated unit with number of poles as required by the load served, full-voltage controller for thermal overload protected fractional horsepower induction motors with thermal overload unit, NEMA 250 Type 1 disconnect.

# 2.06 ROOF MOUNTED TIERED EXHAUST FAN

A. GENERAL

- 1. Base fan performance at standard conditions (density 0.075 Lb. /ft3).
- 2. Fans selected shall be capable of accommodating static pressure and flow variations of +/-15% of scheduled values.
- 3. Each fan shall be belt driven.
- 4. Each fan to be equipped with 316 stainless steel lifting lugs for corrosion resistance.
- 5. Fasteners exposed to corrosive exhaust shall be stainless steel.
- 6. Fan assembly shall be designed for a minimum of 125 MPH wind loading, without the use of guy wires.

## B. CORROSION RESISTANT COATING

- 1. All steel fan and system components (fan, nozzle, windband and plenum) shall be corrosion resistant coated with LabCoat<sup>™</sup>, a two-part electrostatically applied and baked, sustainable, corrosion-resistant coating system. Standard finish color to be RAL 7023, concrete grey.
- 2. All parts shall be cleaned and chemically prepared for coating using a multistage wash system which includes acid pickling to remove oxide, improving the coating bond to the substrate.
- 3. The first powder coat applied over the prepared surface shall be an epoxy primer. After application, the coating shall be heated to a gelatinous consistency (partial cure) at which time the second powder coat of polyester resin shall be electrostatically applied and then be cured simultaneously at a uniform temperature of 400°F (204°C).
- 4. The coating system shall not be less than a total thickness of 6 mils, shall not be affected by the UV component of sunlight (does not chalk), and have superior corrosion resistance to acid, alkali, and solvents. Coating system shall exceed 4000-hour ASTM B117 Salt Spray Resistance.
- 5. Note that 10-20 mil thick wet coating systems pollute the environment (air and water), and that these manually applied coatings are not uniform over the impeller surface and can cause fan imbalance and vibration.
- C. FAN HOUSING AND OUTLET
  - 1. Fan housing to be aerodynamically designed with high-efficiency inlet, engineered to reduce incoming air turbulence.
  - 2. Fan housing shall be welded steel and meet specification section 2.15 for corrosion resistant coating. No uncoated metal fan parts shall be acceptable.
  - 3. Load bearing or structural fan components that are fabricated of polypropylene or fiberglass that have lower mechanical properties than steel, have rough interior surfaces in which corrosive, hazardous compounds can collect, and / or which chalk and structurally degrade due to the UV component of the sunlight shall not be acceptable.
  - 4. A high velocity conical discharge nozzle shall be supplied by the fan manufacturer and be designed to efficiently handle an outlet velocity of up to 6000 FPM (30.48 m/s). Discharge nozzles shall be steel with corrosion resistant coating or chemical resistant medium density polyethylene with UV inhibitors to prevent chalking and have smooth interior surfaces. Discharge stack caps or hinged covers, impeding exhaust flow shall not be permitted.
  - 5. Provide housing drain for removal of cleaning fluids, rain and condensation.
  - 6. A bolted and gasketed access door shall be supplied in the fan housing allowing for servicing and cleaning. Access door can also be used for impeller inspection or removal of impeller, shaft and bearings without removal of the fan housing.

- D. FAN IMPELLER
  - 1. Fan impeller shall be centrifugal, backward inclined, with non-stall characteristics. The impeller shall be electronically balanced both statically and dynamically per AMCA Standard 204.
  - 2. Fan impeller shall be manufactured of aluminum (AMCA type B spark resistant), fully welded and meet specification section 2.15 for corrosion resistant coating.
- E. FAN BYPASS AIR PLENUM
  - 1. For constant volume systems, the fan shall be connected directly to the exhaust duct without the need of a bypass air plenum. Fans mounted directly to roof curbs shall be provided with a damper tray located in the roof curb for mounting of the gravity isolation damper.
  - 2. For variable volume systems, a bypass air plenum shall be provided as shown on drawings. The plenum shall be equipped with a bypass air damper and intake air hood with bird screen for introducing outside air at roof level upstream of the fan.
  - 3. The plenum shall be constructed of fully welded steel, meet specification section 2.15 for corrosion resistant coating, and mount on roof curb as shown on the project drawings. Plenum to include clean-out access door for cleaning the inlet venturi and inlet duct, and additional drain for grease collection. Plenums that are fabricated of plastics or resins that are combustible and have mechanical properties less than steel shall not be acceptable.
  - 4. The bypass air plenum shall be mounted on factory fabricated roof curb provided by the fan manufacturer, as shown on the project drawings (see section 2.5)
  - 5. Fan designs that use inlet flexible connectors that can leak causing loss of lab exhaust shall not be accepted.
  - 6. Bypass air dampers shall be opposed-blade design and coated with up to 4 mils of Hi-Pro Polyester resin, electrostatically applied and baked.
  - 7. A fan isolation damper, either gravity backdraft or two position actuated, fabricated of steel or aluminum, and coated with minimum 4 mils of Hi-Pro Polyester resin, electrostatically applied and baked, shall be provided as shown on the project documents.
  - 8. Blower / Plenum vibration isolation shall be limited to neoprene / cork vibration pads.
- F. BYPASS AIR PLENUM CURB
  - 1. Exhaust system manufacturer shall supply a structural support curb for the plenum, of specified height, as shown on the drawings.
  - 2. Curb shall be fabricated of a minimum of 14 gauge of galvanized corrosion resistant coated steel and structurally reinforced.
  - 3. Curbs shall be insulated.
  - 4. Roof curb to be a minimum of 18 inches tall and include venting to prevent heat build-up around the duct.
  - 5. When properly anchored to the roof structure, the standard curb / plenum / blower assembly shall withstand wind loads of up to 125 mph without additional structural support.
- G. FAN MOTORS AND DRIVE
  - 1. Motors shall be premium efficiency, standard NEMA frame, 1800 or 3600 RPM, Totally Enclosed Fan Cooled (TEFC) with a 1.15 service factor. A factory-mounted NEMA 4 disconnect switch shall be provided for each fan. Motor maintenance shall be accomplished without fan impeller removal or requiring maintenance personnel to access the contaminated exhaust components.
- 2. Drive belts and sheaves shall be sized for 200% of the motor horsepower, and shall be readily and easily accessible for service, if required. Drive shall consist of a minimum of two belts under all circumstances.
- 3. Fan shaft to be turned and polished of 316 stainless steel, coated with corrosion resistant coating.
- 4. Fan shaft bearings shall be Air Handling Quality, ball or roller pillow block type and be sized for an L-10 life of no less than 100,000 hours. Bearings shall be fixed to the fan shaft using concentric mounting locking collars, which reduce vibration, increase service life, and improve serviceability. Bearings that use set screws shall not be allowed.
- 5. All shaft bearings shall have extended lube lines with Zerk fittings.

# PART 3 EXECUTION

#### 3.01 EXAMINATION

A. Verify roof curbs and exhaust hoods are installed and dimensions are as shown on shop drawings.

#### 3.02 PREPARATION

A. Coordinate with other trades for installation of roof curbs. Refer to requirements of Division 07 for installation.

# 3.03 INSTALLATION

- A. Secure fans with stainless steel lag screws to roof curb.
- B. Suspended Fans: Install flexible connections specified in Section 23 3300 between fan and ductwork. Ensure metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.
- C. Install backdraft dampers on inlet to roof exhaust fans.
- D. Provide backdraft dampers on outlet from cabinet and ceiling fans and as indicated on Drawings.
- E. Install safety screen where inlet or outlet is exposed.
- F. Install backdraft dampers on discharge of exhaust fans and as indicated on Drawings.

# 3.04 MANUFACTURER'S FIELD SERVICES

A. Division 01 - Quality Requirements: Requirements for manufacturer's field services.

# 3.05 CLEANING

A. Vacuum clean inside of fan cabinet.

#### 3.06 **DEMONSTRATION**

A. Demonstrate fan operation and maintenance procedures.

# 3.07 PROTECTION OF FINISHED WORK

A. Do not operate fans for until ductwork is clean, filters in place, bearings lubricated, and fan has been test run under observation.

### SECTION 23 3600 AIR TERMINAL UNITS

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Variable volume terminal units.
- B. Fan Powered VAV Terminal Units.

# 1.02 REFERENCES

- A. NFPA 90A Installation of Air Conditioning and Ventilation Systems.
- B. UL 181 Factory-Made Air Ducts and Connectors.

#### 1.03 SUBMITTALS

- A. Submit product data under provisions of Section 23 0500 and Division 01.
- B. Submit product data indicating configuration, general assembly, and materials used in fabrication. Include catalog performance ratings which indicate air flow, static pressure, and NC designation.
- C. Submit manufacturer's installation instructions under provisions of Section 23 0500 and Division 01 Standard General Provisions.

#### 1.04 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data under provisions of Section 23 0500 and Division 01.
- B. Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts lists.

#### 1.05 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum three years documented experience.

#### 1.06 WARRANTY

A. Provide warranty under provisions of Division 01.

# PART 2 PRODUCTS

# 2.01 MANUFACTURERS

- A. Krueger.
- B. Titus.
- C. Price.
- D. Trane.
- E. Substitutions: Under provisions of Division 01 Standard General Provisions.

#### 2.02 VARIABLE AIR VOLUME (VAV) TERMINAL UNITS

- A. Variable air volume supply air terminals for connection to single medium pressure duct, central air system. Provide hot water heating coil at units noted on the drawings.
- B. Identify each VAV unit with clearly marked identification label and airflow indicator. Label shall include unit nominal air flow, maximum factory set air flow, minimum factory set air flow, and coil type.
- C. The control system serving the VAV air terminal units shall be electronic DDC controls. The contractor shall coordinate fully with Specification Section 23 0923. Controls will be furnished by Section 23 0923 for field installation by control contractor or installed by the factory; coordinate with DDC contractor. Verify controls are compatible with VAV boxes and enclosures are sized to accommodate control components.

- D. Boxes to be able to provide accurate flow measurements with 1-1/2 diameters or less of straight ductwork prior to unit inlet.
- E. Casings: Minimum 22 gauge galvanized steel.
- F. Coil: Hot water reheat coils shall be enclosed in a minimum 20-gauge galvanized steel casing with slip and drive construction for attachment to metal ductwork. Coils shall be factory installed on the terminal discharge. Fins shall be rippled and corrugated heavy gauge aluminum, mechanically bonded to tubes. Tubes shall be copper with minimum wall thickness of 0.016-inch with male solder header connections. Coils shall be leak tested to 300 psi with minimum burst pressure of 1800 psi at ambient temperature. Number of coil rows and circuits shall be selected to provide performance as required per the plans. Coil performance data shall be based on tests run in accordance with ARI Standard 410.
- G. Lining: Unit casing shall be lined with 13/16" thick, 4 lb. density, rigid board insulation with nylon reinforced foil covering insulation fibers that meets UL 181 and NFPA 90A. Liner shall be attached to unit casing with bull nosing to seal the insulation cut edges.
- H. Access Doors: Locate an access door in each box, to allow adequate space for cleaning.
- I. Assembly: Air volume damper, fans, and controls in single cabinet.
- J. Plenum Air Inlets: S and drive connections for duct attachment.
- K. Identify each airflow unit with clearly marked identification label and airflow indicator. Label shall include unit nominal airflow, maximum factory set air flow, minimum factory set air flow, and coil type.
- L. Locate air volume damper and flow sensor assembly inside unit casing. Construct from extruded aluminum or 20 gauge galvanized steel components. Key damper blades into shaft with nylon fitted pivot points.

# 2.03 FAN POWERED VARIABLE AIR VOLUME (VAV) TERMINAL UNITS

- A. CONSTRUCTION
  - 1. General. Series/Parallel Fan-Powered Terminal Units shall be GREENHECK Air Terminal Units. The units shall be the size and capacity as outlined in the plans and specifications. Casing dimensions shall be checked to ensure the terminals fit the available space.
  - 2. Casing. The air terminals shall be constructed of galvanized steel. The casing shall be a minimum of 22-gauge. The terminal primary air inlet valve shall have a round inlet for field duct connection. The terminal unit discharge shall allow for a rectangular flanged duct connection. Units shall have a universal control-mounting panel constructed of minimum 22-gauge steel. Control panel shall include stand-offs to allow controls to be mounted without penetrating the terminal casing. Control panels without stand-offs are not acceptable. Fan mounting deck shall be a minimum of 18-gauge.
  - 3. Optional Filter Rack. Unit shall include filter rack in the induced air inlet and shipped from the manufacturer with a 1 or 2"construction filter.
  - 4. Optional Sliding Door Control Panel Cover. Provide a sliding control panel cover that slides towards the primary inlet and prevents the cover from being removed.
- B. PRIMARY INLET AIR VALVE
  - Inlet Tube. Primary inlet air valve assembly shall have a seamless butt weld on round inlet tube to minimize leakage and prevent the damper from binding on overlapping seam welds. Inlet tubes with overlapping welds or non- continuous, skipped welds are not acceptable. Inlet air valve shall have three structural beads machine formed into the tube. One external bead shall be provided for the attachment of flexible duct. Inlet air valves without three structural beads are not acceptable.
  - 2. Flow Sensor. Primary inlet air valve flow sensor shall be multi-quadrant averaging sensor with flow sampling of both velocity pressure and flow differential pressure from four

quadrants, and shall contain two control ports and two accessory ports. Flow sensors sampling only velocity pressure in all four quadrants are not acceptable. Sensors reading differential pressure with fewer than 8 measuring points are not acceptable. All piping connections to the flow sensor must be made with external ports that extend through damper tube. Units with piping connections made in the primary air stream are not acceptable. Flow sensors with plastic piping connections of any kind are not acceptable. At an inlet velocity of 2000 fpm, the differential static pressure required to operate any terminal size shall not exceed 0.14" wg. for the basic terminal.

- 3. Optional Removable Sensor. Air terminals with inlet flow sensing devices shall be provided with a gasketed access door to permit removal, inspection and cleaning of the air flow sensor.
- 4. Damper Assembly. Damper shaft shall rotate in a self-lubricating, long life, low friction thermo- plastic bearing. Damper shaft construction shall be one piece, continuous extruded aluminum. Damper shaft end shall include a permanent cast damper position indicator. Damper tube shall be free of obstructions including damper stops to allow the free rotation of the damper. Mechanical damper stops located in the inlet tube are not acceptable. A flexible gasket-mounted damper blade without adhesives shall provide damper seal. Damper gasket shall include slit partitioning around the perimeter to prevent damper noise at low flows near full close off. Damper gaskets without perimeter slit partitioning are not acceptable. Mechanically fastened damper assembly shall be double layer, 18 gauge equivalent, galvanized steel with integral blade seal. Leakage through the damper assembly shall be less than 1% of maximum CFM at 3" static pressure.
- C. INSULATION
  - Optional Closed-Cell Foam Insulation. Air Terminals shall be internally insulated with (½", 1") thick, 1.5lb. /ft3 density, closed-cell foam insulation and shall be Thermopure for fiber free application. Exposed fiberglass is not acceptable. Insulation shall comply with UL 181 and NFPA 255 (25/50). Material shall be chemically resistant to most hydrocarbon based solvents. Material shall not support mold growth or demonstrated degradation while subject to air erosion when tested in accordance to UL 181 and UMC 10.1.2.
- D. FAN ASSEMBLY, PSC/ECM MOTORS, AND CONTROLS
  - 1. Fan Assembly. Unit construction shall include isolation between the motor and fan housing.
  - 2. ECM Motor. Optional ECM Motor: Fan shall be a forward curve, dynamically balanced with a direct drive motor. Motors shall be single phase, 60 cycle, 120, 208, or 277 volts. The motor shall be single speed manufactured specifically to meet the torque requirements for each size terminal.
  - 3. ECM Controls. Units shall include the model XG-ECM-RPM controller by GREENHECK. Controller shall allow remote adjustment of the motor. Controller shall accept either a 2-10 Vdc signal or 4-20 mA signal to control RPM. Control shall also allow the option for a 1 Vdc signal to turn off the fan. Units shall include the model XG-ECM-VCU controller by GREENHECK. Controller shall allow manual motor adjustment. Controller shall have a 4 digit LED display indicating motor RPM. The display shall also show a flow index.
- E. HOT WATER COIL
  - 1. Construction. Hot Water Coils are to be factory mounted to the discharge outlet of the terminal. The number of rows and circuits shall meet the capacities as shown in the schedule. Hot water coils shall be enclosed in a minimum 20-gauge coated steel casing allowing attachment to metal ductwork with a slip and drive connection. Fins shall be rippled and sine wave type, constructed from heavy gauge aluminum, and mechanically bonded to the tubes. Tubes shall be copper with a minimum wall thick- ness is 0.016" with male sweat header connections.

- 2. Performance. Coils shall be leak tested to 300 psi with minimum burst of 2000 psi at ambient temperature. Coil performance data shall be rated and presented in accordance with AHRI standard
- 3. 410. Coils must be ARI rated, certified and include an AHRI label. Coils that are not AHRI rated, certified or labeled AHRI are not acceptable.

# PART 3 EXECUTION

# 3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide ceiling access doors or locate units above easily removable ceiling components.
- C. Support units individually from structure. Do not support from adjacent ductwork.
- D. Label ceiling grid adjacent to ceiling tile for access to unit in accordance with Section 23 0553.
- E. Connect to ductwork in accordance with Section 23 3100.
- F. Field verify connection requirements to existing ductwork. Provide ductwork transition as required for connection to existing ductwork.
- G. Provide gasketed access door in ductwork downstream of heating coil for access.

# SECTION 23 3700 AIR OUTLETS AND INLETS

# PART 1 GENERAL

# 1.01 WORK INCLUDED

- A. Diffusers.
- B. Diffuser Boots.
- C. Registers/Grilles.
- D. Louvers.
- E. Louvered Penthouses.
- F. Roof Hoods.
- G. Goosenecks.

# 1.02 REFERENCES

- A. ADC 1062 Certification, Rating and Test Manual.
- B. AMCA 500 Test Method for Louvers, Dampers and Shutters.
- C. ANSI/NFPA 90A Installation of Air Conditioning and Ventilating Systems.
- D. ARI 650 Air Outlets and Inlets.
- E. ASHRAE 70 Method of Testing for Rating the Air Flow Performance of Outlets and Inlets.
- F. SMACNA HVAC Duct Construction Standard.

# **1.03 QUALITY ASSURANCE**

- A. Test and rate performance of air outlets and inlets in accordance with ADC Equipment Test Code 1062 and ASHRAE 70.
- B. Test and rate performance of louvers in accordance with AMCA 500.

# 1.04 REGULATORY REQUIREMENTS

- A. Conform to ANSI/NFPA 90A.
- B. Earthquake tabs, in seismic zones, in accordance with IBC Standards.

# 1.05 SUBMITTALS

- A. Submit product data under provisions of Division 01.
- B. Provide product data for items required for this project.
- C. Review requirements of outlets and inlets as to size, finish, and type of mounting prior to submitting product data.

# PART 2 PRODUCTS

# 2.01 ACCEPTABLE MANUFACTURERS - DIFFUSERS, REGISTERS AND GRILLES

- A. Krueger.
- B. Price.
- C. Titus.
- D. Substitutions: Under provisions of Division 01.

# 2.02 CEILING SUPPLY REGISTERS/GRILLES

- A. Streamlined and individually adjustable curved blades to discharge air along face of grille, 2way deflection.
- B. Fabricate 1-1/4 inch margin frame with countersunk screw mounting and gasket.
- C. Fabricate of aluminum extrusions with factory off-white enamel finish.

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D. Provide integral, gang-operated opposed blade dampers with removable key operator, operable from face.

#### 2.03 CEILING GRID CORE EXHAUST AND RETURN REGISTERS/GRILLES

- A. Fixed grilles of  $1/2 \times 1/2 \times 1/2$  inch louvers.
- B. Fabricate 1-1/4 inch margin frame with countersunk screw mounting or lay-in frame for suspended grid ceilings.
- C. Fabricate of aluminum with factory baked enamel finish.
- D. Where not individually connected to exhaust fans, provide integral, gang-operated opposed blade dampers with removable key operator, operable from face.
- E. Provide earthquake tabs for installation in lay-in ceiling.

#### 2.04 CEILING/WALL LINEAR EXHAUST AND RETURN SLOT DIFFUSERS

- A. Continuous one inch wide slot, number of slots per schedule, with adjustable vanes for left, right, or vertical discharge.
- B. Fabricate of aluminum extrusions with factory baked enamel off-white finish.
- C. Fabricate 1-1/4 inch margin frame with countersunk screw support clips for T-bar mounting and gasket.
- D. Provide earthquake tabs for installation in lay-in ceiling.

#### 2.05 CEILING/WALL SLOT DIFFUSERS

- A. Continuous one inch wide slot, number of slots per schedule, with adjustable vanes for left, right, or vertical discharge.
- B. Fabricate of aluminum extrusions with factory baked enamel off-white finish.
- C. Fabricate 1-1/4 inch margin frame with countersunk screw support clips for T-bar mounting and gasket.
- D. Provide earthquake tabs for installation in lay-in ceiling.

#### 2.06 WALL SUPPLY REGISTERS/GRILLES

- A. Streamlined and individually adjustable blades, depth of which exceeds 3/4 inch maximum spacing with spring or other device to set blades, horizontal face, double deflection.
- B. Fabricate 1-1/4 inch margin frame with countersunk screw mounting and gasket.
- C. Fabricate of steel with 20 gauge minimum frames and 22 gauge minimum blades, steel and aluminum with 20 gauge minimum frame, or aluminum extrusions, with factory baked enamel off-white finish.
- D. Provide integral, gang-operated opposed blade dampers with removable key operator, operable from face.
- E. In gymnasiums, blades shall be front pivoted, welded in place or securely fastened to be immobile.

#### 2.07 WALL SUPPLY REGISTERS/GRILLES

- A. Streamlined and individually adjustable curved blades to discharge air along face of grille, twoway deflection.
- B. Fabricate 1-1/4 inch margin frame with countersunk screw mounting and gasket.
- C. Fabricate of aluminum extrusions with factory baked enamel off-white finish.
- D. Provide integral, gang-operated opposed blade dampers with removable key operator, operable from face.

# 2.08 WALL EXHAUST AND RETURN REGISTERS/GRILLES

- A. Streamlined blades, depth of which exceeds 3/4 inch spacing, with spring or other device to set blades, horizontal face.
- B. Fabricate 1-1/4 inch margin frame with countersunk screw mounting.
- C. Fabricate of steel with 20 gauge minimum frames and 22 gauge minimum blades, steel and aluminum with 20 gauge minimum frame, or aluminum extrusions, with factory baked enamel off-white finish.
- D. Where not individually connected to exhaust fans, provide integral, gang-operated opposed blade dampers with removable key operator, operable from face.

#### 2.09 ACCEPTABLE MANUFACTURERS - LOUVERS

- A. Greenheck.
- B. Ruskin.
- C. Pottorff.
- D. Substitutions: Under provisions of Division 01.

#### 2.10 LOUVERS

- A. Provide 6 inch deep louvers with blades on 45 degree slope with center baffle and return bend, heavy channel frame, birdscreen with 3/4 inch square mesh for exhaust and 1 inch for intake.
- B. Fabricate of 16 gauge galvanized steel or 12 gauge extruded aluminum, welded assembly, with factory baked enamel finish.
- C. Fabricate louver penthouses with mitered corners and reinforce with structural angles.

#### 2.11 ACCEPTABLE MANUFACTURERS - ROOF HOODS

- A. Pace.
- B. Greenheck.
- C. Carnes.
- D. Substitutions: Under provisions of Division 01.

#### 2.12 ROOF HOODS

- A. Fabricate air inlet or exhaust hoods in accordance with SMACNA HVAC Duct Construction Standards.
- B. Fabricate of galvanized steel, minimum 16 gauge base and 20 gauge hood, or aluminum, minimum 16 gauge base and 18 gauge hood; suitably reinforced; with removable hood; birdscreen with 1/2 inch square mesh for exhaust and 3/4 inch for intake, and factory baked enamel finish.
- C. Mount unit on minimum 16 inch high curb base with insulation between duct and curb.
- D. Make hood outlet area minimum of twice throat area.

#### 2.13 GOOSENECKS

- A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards of minimum 18 gauge galvanized steel.
- B. Mount on minimum 16 inch high curb base.

#### PART 3 EXECUTION

#### 3.01 INSTALLATION

- A. Install items in accordance with manufacturers' instructions.
- B. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.

- C. Install diffusers to ductwork with air tight connection.
- D. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, regardless of whether dampers are specified as part of the diffuser, or grille and register assembly.
- E. Paint ductwork visible behind air outlets and inlets matte black.

#### SECTION 23 4550 VENTILATION SYSTEM CLEANING

#### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Cleaning of air distribution systems including, but not limited to, fans, air handling equipment, duct work and accessories, air plenums, terminal units, supply and return air distribution devices within the areas of remodel work for the existing building.
- B. The following systems and equipment do not require cleaning: ceiling spaces used as return air plenums, boiler room ventilation systems, combustion air systems, or make-up air systems used exclusively in conjunction with any of these exhaust systems.

# 1.02 RELATED SECTIONS AND DRAWINGS

- A. Section 23 0500 Basic Mechanical Materials and Methods.
- B. Section 23 4551 Ventilation System Cleaning Accessories

#### 1.03 REFERENCE

- A. North American Insulation Manufacturers Association (NAIMA) Cleaning Fibrous Glass Insulated Air Duct Systems.
- B. ACR, The NADCA Standard: 2021 Edition for the Assessment, Cleaning, and Restoration of HVAC Systems.
- C. Asbestos Hazardous Emergency Response Action (AHERA) Documentation.

#### 1.04 SUBMITTALS

- A. Submit under provisions of Division 01.
- B. Submittals shall be provided in electronic PDF Format. The data in the electronic file shall be arranged and indexed under basic categories. An index shall be included with bookmarks and identifying tabs between sections.
- C. Provide Qualifications included NADCA certifications and minimum 3 project references for projects of similar size and complexity.
- D. Initial Contractor Work Plan Submittal.
  - 1. Initial Contractor Work Plan shall be submitted by the Contractor within one week of award of contract for review and approval by the Owner.
  - 2. Initial Contractor Work Plan shall consist of two separate parts, a Project Work Plan manual and a separate set of Contractor Project Drawings.
  - 3. Project Work Plan manual shall include the following information presented in a report, bound 8-1/2"x11" format, arranged in the sections as follows:
    - a. Cover sheet bearing the title and date of the project and the name, address, and contact number of the Contractor.
    - b. PROJECT SUMMARY: This section shall outline the intended approach to be exercised by the Contractor to successfully perform this project. It shall also include the work plan, work practices, and other steps the Contractor will take to minimize and measure his worker's exposure to asbestos. A statement shall be explicitly made certifying that the Contractor has full knowledge of the extent of the services required to complete this project.
    - c. PROJECT SCHEDULE: This section shall outline the preliminary schedule of the project identifying specific critical points with respect to inspections of system for partial acceptance by the Owner.
    - d. PROJECT PERSONNEL: This section shall include information concerning personnel to be assigned to specific tasks.

- e. MEANS AND METHODS: This section shall include information concerning equipment that will be utilized for this project. Specific approved methods shall be identified with respect to each equipment type, air handling unit, coils, ductwork, etc., to be cleaned. INCLUDE HEPA EQUIPMENT PERFORMANCE DATA showing capture efficiency of 99.97% rated at 0.3 micron particulate.
- f. QUALITY CONTROL PROCEDURE: This section shall include, in statement form, Contractor's own inspection procedure to be executed prior to submission of work for inspection by the Owner.
- 4. Contractor Project Drawing shall consist of markup of project plans by the Contractor showing location of required demolition and repair and showing proposed new access points, access panels, access doors, and shall identify all equipment and areas to be cleaned. The Contractor Project Drawing shall form the basis and record of inspection during the progress of this project.
- E. Final Submittal/Project Completion Report.
  - 1. The Contractor shall make final submittal of an updated Contractor Project Work Plan and Contractor Project Drawing reflecting the actual work performed and the as-built conditions and revise the report title as the Project Completion Reports. The Contractor Project Drawings shall accurately depict the as-built locations of all access points, access panels, access doors, etc. Final submittal shall be submitted minimum of one week prior to request for final inspection to allow the Owner sufficient time for review and approval.
  - 2. The Contractor shall include an appendix in the Project Completion Report for the inclusion of photographic records of selected duct sections, duct work accessories such as turning vanes, etc., and other system equipment demonstrating conditions before and after the cleaning. Number of photo-documented locations shall be a minimum of 5 distinct system locations per single system set. Arrange photographs on 8-1/2" x 11" pages with captions denoting information presented. Photographs shall be color of sufficient clarity to show the intended information. Black and white photocopies not allowed.
  - 3. The Contractor shall include an appendix in the Project Completion Report for the documentation of observed deficiencies relating to this project observed during the work of this project and those not addressed as part of this project. Provide sufficient information for use by the Owner in separate follow-up remediation efforts.

# 1.05 APPROVED CLEANING METHODS

- A. Direct Impact Removal Method.
  - 1. This method involves the direct removal of embedded dirt and debris using hand tools or hand held power tools such as scrapers and brushes from surfaces that are capable of sustaining significant degree of impact without permanent deformation.
  - 2. Tools for this method are limited to that which will not damage surface coating or removal of base material as a result of the application.
  - 3. Where application of this method may introduce airborne dust, negative pressure HEPA vacuum collection equipment must be utilized as a means of capturing the airborne dust while work is in progress. HEPA vacuum equipment exhaust must be exhausted to the outside of the facility.
- B. Contact Vacuuming Method.
  - 1. This method involves the application of HEPA vacuum-cleaning equipment with hand operated brush head in direct contact with the surface to be cleaned.
  - 2. Tools for this method are limited to that which will not damage surface coating as a result of the application.
  - 3. Where application of this method may introduce air borne dust, negative pressure HEPA vacuum collection equipment must be utilized as a means of capturing the airborne dust

while work is in progress. HEPA vacuum equipment exhaust must be exhausted to the outside of the facility.

- C. Air Wash Method.
  - 1. This method involves the direct application of compressed air as a means to loosen dirt and debris which is then drawn into a HEPA vacuum collection equipment utilized to develop a negative pressure in the area to be cleaned. HEPA vacuum equipment exhaust must be exhausted to the outside of the facility.
- D. Power Brush Method.
  - 1. This method involves the use of pneumatic or electrically powered rotary bristle brush to loosen dirt and debris which is then drawn into a HEPA vacuum collection equipment utilized to develop a negative pressure in the area to be cleaned. HEPA vacuum equipment exhaust must be exhausted to the outside of the facility.

#### 1.06 QUALIFICATIONS

A. Minimum qualifications: NADCA certified Air Systems Cleaning Specialits and Demonstration of satisfactory completion of five projects of similar scope in the State of Alaska during the past five years. Provide references if requested.

# 1.07 QUALITY ASSURANCE

- A. The Contractor shall arrange work in such manner as to not impact the normal operation of the facility.
- B. The Contractor shall assign only personnel regularly engaged in the specific tasks assigned throughout the project.
- C. The Contractor shall make available the entire project for inspection by the Owner at all times. Where such inspection may require specific access, observation, or personnel protective equipment, the Contractor shall make such equipment available for use by the Owner.
- D. The Owner reserves the right to make inspections of work site, work in progress, and reinspection of completed work regardless of previous inspection performed. The Contractor shall make arrangements to allow for inspection by the Owner.
- E. The Owner reserves the right to issue Stop Work Order affecting the project either in part or its entirety to the Contractor with no further remedy to the Contractor if the Owner determines the action of the Contractor or the condition of work represents a potential impact to the safety and operation of the facility. The Contractor shall comply with such Stop Work Order and proceed to make any necessary remediation or supplement as deemed appropriate by the Owner. The Contractor shall not resume work without formal written authorization by the Owner. Cost associated with the Stop Work Order shall be borne by the Contractor and will not be a basis for increase of contract amount or time extension.

#### 1.08 PROJECT/SITE CONDITIONS

- A. The Contractor shall arrange the work in such manner as to minimize potential for contamination of occupied spaces.
- B. The Contractor shall be responsible for the condition of the occupied areas served by the systems under this project and shall provide the necessary cleaning effort on a daily basis.
- C. The Contractor shall be responsible for the safety of the workers and building occupants. Where overhead work is performed, provide hard hats for workers in place and for any building occupants that may enter into the work area.

# 1.09 INSPECTION OF PARTIAL WORK/PARTIAL ACCEPTANCE

A. The Contractor shall coordinate for the Owner's inspection and acceptance of components of systems that may not be available at time of final inspection. Submit request for inspection in writing to the Owner a minimum of 24 hours prior to the requested inspection. B. Partial inspection shall be on a system basis. In general, an entire ductwork system and accessories associated with one air handling system shall be covered under one inspection.

### 1.10 SYSTEM START-UP/FINAL INSPECTION

- A. The Contractor shall coordinate for the Owner's witness of the Startup and Final Inspection of all equipment at the completion of the project. Submit request for inspection in writing to the Owner a minimum of 24 hours prior to the requested inspection and only after the approval of the Final Submittal.
- B. Upon completion of Final Inspection, the Contractor shall perform the startup of the equipment and, after the initial start-up period, conduct a walk-through of the facility with the Owner to verify the condition of the spaces served by the equipment is ready for final air quality clearance monitoring.
- C. At completion of the project, proper operation of Fire/Smoke dampers shall be demonstrated. Deficiencies shall be identified for potential change order notified through the Contractor to the Owner.

# 1.11 AIR QUALITY CLEARANCE MONITORING

- A. The Owner will, at his own expense, contract a separate testing agency to provide air quality clearance monitoring to support this project. The air quality clearance monitoring testing shall monitor the airborne dust level and to detect possible release of asbestos fibers into the building atmosphere.
- B. An initial air quality clearance monitoring test will be conducted prior to the beginning of the Contractor's work to establish the base line data of airborne dust level.
- C. Upon completion of the work by the Contractor, and after the acceptance by the Owner and the start-up process, the Owner will initiate post-cleaning air quality clearance monitoring by a separate Contractor. If the post-cleaning air quality clearance monitoring test results show a higher level of dust in the air than the base line results, or if asbestos fiber has been introduced into the building atmosphere, the Contractor shall immediately arrange for the air purging of the affected areas. The additional cost of the air purging shall be the responsibility of the Contractor and shall not constitute grounds for additional compensation.
- D. Upon completion of the Contractor's air purging operation, the Contractor shall, at his own expense, contract and provide a follow-up air quality clearance monitoring to determine if the air purging operation was effective. A surface and equipment cleaning regiment will be required if air purging is unable to produce a final air quality clearance monitoring test which shows levels below the base line results.

#### PART 2 PRODUCT

# NOT USED

# PART 3 EXECUTION

#### 3.01 PREPARATION

- A. Temporary Filters
  - 1. The Contractor shall provide temporary filters in all equipment where filters are installed and in operation during this project. Existing filters may not be reused and shall be disposed of by the Contractor. The Contractor-installed temporary filters shall remain in place during the project until the time of final inspection except when the filter section is being cleaned. Prior to system start-up/final inspection, new final service filters matching performance of Division 23 4551 shall be installed.
- B. Work Area Preparation
  - 1. Prior to start of work, the Contractor shall provide sufficient covering over all surfaces around work area with plastic sheets or drop cloth. Pay particular attention to any equipment that may be damaged by dust or debris.

- 2. Provide floor covering where the contractor may store material or tools to avoid damage to the flooring.
- 3. Provide temporary plastic covering over smoke detectors to avoid accidental trip due to airborne dust and to minimize dust build-up in the detector sensor components.

# 3.02 CLEANING PROCEDURE

- A. Fans.
  - 1. Fans shall be cleaned free of dirt and debris on all surfaces including fan housing, fan scroll, fan blades.
  - 2. Methods approved for cleaning of fans shall be Direct Impact Removal and Contact Vacuuming Methods.
- B. Air Handling Equipment.
  - 1. Interior of air handling units shall be cleaned free of dirt and debris on all surfaces.
  - 2. Exposed internal acoustical and thermal lining within air handling units to be cleaned in place. Contractor shall immediately notify Owner if lining is found to be damaged upon initial inspection. If lining is damaged during cleaning, Contractor is responsible for replacement of damaged lining. Owner will visually inspect damage and determine whether lining is to be resurfaced or replaced.
  - 3. Clean unit coil where applicable in accordance with procedure prescribed elsewhere in this section.
  - 4. Clean unit fan in accordance with procedure prescribed elsewhere in this section.
  - 5. Methods approved for cleaning of air handling units shall be Direct Impact Removal and Contact Vacuuming Methods.
- C. Ductwork and Accessories.
  - 1. Provide adequate access to allow cleaning of sections of ductwork and accessories.
  - 2. Interior of ductwork shall be cleaned free of dirt and debris on all surfaces. Interior and exterior surfaces including operating mechanism and linkage on all balancing dampers, fire and fire/smoke dampers shall be cleaned in place. Replace fusible links with matching type and temperature ratings.
  - 3. Exposed internal acoustical and thermal lining to be cleaned in place. Contractor shall immediately notify Owner if lining is found to be damaged upon initial inspection. If lining is damaged during cleaning, Contractor is responsible for replacement of damaged lining. Owner will visually inspect damage and determine whether lining is to be resurfaced or replaced.
  - 4. Avoid damage to ductwork and accessories. Ensure ductwork integrity is maintained and ductwork accessories are fully functional after cleaning operation.
  - 5. Where existing ductwork is located under floor slab, remove grilles, registers and diffusers and clean all accessible surfaces. Access points or panels not required in under slab ductwork.
  - 6. Sawdust collection system ductwork to be cleaned using existing cleanouts and access points or panels to greatest extent possible. Where necessary, install new access panels rated for system design pressure.
  - 7. Methods approved for cleaning of ductwork and accessories shall be Direct Impact Removal, Contact Vacuuming Methods, Air Wash Method, and Power Brush Method.
- D. Air Plenum, Terminal Units, VAV boxes
  - 1. Provide adequate access to allow cleaning of sections of air plenum, terminal units, and VAV boxes.

- 2. Interior of air plenum, terminal units, and VAV boxes shall be cleaned free of dirt and debris on all surfaces. Interior and exterior surfaces including operating mechanism and linkage on control dampers shall be cleaned in place. Replace fusible links with matching type and temperature ratings.
- 3. Exposed internal acoustical and thermal lining within air plenum, terminal units and VAV boxes to be cleaned in place. Contractor shall immediately notify Owner if lining is found to be damaged upon initial inspection. If lining is damaged during cleaning, Contractor is responsible for replacement of damaged lining. Owner will visually inspect damage and determine whether lining is to be resurfaced or replaced.
- 4. Mark existing control dampers setting and ensure are fully functional after cleaning operation.
- 5. Clean unit coil where applicable in accordance with procedure prescribed elsewhere in this section.
- 6. Clean unit fan where applicable in accordance with procedure prescribed elsewhere in this section.
- 7. Clean interior of outside air intake plenums. Remove and clean roof intake hoods.
- 8. Methods approved for cleaning of air plenum, terminal units, and VAV boxes shall be Direct Impact Removal, Contact Vacuuming Methods and Power Brush Method. Power brush method limited to air plenums of significant size only.
- E. Supply, Return and Exhaust Air Registers, Grilles, and Diffusers
  - 1. Remove supply, return, and exhaust air distribution devices to allow thorough cleaning of all surfaces and takeoff connections.
  - 2. Immediate building surfaces around locations where supply and return air distribution devices are installed shall be cleaned free of dirt and debris buildup prior to reinstallation.
  - 3. Methods approved for cleaning of registers, grilles, and diffusers shall be Direct Impact Removal and Contact Vacuuming Methods.

# 3.03 INSPECTIONS BY THE OWNER

- A. The Contractor shall be responsible for providing adequate and safe access including ladders, lighting devices, and bore-scope equipment as appropriate for use by the Owner to perform the necessary inspection activities.
- B. The Contractor shall arrange the equipment for inspection to demonstrate the following:
  - 1. All affected equipment shall be turned off during the inspection.
  - 2. All access doors on air handling units in open position for the inspection of interior surfaces.
  - 3. All filter racks shall be visible for inspection showing new air filters and filter bracket in place.
  - 4. Control linkage and balancing devices connected and locked in the position after the balancing and with the new position identified with appropriate marking.
- C. Owner's Acceptance of Contractor's Performance.
  - 1. The Owner shall, based on the inspection result, accept the systems as having been cleaned or reject all or part of the systems as deficient work requiring immediate remediation by the Contractor.
  - 2. If the work is considered to be deficient, the Contractor shall immediately remediate the deficiencies reported and request for re-inspection upon completion.

# 3.04 START-UP OF SYSTEMS WITH DUCTWORK CONNECTIONS

A. The Contractor may start up the system upon acceptance by the Owner. Prior to system startup, the Contractor shall provide filter media at all system outlets to protect the occupied spaces and to replace the temporary construction filters in all air moving equipment with new final service filters.

- B. Upon start-up of systems, conduct an initial purge run. The Contractor shall coordinate with the Owner as appropriate to allow system to operate a minimum of 4 hours at full flow condition with outlet filter media in place.
- C. At the end of the initial purge run, the Contractor shall remove all outlet filter media and return the system to normal operation.
- D. The Contractor shall re-inspect the system and the affected occupied spaces within 12 hours of normal operation to ensure no dirt and debris is present from the operation of the system. If dirt and debris is evident due to the operation of the system, the Contractor shall bear the cost of the necessary remedial cleaning.

#### SECTION 23 4551 VENTILATION SYSTEM CLEANING ACCESSORIES

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

A. Ductwork and accessories under the scope of this project specified herein and elsewhere.

### 1.02 RELATED SECTIONS AND DRAWINGS

- A. Section 23 0500 Basic Mechanical Materials and Methods.
- B. Section 23 4550 Ventilation System Cleaning.

#### 1.03 REFERENCE

- A. HVAC Duct Construction Standards, Metal, and Flexible Sheet Metal and Air-conditioning Contractors National Association SMACNA, latest edition.
- B. Underwriters' Laboratories (UL) Listing.
- C. American Society of Heating, Refrigeration, and Air-conditioning Engineers (ASHRAE) Standards.
- D. ACR, The NADCA Standard: 2021 Edition for the Assessment, Cleaning, and Restoration of HVAC Systems.

#### 1.04 SUBMITTALS

- A. Submit under provisions of Division 01.
- B. Provide product data submittals for all products specified under this section.

#### 1.05 QUALITY ASSURANCE

A. All work under this section shall be performed by firms and persons licensed and experienced in the trade.

# PART 2 PRODUCT

#### 2.01 CLEANING ACCESS POINTS, RECTANGULAR AND ROUND DUCT

- A. The contractor shall install access points into supply and return air systems. Maximum distance between accesses shall be 15 feet with maximum of one aggregate 90 degrees change in duct direction and without any obstruction between accesses as to accommodate cleaning of all related ductwork, and to allow inspection by the Owner by bore scope. Exceptions: Duct cleaning access points may be installed at increased intervals on straight runs of duct providing that cleaning and bore scope inspection can be adequately performed. Additional access points may be required by Owner if adequate cleaning cannot be verified.
- B. Access points shall be a permanent and reusable system measuring <sup>3</sup>/<sub>4</sub>" to 6" in diameter. Install access points with rubber stop in opening such that when stop is secured in place no noticeable leak is evident.

#### 2.02 CLEANING ACCESS PANELS, RECTANGULAR DUCT

- A. Duct Access Size: Provide shop fabricated access panel of sufficient size to allow personnel entry up to shoulder level in ductwork section 18" or larger in dimension and minimum of 8"x8" in ductwork section smaller than 18" in dimension or as large as allowed by the actual dimension of the ductwork. Access panels shall be provided at turning vanes, damper locations, terminal units, duct silencers, coils, and air plenums to allow cleaning of both upstream and downstream surfaces. With the exception of coils, duct cleaning access panels do not necessarily need to be installed on both sides of such devices, providing that all surfaces of such devices can be adequately cleaned and inspected. Additional access panels may be required by Owner if adequate cleaning cannot be verified.
- B. Construction: Hot dipped galvanized steel sheet. Gauge shall be same as the ductwork. Reinforced, cross-braced or otherwise stiffened.

# 2.03 CLEANING ACCESS PANELS, ROUND DUCT

- A. Duct Access Size: Provide shop fabricated access panel of sufficient size to allow personnel entry up to shoulder level in ductwork section 18" or larger in diameter and minimum of 8" x 8" in ductwork section smaller than 18" in diameter or as large as allowed by the actual dimension of the ductwork. Access panels shall be provided at turning vanes, damper locations, duct silencers, and coils to allow cleaning of both upstream and downstream surfaces. With the exception of coils, duct cleaning access panels do not necessarily need to be installed on both sides of such devices, providing that all surfaces of such devices can be adequately cleaned and inspected. Additional access panels may be required by Owner if adequate cleaning cannot be verified.
- B. Construction: Hot dipped galvanized steel sheet. Gauge shall be same as the ductwork. Reinforced, cross-braced or otherwise stiffened. Rolled to meet the duct curvature.

# 2.04 SPECIAL PROVISIONS FOR ARCHITECTURAL EXPOSED DUCT WORK

- A. Exposed Architectural Ductwork Access Panel Locations:
  - 1. Contractor shall minimize the number of access locations on ductwork in accordance with the following.
  - 2. In duct mains 24" diameter and larger, install access at no more than 50' on center and at each change of direction. Locate access near ductwork support points and on the side of the ductwork away from primary view(s) but with sufficient clearance for work. Access shall be a prefabricated access door similar to SEMCO DUCTMATE Sandwich Access Doors of sizes as recommended by the manufacturer's catalog cut sheet.
  - 3. In duct branches and mains between 24" and 16" diameters, install access at no more than 25 feet on center and at each change of direction. Locate access near ductwork support points and on the side of the ductwork away from primary view(s) but with sufficient clearance for work. Access shall a prefabricated access door similar to SEMCO DUCTMATE Sandwich Access Doors of sizes as recommended by the manufacturer's catalog cut sheet.
  - 4. In duct branches and take-offs smaller than 16" diameter. Install access at point of take-off and at every 180-degree aggregate change of direction. Locate access near ductwork support points and on the side of the ductwork away from primary view(s) but with sufficient clearance for work. Access shall be a prefabricated access door similar to SEMCO DUCTMATE Sandwich Access Doors of sizes as recommended by the manufacturer's catalog cut sheet.
  - 5. At terminal coils, install sheet metal panel hand access hatch on the upstream and downstream side coil connection fittings. Downstream side access may be deleted if downstream coil face may be accessed through terminal diffusers. Access panel shall be of similar construction for rectangular duct work specified in section 23 3100.
- B. Painting Requirements for Affected Exposed Architectural Ductwork
  - 1. All access doors and all affected ductwork on existing painted architectural ductwork shall be properly primed and painted to match existing. Contractor shall field match existing paint color and appearances.

#### 2.05 SPECIAL PROVISIONS FOR MEDIUM VELOCITY VAV SUPPLY DUCTWORK

- A. Medium Velocity VAV Supply Ductwork Access Point/Access Panel Locations
  - 1. Access points and access panels shall be provided in the sizes and locations previously specified for round ductwork.
  - 2. All access points and access panels shall be a prefabricated access door similar to SEMCO DUCTMATE Sandwich Access Doors.

# 2.06 ACCESS DOORS FOR CONCEALED DUCTWORK OR EQUIPMENT

A. Unless specifically shown otherwise, ductwork or equipment to be cleaned which is concealed behind permanent construction, such as gypsum board chases or ceilings shall be cleaned to

greatest extent possible from nearest accessible location. Provide access panels in duct at nearest accessible point.

B. Where access doors are specifically indicated, provide doors with minimum 16 gauge steel frame with welded joints and furnished with anchorage for securing into specific construction. Doors shall be hinged to frame and provided with a key operated lock. Prime coat and paint to match adjacent construction; Nystrom, or equal.

# 2.07 ACOUSTIC DUCT LINING, REPLACEMENT

- A. Duct liner shall be constructed of long textile-type glass fibers composition firmly bonded together with a thermosetting resin with a fire-resistant composite surface overlaid, in compliance with NFPA 90A.
- B. Physical Properties
  - 1. Surface burning characteristics shall not exceed flame spread rating of 25 and smoke development rating of 50 per UL 723.
  - 2. Velocity rating shall be a minimum of 6,000 fpm per ASTM C1071.
  - 3. Water vapor absorption shall be less than 3% by weight per ASTM C1104.
  - 4. Fungi growth resistance shall be negative per ASTM C665 and G21.
  - 5. Bacteria growth resistance shall be negative per ASTM G22.
  - 6. Minimum density of 1.5 pound per cubic feet.
  - 7. Thermal performance rating of 0.28 Btu-inch/hour-square feet-deg F.
- C. Sound Absorption Performance: Minimum acoustic performance shall be within 5% of the performance of the acceptable product listed.
- D. Acceptable Product: CertainTeed ToughGard Type 150 or equal.

# 2.08 ACOUSTIC DUCT LINING, RESURFACING

- A. Resurfacing agent surface burning characteristics shall not exceed flame spreadrating of 25 and smoke development rating of 50 per UL 723.
- B. Resurfacing agent shall be a water-based product specifically recommended by the manufacturer for the intended application.
- C. Acceptable products: MEI, Fosters, approved equal.

# 2.09 FLEXIBLE DUCT, REPLACEMENT

A. In accordance with Section 23 3100.

# 2.10 FILTERS

- A. Air filter shall be medium efficiency, pleated, disposable type. Each filter shall consist of a nonwoven cotton and synthetic fabric media, media support grid and enclosing frame. The filter shall be listed for Class 1 service.
- B. Filter shall have an average efficiency of MERV 13.
- C. Acceptable Product: AP-Thirteen series filters or approved equal.
- D. Additional filter types as required for specific equipment.

# PART 3 EXECUTION

# 3.01 GENERAL

A. Coordinate installation with respect to existing equipment, do not block access to electrical junction boxes, light fixtures, and any existing mechanical and electrical equipment requiring maintenance access.

# 3.02 INSTALLATION OF CLEANING ACCESS

- A. Locate cleaning access at readily accessible locations requiring minimum disturbance to adjacent building elements.
- B. Arrange access level and plumb with respect to the ductwork section.
- C. Smooth out edges of cut out in existing ductwork for access installation. Do not allow any resulting deformation to protrude into air stream.
- D. Provide metal angle stiffener at edges more than 18 inches in length or where deemed necessary to maintain structural integrity of the ductwork.
- E. Provide additional hangers and bracing as appropriate where the installation of the access compromises the original support of the ductwork.
- F. Install access with rubber gasket around opening permanently bonded to the access panel such that when access cover is secured in place no noticeable leak is evident.
- G. Secure access cover with hex-head sheet metal screw fastener at maximum of 6 inches on center. Select screw size to limit protrusion into ductwork of no more than 1/2 inch.
- H. Where access is installed in lined ductwork, provide lining on interior side of access cover and extend existing lining as appropriate to the edge of the access opening such that the two lining sections mate against each other when the access cover is secured in place. Provide nosing on all end edges of lining. Seal all seams in lining sections.
- I. For shop fabricated round duct access panels, provide full circumference one inch width sheetmetal hold down straps around ductwork with ends bolted to hold access panel in place tight against the ductwork. Do not secure straps to ductwork with screws.
- J. Where excessive sagging is observed in the ductwork due to the installation of the access panel, provide stiffening rods to retain original ductwork shape.

#### 3.03 RESURFACING OF LINED DUCTWORK

- A. When directed by Owner to resurface existing lined ductwork, first clean all surfaces to be resurfaced. Existing lining must be accepted by the Owner as adequately cleaned prior to resurfacing.
- B. Resurfacing to be performed in strict accordance with manufacturer's instructions and the requirements of NADCA Standard ACR.

# 3.04 REPLACEMENT OF ACOUSTIC DUCT LINING OR DUCTWORK

- A. When directed by Owner to replace existing duct lining, the existing liner shall be removed prior to installation of replacement liner. Remove all residual existing liner material, fasteners, and glue. Clean surface free of any remaining debris prior to installation of new replacement liner.
- B. At Contractor's option, in lieu of replacing acoustical duct lining, the existing acoustically lined ductwork may be completely replaced with new acoustically lined ductwork of the same dimension, configuration, and orientation.
- C. Install replacement liners in accordance with SMACNA installation standard with the additional requirement that all edges of acoustical lining shall be treated with adhesive sealant or with proper nosing.
- D. Lining to be installed by impaling on welded pins with supplemental surface adhesive.
- E. Install replacement ductwork in accordance with SMACNA installation standards.

# 3.05 INSTALLATION OF REPLACEMENT FLEXIBLE DUCT

- A. Layout replacement flexible duct to avoid excessive air flow turns or kinking of duct section.
- B. Install replacement flexible duct with both interior and exterior polyester liners folded into the fiberglass insulation with sufficient overlap to seal the fiberglass insulation from the air stream at both the connections to the ductwork and the diffuser.

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C. Support flexible duct with 1" steel bands from structure above as necessary to maintain internal air flow path. Do not allow flexible duct to lay on ceiling unsupported.

# 3.06 INSTALLATION OF FILTERS

- A. Install filters in existing filter holding rack in arrangement as intended by the filter holding rack design. Provide new retainer clips if existing clips are missing or damaged.
- B. Where bypass gap existing between filters and filter rack, eliminate bypass by providing adequate size sheetmetal bracket between filter and filter rack.

# 3.07 REPAIR OF EXISTING DUCTWORK WHERE REQUIRED

- A. Where existing ductwork shows evidence of significant sagging, deformation, or separation at joints, repair as appropriate to return the ductwork to serviceable condition.
- B. Consider minor repair in the immediate area of access panel installation as part of this work at no additional cost to the Owner.

### SECTION 23 5100 BREECHINGS, CHIMNEYS, AND STACKS

# PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Venting for Condensing Appliances.
- B. MRI Quench Vent.

# 1.02 REFERENCES

- A. ANSI/ASTM A167 Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- B. ANSI/ASTM A525 Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, General Requirements.
- C. ASTM A653/A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- D. ASTM A924/A924M Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
- E. ASTM A1011/A1011M Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
- F. ASTM C401 Standard Classification of Alumina and Alumina-Silicate Castable Refractories.
- G. ANSI Z21.66 Electrically Operated Automatic Vent Damper Devices for Use with Gas-Fired Appliances.
- H. ANSI Z21.67 Mechanically Actuated Automatic Vent Damper Devices for Use with Gas-Fired Appliances.
- I. ANSI Z21.68 Thermally Operated Automatic Vent Damper Devices for Use with Gas-Fired Appliances.
- J. ANSI Z95.1 (NFPA 31) Standard for the Installation of Oil Burning Equipment.
- K. ANSI Z223.1 (NFPA 54) The National Fuel Gas Code.
- L. ASHRAE Handbook, Equipment Volume, Chapter "Chimney, Gas, Vent, and Fireplace Systems."
- M. NFPA 211 Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances.
- N. SMACNA HVAC Duct Construction Standards Metal and Flexible.
- O. UL 103 Standard for Factory Built Low Heat Chimneys.
- P. UL 127 Standard for Factory Built Fireplaces.
- Q. UL 378 Standard for Draft Equipment.
- R. UL 441 Standard for Gas Vents.
- S. UL 641 Standard for Low Temperature Venting Systems.
- T. UL 959 Medium Heat Appliance Factory Built Chimneys.

#### 1.03 DEFINITIONS

- A. Breeching: Vent Connector.
- B. Chimney: Primarily vertical shaft enclosing at least one vent for conducting flue gases outdoors.
- C. Smoke Pipe: Round, single wall vent connector.
- D. Vent: That portion of a venting system designed to convey flue gases directly outdoors from a vent connector or from an appliance when a vent connector is not used.

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E. Vent Connector: That part of a venting system that conducts the flue gases from the flue collar of an appliance to a chimney or vent, and may include a draft control device.

#### 1.04 DESIGN REQUIREMENTS

- A. Factory built vents and chimneys used for venting natural draft appliances shall comply with NFPA 211 and be UL listed and labeled.
- B. Design stack supports for maximum 3-second gust per structural in accordance with Section 23 0548.

#### 1.05 QUALIFICATIONS

A. Manufacturer: Company specializing in the manufacture of products specified in this Section with minimum three years documented experience.

#### 1.06 REGULATORY REQUIREMENTS

- A. Conform to NFPA 54 for installation of natural gas burning appliances and equipment.
- B. Conform to NFPA 31 for installation of oil burning appliances and equipment.

#### 1.07 SUBMITTALS

- A. Submit product data under provisions of Division 01.
- B. Shop Drawings: Indicate general construction, dimensions, weights, support and layout of breeching. Submit layout drawings indicating plan view and elevations.
- C. Product Data: Submit data indicating factory built chimneys, including dimensional details of components and flue caps, dimensions and weights and connection requirements.
- D. Engineering Data: Submit stack sizing calculations confirming proper stack sizing for the specific equipment used on this project.
- E. Manufacturer's Installation Instructions: Submit assembly, support details, and connection requirements.
- F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

#### 1.08 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication, adjust layout as required to avoid conflict with structure.

# PART 2 PRODUCTS

# 2.01 MANUFACTURERS

- A. ICC Chimney.
- B. Jeremias.
- C. Hart & Cooley.
- D. Schebler.
- E. Van Packer.
- F. Substitutions: Under provisions of Division 01.

#### 2.02 HIGH EFFICIENCY CONDENSING BOILER VENTING

- A. Provide all accessories for a complete system each bearing factory applied UL label, including but not limited to supports, roof penetrations, appliance connectors, drain fittings and terminations.
- B. The factory built modular vent shall be laboratory tested and listed in accordance with Underwriters Laboratories Standard UL 1738 for use with category II, III, & IV appliances with a maximum flue gas temperature of 550°F and ULC-S636-95 for gas vent - BH, Class I / Class II 245°C.

- C. Vent sections shall be sealed with ½" banded flanges and silicone joint sealant for temperatures up to 600°F with a UL tested pressure rating of 40" w.c.
- D. Inner shell material shall be type AL 29-4C® stainless steel. Inner shell thickness shall be 20 gauge. All inner shell seams shall be full penetration welded. Riveted, tack or spot welded seams are not permitted.
- E. Outer shell material shall be aluminized steel with a thickness of .034", outer shell material can be 304 or 316 stainless steel. All outer shell seams shall be full penetration welded the entire length of the pipe section. Riveted, tack or spot welded seams are not permitted.
- F. There shall be a minimum 1" of 1600°F rated low conductivity ceramic fiber insulation between the inner and outer shells. The insulation is to be securely attached to the inner shell with steel straps and insulating pins welded to the inner shell. Stainless steel centering clips shall be welded to the outer shell to maintain the 1" spacing and ensure concentricity of the shells.
- G. Breeching and vent sections, when installed according to manufacturer's instructions, shall comply with national safety standards and building codes. Stacks terminating above a roof must terminate as required by code or NFPA 211.
- H. Venting shall be designed to drain to boiler condensate treatment tanks.

# 2.03 WATER HEATER VENTING

- A. Polypropylene vent pipe for use with ANSI Category II and IV gas burning appliances, including tankless and storage water heaters, high-efficiency water heaters, condensing boilers and warm air furnaces. PolyPro shall be listed by Intertek to the ULC S636 standard in Canada and is rated as a Class IIA, IIB and IIC vent system suitable for exhaust temperatures up to 230F / 110C, and a maximum positive pressure of 15 in-w.c. Duravent PolyPro Commercial or approved equal.
- B. Provide all accessories for a complete system including but not limited to supports, flashings, termination cap, etc.

#### 2.04 MRI QUENCH VENT

- A. Rated for -452 degrees Fahrenheit, 225" W.C.
- B. Constructed of 20GA ASTM 304 Staineless steel. All components to be Stainless steel construction.
- C. Include flexible bellows for thermal contractor.
- D. Provide optional KL Clamps for joint reinforcement.
- E. Provide with roof termination as shown on design documents.
- F. Jeremias QV-MRI or equal.

# PART 3 EXECUTION

#### 3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide double wall, insulated vent continuous from appliance outlet to exterior termination. Vent shall be sloped to drain to appliance condensate treatment tank. Provide all necessary connections and additional piping as required to allow system to drain to condensate treatment tanks where slope cannot be maintained.
- C. Install in accordance with recommendations of ASHRAE -Handbook, Equipment Volume, Chapter "Chimney, Gas, Vent, and Fireplace Systems", and NFPA 54.
- D. Level and plumb chimney and stacks.
- E. Clean breechings, chimneys, and stacks during installation, removing dust and debris.

- F. At appliances, provide slip joints permitting removal of appliances without removal or dismantling of breechings, chimneys, or stacks.
- G. No single wall vent connectors or breechings are permitted.

# SECTION 23 5216 CONDENSING BOILERS

# PART 1 GENERAL

# 1.01 SECTION INCLUDES

- A. Condensing Gas Boilers.
- B. Controls and Boiler Trim.

# 1.02 REFERENCES

- A. American National Standards Institute:
  - 1. ANSI Z21.13 Gas-fired Low Pressure Steam and Hot Water Boilers.
- B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
  - 1. ASHRAE 90.1 Energy Standard for Buildings Except Low-Rise Residential Buildings.
- C. American Society of Mechanical Engineers:
  - 1. ASME Section IV Boiler and Pressure Vessel Code Heating Boilers.
  - 2. ASME Section VIII Boiler and Pressure Vessel Code Pressure Vessels.
  - 3. ASME CSD-1 (Controls and Safety Devices).
- D. Hydronics Institute:
  - 1. H.I. Heating Boiler Standard Testing and Rating Standard for Heating Boilers.
- E. National Fire Protection Association:
  - 1. NFPA 54 National Fuel Gas Code.

# 1.03 SUBMITTALS

- A. Submit product data under provisions of Division 01.
- B. Product Data: Include performance data, operating characteristics, furnished specialties and accessories.
  - 1. Prior to flue vent installation, engineered calculations and drawings must be submitted to Architect/Engineer to thoroughly demonstrate that size and configuration conform to recommended size, length and footprint for each submitted boiler.
- C. Pressure Drop Curve: Submit pressure drop curve for flows ranging from 0 GPM to maximum value of boiler.
  - 1. If submitted material is different from that of the design basis, boiler manufacture shall incur all costs associated with reselection of necessary pumps. Possible differences include, but are not limited to, the pump type, pump pad size, electrical characteristics and piping changes.
- D. Shop Drawings: For boilers, boiler trim and accessories, include:
  - 1. Plans, elevations, sections, details and attachments to other work.
  - 2. Wiring Diagrams for power, signal and control wiring.
- E. Source Quality Control Test Reports: Reports shall be included in submittals.
- F. Field Quality Control Test Reports: Reports shall be included in submittals.
- G. Submit data showing boiler burner, controls and boiler control panel wiring.

# 1.04 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data under provisions of Division 01.
- B. Include manufacturer's descriptive literature, operating instructions, cleaning procedures, replacement parts list, and maintenance and repair data.

C. Include reports from manufacturers field service testing.

### 1.05 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum three years experience.
- B. The equipment shall, at a minimum, be in strict compliance with the requirements of this specification and shall be the manufacturer's standard commercial product unless specified otherwise. Additional equipment features, details, accessories, appurtenances, etc. which are not specifically identified but which are a part of the manufacturer's standard commercial product, shall be included in the equipment being furnished.
- C. The equipment shall be of the type, design, and size that the manufacturer currently offered for sale and appears in the manufacturer's current catalogue. The equipment shall be new and fabricated from new materials and shall be free from defects in materials and workmanship.
- D. All units of the same classification shall be identical to the extent necessary to insure interchangeability of parts, assemblies, accessories, and spare parts wherever possible.
- E. In order to provide unit responsibility for the specified capacities, efficiencies, and performance, the boiler manufacturer shall certify in writing that the equipment being submitted shall perform as specified. The boiler manufacturer shall be responsible for guarantying that the boiler provides the performance as specified herein.

#### **1.06 CERTIFICATIONS**

- A. Manufacturer's Certification: The boiler manufacturer shall certify the following:
  - 1. The products and systems furnished are in strict compliance with the specifications.
  - 2. The boiler, burner and other associated mechanical and electrical equipment have all been properly coordinated and integrated to provide a complete and operable boiler.
  - 3. ASME certification.
  - 4. UL certification.
  - 5. The specified factory tests have been satisfactorily performed.
  - 6. The specified field tests have been satisfactorily performed.
- B. Contractor's Certification: The contractor shall certify the following:
  - 1. The products and systems installed are in strict compliance with the specifications.
- C. Boiler Inspectors' Certification: All boiler inspections during hydrostatic testing shall be performed by an authorized boiler inspector who is certified by the National Board of Boiler and Pressure Vessel Inspectors and shall be submitted in writing prior to final acceptance by the engineer.

# 1.07 REGULATORY REQUIREMENTS

- A. Conform to ANSI/NFPA 70 code for internal wiring of factory wired equipment.
- B. Conform to ANSI/ASME SEC4 and SEC 8D for boiler construction.
- C. Units: AGA certified. UL labeled.

# 1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store. and protect products to site under provisions of Division 01.
- B. Accept boilers and accessories on site in factory shipping packaging. Inspect for damage.
- C. Protect boilers from damage by leaving packing in place until installation.
- D. Protect units before, during, and after installation from damage to casing by leaving factory shipping packaging in place until immediately prior to final acceptance.

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### 1.09 WARRANTY

A. Provide one year warranty for the entire boiler under provisions of Division 01.

#### PART 2 PRODUCTS

#### 2.01 ACCEPTABLE MANUFACTURERS

- A. Reillo.
- B. Substitutions: Under provisions of General Conditions in Division 01.

#### 2.02 HIGH EFFICIENCY CONDENSING BOILERS

- A. Boilers using cast iron, cast aluminum or copper finned tube heat exchangers are unacceptable.
- B. The heat exchanger shall be a water tube design. Firetube heat exchangers shall not be accepted.
- C. The heat exchanger shall be manufactured by the boiler manufacturer and consist of a dual helical coil design. Each helical coil shall consist of a single continuous tube, connected only at the ends. Coils constructed with multiple tubes or multiple connections to a common manifold shall not be accepted.
- D. The heat exchanger shall have water-backed reservoirs on each end of the helical coils. Such reservoirs shall allow expansion and contraction of the coil with minimal mechanical stress.
- E. The shape of the tubing shall be such to prevent pooling or collecting of condensation anywhere on the surface of the tubing.
- F. The water tube shall have a minimum equivalent diameter of 1". To minimize the negative potential effects of internal scaling, heat exchangers with tube sizes less than 1" equivalent diameter shall not be accepted.
- G. The helical coil shall have a water velocity of at least 1.8 ft/s. Heat exchangers with a water velocity of less than 1 ft/s shall not be accepted.
- H. The water tube (AISI 316L/316Ti) stainless steel heat exchangers shall be inspected and tested to ASME Section IV requirements and shall bear the ASME section IV seal of approval.
- I. The heat exchangers shall have welded construction (no gaskets) consisting of two pipes working in parallel. Each coil shall have no more than two welded joints (one at each end). The heat exchanger shall be a fully condensing cylindrical counter-flow water tube design with AISI stainless steel tubes and headers.
- J. The heat exchanger shall consist of 316L or 316Ti stainless steel. 400 Series ferritic stainless steel, such as 439 stainless, shall not be acceptable due to its relatively low pitting resistance equivalent number and relatively low ultimate tensile strength. Due to their unproven/relatively short historical track record in condensing boilers, Duplex Alloy materials are also unacceptable.
- K. Carbon steels (including but not limited to SA-516 Gr.70 & SA-53 Gr.B) shall not be allowed anywhere potential condensing may occur (in both the firing and condensing chambers of the boiler), regardless of whether the potential condensing is a result of normal or abnormal operating conditions.
- L. Boilers using cast iron, cast aluminum or copper finned tube heat exchangers are unacceptable.
- M. The pressure vessel shall be fully insulated with high temperature insulation.
- N. Each 500 MBH module shall be fully independent and "stand alone" with maximum working pressure of 80 psig (550 kPa).
- O. For ease of removal and replacement, the gas and water connections for the heat exchanger shall include O-ring compression seals. Threaded connections are unacceptable. The heat

exchanger shall include a roller tray to slide the exchanger from the boiler cabinet. The individual modules shall be removable from the boiler while the other modules remain firing. The removal and replacement of such heat exchanger shall not require welding or hoisting equipment.

- P. The boiler shall be capable of operating with a minimum outlet water temperature of 68 °F.
- Q. Each heat exchanger shall be accessible for visual inspection and cleaning of all internal fire side surfaces.

#### 2.03 COMBUSTION CHAMBER

- A. The boiler shall have sealed combustion capability with an engineered gas/air chamber that ensures proper mixing for stable combustion at all firing rates.
- B. The combustion chamber shall be a stainless steel construction and an integral part of the heat exchanger which shall be a cylindrical stainless steel counter-flow design.
- C. A window view port shall be provided for visual inspection of the boiler combustion during firing.
- D. The firing chamber shall consist of 316L or 316Ti stainless steel. Carbon steel firing chambers shall not be accepted due to the possibility of condensing in such area in the event of abnormal operating conditions.

# 2.04 GAS TRAIN

- A. Each boiler shall be provided with a factory assembled, piped and wired main gas train.
- B. The main gas train shall consist a low gas pressure switch (manual reset) and a high gas pressure switch (manual reset) as required by code.
- C. Each heat exchanger shall have its own zero governing gas valve to include dual safety shut off. Each heat exchanger shall also have its own manual gas shutoff valves; one upstream of the zero governing gas valve and one between the zero governing gas valve and the blower.
- D. The boiler shall be LPG convertible.
- E. The boiler shall operate on 4"-14" W.C. gas pressure when operating with natural gas and 8"-13" W.C. gas pressure when operating with propane gas.
- F. The boiler shall need no component changes to operate at high altitude.
- G. Each heat exchanger module shall have an air/gas ratio control gas valve. The air/gas ratio gas valve shall sense the pressure across the venturi and supply gas to premix with air. This operation shall provide seamless modulation through the entire range of firing rate.

# 2.05 BURNER

- A. The burner shall be a premix burner with a stainless steel knitted metal fiber construction. Ceramic or non-metallic burners are unacceptable.
- B. The burner shall be fully modulating; multi-staged burners with 'stepped' firing rates shall not be accepted.
- C. The burner shall be direct-ignition and include a single self-grounding electrode designed for both ignition and flame monitoring. Separate ignition and flame rods are not acceptable. The use of glow plugs shall not be accepted in lieu of spark ignition.
- D. Flame monitoring shall be flame rod (rectification) type. The use of thermocouple, thermopile or other temperature based flame monitoring shall not be accepted due to their slow response times. Infra-red or ultraviolet sensors shall not be accepted due to their high replacement costs.
- E. Air/Gas ratio control gas valve shall operate on the principle of negative pressure and modulate to maintain combustion characteristics across the full operating range, which shall provide safe operation even in the case of blocked air intake.

- F. The air-gas ratio control valve shall be self-compensating. It shall automatically compensate for changes in draft, backpressure, or air density resulting from changes in ambient air temperature.
- G. The combustion air/gas mixing blower shall be a fully modulating variable speed design capable of matching the burner turndown.
- H. The exhaust venting shall be made of 316L stainless steel. Polypropylene plastic venting shall not be acceptable inside the boiler cabinet. The seams shall be positively secured to prevent leaks.

### 2.06 EMISSIONS

- A. The burner shall not produce more than 0.04% of carbon monoxide (CO) at all firing rates.
- B. The burner shall be certified for Oxides of Nitrogen (NOx) of 9 ppm corrected to 3% oxygen.
- C. The burner shall operate with natural gas or propane at no more than 5.1% excess oxygen at all firing rates.

### 2.07 CONTROLS

- A. The boiler shall have a touchscreen display located outside the front door panel and a service screen located inside the front door panel. The service screen shall be password protected to prevent unauthorized access to safety critical parameters.
- B. The outer display shall consist of a 7" color touchscreen and shall provide full diagnostics including real time data logging, error history, and current operating status/data. Annunciation shall include a minimum of the last ten error codes. Operation data such as temperature and firing rates shall be annunciated with a graphic trend display.
- C. The operator touchscreen and service display are intended for annunciation purposes and shall not be control devices. In the event of a touchscreen failure, the boiler shall continue to operate normally without any disruption.
- D. The touchscreen shall display the amount of water flow going through each module.
- E. The control shall automatically cascade the internal modules to main temperature control. Cascade sequencing shall be designed to optimize boiler efficiency by maintaining a maximum number of modules on, at minimal firing rates while maintaining overall temperature setpoint. Controller shall also automatically rotate the lead boiler and heat exchanger to evenly distribute 'wear-and-tear' of components.
- F. The control shall be capable of lead/lag sequencing up to eight 8 boilers in "Cascade".
- G. Operational data and error history from lag boilers may be accessed through a single touchscreen on the lead boiler.
- H. The touchscreen shall display any error codes whether automatically reset or manually reset.
- I. The controller shall include functions such as frost protection, system de-aeration, and touchscreen shall annunciate when such functions are activated.
- J. The boiler shall be provided as a standard with ModBus RS485 communication capabilities. The RS485 ModBus communication shall be capable of annunciating status and operating data from all boilers through the touchscreen or Building Automation System.
- K. Optional protocol converter for ModBus Lonworks, N2, BacNet MS/TP or BacNet IP shall be available as an optional accessory.
- L. The boiler control system shall be capable of accepting 0-10VDC remote external analog signal to control the temperature set point.
- M. The control system shall be capable of resetting the set point based on outdoor air temperature with the optional outside air temperature sensor (included for field installation). Graphic display of the reset curve shall be available through the operator touchscreen.

- N. The boiler safety control shall be furnished with common interlock controls for low gas pressure, high gas pressure, water pressure and secondary low water cut off.
- O. Each heat exchanger module within the boiler shall be furnished with the following safety control devices: blocked flue, blocked condensate, water temperature high limit, exhaust stack temperature limit, water flow meter and primary low water cutoff. If any of these safety interlocks detect an abnormal condition, they will shutdown the individual burner/heat exchanger module while allowing the other heat exchanger modules to operate without disruption.
- P. The control shall graphically show the firing rate of each module in the boiler and each boiler in the cascade.
- Q. The firmware of the boiler touchscreen shall have the capability to be upgraded via USB stick.
- R. The boiler shall display service reminder notifications.

# PART 3 - EXECUTION

#### 3.01 INSTALLATION

- A. Install in strict accordance with manufacturer's installation instructions.
- B. Install equipment in strict compliance with state and local codes and applicable NFPA standards.
- C. Maintain manufacturer's recommended clearances around sides and over top of equipment.
- D. Install components that were furnished loose with equipment for field installation.
- E. Provide all interconnecting electrical control and power wiring. Provide for connection to electrical service.
- F. Provide all piping for boiler pipe connections.
- G. Pipe relief valves to 6" above finished floor or glycol tank (for snowmelt system only).
- H. Pipe condensate drains to acidic condensate neutralizer. Provide p-trap upstream of neutralizer. All piping shall be PVC and supplied/installed by the contractor. Plastic tubing is an acceptable alternative when used with barbed fittings. All PVC joints shall be glued in place and all barbed fittings shall be secured with tie wraps. All neutralizing tubes shall be secured to the floor or wall so as not to be exposed to damage or within a normal walkway. The contractor shall fill all "P-traps" and neutralizing tubes with tap water before the firing of any boiler.

#### 3.02 MANUFACTURER'S FIELD SERVICES

- A. Prepare and start systems under provisions of Division 01. Instruct operating personnel.
- B. Submit written report after start-up including control settings and performance chart of control system.
- C. Coordinate all work with Specification Section 23 0923 and 23 0993. Perform start-up in conjunction with testing of BAS systems to insure interface between boiler controls and BAS controls are complete and fully functional. Verify system operation in accordance with the sequence of operation.
- D. Commission Boilers per manufacturer's recommendations provide field start-up service by factory certified boiler technician.
- E. Equipment inspection: Boiler manufacturer's representative to provide jobsite assistance to inspect boilers and other equipment verifying completeness of equipment supplied. Casing, insulation and boiler mounted controls shall ship loose for field assembly by Manufacturer's Representative after boiler has been set and mounted on legs by installing contractor. Installing contractor shall provide laborer for assistance.
- F. Start-up shall be conducted by experienced and factory authorized technician in the regular employment of the boiler supplier, and shall include the following:

- 1. Demonstrate that boiler, burner, controls and accessories comply with requirements of this Section as proposed by the boiler and accessories supplier. Pre-test all items prior to scheduling the final testing that will be witnessed by the test engineer.
- 2. Readings at different firing rates (20, 50, 75 and 100%) of load for the modulating burner shall be taken with a written report of the tests submitted to the engineer. The reports shall include readings for each firing rate tested and shall include stack temperatures, O2, CO, NOx, and overall boiler efficiency.
- 3. Auxiliary Equipment and Accessories: Observe and check all valves, draft fans and electric motors, as well as other accessories and appurtenant equipment during the operational and capacity tests for leakage, malfunctions, defects, and non-compliance with referenced standards or overloading as applicable.
- G. Substantial Completion Demonstration Requirements:
  - 1. Fireside inspection.
  - 2. Set up fuel train and combustion air system.
  - 3. Set up operating set points.
  - 4. Check all safeties, including: Flame safeguard, LWCO, ALWCO, Air flow, Fuel pressures, High limits.
  - 5. Set up and verify efficiencies at 20%, 50%, 75%, and 100%.
  - 6. Set up and verify burner turndown.
  - 7. Training to include all safety procedures, maintenance procedures, control operations, and diagnostic procedures. Training to be provided in a single 4 hour continuous session to accommodate operator's availability on site.
- H. Submit written report after start-up including control settings and performance chart of control system.

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### SECTION 23 5700 HEAT EXCHANGERS FOR HVAC

# PART 1 GENERAL

# 1.01 SECTION INCLUDES

- A. Brazed Plate Heat Exchangers.
- B. Plate and Frame Type Heat Exchangers.
- C. Accessories and Trim.

# 1.02 RELATED SECTIONS

- A. Section 23 0500 Common Work Results for HVAC.
- B. Section 23 2113 Hydronic Piping.
- C. Section 23 2116 Hydronic Specialties.
- D. Section 23 0519 Meters and Gauges for HVAC piping.

# 1.03 REFERENCES

A. ANSI/ASME - Boilers and Pressure Vessels Code.

# 1.04 REGULATORY REQUIREMENTS

A. Conform to Section 8D of the ANSI/ASME Boilers and Pressure Vessels Code for manufacture of tubular heat exchangers and heat exchanger shells.

# 1.05 SUBMITTALS

- A. Submit product data under provisions of Division 01.
- B. Indicate dimensions, locations, and size of tappings and performance data.
- C. Submit manufacturer's installation instructions under provisions of Division 01.
- D. Submit design data in sufficient detail to verify that heat exchangers meet or exceed specified requirements.

# 1.06 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data under provisions of Division 01.
- B. Include start up and shut down instructions, assembly drawings, and spare parts lists.

# 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site under provisions of Division 01.
- B. Store and protect products under provisions of Division 01.
- C. Protect internals from entry of foreign material by temporary caps on flanged openings.

# 1.08 EXTRA MATERIALS

- A. Provide two sets of replacement gaskets.
- B. Provide one set of wrenches for disassembly of plate type heat exchangers.

# PART 2 PRODUCTS

# 2.01 MANUFACTURERS - BRAZED PLATE TYPE HEAT EXCHANGERS

- A. Alfa-Laval.
- B. Danfoss.
- C. Kelvion.
- D. ONDA Advanced Heat Exchangers.
- E. Taco.
- F. Tranter.

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- G. Bell & Gossett.
- H. Substitutions: Under provisions of Division 01.

### 2.02 BRAZED PLATE TYPE HEAT EXCHANGER

- A. Plates: Stainless steel Type 316L, vacuumed brazed together with high temperature copper braze with Nickel Alloy, ASME Certified
- B. Nozzles: Threaded connections.
- C. Maximum working pressure 150 psig, maximum working temperature 350 Degrees F.

# 2.03 MANUFACTURERS - PLATE TYPE HEAT EXCHANGERS

- A. Graham.
- B. Tranter.
- C. Alfa-Laval.
- D. ACS-Hoval.
- E. Substitutions: Under provisions of Division 01.

# 2.04 PLATE AND FRAME TYPE HEAT EXCHANGER

- A. Frames: Carbon steel with baked epoxy enamel paint, [stainless steel] side bolts and shroud.
- B. Plates: Stainless steel Type 304.
- C. Gaskets: [Nitrile rubber.] [Ethylene propylene diene monomer (EPDM).] [Viton.] [Neoprene.] [Hypalon.] [Resin-cured butyl rubber.] [\_\_\_\_\_.]
- D. Nozzles: 150 psig ASA rubber rated flange type.

# PART 3 EXECUTION

# 3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install to permit removal of plates with minimum disturbance to installed equipment and piping.
- C. Support heat exchangers on welded steel pipe and angle floor stand.
- D. Pipe relief valves to nearest floor drain.
- E. Pipe drain valves to nearest floor drain.

# 3.02 WATER TO WATER HEAT EXCHANGER TRIM

- A. Water Inlets and Outlets: Thermometer wells, pressure gauge tappings.
- B. Heated Water Outlet: Thermometer well for temperature regulator sensor, ASME rated pressure relief valve, valved drain.

# SECTION 23 6400 PACKAGED WATER CHILLERS

### PART 1 GENERAL

#### 1.01 WORK INCLUDED

- A. Air Cooled Chiller Package.
- B. Controls and Control Panel.

# 1.02 REFERENCES

#### 1.03 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Division 01.
- B. Show on shop drawings equipment, piping connections, valves, strainers, and thermostatic valves required for complete system.
- C. Submit certification that related components not furnished by chiller manufacturer have been selected in accordance with his requirements.
- D. Submit manufacturer's installation instructions under provisions of Division 01.

# PART 2 PRODUCTS

#### 2.01 ACCEPTABLE MANUFACTURERS

- A. York.
- B. Aermec.
- C. Substitutions: Under provisions of Division 01.

#### 2.02 CHILLERS

- A. General: Install and commission, as shown on the schedules and plans, factory assembled, charged, and tested air cooled scroll compressor chiller(s) as specified herin. Chiller shall be designed, selected, and constructed using a refrigerant with Flammability rating of "1", as defined by ANSI/ASHRAE STANDARD 34 Number Designation and Safety Classification of Refrigerants. Chiller shall include scroll compressors, direct-expansion type evaporator, air-cooled condenser, refrigerant, lubrication system, interconnecting wiring, safety and operating controls including capacity controller, control center, motor starting components and special features as specified herin or required for safe, automatic operation.
- B. Cabinet: External structural members shall be constructed of heavy guage, galvanized steel coated with baked on powder paint which, when subject to ASTM B117, 1000 hour, 5% salt spray test, yields minimum ASTM 1654 rating of "6".
- C. Operating Characteristics: Provide low and high ambient temperature control options as required to ensure unit is capable of operation from 30°F to 115°F (-1°C to 46°C) ambient temperature.
- D. Service Isolation valves: Discharge (ball type) isolation valves factory installed per refrigerant circuit. Includes a system high-pressure relief valve in compliance with ASHRAE15.
- E. Pressure Transducers and Readeout Capability
  - 1. Discharge Pressure Transducers: Permits unit to sense and display discharge pressure.
  - 2. Suction Pressure Transducers: Permits unit to sense and display suction pressure.
  - 3. High Ambient Control: Allows units to operate when the ambient temperature is above 115°F (46°C). Includes discharge pressure transducers

#### 2.03 COMPRESSORS

- A. Compressors: Shall be hermetic, scroll-type, including:
  - 1. Compliant design for axial and radial sealing.

- 2. Refrigerant flow through the compressor with 100% suction cooled motor.
- 3. Large suction side free volume and oil sump to provide liquid handling capability.
- 4. Compressor crankcase heaters to provide extra liquid migration protection.
- 5. Annular discharge check valve and reverse vent assembly to provide low-pressure drop, silent shutdown and reverse rotation protection.
- 6. Initial oil charge.
- 7. Oil level sight glass.
- 8. Vibration isolator mounts for compressors.
- 9. Brazed-type connections for fully hermetic refrigerant circuits.
- 10. Compressor Motor overloads capable of monitoring compressor motor current. Provides extra protection against compressor reverse rotation, phase-loss and phase-imbalance.

#### 2.04 EVAPORATORS

- A. Evaporator shall be brazed-plate stainless steel construction capable of refrigerant working pressure of 650 psig (3103 kPa) and liquid side pressure of 150 psig (1034 kPa).
- B. Brazed plate heat exchangers shall be UL listed.
- C. Exterior surfaces shall be covered with 3/4" (19mm), flexible, closed cell insulation, thermal conductivity of 0.26k ([BTU/HR-Ft<sup>2</sup> °F]/in.) maximum.
- D. Water nozzles shall be provided with grooves for field provided ANSI/AWWA C-606 mechanical couplings.
- E. Evaporator shall include vent and drain fittings and thermostatically controlled heaters to protect to -20°F (-29°C) ambient in off-cycle.
- F. A serviceable wye-strainer and mechanical couplings shall be provided for field installation on evaporator inlet prior to startup.
- G. Evaporator shall be provided with piping extension kit and mechanical couplings to extend liquid connection from evaporator to edge of unit. Thermal dispersion type flow switch shall be factory installed in the evaporator outlet pipe extension and wired to the unit control panel. Insulation and heat trace on piping shall be responsibility of installing contractor. Extension kit nozzle connections shall be ANSI/AWWA C-606 (grooved).

#### 2.05 CONDENSERS

- A. Coils: Condenser coils shall be constructed of a single material to avoid galvanic corrosion due to dissimilar metals. Coils and headers are brazed as one piece. Integral sub cooling is included. Coils shall be designed for a design working pressure of 650 PSIG (45 bar). Condenser coil shall be washable with potable water under 100 psi (7 bar) pressure.
- B. Low Sound Fans: Shall be dynamically and statically balanced, direct drive, corrosion resistant glass fiber reinforced composite blades molded into a low noise, full-airfoil cross section, providing vertical air discharge and low sound. Each fan shall be provided in an individual compartment to prevent crossflow during fan cycling. Guards of heavy gauge, PVC (poly-vinylchloride) coated or galvanized steel shall be factory installed.
- C. Fan Motors: High efficiency, direct drive, 6 pole, 3 phase, insulation class "F", current protected, Totally Enclosed Air-Over (TEAO), rigid mounted, with double sealed, permanently lubricated, ball bearings.
- D. Low Sound Fans with Variable Speed Drives. All fans shall be powered by VSDs. Fans shall provide vertical air discharge from extended orifices. Fans shall be composed of corrosion resistant aluminum hub and glass-fiber-reinforced polypropylene composite blades molded into
a low-noise airfoil section. Fan impeller shall be dynamically balanced for vibration-free operation. Fan guards of heavy gauge, PVC (polyvinyl chloride) coated or galvanized steel.

#### 2.06 CONTROLS

- A. Provide factory wired and mounted control panel inside equipment room. Provide panel incorporating refrigeration and electrical controls, including gauges for oil and refrigerant pressures, pump and fan switches, indicator lights, system switch, and load limit controls.
- B. In starter and disconnect enclosure provide control power transformer, load limit relay current transformer, magnetic overload protection devices, and safety circuits and starters for compressor, oil pump, and condenser fans.
- C. General: Automatic start, stop, operating, and protection sequences across the range of scheduled conditions and transients.
- D. Power/Control Enclosure: Rain and dust tight NEMA 3R powder painted steel cabinet with hinged, latched, and gasket sealed door.
- E. Microprocessor Control Center:
  - 1. Automatic control of compressor start/stop, anti-coincidence and anti-recycle timers, automatic pumpdown at system shutdown, condenser fans, evaporator pump, evaporator heater, unit alarm contacts, and chiller operation from -10°F to 125°F (-23°C to 52°C) ambient. Automatic reset to normal chiller operation after power failure.
  - 2. Software stored in non-volatile memory, with programmed setpoints retained in lithium battery backed real-time-clock (RTC) memory for minimum 5 years.
  - 3. Forty character liquid crystal display, descriptions in English (or Spanish, French, Italian, or German), numeric data in English (or Metric) units. Sealed keypad with sections for Setpoints, Display/Print, Entry, Unit Options & clock, and On/Off Switch.
  - 4. Programmable Setpoints (within Manufacturer limits): display language; chilled liquid temperature setpoint and range, remote reset temperature range, daily schedule/holiday for start/stop, manual override for servicing, low and high ambient cutouts, low liquid temperature cutout, low suction pressure cutout, high discharge pressure cutout, anti-recycle timer (compressor start cycle time), and anti-coincident timer (delay compressor starts).
  - 5. Display Data: Return and leaving liquid temperatures, low leaving liquid temperature cutout setting, low ambient temperature cutout setting, outdoor air temperature, English or metric data, suction pressure cutout setting, each system suction pressure, liquid temperature reset via a 4-20milliamp or 0-10 VDC input, anti-recycle timer status for each compressor, anti-coincident system start timer condition, compressor run status, no cooling load condition, day, date and time, daily start/stop times, holiday status, automatic or manual system lead/lag control, lead system definition, compressor starts/operating hours (each), status of hot gas valves, evaporator heater and fan operation, run permissive status, number of compressors running, liquid solenoid valve status, load & unload timer status, water pump status.
  - 6. System Safeties: Shall cause individual compressor systems to perform auto shut down; manual reset required after the third trip in 90 minutes. System Safeties include: high discharge pressure, low suction pressure, high pressure switch, and motor protector. Compressor motor protector shall protect against damage due to high input current or thermal overload of windings.
  - 7. Unit Safeties: Shall be automatic reset and cause compressors to shut down if low ambient, low leaving chilled liquid temperature, under voltage, and flow switch operation.
  - 8. Alarm Contacts: Low ambient, low leaving chilled liquid temperature, low voltage, low battery, and (per compressor circuit): high discharge pressure, and low suction pressure.

- 9. BAS Communications: YORKTalk 2, BACnet MS/TP, Modbus and N2 communication capabilities are standard.
- F. Manufacturer shall provide any controls not listed above, necessary for automatic chiller operation. Mechanical Contractor shall provide field control wiring necessary to interface sensors to the chiller control system.

### 2.07 ACCESSORIES AND OPTIONS

- A. Provide the following:
- B. Microprocessor controlled, Factory installed Across-the-Line type compressor motor starters as standard.
- C. High Ambient Control: Permits unit operation above 115°F ambient.
- D. Power Supply Connections:
  - 1. Control Power Transformer: Converts unit power voltage to 120-1-60 (500 VA capacity). Factory-mounting includes primary and secondary wiring between the transformer and the control panel.
- E. Protective Chiller Panels (Factory or Field Mounted).
  - 1. Louvered/Wire Panels: Louvered steel panels on external condenser coils painted as per remainder of unit cabinet. Heavy gauge, welded wire-mesh, coated to resist corrosion, around base of machine to restrict unauthorized access.
- F. Thermal Dispersion Flow Switch (Factory installed and wired in piping extension kit): Normally open, 30bar pressure rating, stainless steel 316L construction, IP67, -4°F to 158°F ambient rating.
- G. Hot Gas By-Pass: Permits continuous, stable operation at capacities below the minimum step of unloading to as low as 5% capacity (depending on both the unit & operating conditions) by introducing an artificial load on the evaporator. Hot gas by-pass is installed on only one refrigerant circuit.
- H. Low Temperature Process Glycol: Leaving chilled liquid setpoint range 10°F to 50°F (-12°C to 10°C)
- I. Sound Reduction (Factory installed):
  - 1. Compressor Acoustic Sound Blankets.
- J. Vibration Isolation (Field installed):
  - 1. 2" Deflection Restrained Spring Isolators: Level adjustable, restrained mounts in rugged welded steel housing with vertical and horizontal limit stops. Housings shall be designed to withstand a minimum 1.0g accelerated force in all directions to 2 inches (50.8 mm)

# PART 3 EXECUTION

# 3.01 INSTALLATION

- A. Install chiller package on steel or concrete beams in accordance with manufacturer's instructions.
- B. Provide isolators between unit and structural support members to dampen vibration transmission in accordance with Section 23 0548.
- C. Installing Contractor shall paint damaged and abraded factory finish with touch-up paint matching factory finish.
- D. Coordinate all control requirements and connections with Controls Contractor.

#### 3.02 ADJUSTING

A. Supply initial charge of refrigerant and oil.

B. Supply service of factory trained representative for a period of three days to supervise testing, dehydration, and charging of units, start-up, and instruction on operation and maintenance to Owner.

### SECTION 23 7200 AIR TO AIR ENERGY RECOVERY EQUIPMENT

# PART 1 GENERAL

### 1.01 SECTION INCLUDES

- A. Energy Recovery Ventilators
- B. Product Accessories and system components
- C. General Installation requirements

### 1.02 QUALITY ASSURANCE

A. Unit shall be preapproved for California Office of Statewide Health Planning and Development (OSHPD) special seismic certification (OSP-0180-10) or an approved equivalent.

### 1.03 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Division 01.
- B. Shop drawings shall indicate assembly, unit dimensions, weight loading, required clearances, construction details, and field connection details.
- C. Product data shall indicate dimensions, weights, capacities, ratings, fan performance, motor electrical characteristics, and gauges and finishes of materials. Contractor not to exceed unit dimensions specified in the contract documents.
- D. Provide fan curves with specified operating point clearly plotted.
- E. Submit sound power levels for both fan outlet and casing radiation at rated capacity.
- F. Submit product data of filter media, filter performance data, filter assembly, and filter frames.
- G. Submit electrical requirements for power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.
- H. Submit manufacturer's installation instructions under provisions of Division 01.

# 1.04 WARRANTY

A. Manufacturer shall provide a limited "parts only" warranty for a period of 60 months from the date of original equipment shipment from the factory. Warranty shall cover material and workmanship that prove defective, within the specified warranty period, provided manufacturer's written instructions for Installation, Operation, and Maintenance have been followed. Warranty excludes parts associated with routine maintenance, such as belts and filters.

### 1.05 QUALITY ASSURANCE

A. Unit shall be certified under UL-1812, Standard for Ducted Air to Air Heat Exchangers. Due to ongoing product offerings and upgrades, some models and options are not included in UL Listing reports. Consult manufacturer for more information.

### 1.06 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data under provisions of Division 01.
- B. Include instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists, and wiring diagrams.

#### 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site under provisions of Division 01 in factory-fabricated protective containers, with factory-installed shipping skids and lifting lugs.
- B. Store and protect products under provisions of Division 01.
- C. Store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

# 1.08 ENVIRONMENTAL REQUIREMENTS

A. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

### PART 2 PRODUCTS

### 2.01 ACCEPTABLE MANUFACTURERS – SEMI CUSTOM ENERGY RECOVERY VENTILATORS

- A. Ventus.
- B. Daikin.
- C. Substitutions: Under provisions of Division 01.

### 2.02 CONSTRUCTION

- A. GENERAL
  - 1. Furnish and install where shown on the plans air handling units with construction features as specified below. The units shall be provided and installed in strict accordance with the specifications. All units shall be complete with all components and accessories as specified. Any exceptions must be clearly defined. The contractor shall be responsible for any additional expenses that may occur due to any exception made.
- B. FACTORY TESTING AND QUALITY CONTROL
  - 1. Standard Factory Tests: The fans shall be factory run tested to ensure structural integrity and proper RPM. All electrical circuits shall be tested to ensure correct operation before shipment of unit. Units shall pass quality control and be thoroughly cleaned prior to shipment.

### C. UNIT CONSTRUCTION DESCRIPTION

- 1. General: Provide factory-fabricated air handling units with capacity as indicated on the schedule. Units shall have overall dimensions as indicated and fit into the space available with adequate clearance for service as determined by the Engineer. Units shall be completely assembled or multiple sectioned, shall be shipped as a single package (except where shipping limitations prevent) de-mounted into modular sections in the field by the contractor. Units shall be furnished with sufficient gasket and bolts for reassembly in the field by the contractor. Unit manufacturer shall provide certified ratings conforming to the latest edition of AMCA 210, 310, 500 and AHRI 410. All electrical components and assemblies shall comply with NEMA standards. Unit internal insulation must have a flame spread rating not over 25 and smoke developed rating no higher than 50 complying with NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems." Units shall comply with NFPA 70, "National Electrical Code," as applicable for installation and electrical connections of ancillary electrical components of air handling units. Tags and decals to aid in service or indicate caution areas shall be provided. Units shall be UL or ETL listed.
- D. Unit Casing The construction of the air handling unit shall consist of a Non-skeleton structure made by a "C" or "L" sandwich 2.0 inch thick polyurethane foam with an external side 22 gauge coated steel and 22 gauge galvanized steel on the inside, making it a double wall construction. The coating on the exterior surface provides a minimum of 2,000 hours Salt Spray rated corrosion resistance (per ASTM B-117). All the elements are connected with sealed joints.
- E. Insulation Entire unit to be insulated with a full (R13) 2" thick closed cell foam insulation. All insulation edges shall be encapsulated within the panel. All field penetrations must be completely sealed by installing contractor.
- F. Access Doors The unit shall be equipped with a solid double wall insulated (same as the unit casing), hinged or latched access doors as shown on the plans. The doorframe shall be extruded aluminum, with a built-in thermal break barrier and full perimeter gasket. The door hinge assembly shall be made of composite material.

- G. Unit shall be mounted on an 8 inch high x 2.5 inch wide x 13 gauge 'C' channel galvanized steel base rail.
- H. UNIT COMPONENT DESCRIPTION
  - 1. Unit Fans All fans shall meet the air flow performance specified and shall not exceed the break horsepower or sound power levels specified on the mechanical equipment schedule. Fan performance shall be based on testing and be in accordance with AMCA Standards 210 and 300.
- I. FANS
  - 1. The fan shall include direct driven, arrangement up to 5 plenum fans constructed per AMCA requirements for the duty specified. Fans shall be classified as class II or class III as required; class I fans are not acceptable. Fan wheels shall be made of aluminum construction and rated in accordance with and certified by AMCA for performance. All fans shall be selected to deliver the specified airflow quantity at the specified operating Total Static Pressure and specified fan/motor speed. The fan shall be selected to operate at a system Total Static Pressure that does not exceed 90% of the specified fan's peak static pressure producing capability at the specified fan/motor speed. Each fan/motor assembly shall include a G90 galvanized steel motor support plate and fan base with internal RIS isolation.
  - 2. All motors shall be standard foot mounted type TEFC selected at the specified operating voltage, RPM, and efficiency as specified or as scheduled elsewhere. Motors shall meet the requirements of NEMA MG-1 Part 30 and 31, section
  - 3. Motors shall be manufactured by Baldor, Siemens, Toshiba or WEG that operate at varying synchronous speeds as driven by an approved VFD. Motor HP shall not exceed the scheduled HP as indicated in the AHU equipment schedule(s). Steel cased motors and/or ODP motors are not acceptable. All motors shall include permanently sealed L10-400,000 hr bearings with shaft grounding to protect the motor bearings from electrical discharge machining due to stray shaft currents. Each fan wheel shall be dynamically balanced to BV-3 or better.
  - 4. Each fan motor shall be individually wired to a control panel containing one VFD per fan circuit breakers and a through the door rotary style disconnect switch. Each VFD shall be sized for the HP of the accompanying fan motor. Wire, breaker and disconnect sizing shall be determined, and installed, in accordance with applicable NEC standards and local code requirements.
- J. Heat Transfer Coils Water Coil
  - 1. Performance is to be certified under AHRI Standard 410. Coils exceeding the range of AHRI standard rating conditions shall be noted.
  - 2. Single stacked cooling coils shall be mounted on rack to permit coils to slide out individually from the unit. Provide intermediate drain pans on all double stacked cooling coils. The intermediate pan shall drain to the main drain pan. Water coils shall be constructed of seamless copper tubing mechanically expanded into fin collars. All fins shall be continuous within the coil casing to eliminate carryover inherent with a split fin design.
  - 3. Headers are to be seamless copper with die formed tube holes.
  - 4. Connections shall be male pipe thread (MPT) with vent and drain. All coil connections shall be extended to the exterior of the unit casing by the manufacturer. Coils shall be suitable for 261 PSIG working pressure. Maximum leak tested pressure shall be 522 PSIG and maximum burst pressure shall be 1189 PSIG.
  - 5. Water coils shall have the following construction:
    - a. 1/2" o.d. x .020" wall copper tube with .020" return bends

- b. .006" aluminum fins
- c. Stainless steel casing for 4, 6, and 8 row coils and Galvanized casing for 1, 2, and 3 row coils.
- K. Heat Transfer Coils Direct expansion coils
  - Direct expansion coils shall be constructed of seamless copper tubing mechanically expanded into fin collars. All fins shall be continuous within the coil casing to eliminate carryover inherent with a split fin design. Fins shall be die formed plate type. Headers are seamless copper with die formed tube holes. Connections shall be O.D. sweat copper and include a refrigerant distributor. Coils shall be suitable for 261 PSIG working pressure. Maximum leak tested pressure shall be 522 PSIG and maximum burst pressure shall be 1189 PSIG.
  - 2. Standard direct expansion coils shall have the following construction:
    - a. 1/2" o.d. x .016" wall copper tube with .016" return bends
    - b. .006" aluminum fins
    - c. Stainless steel coil casing
- L. Condensate / Drain Pans The drain pan shall be fabricated from stainless steel. All pans are to be pitched for complete drainage with no standing water in the unit. Provide stainless steel drain connection extended to the exterior of the casing. All drain connections shall be piped and trapped separately for proper drainage.
- M. Filters Provide filters of the type indicated on the schedule. Factory fabricated filter sections shall be of the same construction and finish as the unit. Side service filter racks shall be fabricated from galvanized steel and include hinged access doors. Internal blank-offs shall be provided by the air unit manufacturer as required to prevent air bypass around the filters. Each filter rack shall include a factory mounted pressure gauge.
- N. Medium Efficiency MERV 8 Pleated filters Provide 2" filters as specified on filter schedule. Filters shall be in compliance with ANSI/UL 900 – Test Performance of Air Filters. Provide (2) total sets of media.
- O. Dampers Ultra-low leakage Class 1A dampers (less than 3 cfm/sq ft. @ 1" w.g.) as indicated on the unit drawings. Ultra-low leakage dampers shall have insulated, extruded aluminum airfoil blades. Flat or formed metal blades are not acceptable. The damper blade shall incorporate rubber edge seals and Aluminum, zinc plated or stainless steel square steel shaft for a non-slip operation. Shaft bearings shall be spherical – non corrosive nylon to eliminate friction and any metal to metal contact.
- P. Plate Heat Exchanger Where applicable, units will be fabricated with an aluminum plate heat exchanger. The exchanger package consists of aluminum plates with pressed-in spacers; condensate drainage is possible in every direction. The plates are connected by a fold, which gives a severalfold material thickness at air entry and exit. The corners of the exchanger package are sealed into especially rigid aluminum extrusions in the casing with a sealing compound. The side walls of galvanized steel are bolted tightly to these extrusions. All performance data is AHRI-certified.
- Q. Heat exchangers will include factory mounted face and bypass dampers.
- R. Drain pans will be included on both sides of the heat exchanger and will be factory piped to the exterior of the unit. Drains will be the same size and construction as the condensate/drain pans on the remainder of the unit.
- S. ELECTRICAL POWER AND CONTROLS
  - 1. All electrical and automatic control devices not previously called out or listed below are to be furnished and installed in the field by OTHERS.
  - 2. All wiring shall be (75°C) Insulated copper wires.

- 3. The unit shall feature a mounted permanent nameplate displaying at a minimum the manufacturer, serial number, model number and current and amps voltage. The unit must have an ETL or UL Listing and bear the appropriate mark.
- 4. Conduit shall consist of a combination of EMT or flexible metal conduit as required. Liquidtite flexible metal conduit may be used outside the air tunnel for wet locations.
- 5. The unit shall feature a main non-fused disconnect of the proper amp rating to allow shutoff of all electrical motors and VFDs.

# PART 3 EXECUTION

# 3.01 INSTALLATION

- A. Install unit per manufacturer's recommendations and instructions as described in the Installation, Operation and Maintenance (IOM) manual.
- B. Contractor shall NOT use the units to provide temporary heating, cooling or ventilation to the building during construction.

# 3.02 EXAMINATION

- A. After completing the installation, inspect the air handler for damage, dirt or debris. Remove all dirt, construction debris and repair any damage to the finish including chips, scratches or dents.
- B. Replace the filters used during the construction phase.

# 3.03 FIELD QUALITY CONTROL

- A. Do not startup the equipment until the following operations are completed:
- B. All controls are installed and fully operational.
- C. Power is connected to the unit.
- D. Shipping materials have been removed.
- E. Filtration media is installed and clean.
- F. Piping and duct connections are installed and operational.
- G. Leak checks are completed on all water connections.
- H. All wiring, refrigerant piping, gasketing and hardware are properly installed on any multiple section units.

# SECTION 23 7300 INDOOR CENTRAL-STATION AIR-HANDLING UNITS

# PART 1 GENERAL

# 1.01 WORK INCLUDED

A. Indoor Central-Station Air-Handling Units.

# 1.02 REFERENCES

- A. AMCA 99 Standards Handbook.
- B. AMCA 210 Laboratory Methods of Testing Fans for Rating Purposes.
- C. AMCA 300 Test Code for Sound Rating Air Moving Devices.
- D. AMCA 301 Method of Publishing Sound Ratings for Air Moving Devices.
- E. AMCA 500 Test Methods for Louver, Dampers, and Shutters.
- F. ANSI/AFBMA 9 Load Ratings and Fatigue Life for Ball Bearings.
- G. ANSI/AFBMA 11 Load Ratings and Fatigue Life for Roller Bearings.
- H. ANSI/UL 900 Test Performance of Air Filter Units.
- I. ARI 410 Forced-Circulation Air-Cooling and Air-Heating Coils.
- J. ARI 430 Standard for Central-Station Air-Handling Units.
- K. ARI 435 Standard for Application of Central-Station Air- Handling Units.
- L. NFPA 90A Installation of Air Conditioning and Ventilation Systems.
- M. SMACNA Low Pressure Duct Construction Standards.

# 1.03 QUALITY ASSURANCE

- A. Fan Performance Ratings: Conform to AMCA 210 and bear the AMCA Certified Rating Seal.
- B. Sound Ratings: AMCA 301; tested to AMCA 300 and bear AMCA Certified Sound Rating Seal.
- C. Fabrication: Conform to AMCA 99 and ARI 430.
- D. Filter Media: ANSI/UL 900 listed, Class I or Class II, approved by local authorities.
- E. Air Coils: Certify capacities, pressure drops, and selection procedures in accordance with ARI 410.
- F. Air Handling Units: Product of manufacturer regularly engaged in production of components who issues complete catalog data on total product.

# 1.04 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Division 01.
- B. Shop drawings shall indicate assembly, unit dimensions, weight loading, required clearances, construction details, and field connection details.
- C. Product data shall indicate dimensions, weights, capacities, ratings, fan performance, motor electrical characteristics, and gauges and finishes of materials.
- D. Provide fan curves with specified operating point clearly plotted.
- E. Submit sound power levels for both fan outlet and casing radiation at rated capacity.
- F. Submit product data of filter media, filter performance data, filter assembly, and filter frames.
- G. Submit electrical requirements for power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.
- H. Submit manufacturer's installation instructions under provisions of Division 01.

# 1.05 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data under provisions of Division 01.
- B. Include instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists, and wiring diagrams.

### 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site under provisions of Division 01 in factory-fabricated protective containers, with factory-installed shipping skids and lifting lugs.
- B. Store and protect products under provisions of Division 01.
- C. Store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

### 1.07 ENVIRONMENTAL REQUIREMENTS

A. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

### 1.08 EXTRA STOCK

A. Provide one set disposable panel filters for each unit under provisions of Division 01.

### PART 2 PRODUCTS

### 2.01 ACCEPTABLE MANUFACTURERS

- A. Alliance.
- B. Haakon.
- C. Daikin.
- D. Substitutions: Under provisions of Division 01.

#### 2.02 GENERAL

- A. Steel: Galvanized in accordance with ASTM A386 or ASTM A525, G-90 hot dipped, or finished with heat cured Aliphatic Polyester Polyurethane; thickness in accordance with US Standard gages.
- B. Steel: Galvannealed in accordance with ASTM A653 and finished with heat cured Aliphatic Polyester Polyurethane; thickness in accordance with US Standard gages.
- C. Aluminum sheet and plate; 3003-H14 alloy, conforming to ASTM B209.
- D. Stainless Steel: Type 304 and 304L in accordance with ASTM A240. Plate to have hot-rolled annealed finish, Sheet to have 2B finish.
- E. Stainless Steel: Type 316 and 316L in accordance with ASTM A240. Plate to have hot-rolled annealed finish, Sheet to have 2B finish.
- F. Custom air handling equipment shall be a factory-assembled module, these modules will be disassembled to ship then reassembled in the field.
- G. Design and assemble units to ensure that each enclosure is engineered to withstand 8" WG positive or negative internal pressure, or fan shut-off static pressure, whichever is greater. Leakage shall be less than 1/2 of 1% of design airflow. Wall, roof, and door panel deflection shall not exceed 1/200 of the span of the panel when operating at 1.5 times schedule fan pressure or a maximum of 10 inches WG static pressure. Floor deflection shall not exceed 1/16" at 1.5 times schedule fan pressure or a maximum of 8 inches WG static pressure with a live load of 225 pounds per sq. ft.
- H. Design and assemble units to require only external connection of electrical power, ductwork, chilled water, hot water, steam, drain and condensate piping.

- 1. For motor power connections, provide a non-fused service disconnect switch on the exterior wall of the unit. Completely wire service disconnect back to motor connection box with conduit.
- 2. For floor and condensate drains, provide a recessed floor drain piped un-der the unit floor and extended through base perimeter of the equipment. Condensate floor drain shall be provided under the cooling coils and is an integral part of the floor system.
- 3. Extend piping connections for each coil, or humidifier (if required) 3 inches through panel casing. Terminate piping with either a flange or a threaded connection at full size and cap.
- I. Factory install all internal electrical components, conduits, electrical conductors, junction boxes, control tubing and piping. All conduits shall be EMT and shall be properly supported and securely attached to units.
- J. Removable panels shall be installed and located to facilitate fan, coil and other major component removal.
- K. Provide 1-1/4" floor drains in sections as shown on the layout drawings. Openings shall be carefully cut into the floor plate and continuously welded in place. Schedule 40 drain piping to be insulated and routed to the exterior of the unit base and capped with a pipe cap. Floor drains shall be sloped to drain with no standing water.
- L. All conduits penetrating the unit casing shall be sealed airtight. After wire is pulled, conduit shall be sealed so that air cannot be transferred into or out of the unit through conduits. Seal conduit airtight at all filter racks.
- M. Air handling equipment shall be draw-thru type or as shown on equipment layout drawings and shall contain heating coils, cooling coils, humidifiers, throwaway media filters, control dampers, and either vane axial, plenum or centrifugal fans in accordance with the equipment schedules data sheets.
- N. All casing seams and joints shall be sealed air and water tight.
- O. Piping sleeves shall be provided for all pipes, instrument lines and conduit passing through the unit floor. These sleeves must be at least 1" tall and sealed water tight.
- P. Casing fastening bolts, screws or rivets shall match equipment construction. Fasteners on the exterior of Outdoor equipment shall be Type 304 stainless steel.
- Q. Junction boxes or connectors should be provided at shipping split break points and electrical and pneumatic connections and shall be properly tagged for reconnection. 120/1/60 connections at shipping splits shall utilize 25A Wago quick connectors to facilitate reconnection.
- R. Units to be supplied with removable lifting lugs. Each section must have a minimum of four lifting lugs.
- S. Fabricate draw-through type air handling units suitable for medium pressure operation.
- T. Fabricate units with all components indicated on the drawings.
- U. Factory fabricate and test air handling units of sizes, capacities, and configuration as indicated and specified.

# 2.03 CASING

- A. WALLS AND ROOF
  - Equipment casing shall be double wall insulated standing seam modular panel construction. Exterior wall shall be 16 gauge G60 Galvannealed steel primed and coated with heat cured Aliphatic Polyester Polyurethane. The Interior wall shall be 20 gauge G90 bright galvanized. Insulation shall be 2-inch 1.5#/cu. ft. fiberglass type insulation for walls and roof, having an insulation thermal conductivity "K" factor of not less than 0.24 BTU/Hr./Sq. Ft./Degree F @ 75°F mean and the following sound attenuation characteristics:

| Octave Bands           | 125 | 250 | 500  | 1K   | 2K   | 4K   | NRC  |
|------------------------|-----|-----|------|------|------|------|------|
| Absorption Coefficient | .15 | .77 | 1.11 | 1.08 | 1.00 | 1.03 | 1.00 |

#### B. PANEL CONNECTIONS

1. All panel connection seams shall use Polyurethane Sealant between the panels and the panels shall be bolted together using zinc plated 1/4-20 bolts on 8" centers. Sheet metal or "Tek" screws are not acceptable for sealing pressure containing panels.

### C. FLOORING

1. Equipment floor shall be 16 gauge bright galvanized as standard. The floor shall be supported by intermediate and structural members on maximum of 24" centers. All seams shall be supported underneath by structural supports. Floor shall be attached to base structure by welding from underneath on maximum 6" centers. Floor seams shall consist of minimum 1" standing seams, sealed and covered with cleats to ensure water and air tightness. TEK screw attachment of floor skin to structural base frame is not acceptable.

### D. ACCESS DOORS

- Access doors shall be provided full height (72") where unit height permits, and shall be 24" wide where section length permits, otherwise minimum of 18" shall be used. Doors shall be 2" thick, double wall and insulated type. Exterior door panels shall be painted G60 Galvannealed steel with minimum 2,000 hour performance paint in accordance to ASTM B117 Salt Fog Test; interior panels are bright galvanized G90 steel. Door insulation shall be injected urethane foam with a minimum R value of 13-Ft2-°F/BTU. Door frames shall be heavy aluminum extrusion with one-piece, closed cell, replaceable santoprene gasket seal.
- 2. Door hinges shall be die-cast zinc with provision for adjustment without the use of shims or special tools. Door latches and handles are to be bolted to the unit and made with corrosion resistant materials. Bolts, nuts and shafts for door latches, handles and hinges shall be made of zinc plated steel. Door latch and pawl assembly shall be industrial quality and corrosion resistant with a handle on both the inside and outside of door. Latching mechanism shall be of conical roller design. Latch and pawl assembly shall be bolted together without the use of set screws allowed.
- 3. All doors to fan sections shall be provided with latches which require a tool to open.
- 4. Viewing windows shall have double thermal pane with wire reinforced safety glass.
- 5. Outdoor equipment will have a rain guard installed over each door.
- E. FRAME AND/OR BASE
  - 1. Base perimeter shall be constructed from ASTM A36 structural steel "C" channel. Internal supports shall consist of structural rectangular tubing on minimum 24" centers. All fans and coils shall be supported on a minimum 1/4" thick structural tubular steel. The equipment base shall be fully welded. Height and selection of structural members shall take into account internal loading, equipment height, length, width and number of split sections as to limit base deflection to 1/200 of span.
  - 2. Curb mounted equipment shall be provided with a curb attachment angle welded on the inside of the base perimeter steel.
  - 3. Provide each section with a minimum of four removable lifting lugs per shipping section attached to the structural steel base along the longest length of the equipment. Removable type lifting lugs shall be provided with welded attachments.
  - 4. All base structural members shall be Bead Blasted down to bare metal before welding, priming and painting.

5. Paint completed frame and/or base with two coats of Cardinal High Build 2K Epoxy Primer (3.0-5.0 mills). 2 coats of Aliphatic polyester polyurethane, color is Battleship Gray, finish is Gloss (3.0 – 4.0 mils).

# 2.04 MIXING BOX

- A. The mixing box shall be designed to provide high efficiency mixing of the two airstreams at different temperatures. Connections shall be as indicated.
- B. Mixing box shall be factory fabricated and have the same finish and insulation as the unit casing. If unit is shipped unassembled, supplier shall furnish all bolts, screws, fasteners and gaskets required for assembly.
- C. Mixing box shall be provided with parallel blade damper sets for merging of return air stream and outside air stream inside box.
- D. Dampers shall have manual locking quadrants unless otherwise specified.

### 2.05 FANS

- A. Basis of design for specific purpose plenum fans is the AcoustiFLO Modular Fan. Each fan assembly (module, cell, or cube) shall be complete with; motor, single width single inlet (SWSI) centrifugal fan wheel, and inlet cone. The preferred fan configuration is Arrangement 4 (direct drive) with the fan wheel mounted directly on the motor shaft.
- B. Aerodynamic performance of each fan (flow, pressure, and bhp) shall be AMCA Certified. Scheduled BHP for each fan is maximum allowable.
- C. Acoustic performance of each fan shall be traceable to the AMCA Certified Ratings Program.
- D. Maximum allowable outlet sound power for AHU2-1 and AHU2-2 supply fans shall be as follows:

| Center    | 62.5 | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 |
|-----------|------|-----|-----|-----|------|------|------|------|
| Frequency |      |     |     |     |      |      |      |      |
| Outlet Lw | 85   | 87  | 92  | 91  | 94   | 86   | 83   | 76   |

E. Maximum allowable inlet sound power for AHU2-1 and AHU2-2 return fans shall be as follows:

| Center    | 62.5 | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 |
|-----------|------|-----|-----|-----|------|------|------|------|
| Frequency |      |     |     |     |      |      |      |      |
| Inlet Lw  | 84   | 75  | 83  | 76  | 75   | 78   | 78   | 73   |

- F. A pressure summary shall be included in the submittal to identify respective pressure tabulations including but not limited to; outlet effect within the discharge section, coils, filters clean, filters loaded (clean and dirty ratings required), dampers, inlet effect within the cabinet, louvers, sound attenuators and system effects.
- G. At design flow and design pressure the selection point shall not exceed 90% of the peak static pressure available from the fan at design operating speed.
- H. All VAV/VFD fans shall be stable down to 40% of design air flow. Minimum pressure at zero flow will be assumed as one (1) inch or as required per ASHRAE 90.1.
- Each fan assembly shall be balanced to AMCA/ANSI 204, balance / vibration grade three (BV-3). In addition, vibratory force at the point of interface between the fan and support structure shall not exceed 10 micro-G. This measurement shall be made on each fan prior to installation in the AHU. Measurements shall be submitted prior to shipment of the AHU.
- J. The fan shall be sized such that the motor operating speed does not exceed ninety (90) hertz output frequency from the variable frequency drive (VFD).

- K. There shall be one (1) VFD per motor.
- L. Motors shall be equipped with a shaft grounding ring equivalent to AEGIS SGR. Motor bearings shall have a minimum L-10 life of 100,000 hours.
- M. Motor bearings shall be provided with fittings for re-lubrication.
- N. If belt driven fans are proposed motor bearings shall have a minimum L-10 life of 600,000 hours.
- O. For any fan section containing more than one fan, provide hardware that minimizes reverse flow in the event of a fan/motor/VFD failure or fault. The pressure loss through the isolation device shall be identified as a line item in the static pressure summary. Damper pressure drop based on testing in straight runs of ductwork is not representative of this specific application. Suppliers electing to use dampers shall provide third party test results which validate the damper's aerodynamic penalty.
- P. Acceptable sound absorbing media shall be slag wool, UltraTouch® or melamine foam. All sound absorbing media shall be encapsulated. Acceptable forms of encapsulation shall be Mylar, Tedlar, or Typar. Perforated metal is not recognized as a method of encapsulation. If fiberglass is proposed it must be encapsulated behind two separate layers of an approved encapsulation media and must be certified to contain no formaldehyde.
- Q. Each inlet cone shall be provided with four (4) static pressure taps mounted flush in the throat. All taps shall be connected in parallel and brought to a single barb fitting.
- R. Each fan assembly shall have a flow/pressure/speed test prior to installation in the AHU. Test results shall be submitted prior to shipment of the AHU.
- S. Fan blades shall be an extruded aluminum air foil shape and be welded to the front and back plate of the fan wheel. Fans shall be constructed to Class 3. The hub shall be secured to the motor shaft with a compression type coupling.
- T. All steel components shall be sand blasted prior to painting. Paint shall be powder coat.
- U. All nuts shall be self-locking.
- V. Bolted connections shall be drilled and doweled.

### 2.06 COILS

- A. Hot Water and Chiller Water Coils:
  - 1. Acceptable manufacturers are:
  - 2. RAE
  - 3. Modine
- B. Coil Design
  - 1. Intermediate drain pans: Provide 16 gauge 304 stainless steel drain pans under all cooling coils as indicated. Cross brake pan to drain connection. Drain piping that is exposed to air stream shall be Type M Copper.
  - 2. Condensate recessed floor pan shall be an integral part of the floor. The pan shall be sloped to allow proper drainage. The condensate drainpipe shall be 304SS and welded into the deep end of the sloped drain pan. Drain pipe to be extended 3" through the base steel and capped.
- C. Chill Water Coils
  - 1. Tubes shall be round, seamless copper tubes, 5/8" O.D., arranged in counter flow pattern with respect to airflow. Bronze spring type turbulators shall be used at water velocities below 8 fps. Tube thickness shall not be less than 0.04 times the O.D. of the tube.

- 2. Fins shall be plate-type aluminum. Fins continuous across entire coil length and up to 54" in height and die-formed in multiple stages with full fin collars for maximum fin-tube contact and accurate spacing. Fins me-chanically bonded to tubes. Fin spacing shall not be closer than 12 fins per inch unless otherwise shown on the drawings.
- Casings to be 304 stainless steel. 16 gauge formed end supports and top and bottom channels. One 16 gauge 304 stainless steel center tube sup-port on lengths over 48"; Two or more supports on ordering lengths over 96".
- 4. Water coils are leak tested at 315 psig (dry air) for standard water coils and 125 psig for water coils with removable headers at the factory. Coils are to be pressurized then completely submerged in water containing a wetting agent.
- 5. Headers shall be constructed from UNS 12200 seamless copper con-forming to ASTM H55. Return and supply headers are located on the same side of the coil. Connections to be extended through panel wall un-less coils are internally piped. Connections to be carbon steel or red brass.
- 6. Coils sized to allow design CFM to flow under 500 FPM through coils.

# 2.07 UV LIGHT

- A. Surface Treatment and Maintenance of Cooling Coils for AHU or Packaged Unit
  - 1. Irradiation
    - a. UV-C Fixtures shall be installed in sufficient quantity and in a configuration to provide even distribution of UV-C energy on cooling coil surface area. When installed, the minimum UV-C irradiance striking any point on a plane representing the surface of the coil shall not be less than 50 microwatts per square centimeter.
    - b. Average UV-C irradiance shall be 150 microwatts minimum per square centimeter, in accordance with ASHRAE guidelines published in current ASHRAE Handbook— HVAC Applications Chapter 60 – Ultraviolet Air and Surface Treatment
- B. UV-C Germicidal Irradiation System
  - 1. UV-C Germicidal Irradiation System shall consist of the UV-C Fixtures needed to meet the level of irradiance specified.
  - 2. The manufacturer shall use computation modeling software for selecting the appropriate number of UV-C Fixtures for the UV-C Germicidal Irradiation System of each HVAC unit. The software shall produce tabular and graphical representation of UV-C disinfection modeling calculations, irradiation, intensity and UV dosage calculations to determine fixture placement, energy distribution and projected disinfection rates of targeted pathogens.
- C. UV-C Fixtures
  - 1. UV-C Fixtures shall be germicidal, high output, with factory assembled and tested housings and mounting structures. Each UV-C Fixture shall consist of a lamp, lamp socket(s), power supply and lamp wiring.
  - 2. Power Supply:
    - a. Power supply shall be of a high efficiency, high frequency, high power factor type with capability to operate with an input of 100-277VAC matched to the lamp and designed to maximize radiance and reliability.
    - b. The power supply shall be protected from failure in the event of lamp failure and capable of operation indefinitely when powered with no lamp or failed lamp.
    - c. The power supply shall be UL listed and designed for maximum UVC output and reliability.

- 3. The UV-C Fixture shall allow for installation of the power supplies in one of the following configurations:
  - a. In a drip proof enclosure inside the air handling unit, package unit or supply or return duct.
  - b. Within optional vertical or horizontal mounting struts inside the air handling unit, package unit or supply or return duct.
  - c. In a separate electrical enclosure outside the air handling unit, package unit or supply or return duct for indoor installations
  - d. Refer to the project details for mounting location
- 4. Lamp Sockets:
  - a. Sockets shall be constructed of UV-C resistant materials
  - b. The Lamp Socket shall accommodate a single ended four-pin UV-C lamp
  - c. Wires from the lamp socket to the power supply shall be coated with a Teflon-type material and rated at 600 volts.
- 5. Lamp:
  - a. Lamp shall be a high output (nominal 825 milliamps), T-5 diameter, hot cathode, low pressure UV-C lamp. Lamp tubes shall be constructed of Sodium Barium glass and internally coated, designed to extend lamp life and maintain output. Uncoated quartz lamp tubes shall not be acceptable.
  - b. Lamps shall be equipped with a four-pin lamp base.
  - c. When specified, lamps with UV-C transparent polymer sleeves shall be provided. Application of the polymer sleeve shall have the benefit of protecting the lamp and in the event of breakage, contain the glass and mercury for disposal.
- 6. Lamp life shall be a minimum of 9000 continuous hours of service.
  - a. The lamp shall produce no less than 80% of its initial UV-C output at end of useful life.
  - b. Manufacturer shall provide proof of testing data that shows lamp intensity at the end of useful lamp life.
- 7. Each lamp shall contain no more than 5.0 milligrams of mercury.
- 8. Lamps shall produce 254nm UV energy at up to 180m/min air velocity in temperatures from 12° C to 57° C without production of ozone.
  - a. Performance curves of the lamp at system operating temperatures and air velocity shall be available from the system manufacturer and provided upon request.

# 2.08 FILTERS

- A. Non-ionizing, polarized media electronic air cleaners:
  - 1. Certifications:
    - a. The Air Cleaner shall have been tested and meet UL Standard 867 and CSA Standard C22.2 No. 187-M19986 for electrostatic Air Cleaners.
    - b. The Air Cleaner shall have been tested and meet seismic standards under CA OSHPD Special Seismic Certification Preapproval or other state equivalent program. Reference CA OSHPD OSP #0269-10
  - 2. Operation: The Air Cleaner shall have an active electrostatic field that polarizes a dielectric media. It shall not ionize airborne particles or produce ozone.
  - 3. Laboratory Testing Performance: Using the ASHRAE 52.2 protocol with carbon black in the test dust, the Air Cleaner shall test at MERV 14. Using the ASHRAE 52.2-NC protocol

(with no carbon in the loading dust), the Air Cleaner shall test at MERV 15. As installed, it shall have a clean static pressure drop of less than 0.32" w.g. at 500 feet per minute and shall increase in resistance no more than 0.25" w.g. with a dust loading of 2,855 grams. It shall hold a total of 4,582 grams of dust at its final resistance of 1.4" w.g. per 24x24 module. Any substitute Air Cleaner must meet these MERV ratings, static pressures and loading characteristics. The Air Cleaner manufacturer must provide testing from an approved ASHRAE test lab to verify MERV rating, operational and loading performance.

- 4. Construction: The Air Cleaner modules shall consist of four or six individual Air Cleaners. Each Air Cleaner shall be 18" high and 29.5" deep and the width shall be 43". The construction of the Air Cleaner frame shall be aluminum, and the screens, side panels and attachment flanges shall be of galvanized steel. The Air Cleaner modules and each component thereof must have a positive seal where necessary to prevent bypass of air.
- 5. Electronics: The high voltage powerheads shall require 24 volts AC input and have a 9.5kV DC output. The powerheads must be fully potted and connected in parallel.
- 6. Control Panel: The 24VAC power supply must be a UL or CSA certified transformer, class "2" type, which shall permit one side of the secondary output (24V) to be attached to electrical ground. A Filter Minihelic gauge shall be installed in the Unit Control Panel (optional direct readout or signal tied into building automation).
- 7. Filter Media: Each Air Cleaner shall have a disposable and recyclable media pad with a minimum of a class "2" fire rating. It shall have a positive seal in the overall filter assembly.
- 8. Configuration: The Air Cleaners will be arranged in pre-fabricated module assemblies. The number of modules and width shall be such that the face velocity thru the filter bank shall be no more than 450 fpm. The frames and electronics of the V8 modules will be permanently mounted in the air handler. The filter rack will be constructed so as to allow front access for media changes of the V8 assembly.
- 9. Air handler manufacturer shall provide a fully operational filter section that includes factory mounting and wiring of the filter system. All associated electrical and control wiring integral to the air cleaner to be provided by the air cleaner manufacturer.

# 2.09 DAMPERS

- A. Acceptable Manufacturers
  - 1. Tamco
  - 2. Ruskin
  - 3. Greenheck
- B. Control Dampers shall be opposed or Parallel (At mixing boxes) blade type.
- C. Joints shall be tight and uniform width. Dampers shall be free of visible burrs and cuts.
- D. Supplier shall furnish construction details of all dampers.
- E. Dampers shall be aluminum construction. Damper frames shall be formed of
- F. 0.080" aluminum, mechanically joined. Blades shall be airfoil design of aluminum construction. Blades to have a nominal width of 6" with a maximum width of 8". Furnish dampers with jackshafts and locking quadrants.
- G. Bearings shall utilize Celcon inner bearing fixed around a 7/16" hexagon pivot pin. Outer bearing is polycarbonate and is inserted into the frame. Metal to metal sealing methods are not acceptable.
- H. Dampers provided with extruded silicon frame seals. Metallic self-compressing stainless steel side seals are not acceptable. Linkage shall be corrosion resistant and concealed in end channel frame. Blade pin shall be 7/16" hexagon steel, zinc plated.

I. Dampers shall be AMCA rated for Leakage Class 1A @ 1"WG.

### 2.10 ELECTRICAL

- A. Lighting and receptacles:
  - 1. Provide a marine type waterproof light fixture with 1100 lumen cool white LED lamp, rated for 125V, in each housing module ca-pable of 10 foot candles minimum lighting.
  - 2. Provide a light switch outside the supply fan door where applicable. Switch to have a weatherproof cast metallic cover.
  - 3. Provide a Weatherproof/Tamperproof 20A GFCI receptacle under light switch at fan section door with a weatherproof in-use cover.
  - 4. Provide <sup>3</sup>/<sub>4</sub>" conduit through casing wall for 120V power wiring to enter unit from a single point connection junction box on the ex-terior wall of the unit.
  - 5. Light switches and receptacles shall be approved for outdoor installation. Light switches and receptacles shall be rated for 20A.
  - 6. Light fixture to have a glass globe and a wire or cast guard. Light sockets shall be porcelain, medium base.
- B. Power:
  - 1. Install a non-fused disconnect switches, as required for complete and operable system.
  - 2. Electrical components, devices, and materials shall be sized in accordance with NEC requirements for 40 degrees C operating conditions.
- C. Wiring and Conduits:
  - 1. All electrical wiring shall be installed in EMT, minimum size of 1/2 inch. Use liquid tight flexible metal conduit at motors, transformers and any device subject to vibration and where rigid conduit is not applicable. Flexible conduit shall not exceed 48 inches in length.
- D. Controls
  - 1. All controls and operators will be provided by the owner, or by the equipment manufacturer to be factory installed.
  - 2. Control sequence equipment manufacturer for controls installation from the engineer or contractor.
- E. Tubing, Fittings, and Instrument Block Valves:
  - 1. All pneumatic tubing shall be NFPA 90A rated polyethylene tubing, 1/4 inch outside diameter.
  - 2. All tube fittings shall be brass.
  - 3. Instrument block valves shall be brass, line size, forged body needle valves.

#### 2.11 DISCONNECTS

A. Disconnect switches shall be heavy duty type, single throw, non-fusible, and selected from the table below.

| Motor H.P. | Disconnect Rating     | Туре .       |
|------------|-----------------------|--------------|
| 0-20       | 30A, 3 Pole, 480 Vac  | NEMA 12/3R/4 |
| 25-50      | 60A, 3 Pole, 480 Vac  | NEMA 12/3R/4 |
| 60-75      | 100A, 3 Pole, 480 Vac | NEMA 12/3R/4 |
| 100-125    | 200A, 3 Pole, 480 Vac | NEMA 12/3R/4 |

B. Disconnect switches shall have NEMA 12 enclosures for indoor use, NEMA 3R/4 enclosures for outdoor use.

- C. Switches shall be operated with external operating handle, an integral part of the box not the cover. The operating mechanism shall be quick-make, quick-break, and shall not be capable of being restrained by the operating handle during the opening or closing operation.
- D. Dual interlocks shall interlock the switch box cover when the switch contacts are closed and the switch mechanism is in the "on" position. An interlock release shall be provided to defeat the interlocking mechanism and to permit opening the box cover when the switch contacts are closed, using an external hand tool.
- E. Switch handles shall be designed for padlocking in the "off" position. All current-carrying metal parts of the switch shall be enclosed.
- F. Each fan motor shall have its own disconnecting means.

# PART 3 EXECUTION

# 3.01 INSTALLATION

- A. Unit manufacturer shall provide a qualified supervisor to instruct and supervise the Contractor in rigging, erecting, pre-operation checkout and starting of each unit as necessary. The price for such services shall be indicated in the unit manufacturer's quote. Manufacturer's supervisor shall be a senior service technician trained in the startup of industrial HVAC Systems not a factory worker.
- B. Install in accordance with manufacturer's instructions And in conformance with ARI 435.

# 3.02 ELECTRICAL INSTALLATION

- A. All power, lighting, control, and instrumentation wiring shall be installed in EMT Conduit. Separate conduit systems shall be provided as follows:
  - 1. Power Circuitry
  - 2. Lighting Circuitry
  - 3. Control and Instrumentation Circuitry
- A. Flexible conduit shall be used to connect conduits to motor. The maximum allowable length of flexible conduit shall be four feet.
- B. All conduit connections to boxes and fittings shall be supported not more than 18 inches from connection point. All conduit bends shall be supported not more than 18 inches from each change in direction.
- C. Exposed conduits shall be securely clamped and supported with pipe hangers or galvanized one-hole pipe straps fastened to structure with bolts, screws, and anchors.
- D. The spacing of supports for horizontal runs of 1/2-inch conduit or larger shall be not more than 8 feet. The spacing of supports for vertical runs of 1/2, and 1 1/4 inch conduits shall be not more than 7 feet. The spacing of supports for vertical runs of 1 1/2 inch or larger conduits shall be not more than 7 feet.
- E. All unit wiring for external connections shall be terminated on the left hand side of the outgoing terminal blocks.
- F. When multiple vertical rows of terminal boards are located in the same terminal box, a minimum of four inches clear space shall be provided between adjacent vertical rows.
- G. Power and control and instrumentation wiring shall be separated from each other and shall not be terminated on the same terminal blocks.

# 3.03 IDENTIFICATION

A. All control and instrument wiring shall be identified with a unique wire number. These numbers shall agree with the numbers shown on the supplier's wiring diagrams. Control circuit wiring shall be permanently identified with wire markers applied within 1" of each terminal or connection.

B. All pipe connections on the exterior of the unit shall be clearly labeled for field connection.

### 3.04 TESTS AT THE JOB SITE

- A. All units will be field tested by an independent testing/balancing contractor after installation. Any deficiencies found at this time will be corrected at the cost of the equipment manufacturer.
- B. Equipment manufacturer shall provide a qualified service technician to be present at the job site when air handling units are tested by the Owner's Test and Balance Contractor. It is the responsibility of the unit manufacturer to see that all necessary corrections are made and the units are performing in accordance with the specification. One day shall be provided in base bid for this work.
- C. Equipment manufacturer shall provide a qualified technician to instruct the Owner's personnel on maintenance and operation of the air handling units for a minimum of one day after installation.
- D. It is the responsibility of the unit manufacturer to coordinate with the Owner or Owner's Representative to establish a schedule for the events previously described.

#### 3.05 FINAL CLEANING

A. The outside and particularly the inside of each air handling unit shall be thoroughly cleaned. Industrial grade cleaners can be used to remove construction dust. Any sheet metal mil finish or grease can be removed with an environmentally safe and non-toxic C9-C12 Propanol Hydrocarbon. All proposed cleaning materials shall have contents identified and approved prior to use. Unit openings shall then be covered with sheet-metal. The unit shall be wrapped with 7 mils of shrink wrap and heated to maintain unit cleanliness standards for shipping.

# 3.06 UNIT SHIPMENT

A. All units must be scheduled to ship with the AHU manufacturer and the owner. These dates are to be determined and agreed upon by both parties.

#### 3.07 WARRANTY

A. These units will be guaranteed free of defects for a period of one year. All work and workmanship is done by highly trained professionals and their workmanship is guaranteed for a period of one year. The warranty of all components will be the manufacturer's standard warranties serviced by the air handling unit manufacturer.

### SECTION 23 8123 COMPUTER-ROOM AIR-CONDITIONERS

# PART 1 GENERAL

# 1.01 SECTION INCLUDES

- A. Air Conditioning Units.
- B. Controls and Control Panels.
- C. Dry Cooler Units.

# 1.02 REFERENCES

- A. ANSI/ASME Boilers and Pressure Vessels Code.
- B. ANSI/NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum).
- C. ANSI/NFPA 90A Installation of Air Conditioning and Ventilation Systems.
- D. ASHRAE 52 Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter.
- E. FS TT-C-490 Cleaning Method and Pretreatment of Ferrous Surfaces for Organic Coatings.
- F. UL Underwriters Laboratories.

# **1.03 REGULATORY REQUIREMENTS**

A. Conform to ANSI/NFPA 90A for the installation of computer room air conditioning units.

# 1.04 SUBMITTALS

- A. Submit product data under provisions of Division 01.
- B. Submit product data for manufactured products and assemblies required for this project.
- C. Indicate water, drain, electrical, and refrigeration rough-in connections on shop drawings or product data.
- D. Submit manufacturer's installation instructions under provisions of Division 01.

# 1.05 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data under provisions of Division 01.
- B. Include manufacturer's descriptive literature, operating instructions, installation instructions, and maintenance and repair data.

# 1.06 WARRANTY

- A. Provide five year manufacturer's warranty under provisions of Division 01.
- B. Warranty: Include coverage of refrigeration compressors.

# 1.07 EXTRA MATERIALS

A. Provide one set of filters for each unit under provisions of Division 01.

# PART 2 PRODUCTS

# 2.01 MANUFACTURERS

- A. AboveAir.
- B. Substitutions: Under provisions of Division 01.

# 2.02 AIR-COOLED, SPLIT OR FLOOR MOUNTED AIR CONDITIONING UNIT.

- A. Cabinet Free Standing Unit
  - 1. Evaporator compartment:
    - a. Construction: Single-wall insulated panels, heavy gauge galvanized steel with powder-coat paint finish.

- b. Insulation and Adhesive.
  - 1) Material: High density 2 lb/f t<sup>2</sup> closed cell foam.
  - 2) Thickness: 1 inch.
  - 3) Adhesive: ASTM C 916, Type I compliant.
- c. Drain pan: Stainless steel, insulated.
- d. Air pattern: UFFR: Up-Flow, Front Free or Rear-Ducted Return.
- e. Filter: 2" Merv-8.
- 2. Condensing compartment (Packaged, Split Air-Cooled Ducted, Split Water-Cooled):
  - a. Construction: Single-wall, heavy gauge galvanized steel with powder-coat paint finish.
  - b. Insulation.
    - 1) Material: High density 2 lb/f t<sup>2</sup> closed cell foam.
    - 2) Thickness: 1 inch.
    - 3) Adhesive: ASTM C 916, Type I compliant.
  - c. Air pattern: Free-Discharge.
- B. Direct expansion cooling system.
  - 1. Direct-expansion type system.
    - a. Compressor(s): Single or Dual circuit lead digital scroll.
      - 1) Refrigerant: R-410A
      - 2) Overload protected
    - b. High refrigerant pressure safety switch.
    - c. Low refrigerant pressure safety switch.
    - d. Crankcase heater.
    - e. Filter-drier.
    - f. Sight-glass.
    - g. Thermal expansion valves with external equalizer.
    - h. Capacity control: Hot gas bypass.
    - i. Low ambient control option: -30°F Flooded head pressure control valve.
    - j. Additional options: Receiver, Suction line accumulator, Sound jacket.
- C. Coils
  - 1. Evaporator Coil:
    - a. Construction: Aluminum-plate fin and seamless copper tube in galvanized steel casing.
    - b. Fins: 12 fpi.
    - c. Coating: HYCOR 2-Coat Corrosion Resistant Hydrophilic Fin-Stock.
  - 2. Chilled Water Coil:

- a. Construction: Aluminum-plate fin and seamless copper tube in galvanized steel casing.
- b. Fins: 12 fpi.
- c. Coating: HYCOR 2-Coat Corrosion Resistant Hydrophilic Fin-Stock.
- d. Valve type: Factory-installed, 2-way or 3-way per plans.
- e. Valve pressure rating: 300 psig.
- f. Control: Modulating.
- 3. Condenser Coil (Air-Cooled, Ducted):
  - a. Construction: Aluminum-plate fin and seamless copper tube in galvanized steel casing.
  - b. Coating: HYCOR 2-Coat Corrosion Resistant Hydrophilic Fin-Stock.
- 4. Condenser Coil (Air-Cooled, Free-Standing):
  - a. Construction: Aluminum-plate fin and seamless copper tube in galvanized steel casing.
  - b. Coating: HYCOR 2-Coat Corrosion Resistant Hydrophilic Fin-Stock.
- 5. Hot Water Heat:
  - a. Construction: Aluminum-plate fin and seamless copper tube in galvanized steel casing.
  - b. Rows: 1
  - c. Coating: None.
  - d. Valve type: Factory-installed, 2-way or 3-way per plans.
  - e. Valve pressure rating: 300 psig.
  - f. Control: Modulating.
- 6. Steam Heat:
  - a. Construction: Aluminum-plate fin and seamless copper tube in galvanized steel casing.
  - b. Rows: 1
  - c. Coating: None.
  - d. Valve type: Factory-installed, 2-way or 3-way per plans.
  - e. Valve pressure rating: 300 psig.
  - f. Control: Modulating.
- 7. Freecooling Coil:
  - a. Construction: Aluminum-plate fin and seamless copper tube in galvanized steel casing.
  - b. Coating: HYCOR 2-Coat Corrosion Resistant Hydrophilic Fin-Stock.
  - c. Valve type: Factory-installed, 2-way or 3-way per plans.
  - d. Valve pressure rating: 300 psig.

- e. Control: Modulating.
- D. Humidifier
  - 1. Electrode steam canister type humidifier with disposable canister, steam distributor, and fill and drain valves.
  - 2. Control: Single stage with automatic flush cycle.
- E. Fans
  - 1. Supply fan:
    - a. Type: Backward-inclined, high efficiency impeller.
    - b. Motor: Direct drive, EC.
    - c. Direct Drive: Motor mounted resiliently in the fan inlet.
  - 2. Condenser fan (Ducted Condenser):
    - a. Type: Backward-inclined, high efficiency impeller.
    - b. Motor: Direct drive, EC.
    - c. Direct Drive: Motor mounted resiliently in the fan inlet.
  - 3. Condenser fan (Free-standing Condenser):
    - a. Type: Axial propeller.
    - b. Motor: Direct drive, EC.
- F. Motors
  - 1. Motor sizes: As indicated herein, or such that the motor will not be required to operate in service factor range about 1.0.
  - 2. Service Factor: 1.15.
  - 3. Motor Bearings: Maintenance free, permanently lubricated deep-groove bearings
  - 4. Efficiency: Premium.
- G. Controls
  - 1. Carel Microprocessor based PLC controller.
    - a. Control type: MC-2000S RH Temperature & humidity control.
    - b. Fan speed control: Variable speed based on fan speed temperature sensor
    - c. Remote-mounted display terminal with push button navigation and 200 ft display cable.
    - d. Safeties and Alarms:
      - 1) Air Proving.
        - a) Unit shuts down on alarm.
      - 2) Dirty Filter.
      - 3) Life Safety Alarm.
        - a) Unit shuts down on alarm.
      - 4) Condensate Overflow.
        - a) Compressor and humidifier lockout on alarm.

- 5) Circuit 1 & 2 high pressure switch.
  - a) Compressor lockout on alarm after 3 failures in 10 minutes or failure to reset after 30 seconds.
- 6) Circuit 1 & 2 low pressure switch.
  - a) Compressor lockout on alarm after 3 minutes start delay.
- e. Controls up to 2 stages of cooling, 2 stages of heating, and 1 stage of humidification.
- f. Component run time data.
- g. Real time clock (time stamped alarms).
- h. Sensors:
  - 1) Temperature Control: Space mounted temperature/humidity sensor.
  - 2) Fan Speed Control: Space] mounted temperature/humidity sensor.
- i. BMS communication: BACnet IP.
- H. Accessories
  - 1. Condensate pump: Compact, 20 ft lift.
    - a. Condensate pump mounting: Unit Mounted.
    - b. Condensate pump power: Fused connection at unit.
  - 2. Smoke detector: Field, duct mounted.
  - 3. Firestat: By others.
  - 4. Water-leak detector: Cable-type.
  - 5. Vibration isolation: Hanging spring vibration isolators.
  - 6. Disconnect: Main power, non-fused and Condenser power, non-fused.
  - 7. Electrical protection: Voltage/Phase Monitor.

#### 2.03 DRY COOLER UNITS

- A. Cabinet Construction: The drycooler cabinet shall be constructed of heavy gauge, corrosion resistant galvanized steel. All multiple fan units shall be divided by full width baffles to separate individual fan sections, prevent air bypass and provided additional casing reinforcement.
- B. Component Access: Removable fan guards shall provide ease of coil cleaning and fan and motor service. Electrical components shall be accessible through a weather-tight enclosure at the end of the unit.
- C. Electrical System: The unit electrical components shall be mounted in a weather-tight enclosure located at the header end of the drycooler. Fan motor contactors shall be provided with selected fan cycling kit. The system shall be complete with main power to 24V control transformer and dry-contact closure for remote unit stop/start. The electrical control panel shall be built in accordance and approved by UL.
- D. Glycol Fluid Temperature Control: Fluid temperature sensing aquastats shall be provided to cycle fans ON and OFF for automatic control of the leaving glycol temperature. Individual fans shall be cycled on single fan-width units; or in pairs on dual fan-width units. The fan, or fans, nearest the header end of the unit shall run continuously.
- E. Glycol Coil: The drycooler coil shall be constructed of copper tubes and aluminum fins. Coil casings shall be constructed of 16 gauge galvanized steel. Coils shall have single inlet and outlet steel MPT connections plus universal drain or vent connection. All coils shall be factory

leak tested at 400 psig dry nitrogen. Coils shall be designed in accordance with ARI Standard 410.

- F. Propeller Fans: Fans shall be direct-driven aluminum propeller blade type with painted steel hubs. Fans shall be dynamically balanced and factory tested prior to shipping. Fans shall have dual square head set screws spaced 90 degrees apart that seat on one flat and one keyway on the motor shafts. Fan diameters shall not exceed 30 inches. The fan assembly shall be designed for free discharge.
- G. Fan Guards: Fan guards shall be heavy-gauge, closemeshed steel wire with vinyl coating for maximum rigidity, long life and attractive appearance.
- H. Fan Motors: Fan motors shall be heavy duty PSC or three phase open drip-proof type with permanently lubricuted ball bearings and built-in overload protection. All motors shall be factory wired with leads terminating in a weather-tight enclosure located opposite the header end of the unit.
- I. Optional Features: A main power non-fused disconnectswitch shall be factory installed.

# PART 3 EXECUTION

# 3.01 EXAMINATION

- A. Examine the area and conditions where the unit will be installed for compliance with the installation requirements for the unit before equipment installation.
- B. Verify roughing-in for equipment is coordinated with actual locations of piping, duct, and electrical connections before equipment installation.
- C. Do not install equipment until unsatisfactory conditions are remedied.

### 3.02 INSTALLATION

- A. Install unit in accordance with manufacturer's requirements and approved documentation.
- B. Complete all ductwork, refrigerant piping, control, power wiring, and other service connections in accordance with Division 23 and Division 26.
- C. Verify unit has been leak checked in accordance with manufacturer's requirements and provided with an appropriate starting charge when breaking vacuum.
- D. Prepare inspection report confirming that the unit is ready for startup.

# 3.03 STARTUP AND FIELD QUALITY CONTROL

- A. Engage a factory-authorized service representative to test and inspect components, assemblies, equipment installation, and final connection.
- B. The factory-authorized service representative shall complete all tests as required by the manufacturer.
- C. Prepare and submit startup report to manufacturer.

#### 3.04 CLEANING AND PROTECTION

- A. Protect unit from damage during construction operation. Do not leave access doors open or allow debris to accumulate in the unit. Promptly repair or remove and replace any damaged materials.
- B. After completing system installation and testing, balancing, and adjustments, clean unit and replace filters.

# 3.05 DEMONSTRATION

A. Engage a factory-authorized representative to train owner's maintenance personnel to adjust, operating, and maintain the unit.

# 3.06 OCCUPANCY ADJUSTMENT

A. When requested within 12 months of substantial completion, adjust the system to meet the needs of the occupants to suit the actual operating conditions. Provide up to two visits to project for this purpose.

### SECTION 23 8200 CONVECTION HEATING AND COOLING UNITS

# PART 1 GENERAL

### 1.01 SECTION INCLUDES

- A. Finned Tube Radiation.
- B. Finned Tube Fan Powered.
- C. Unit Heaters.
- D. Cabinet Unit Heaters.
- E. Fan-coil Units.

### 1.02 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code.

# 1.03 SUBMITTALS

- A. Submit product data under provisions of Division 01.
- B. Submit schedules of equipment and enclosures typically indicating length and number of pieces of element and enclosure, corner pieces, end caps, cap strips, access doors, pilaster covers, and comparison of specified heat required to actual heat output provided.
- C. Indicate mechanical and electrical service locations and requirements, specifically indicating deviations from indicated products.

### 1.04 PROJECT RECORD DOCUMENTS

- A. Submit record documents under provisions of Division 01.
- B. Accurately record actual locations of access doors in radiation cabinets required for access or valving.

#### 1.05 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data under provisions of Division 01.
- B. Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings.

#### 1.06 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum three years' experience.

#### **1.07 REGULATORY REQUIREMENTS**

A. Conform to applicable code for internal wiring of factory wired equipment.

#### 1.08 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to site under provisions of Division 01.
- B. Store and protect products under provisions of Division 01.
- C. Protect units from physical damage by storing in protected areas and leaving factory covers in place.

#### 1.09 SEQUENCING AND SCHEDULING

A. Install radiation, fan-coil units, unit ventilators and radiant heaters (equipment exposed to finished areas) after walls and ceiling are finished and painted. Avoid damage.

#### 1.10 WARRANTY

- A. Provide one year manufacturer's warranty under provisions of Division 01.
- B. Warranty: Include coverage of motors specified under this section.

# PART 2 PRODUCTS

#### 2.01 FINNED TUBE – RADIATION

- A. Heating Elements: <sup>3</sup>/<sub>4</sub>" ID tube tube, 0.123 inch minimum wall thickness mechanically expanded into evenly spaced steel fins.
- B. Element Hangers: Quiet operating, ball bearing cradle type providing unrestricted longitudinal movement, on enclosure brackets.
- C. Enclosures: 16 gauge steel enclosure. Provide easily jointed components, with male/female slip joints and 14 gauge gussets, for wall to wall installation. Support rigidly, on wall or floor mounted brackets.
- D. Finish: Factory applied baked enamel of color as selected on visible surfaces of enclosure or cabinet.
- E. Capacity: Based on 65° F entering air temperature, 120° F average water temperature.

#### 2.02 FINNED TUBE – FAN POWERED

- A. Heating Elements: <sup>3</sup>/<sub>4</sub>" inch ID condenser tube, 0.123 inch minimum wall thickness mechanically expanded into evenly spaced steel fins. Fin spacing shall be 0.7". <sup>1</sup>/<sub>2</sub>" NPT connections on left hand side.
- B. Element Hangers: Unit shall be recessed 3.35" into the concrete slab.
- C. Enclosures: 19 gauge steel for installation in floor slab.
- D. Fans: Centrifugal forward-curved double-width wheels, statically and dynamically balanced, direct driven.
- E. Motor: Electronically Commutated (ECM). Refer to Section 23 0500; resiliently mounted.
- F. Control: Multiple speed switch, factory wired, located in cabinet.
- G. Grilles: Wooden or aluminum grille per arch.
- H. Finish: Factory applied baked enamel of color as selected on visible surfaces of enclosure or cabinet.
- I. Capacity: Based on 65° F entering air temperature, 120° F average water temperature.

# 2.03 MANUFACTURERS – UNIT HEATERS

- A. Zehnder.
- B. Modine.
- C. Sterling.
- D. Substitutions: Under provisions of Division 01.

#### 2.04 UNIT HEATERS

- A. Coils: Seamless copper tubing, 0.025 inch minimum wall thickness, silver brazed to steel headers, and with evenly spaced aluminum fins mechanically bonded to tubing.
- B. Casing: 18 gauge steel with threaded pipe connections for hanger rods.
- C. Finish: Factory apply baked enamel color as selected on visible surfaces of enclosure or cabinet.
- D. Fan: Direct drive propeller type, statically and dynamically balanced, with fan guard; horizontal models with permanently lubricated sleeve bearings; vertical models with grease lubricated ball bearings.
- E. Air Outlet: Adjustable pattern diffuser on projection models and two way louvers on horizontal throw models.
- F. Motor: Refer to Section 23 0500; horizontal models with permanently lubricated sleeve bearings; vertical models with grease lubricated ball bearings.

- G. Control: Local disconnect switch.
- H. Capacity: Based on 65° F entering air temperature, 120° F average water temperature.

### 2.05 MANUFACTURERS - CABINET UNIT HEATERS

- A. Jaga.
- B. Substitutions: Under provisions of Division 01.

### 2.06 CABINET UNIT HEATERS

- A. Coils: Evenly spaced aluminum fins mechanically bonded to copper tubes with 11 fins per inch. 3/4" NPT connections.
- B. Cabinet: 19 gauge steel with exposed corners and edges rounded, easily removed panels, glass fiber insulation integral grilles.
- C. Finish: Factory applied baked enamel of color as selected on visible surfaces of enclosure or cabinet.
- D. Fans: Centrifugal forward-curved double-width wheels, statically and dynamically balanced, direct driven.
- E. Motor: Electronically Commutated (ECM). Refer to Section 23 0500; resiliently mounted.
- F. Control: Multiple speed switch, factory wired, located in cabinet.
- G. Filter: Easily removed one inch thick glass fiber throw-away type, located to filter air before coil.
- H. Capacity: Based on 65° F entering air temperature, 120° F average water temperature.

#### 2.07 FAN-COIL UNITS

- A. Coils: Evenly spaced aluminum fins mechanically bonded to copper tubes, designed for 200 psi and 220° F. Provide drain pan under cooling coil, easily removable for cleaning, with drain connection.
- B. Cabinet: 16 gauge steel with exposed corners and edges rounded, easily removed panels, glass fiber insulation.
- C. Finish: Factory apply baked enamel color on visible surfaces of enclosure or cabinet.
- D. Fans: An electronically commutated (EC motor) centrifugal fan with double intake, with static and dynamically balanced aluminum or ABS fan units. An electronic brushless synchronous motor with permanent magnets, controlled by a frequency and amplitude modulated inverter which generates a sinus-shaped voltage. The inverter is driven by a single-phase voltage 120Vac 60Hz and is controllable via a 0-10Vdc analog signal. The motor is provided with internal protection.
- E. Electrical connection: By means of terminals (three wire terminals: ground, / + 120V, 0 ... 10 V), standard on the right side of the unit.
- F. Soft filter: Renewable polypropylene synthetic filter (filter class MERV 8), removable from the front or bottom of the unit.
- G. Fan operation at 5.8V allows for significant air throw with sound pressure under 35dBA, without any connection to duct work.
- H. Motor: Refer to Section 23 21 23; sleeve bearings, resiliently mounted.
- I. Control: Multiple speed switch, factory wired, located in cabinet.
- J. Capacity: Based on 65° F entering air temperature, 120° F average water temperature.

# PART 3 EXECUTION

# 3.01 EXAMINATION

A. Verify that surfaces are ready to receive work and opening dimensions are as by the manufacturer.

- B. Verify that required utilities are available, in proper location, and ready for use.
- C. Beginning of installation means installer accepts existing surfaces.

### 3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Locate baseboard radiation on outside walls and run cover continuously wall-to-wall unless otherwise indicated. Center elements under windows. Install end caps where units butt against walls.
- C. Locate finned tube per plans and run cover wall-to-wall unless otherwise indicated. Center elements under windows. Where multiple windows occur over units, divide element into equal segments centered under each window. Install wall angles where units butt against walls.
- D. Install convectors as indicated. Coordinate to assure correct recess size for recessed convectors.
- E. Hang unit heaters from building structure, with pipe hangers anchored to building, not from piping. Mount as high as possible to maintain greatest headroom unless otherwise indicated.
- F. Install cabinet unit heaters as indicated. Coordinate to assure correct recess size for recessed units.
- G. Protect units with protective covers during balance of construction.
- H. Provide hydronic units with shut-off valve on supply; lockshield balancing valve and shut-off valve on return piping. If not easily accessible, extend vent to exterior surface of cabinet for easy servicing.
- I. For cabinet unit heaters, fan coil units, and unit heaters, provide float operated automatic air vents with stop valve.

# 3.03 CLEANING

- A. Clean work under provisions of Division 01.
- B. After construction is completed, including painting, clean exposed surfaces of units. Vacuum clean coils and inside of cabinets.
- C. Touch-up marred or scratched surfaces of factory-finished cabinets, using finish materials furnished by manufacturer.
- D. Install new filters.

### SECTION 23 8300 RADIANT HEATING UNITS

#### PART 1 GENERAL

#### 1.01 WORK INCLUDED

- A. Furnish and install snow melt heating system tubing, distribution manifolds with venting/air purge valve, manifold to tubing fittings, circuit isolation and balancing valves, controls and installation specialties, supervision and field engineering required for complete and proper function of the system.
- B. Patch and repair any existing radiant slab tubing encountered during below slab work.

#### 1.02 REGULATORY REQUIREMENTS

- A. Tubing shall conform to ASTM F876 and F877, and manufactured using the T. Engle process. Tubing oxygen permeation barrier shall conform to DIN 4726.
- B. Installer's Qualification: Installer's shall be qualified in writing as either being certified or certifiable prior to the commencement of the installation.

### 1.03 REFERENCES

- A. ASTM F876 Standard specification for Cross-linked Polyethylene (PEX) Tubing.
- B. ASTM F877 Standard specification for Cross-linked Polyethylene (PEX) Plastic Hot and Cold Water Distribution Systems.
- C. Din 4726 German Standard for Plastic Piping Used in Warm Water Floor Heating Systems.

### 1.04 SUBMITTALS

- A. Provide submittals and shop drawings in accordance with the General Requirements and as specified herein. Submit shop drawings indicating schematic layout of system, including equipment, critical dimensions and tubing/slab penetration details and details for protected exposed PEX tubing.
- B. Submit manufacture's technical instructions.
- C. Submit installers' certification of training for installation of PEX floor heating systems.
- D. Submit data indicating tube sizing and panel performance at tube spacing and warm water temperatures selected.
- E. Submit catalog data on all supports, tube guides, spacers and associated items necessary for the installation of the tubing and manifolds.
- F. Submit manufacturer approved Design Calculations Records.

# 1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver and store tubing and specialties in shipping containers with labeling in place. Do not expose to ultra violet light for more than 90 days.
- B. Protect tubing and specialties from entry of contaminating material by installing tape or plugs in all open ends until installation and /or maintain tubing in the original shipping boxes or packing until usage.
- C. Unprotected tubes shall not be dragged across the ground or concrete surfaces, and shall be stored on a flat surface with no sharp edges.
- D. Tube shall be protected from oil, grease, direct sunlight and other elements as recommended by manufacturer.

### 1.06 WARRANTY

A. The radiant floor system component manufacturer shall warrant the cross-linked polyethylene tubing and all related water distribution components, except controls, to be free from defects in material and workmanship for a period of twenty-five (25) years. Warranty shall be issued upon

presentation of design calculation record forms, and manufacturer approved site inspection reports (SIR).

B. All controls shall be warranted for 18 months and/or two heating seasons.

# PART 2 PRODUCTS

### 2.01 TUBING

- A. PEX-a (Engel-method crosslinked polyethylene) piping: SDR 9, ASTM F876 and F877 with an oxygen barrier meeting DIN 4726.
- B. Fittings: Elbows, adapters, couplings, plugs, tees and multiport tees (1/2 inch through 3 inch nominal pipe size): ASTM F1960 cold-expansion fittings in brass manufactured by the pipe manufacturer, utilizing cold-expansion PEX-a reinforcing rings made of same material as the pipe. Fittings shall be third-party certified to NSF 14 and ASTM F1960 and shall comply with ASTM F876 and ASTM F877.
- C. Temperature and Pressure Rating: Tubing shall be rated for not less than 180°F working temperature and 100 psig working pressure.
- D. Bend Radius: The minimum bend radius for cold bending of the tubing shall be not less than five (5) times the outside diameter. Bends with a radius less than stated shall require the use of a bending template as supplied by the tube manufacturer.

#### 2.02 FITTINGS

- A. Fittings shall be manufactured of brass and shall be supplied by the tubing manufacturer as part of a proven cataloged system.
- B. Tube couplings embedded within the thermal mass shall be brass compression type with ribbed insert and compression sleeves as supplied by the tubing manufacturer.

### 2.03 MANIFOLDS

- A. Material: Distribution manifolds shall be a proven cataloged part of the manufacturer's system.
- B. Balancing Manifolds: Where required by the drawings, manifolds shall be equipped with balancing and isolation valves for each circuit.

# 2.04 MANUFACTURER

- A. MrPEX.
- B. Rehau.
- C. Uponor.
- D. Heat Link.
- E. Substitutions in accordance with Division 01.

### PART 3 EXECUTION

### 3.01 PREPARATION

- A. Concrete Slab on Grade: Subsoil should be compacted, flat and smooth to prevent damage to the tube or insulation.
- B. Preparing the Wall Cavity for Manifold Installation: See drawings to determine the width of the wall cabinet and required wall opening dimensions. Mount the manifold cabinet allowing space for the screed to fill up the front of the tube opening.

#### 3.02 INSTALLATION

- A. Install in accordance with manufacturer's published technical manual.
- B. Route tubing in orderly manner, according to layout and spacing shown in approved submittal drawings. All notes on drawings shall be followed.

- C. At joints and fittings, square and clean end of tube, using a plastic tube cutter and join immediately or cap with tape to seal from contaminants. Where fittings are installed within the thermal mass they shall be wrapped in chloride-free tape.
- D. Remove all twists prior to securing tube. Fasten tubing at no more than 3 feet intervals, being careful not to twist the tube. In thin concrete slabs it may be necessary to secure tubing every 2 feet.
- E. Tubing that must pass through expansion, stress or control joints shall be sleeved a minimum of 10" on each side of the joint. Provide longer sleeve where required by tubing manufacturer installation instructions.
- F. Where tubing exits the floor, a sleeve shall be placed around the tube, with the sleeve extending a minimum of 10" into the floor and exiting by a minimum of 10".
- G. After laying each circuit, cap the end of the tube with tape and label the tube's circuit numbers (supply and return), or connect to associated manifold and label tube length for balancing.
- H. The following precautions shall be taken in areas intended for carpet:
  - 1. Notify carpet layer that hydronic floor heating has been installed.
  - 2. Install metal guards where carpet tack strips will be installed.
- I. The heating system should be put into operation after the poured concrete thermal mass has cured a minimum of 28 days. If it is necessary to operate the heating system to prevent freezing, a maximum flow temperature of 59° F must not be exceeded while the thermal mass is curing. Gradually increase the flow temperature by 10° F each day until it reaches the maximum operating temperature.

#### 3.03 FIELD QUALITY CONTROL

- A. Filling, Testing and Balancing: Tests of hydronic heating systems shall comply with local codes, and, where required, should be witnessed by the building official.
  - 1. Pressure gauges used must show pressure increments of 1 psig and should be located at or near the lowest points in the distribution system.
  - 2. Air Test: Charge the completed, yet unconcealed tubes with air. Do not exceed 100 psig.
    - a. Use liquid gas detector or soap to check for leakage at manifold connections. Relieve air pressure.
  - 3. Water Test: Charge the completed, yet unconcealed tubes with water. Purge all air from tubes. Check system for leakage, especially at all tube joints. Take necessary precautions to prevent water from freezing.
    - a. Perform a preliminary pressure test pressurizing the system to 1.5 times the maximum operating pressure, or 100 psi, whichever is greater for 30 minutes. As the tubing expands, restore pressure, first at 10 minutes into the test and again at 20 minutes. At the end of the 30 minute preliminary test, pressure must not fall by more than 8 psig from the maximum, and there shall be no leakage.
    - b. After performing the preliminary test, perform the main pressure test immediately. The main pressure test shall last 2 hours. The test pressure should be restored and must not fall more than 3 psig after 2 hours. No leakage should be detected.
  - 4. Pressure shall be maintained during installation of the thermal mass.
  - 5. Complete all inspection and test reports as supplied by the manufacturer of the system.

### SECTION 23 8413 HUMIDITY CONTROL EQUIPMENT

### PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Pool Dehumidification Equipment.

### 1.02 REFERENCES

- A. Air-Conditioning and Refrigeration Institute:
  - 1. ARI 630 Selection, Installation, Servicing of Humidifiers.
- B. Sheet Metal and Air Conditioning Contractors:
  - 1. SMACNA HVAC Duct Construction Standard Metal and Flexible.

### 1.03 QUALITY ASSURANCE

A. Units shall be product of manufacturer, regularly engaged in production of such units issuing complete catalog data on such products, and providing local service personnel.

### 1.04 SUBMITTALS

- A. Submit product data under provisions of Div 01.
- B. Submit load calculation inputs and calculated humidity values.

### 1.05 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data under provisions of Div 01.
- B. Include installation instructions, assembly views, maintenance instructions, and replacement parts list.

### 1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and protect products to site under provisions of Div 01.

# **PART 2 PRODUCTS**

# 2.01 ACCEPTABLE MANUFACTURERS - DEHUMIDIFIERS

- A. PoolPak.
- B. Substitutions: Under provisions of Division 01.

#### 2.02 DEHUMIDIFIERS

- A. General
  - 1. Mechanical process dehumidification
  - 2. Indoor cabinet configuration
  - 3. Split system with remote outdoor air-cooled condenser for AC heat rejection
  - 4. Air filtration via MERV-13 pleated panel filters for return
  - 5. Programmable microprocessor controller with remote Internet logging and parameter adjustment
  - 6. Remote operator panel(s)
- B. Cabinet
  - 1. The system shall be designed and configured for indoor applications
    - a. Infill panels and doors shall be constructed with 18 gauge G90 galvanized steel exterior and 18 gauge mil aluminum finish interior suitable for chlorine and pool chemical resistance.
    - b. The structural base frame shall be 3/16" steel channel base with 12-gauge steel cross bracing.

- 2. Cabinet Construction: All cabinet sheet metal shall be galvanized G90 steel or GalvalumeTM alloy with mill-applied zinc phosphate primer followed by an exterior grade white silicone modified polyester top coat. All seams shall be caulked with silicone to prevent air and water leakage or infiltration.
  - a. The cabinet walls shall be of single-wall construction using 20 gauge pre-painted steel with 1 inch of fiberglass insulation protected by an anti-microbial top coat.
  - b. The cabinet roof shall be engineered with structural bending for maximum rigidity with 20-gauge steel and shall be mechanically fastened to the walls of the unit.
  - c. The cabinets shall be mechanically assembled with stainless steel 5/32" sealed blind rivets. Where bolts are required bright zinc plated bolts shall be used.
  - d. Access doors shall be removable, secured to cabinet using heavy-duty stainless steel hex-head bolts with stainless steel washers insulated with rubber gaskets.
- 3. The unit shall be insulated per the following standards:
  - a. One inch thick, surface coated with an anti-microbial layer, protected against perforation and fiber air entrainment with a reinforcing mesh.
  - b. Fire resistant rating to conform to NFPA Standard 90A and 90B.
  - c. Sound attenuation coefficient shall not be less than 1.00 at a frequency of 1,000 Hz as per ASTM Standard C423.
  - d. Thermal conductivity shall not exceed 0.23 Btu/hr-sqft-ft at 75 °F.
- 4. Cabinet configuration shall include:
  - a. A filter rack with separate access doors shall be provided for the return air and minimum outdoor air streams.
  - b. Electrical panel: The unit shall have a built-in electrical control panel in a separate compartment in order not to disturb the airflow within the dehumidifier during electrical servicing. All electrical components shall be mounted on a 16 gauge galvanized sub-panel.
- 5. Internal dampers shall be made from extruded anodized aluminum with a parallel blade configuration and neoprene double-seal tips to minimize leakage. Damper blades shall be mounted on steel rods which rotate on nylon bushings. All damper hardware shall be corrosion resistant.
- C. Filters
  - 1. Filters shall be standard size, replaceable models.
  - 2. Return Air: 2-Inch MERV 13, 90% pleated filters with rust-free non-metallic structure on a slide-in or face-loading rack
  - 3. Exhaust Air: 2-Inch MERV 8, 30% pleated filters with rust-free nonmetallic
  - 4. Dirty air filter switches included on the return air filter for indicating an alarm when pressure drop exceeds a set point.
- D. Coils
  - 1. Evaporator/dehumidifier coils shall be designed for maximum moisture removal capacity
    - a. Coils shall be fully dipped and coated with a polyester/enamel coating for maximum corrosion protection. Coating shall comply with ASTM B117/D1654 and ASTM D2126 for corrosion resistance against common acids, salt and gases.
    - b. Coil shall have galvanized casing and end plates.
    - c. Aluminum fin and copper tubes mechanically bonded to assure high heat transfer.
- 2. Air reheat coils shall be sized for variable heat transfer into the air with a capacity of 100% of the compressors total required heat of rejection. Air reheat coils that are on off will cause unstable space conditions and are not acceptable.
  - a. Coils shall be fully dipped and coated with a polyester/enamel coating for maximum corrosion protection. Coating shall comply with ASTM B117/D1654 and ASTM D2126 for corrosion resistance against common acids, salt and gases.
  - b. Coil shall have galvanized casing and end plates.
  - c. Aluminum fin and copper tube joints mechanically bonded to assure high heat transfer.
- 3. Each evaporator coil shall be provided with a positive draining, compound-sloped, baked powder paint coated aluminum drain pan with fully-welded corners to ensure zero water retention. In no way will stainless steel or galvanized drain pans be acceptable.
- E. Fans and Motors
  - 1. Blower(s) shall be a single width/single inlet airfoil plenum type, secured a machined, ground and polished solid steel shaft. The wheel shall be G90 galvanized steel with baked powder paint coating. The shaft shall be coated with a rust inhibitor.
  - 2. Each supply blower shall be an impeller plenum fan complete with backward curved, three-dimensional, profiled blades made of a high-performance composite material directly driven via a direct current (DC) electronic commuted (EC) motor. The blower and motor shall be completely corrosion resistant and be maintenance free. The EC-Motor shall be of zero-slippage design with continuously variable speed control when connected to the system's controller. Fans that are not direct drive or EC are not acceptable.
  - 3. Each EC motor shall have maintenance-free electronic circuitry, a rotor with permanent magnets, and an integral controller to provide the windings with electrical current so that, the motor rotates continuously and quietly.
  - 4. Each fan shall be statically and dynamically balanced on precision electronic balancers.
  - 5. The motor(s) shall be provided with a low motor noise and high starting torque VFD for air balancing purposes. The VFD shall have a drive efficiency of 96 to 98% with displacement power factor of 0.98. The VFD shall have protective features including: torque limit, heat sink over-temperature, current-limiting DC bus fuse, electronic motor overload with phase-to-phase and ground fault short circuit protection; current limit, over/under torque protection, over/under voltage protection, short circuit current rating of minimum 30kA rms symmetrical when protected by recommended branch circuit protection devices.
- F. Refrigerant System
  - 1. Each refrigeration circuit shall have pressure transducers monitoring the refrigerant discharge (high) and suction (low) pressures. The refrigeration circuit shall be accessible for diagnostics, adjustment and servicing without the need for service manifold gauges.
  - 2. All refrigeration circuits shall have refrigerant control valves, a liquid line filter-drier, a liquid and moisture indicator, an expansion valve, head pressure control feature and pump down feature.
  - 3. The system shall have an externally adjustable balanced port design mechanical thermostatic expansion valve. The valve shall have a removable power head.
  - 4. Tamper proof, hermetically sealed non-adjustable high and low pressure switches and refrigeration service valves shall be installed using Schrader type valves. Refrigeration service valves shall be located outside of the airstream.
  - 5. The suction line shall be fully insulated with 0.500-inch closed cell insulation.
  - 6. Compressors

- a. Hermetic, scroll action compressor, suction gas cooled, suitable for refrigerant R454B.
- b. The compressor(s) shall be mounted on rubber-in-shear isolators to limit the transmission of noise and vibration.
- c. The compressor(s) shall be equipped with removable crankcase heater(s) for liquid migration protection.
- d. The compressor(s) shall be located outside the conditioned air stream.
- G. Air Conditioning
  - 1. The system shall be equipped with an air conditioning mode where excess compressor heat is rejected to an outdoor air-cooled condenser. The outdoor air-cooled condenser shall be capable of rejecting 100% of the compressor heat rejection with an air-on temperature at summer design conditions.
  - 2. The system shall be provided with a dry contact rated for 5A at 24VAC to operate the remote outdoor condenser controls.
  - 3. Each refrigeration circuit shall include refrigerant valves, a receiver with pressure relief valve set to 650 psig, a pressure control valve and a pressure differential valve, and two manual shutoff valves to isolate the outdoor condenser.
  - 4. Coils shall be tested at 600 PSIG and mounted vertically for complete surface utilization. Coils shall be counter flow with a minimum of 10 degrees of liquid sub-cooling and have adequate capacity to dissipate the total heat rejection of the system at design conditions. Condensers shall have guards to protect the coils from vandalism and weather-related damage.
- H. Control Panel
  - 1. The electrical contractor shall be responsible for external power wiring and disconnect switch fusing. Power block terminals shall be provided.
  - 2. Main control panel shall be mounted outside of the process air stream.
  - 3. Blower motors shall be protected against overloads.
  - 4. The system shall have a voltage monitor with phase protection.
  - 5. Available dry contacts shall include:
    - a. Alarm
    - b. Blower interlock
    - c. Stage 1 & 2 heating
    - d. Outdoor air damper control
    - e. Remote exhaust fan #1
    - f. Remote exhaust fan #2
    - g. Remote cooler
    - h. System on
    - i. Heat recovery
  - 6. Terminals shall be provided to send dry contacts to remote coolers.
  - 7. All wiring shall be installed in accordance with UL or CSA safety electrical code regulations and shall be in accordance with the NFPA All components used in the system shall be UL or CSA listed.
  - 8. Wiring diagrams shall be located near the electrical panel(s) on the system. These diagrams shall provide colour-coding and wire numbering for easy troubleshooting. All wires shall be contained in a wire duct.

- 9. The compressor(s) shall have a time delay on start to prevent short cycling.
- 10. Pressure transducers for measuring refrigerant discharge (high) pressure and suction (low) pressure shall be provided.
- 11. An airflow switch and a dry contact for alarm(s) shall be provided and factory-mounted.
- I. Microprocessor Control
  - 1. A microprocessor controller with the following characteristics will be provided:
    - a. All set points and parameter adjustments are pre-programmed at the factory during quality control testing.
    - b. The microprocessor program shall be stored on updatable FLASH memory.
    - c. A minimum of 11 analogue inputs, 4 analogue outputs, 24 digital inputs and 16 digital outputs.
    - d. Four serial interface ports including both RS232 and RS485 types.
    - e. An Ethernet port with RJ-45 connector and LED activity indicator.
    - f. A real time clock to time-stamp the system operation log and to enable a programmable 7-day occupation schedule.
    - g. Two manual demand forced modes to allow the user to manually bypass the microprocessor in the event of controller failure.
    - h. The local and remote operator panel(s) shall have a backlit graphic liquid crystal display with touch controls.
  - 2. The system shall have pressure transducers monitoring the refrigerant discharge (high) and suction (low) pressures. The refrigeration circuit shall be accessible for diagnostics, adjustment and servicing without the need of service manifold gauges.
  - 3. The following status LEDs shall be on the controller:
    - a. Alarm indicates there has been a failure requiring service.
    - b. Dehumidification indicates that the system is dehumidifying the space.
    - c. Cooling indicates that the air-conditioning mode.
    - d. Space Heat indicates that the space heating is operating.
    - e. Maintenance indicates whether or not maintenance is required.
    - f. Manual indicates that the system has been set to manual operation.
  - 4. The following set points shall be accessible and adjustable from the operator panel:
    - a. Space temperature.
    - b. Space relative humidity.
  - 5. The following sensors shall be unit-mounted and monitored at the operator panel. All information from these items shall be actively used in the system control and operation strategies:
    - a. Refrigerant high pressure.
    - b. Refrigerant low pressure.
    - c. Return air temperature.
    - d. Supply air temperature.
    - e. Return air relative humidity.
    - f. Evaporator leaving air temperature.
    - g. Suction temperature.
    - h. Discharge temperature.

- 6. System Fault: Shall indicate via text message to the display what systems require attention or servicing. Built-in monitoring and diagnostics shall allow the user to view the following:
  - a. Power failure.
  - b. Dirty air filter.
  - c. Refrigerant high and low pressure.
  - d. System off.
  - e. Anti-short cycle delay.
- 7. The rotary structure shall be a monolithic fabricated extended surface consisting of inert silicates reinforced with uniform diameter glass fibers for maximum strength. The fabricated structure shall be smooth and continuous in the direction of airflow without interruptions or sandwich layers which restrict airflow or create a leakage path at joining surfaces. Desiccant shall not channel, cake or fracture due to repeated temperature and moisture cycling. The materials of construction shall be water washable, non-toxic and NFPA 255-ASTM E84 compliant.
- 8. Full face contact pressure seals shall be provided to separate the process and reactivation air streams and eliminate detrimental leakage of air or moisture with static pressure differentials of up to 3" of water gauge. Dehumidifier shall be factory assembled; fully automatic, complete with desiccant wheel, reactivation heaters, reactivation energy control system, roughing filters, industrial drive motor, fans, non-racheting desiccant drive unit, automatic controller and all components' auxiliaries. Reactivation energy modulation shall be stepless solid state proportioning type. Dehumidifier shall be functionally tested at the manufacturer's factory and shipped complete with all components necessary to maintain normal operation.
- 9. Optional Accessories:
  - a. Humidistat for on/off control.
  - b. Constant Process blower.
  - c. Process inlet transitions for round duct.

# PART 3 EXECUTION

## 3.01 Product Delivery, Acceptance, Storage and Handling

- A. Perform a thorough physical inspection of the system upon delivery from the shipment carrier.
- B. Identify and immediately report any physical damage to manufacturer.
- C. If the system is to be stored prior to installation, store in a clean, dry place protected from weather, dirt, fumes, water, construction and physical damage.
- D. Handle the system carefully during installation to prevent damage.
- E. Damaged systems or components shall not be installed. Contact the manufacturer for RMA instructions.
- F. Comply with the manufacturer's rigging and installation instructions for unloading the system and moving it into position.

## 3.02 INSTALLATION

- A. Where installing piping adjacent to the system, allow space for service and maintenance.
- B. Duct connections: drawings indicate the general arrangements of the ducts. Connect the system to ducts with flexible duct connectors. Provide flexible duct connectors on inlet and outlet.
- C. Electrical connections: Coordinate electrical connections specified in Division 26.

- D. The agency responsible for start-up should work in accordance with the specifications and in accordance with the manufacturer's instructions and only by workers experienced in this type of work.
- E. Connect unit condensate piping.

## 3.03 START UP

- A. Contact manufacturer prior to start up and confirm procedures required. Follow all start up procedures as provided by the manufacturer.
- B. Remote Internet access and control must be initiated and confirmed by the factory prior to start up for extended labor warranty to be in effect.

# END OF SECTION 23 8413

### SECTION 26 0126 MAINTENANCE TESTING OF ELECTRICAL SYSTEMS

## PART 1 GENERAL

## 1.01 SECTION INCLUDES

- A. Feeder Megohm Testing.
- B. Receptacle Branch Circuit Testing.
- C. Ground Fault Circuit Interrupter Testing.
- D. Electrical Service and Separately Derived System Ground Testing.
- E. Ground Fault Protection Testing.
- F. Transformer Testing.
- G. Phase Rotation.
- H. Additional Testing and Maintenance Requirements in Individual Equipment and System Sections.

## 1.02 REFERENCES

- A. NETA ATS 2021 Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
- B. ANSI/IEEE Std 81-1983 Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System.

#### 1.03 SUBMITTALS

- A. Submit data under provisions of Division 01 and Section 26 0500.
- B. Product Data: Submit technical information for each test instrument to include manufacturer, model number, serial number, ratings, accuracy, and National Institute of Standards and Technology (NIST) Traceable calibration certification.

#### 1.04 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Submit Test Reports per Section 26 0500.

## 1.05 COORDINATION

A. Provide written 72 hours advance notice of all tests to be performed to allow Owner's Representative to witness testing.

#### 1.06 REQUIRED TEST INSTRUMENTS

- A. MEGOHMMETER.
  - 1. Product Description: 1000 Volt DC, portable, insulation and resistance test Megohmmeter.
  - 2. Equipment Accuracy:
    - a. 2000 Megohm Range 3% of full Scale.

## B. BRANCH CIRCUIT ANALYZER

- 1. Product Description: Branch circuit analyzer capable of receptacle testing of voltage drop under load, hot-neutral-ground conductor impedances, common mode (N-G) Voltage, and G.F.C.I. trip point.
- 2. Manufacturer: Ideal SureTest. Model: 61-164 Circuit Analyzer or approved equal.
- 3. Equipment Accuracy:
  - a. AC Voltage and Frequency accuracy: 1% full scale ± 1 digit True RMS.
  - b. Impedance 0.00 1.99 Ohms: 5.0% accuracy.
  - c. Ground-Neutral Voltage 0.0 24.0V: 2.0% accuracy.

- d. % Voltage Drop 12A, 15A, 20A load tests: 5.0% accuracy.
- e. GFCI Test Current/Time 6.0 9.0mA/0.00 6500mS: 2% accuracy.
- C. GROUND RESISTANCE CLAMP-ON METER
  - 1. Product Description: Digital, direct reading clamp-on resistance ground tester capable of measuring ground rod and grid resistance without the use of auxiliary rods, disconnecting the ground system or de-energizing the system under test. Meter shall also be capable of measuring leakage current flowing to ground or circulating in ground loops and ground voltage.
  - 2. Manufacturer: AEMC. Model: 6416 or approved equal.
  - 3. Equipment Accuracy Ground Resistance Auto-Ranging 0.01 to 1500 Ohms:
    - a. 0.010 to  $49.9\Omega$ :  $0.1\Omega$  resolution  $\pm (1.5\% \pm 0.1\Omega)$ .
    - b. 50.0 to 99.5 $\Omega$ : 0.5 $\Omega$  resolution 6 (2% ± 0.5 $\Omega$ ).
    - c. 100 to 199 $\Omega$ : 1 $\Omega$  resolution 6 (3% ± 1 $\Omega$ ).
    - d. 200 to  $395\Omega$ :  $5\Omega$  resolution 6 (5% ± 5 $\Omega$ ).
    - e. 400 to 590 $\Omega$ : 10 $\Omega$  resolution 6 (10% ± 10 $\Omega$ ).
    - f. 600 to 1150 $\Omega$ : 50 $\Omega$  resolution 6 20%.
    - g. 1200 to  $1500\Omega$ :  $50\Omega$  resolution 6 25%.
  - 4. Equipment Accuracy Current Measurement Auto-Ranging 0.2mA to 40A:
    - a. 0.200 to 0.999mA: 1µA resolution ± (2% ±50µ).
    - b. 1.000 to 9.99mA: 10μA resolution ± (2% ±50μ).
    - c. 10.00 to 99.9mA: 100µA resolution ± (2% ±100µ).
    - d. 100.0mA to 0.990A: 1mA resolution ± (2% ±1mA).
    - e. 1.000 to 39.99A: 10mA resolution ± (2% ±10mA).
  - 5. Selectable Measurement Frequency: 50, 60 128 or 2083 Hz.
  - 6. Current Measurement Frequency: 47 800 Hz.
  - 7. Ground Voltage Display: 0.1 to 75.0VAC
  - 8. Inductance Measurement: 10 to 500µH
- D. MULTIMETER
  - 1. Product Description: Digital True RMS Multimeter.
  - 2. Equipment Accuracy:
    - a. AC Voltage Range: 0.75% 6 3 last single digits at 60 Hz.
    - b. AC Current Range: 0.90% 6 3 last single digits at 60 Hz.
    - c. DC Voltage Range: 0.25% 6 1 last single digit.
    - d. DC Current Range: 0.75% 6 1 last single digit.
    - e. Resistance Ranges: 0.50% 6 1 last single digit.
    - f. Frequency Range: 0.10% 6 1 last single digit @ 60 Hz.

## 1.07 TEST INSTRUMENT CALIBRATION

- A. All test equipment shall be in good mechanical and electrical condition.
- B. Provide calibration for each test instrument directly traceable to the National Institute of Standards and Technology (NIST) of higher accuracy than that of the instrument tested.

- C. Provide calibration labels visible on all test equipment. Records, which show date and results of instruments calibrated or tested, shall be kept up-to-date.
- D. Calibrate instruments in accordance with the following frequency schedule:
  - 1. Field instruments: 12 months maximum.
  - 2. Up-to-date instrument calibration instructions and procedures shall be maintained for each test instrument with the equipment.

#### **1.08 MINIMUM REPORT INFORMATION**

- A. Report Criteria: After each test, promptly submit one copy of report to the Owner's Representative. Provide form with the minimum following information:
  - 1. Date issued.
  - 2. Project title and number.
  - 3. Name and Model of Tester and witnesses.
  - 4. Date and time of sampling or inspection.
  - 5. Identification of product and specifications section.
  - 6. Type of inspection or test.
  - 7. Date of test.
  - 8. Results of tests.
  - 9. Indicate compliance or non-compliance with Contract Documents.
  - 10. Final adjustment setting values where applicable.
- B. Submit copy of all tests performed in the O&M manual.

## **1.09 GENERAL REQUIREMENTS**

- A. Include a copy of each test result in the O&M manual.
- B. Provide qualified personnel at site to perform all testing.
- C. Perform specified testing of products in accordance with specified standards or as denoted in this specification whichever is more stringent.
- D. Promptly notify Owner's Representative of irregularities or non-conformance of Work or products.
- E. Perform additional tests when test is performed incorrectly, deemed inaccurate, or incorrectly documented.
- F. The Contractor shall provide all forms, instrumentation and test equipment, loads, and other consumables required to demonstrate the systems to Owner's Representative satisfaction.
- G. Perform and submit all testing prior to substantial completion and system acceptance.
- H. Retest all material, cables etc. that are disturbed after testing.
- I. Replace and retest all material installed which does not meet or exceed the minimum acceptable limits set forth in this specification in accordance with the contract original requirements at no additional charge to Contract Sum/Price.

#### PART 2 PRODUCTS

Not Used

## PART 3 EXECUTION

## 3.01 FEEDER CONDUCTOR TEST

- A. Tests Criteria:
  - 1. Use Megohm meter to test all conductors sized #6AWG and larger.
  - 2. Perform insulation-resistance test on each conductor with respect to ground and adjacent conductors. Applied potential 1000 volts DC for 600 volt rated cable.

- 3. Perform test immediately after installation.
- 4. Clean exposed cable ends with clean cloth and alcohol.
- 5. Test duration shall be one minute.
- 6. Disconnect conductors from all equipment.
- 7. Record the resistance of the insulated conductor under test with all other conductors connected together and to ground (metallic raceway, grounding conductor, etc).
- 8. Perform continuity test to insure correct cable connection.
  - a. Submit test results to Owner's Representative.
- B. Test Values:
  - 1. Minimum insulation-resistance value: 100 megohms.
  - 2. Investigate deviations between adjacent phases.

## 3.02 RECEPTACLE GROUND FAULT CIRCUIT INTERRUPTER TEST

- A. Test Criteria:
  - 1. Use Branch Circuit Analyzer to perform test of each GFCI protected receptacle.
  - 2. Record trip level in ma for each outlet.
  - 3. Submit test results to Owner's Representative.
- B. Test Values:
  - 1. Trip Range: Between 6-9 mA.

## 3.03 ELECTRICAL SERVICE AND SEPARATELY DERIVED SYSTEM GROUND TEST

- A. Test Criteria:
  - 1. Use ground resistance clamp-on meter to measure the resistance, leakage current and ground voltage of service ground with meter clamped between system neutral bond and each grounding electrode. Perform this test on new or existing services and all separately derived systems.
  - 2. Record resistance value in Ohms, leakage current in Amperes or milliamperes, as appropriate, and ground voltage in Volts.
  - 3. Submit test results to Owner's Representative.
- B. Test Values:
  - 1. Maximum ground resistance: 25 Ohms.

## 3.04 GROUND FAULT PROTECTION SYSTEMS

- A. Visual and Mechanical Inspection:
  - 1. Compare equipment nameplate data with drawings and specifications.
  - 2. Visually inspect the components for damage and errors in polarity or conductor routing.
  - 3. Verify that ground connection is made ahead of neutral disconnect link and on the line side of any ground fault sensor.
  - 4. Verify that neutral sensors are connected with correct polarity on both primary and secondary.
  - 5. Verify that all phase conductors and the neutral pass through the sensor in the same direction for zero sequence systems.
  - 6. Verify that grounding conductors do not pass through zero sequence sensors.
  - 7. Verify that the grounded conductor is solidly grounded.
  - 8. Verify correct operation of all functions of the self-test panel.

- 9. Record appropriate operation and test sequences as required by NEC Article 230-95. Submit test results to Owner's Representative.
- B. Electrical Tests:
  - 1. Measure the system neutral-to-ground insulation resistance with the neutral disconnect link temporarily removed. Replace neutral disconnect link after testing.
  - 2. Perform the following pickup tests using primary injection:
    - a. Verify that the relay does not operate at 90 percent of the pickup setting.
    - b. Verify pickup is less than 125 percent of setting or 1200 amperes, whichever is smaller.
  - 3. For summation type systems utilizing phase and neutral current transformers, verify correct polarities by applying current to each phase-neutral current transformer pair. This test also applies to molded-case breakers utilizing an external neutral current transformer.
    - a. The relay shall operate when current direction is the same relative to polarity marks in the two current transformers.
    - b. The relay shall not operate when current direction is opposite relative to polarity marks in the two current transformers.
  - 4. Measure time delay of the relay at 150 percent or greater of pickup.
  - 5. Verify reduced control voltage tripping capability: 55 percent for ac systems and 80 percent for dc systems.
  - 6. Submit test results to Owner's Representative.
- C. Test Values:
  - 1. Relay timing shall be in accordance with manufacturer's specifications but shall not exceed one second at 3000 amperes.

## 3.05 TRANSFORMER TEST

- A. Electrical Test:
  - 1. Use Multimeter to perform test.
  - 2. Measure output voltage under load on secondary side.
  - 3. Submit test results to Owner's Representative.
- B. Test Values:
  - 1. Voltage Output: Test voltage output per transformer nameplate value.
  - 2. Adjust transformer taps to provide closet possible output to rated output voltage within plus or minus 5%.

## 3.06 PHASE ROTATION TEST

- A. Test each three-phase circuit and feeder for consistent phase rotation for the entire power system with a phase rotation meter.
- B. Bump test each motor for proper rotation prior to use.
- C. Correct conductor phase relationship to provide proper phase rotation.
- D. Record the rotation sequence on each panelboard, MDP and Service circuit schedule.
- E. Submit test results of each panelboard, MDP and Service to the Owner's Representative.

## 3.07 PHASE LOAD BALANCE TEST

- A. After energizing building loads conduct a phase load balance test for each new or remodeled panelboard with a clamp on ammeter.
- B. Shift loads to provide current balance within 20% of the other phases. Revise circuit directory and all conductor labels to reflect any changes.

C. Notify Owner's Representative at least 72 hours in advance before test.

# END OF SECTION 26 0126

#### SECTION 26 0500 COMMON WORK RESULTS FOR ELECTRICAL

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

- A. General Requirements specifically applicable to Division 26, in addition to Division 01 provisions.
- B. The electrical system equipment and installation shall comply with all provisions and requirements of this specification, as well as any and all applicable national, state and local codes and standards.

### 1.02 WORK SEQUENCE

A. Construct Work in sequence under provisions of Division 01.

### 1.03 COORDINATION

- A. Coordinate the Work specified in this Division under provisions of Division 01.
- B. Prepare drawings showing proposed rearrangement of Work to meet job conditions, including changes to Work specified under other Sections. Obtain permission of Architect prior to proceeding.

### 1.04 REFERENCES

- A. ANSI/NFPA 70 National Electrical Code, latest adopted edition including all state and local amendments.
- B. NECA Standard of Installation.
- C. NETA ATS Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
- D. Electrical Reference Symbols: The Electrical "Legend" on drawings is standardized version for this project. All symbols shown may not be used on drawings. Use legend as reference for symbols used on plans.
- E. Electrical Drawings: Drawings are diagrammatic; complimentary to the Architectural drawings; not intended to show all features of work. Install material not dimensioned on drawings in a manner to provide a symmetrical appearance. Do not scale drawings for exact equipment locations. Review Architectural, Civil, Structural, and Mechanical Drawings and adjust work to conform to conditions shown thereon. Field verification of dimensions, locations and levels is directed.

#### 1.05 REGULATORY REQUIREMENTS

- A. Conform to ANSI/NFPA 70.
- B. Conform to the latest adopted edition of the International Building Code and the International Fire Code including all state and local amendments thereto.
- C. Obtain electrical permits, plan review, and inspections from authority having jurisdiction.

#### 1.06 SUBMITTALS

- A. Submittal review is for general design and arrangement only and does not relieve the Contractor from any requirements of Contract Documents. Submittal not checked for quantity, dimension, fit or proper operation. Where deviations of substitute product or system performance have not been specifically noted in the submittal by the Contractor, provisions of a complete and satisfactory working installation are the sole responsibility of the Contractor.
- B. In addition to requirements referenced in Division 01, the following is required for work provided under this division of the specification.
  - 1. Provide material and equipment submittals containing complete listings of material and equipment shown on Electrical Drawings and specified herein. Separate from work furnished under other divisions.

- 2. Submittals shall be provided in PDF format with each section indexed in the PDF document. Submittals for Division 26 shall be complete and submitted at one time. Unless given prior approval, partial submittals will be returned unreviewed.
- 3. Clearly identify all material and equipment by item, name or designation used on drawings and in specifications.
- 4. Submit only pages which are pertinent; mark catalog sheets to identify pertinent products, referenced to Specification Section and Article number. Show reference standards, performance characteristics, and capacities; wiring diagrams and controls; component parts; finishes; dimensions; and required clearances.
- 5. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the work. Delete information not applicable.
- 6. Review submittals prior to transmittal; determine and verify field measurements, field construction criteria, manufacturer's catalog numbers, and conformance of submittal with requirements of Contract Documents.
- 7. Coordinate submittals with requirements of work and of Contract Documents.
- 8. Certify in writing that the submitted shop drawings and product data are in compliance with requirements of Contract Documents. Notify Architect/Engineer in writing at time of submittal, of any deviations from requirements of Contract Documents.
- 9. Do not fabricate products or begin work which requires submittals until return of submittal with Architect/Engineer acceptance.
- 10. Equipment scheduled by manufacturer's name and catalog designations, manufacturer's published data and/or specification for that item, in effect on bid date, are considered part of this specification. Approval of other manufacturer's item proposed is contingent upon compliance therewith.

# 1.07 SUBSTITUTIONS

A. In accordance with the General Conditions and the General Requirements, Substitution and Product Options, all substitute items must fit in the available space, and be of equal or better quality including efficiency performance, size, and weight, and must be compatible with existing equipment.

## 1.08 PROJECT RECORD DRAWINGS

- A. Maintain project record drawings in accordance with Division 01.
- B. In addition to the other requirements, mark up a clean set of drawings as the work progresses to show the dimensioned location and routing of all electrical work which will become permanently concealed. Show routing of work in permanently concealed blind spaces within the building. Show complete routing and sizing of any significant revisions to the systems shown.
- C. Record drawing field mark-ups shall be maintained on-site and shall be available for examination of the Owner's Representative at all times.

## 1.09 OPERATION AND MAINTENANCE MANUALS

- A. Provide operation and maintenance manuals for training of Owner's Representative in operation and maintenance of systems and related equipment. In addition to requirements referenced in Division 01, the following is required for work provided under this section of the specifications.
- B. Manuals shall be separate from work furnished under other divisions. Prepare a separate chapter for instruction of each class of equipment or system. Index and clearly identify each chapter and provide a table of contents.
- C. Unless otherwise noted in Division 01, provide one copy of all material for approval.

- D. The following is the suggested outline for operation and maintenance manuals and is presented to indicate the extent of items required in manuals.
  - 1. List chapters of information comprising the text. The following is a typical Table of Contents:
    - a. Electrical Power Distribution.
    - b. Lighting.
    - c. Fire alarm.
    - d. Intercom.
    - e. Standby Generator.
    - f. Electronic Access Control.
    - g. Video Surveillance.
    - h. Other chapters as necessary.
  - 2. Provide the following items in sequence for each chapter shown in Table of Contents:
    - a. Describe the procedures necessary for personnel to operate the system including startup, operation, emergency operation and shutdown.
      - 1) Give complete instructions for energizing equipment and making initial settings and adjustments whenever applicable.
      - 2) Give step-by-step instructions for shutdown procedure if a particular sequence is required.
      - 3) Include test results of all tests required by this and other sections of the specifications.
    - b. Maintenance Instructions:
      - 1) Provide instructions and a schedule of preventive maintenance, in tabular form, for all routine cleaning and inspection with recommended lubricants if required for the following:
        - a) Lighting fixtures.
        - b) Distribution equipment.
        - c) Fire alarm and detection equipment.
        - d) Intercom.
        - e) Emergency generator.
        - f) Standby generator.
        - g) Electronic Access Control.
        - h) Video Surveillance.
      - Provide instructions for minor repair or adjustments required for preventive maintenance routines, limited to repairs and adjustments which may be performed without special tools or test equipment and which requires no special training or skills.
      - Provide manufacturers' descriptive literature including approved shop drawings covering devices used in system, together with illustrations, exploded views, etc. Also include special devices provided by the Contractor.
      - 4) Provide any information of a maintenance nature covering warranty items, etc., which have not been discussed elsewhere.
      - 5) Include list of all equipment furnished for project, where purchased, technical representative if applicable and a local parts source with a tabulation of descriptive data of all electrical-electronic spare parts and all mechanical spare

parts proposed for each type of equipment or system. Properly identify each component by part number and manufacturer.

c. Inspection Certificate: Include copy of certificate of final inspection and acceptance from the Authority Having Jurisdiction.

# 1.10 DEMONSTRATION OF ELECTRICAL SYSTEMS

- A. During substantial completion inspection:
  - 1. Conduct operating test for approval under provisions of Division 01.
  - 2. Demonstrate installation to operate satisfactorily in accordance with requirements of Contract Documents.
  - 3. Should any portion of installation fail to meet requirements of Contract Documents, repair or replace items failing to meet requirements until items can be demonstrated to comply.
  - 4. Have instruments available for measuring light intensities, voltage and current values, and for demonstration of continuity, grounds, or open circuit conditions.
  - 5. Provide personnel to assist in taking measurements and making tests.

## 1.11 CERTIFICATE OF COMPLETION

- A. Submit, at time of request for final inspection, a completed letter in the following format:
- B. I, <u>NAME</u>, of <u>FIRM</u>, certify that the electrical work is complete in accordance with Contract Plans and Specifications, and authorized change orders (copies attached) and will be ready for final inspection as of <u>DATE</u>. I further certify that the following specification requirements have been fulfilled:
  - 1. \_\_\_\_ megger readings performed, \_\_\_ copies of logs attached.
  - 2. \_\_\_\_ ground tests performed, \_\_\_ copies of method used and results attached.
  - 3. \_\_\_\_ operating manuals completed, \_\_\_\_\_ DATE.

#### SIGNED.

- 4. \_\_\_\_\_ as-built drawings up-to-date and ready to deliver to Architect.
- 5. \_\_\_\_\_ fire alarm system final connections, check out and start up completed on \_\_\_\_\_\_ DATE by:

# SIGNED.

Factory Authorized and Trained Technician

6. \_\_\_\_ Electronic Access Control final connections, check out and start up completed on \_\_\_\_\_ DATE by:

#### SIGNED.

Factory Authorized and Trained Technician

7. Instruction of operating personnel completed on \_\_\_\_\_ DATE by:

#### SIGNED.

Owner's Representative

8. \_\_\_\_ emergency lighting system final connections, check out and start up completed on \_\_\_\_\_ DATE by:

SIGNED.

Factory Authorized and Trained Technician

- 9. \_\_\_\_\_ all other tests required by specifications have been performed.
- 10. \_\_\_\_\_ all systems are fully operational.

SIGNED.

## 1.12 WARRANTY

- A. In addition to the requirements of Division 01, or as specified in other sections. Warrant all materials, installation and workmanship for one (1) year from date of acceptance.
- B. Copies of manufacturer product warranties for all equipment shall be included in the operation and installation manuals.

### 1.13 INSTRUCTION OF OPERATING PERSONNEL

- A. In accordance with the requirements of Division 01 and this section provide services of qualified representative of supplier of each item or system listed below to instruct designated personnel of Owner in operation and maintenance of item or system.
- B. Make instruction when system is complete, of number of hours indicated, and performed at time mutually agreeable.

| System or Equipment                    | Hours of Instruction |
|----------------------------------------|----------------------|
| Security system                        | 4                    |
| Fire alarm system                      | 4                    |
| Intercom system                        | 2                    |
| Emergency power system                 | 4                    |
| Electronic Access Controls             | 2                    |
| Video Surveillance                     | 4                    |
| Modify/add other sections as necessary |                      |

- C. Certify that an Anchorage, or greater Palmer/Wasilla Area based authorized service organization regularly carries complete stock of repair parts for listed equipment or systems, that organization is available and will furnish service within 48 hours after request. Include name, address and telephone number of service organization.
- D. Have approved operation and maintenance manuals and parts lists for all equipment on hand at time of instruction.

## PART 2 PRODUCTS

## 2.01 MATERIALS AND EQUIPMENT

- A. All Materials and Equipment shall be new.
- B. All Materials and Equipment shall be listed by Underwriter's Laboratories or equivalent third party listing agency for the use intended.
- C. Materials and Equipment shall be acceptable to the authority having jurisdiction as suitable for the use intended when installed per listing and labeling instructions.
- D. No materials or equipment containing asbestos in any form shall be used. Where materials or equipment provided by this Contractor are found to contain asbestos such items shall be removed and replaced with non-asbestos containing materials and equipment at no cost to the Owner.

E. In describing the various items of equipment, in general, each item will be described singularly, even though there may be numerous similar items.

# PART 3 EXECUTION

# 3.01 WORKMANSHIP

A. Install Work using procedures defined in NECA Standard of Installation and/or the manufacturer's installation instructions.

## 3.02 TESTS

- A. Perform tests in accordance with Section 26 0126 Maintenance Testing of Electrical Systems.
- B. Notify the Owner's representative at least 72 hours prior to conducting any tests.
- C. Following completion of installation, test system ground in accordance with the requirements of NETA ATS 7.13. and all feeders in accordance with NETA ATS 7.3. Submit logs of values obtained, and nameplate data of instruments used prior to final inspection. Include a copy of all data in the power distribution section of the Operation and Maintenance Manuals.
- D. Perform additional tests required under other sections of these specifications.
- E. Perform all tests in the presence of the Owner's representative.

## 3.03 PENETRATIONS OF FIRE BARRIERS

- A. Related information to this section appears in Division 07, Fire Stopping.
- B. All holes or voids created to extend electrical systems through fire rated floors, walls or ceiling shall be sealed with an asbestos-free intumescent fire stopping material capable of expanding 8 to 10 times when exposed to temperatures 250°F or higher.
- C. Materials shall be suitable for the fire stopping of penetrations made by steel, glass, plastic and shall be capable of maintaining an effective barrier against flame, smoke and gases in compliance with the requirements of ASTM E814 and UL 1479.
- D. The rating of the fire stops shall be the same as the time-rated floor, wall or ceiling assembly.
- E. Install fire stopping materials in accordance with the manufacturer's instructions.
- F. Unless protected from possible loading or traffic, install fire stopping materials in floors having void openings of four (4) inches or more to support the same floor load requirements as the surrounding floor.
- G. Seal cable tray penetrations of fire rated floors, walls or ceilings with UL listed, reusable fire stop sealing bags or other approved devices listed in specifications.

## END OF SECTION 26 0500

### SECTION 26 0505 SELECTIVE DEMOLITION FOR ELECTRICAL

### PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Electrical Demolition.

### 1.02 RELATED SECTIONS

- A. Division 01 Alteration Project Procedures.
- B. Division 02 Minor Demolition for Remodeling.

### PART 2 PRODUCTS

### 2.01 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work: As specified in individual Sections.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify field measurements and circuiting arrangements are as shown on Drawings.
- B. Verify that abandoned wiring and equipment serve only abandoned facilities.
- C. Demolition Drawings are based on a non-destructive walkthrough and existing record documents. Report discrepancies to Architect/Engineer before disturbing existing installation.
- D. Beginning of demolition means installer accepts existing conditions.

#### 3.02 PREPARATION

- A. Disconnect electrical systems in walls, floors, and ceilings scheduled for removal.
- B. Coordinate utility service outages with Utility Company.
- C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.
- D. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from Owner at least 30 days before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.
- E. Existing Fire Alarm System: Maintain existing system in service until new system is accepted or plan for relocation of FACP has been accepted. Disable system only to make switchovers and connections. Notify Owner and local fire service at least 48 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area. Fire watch to be provided for outages as a result from relocation of control panel.
- F. Existing Telephone System: Maintain existing system in service. Disable system only to make switchovers and connections. Notify Owner and Telephone Utility Company at least 48 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.
- G. Existing Electric Access Control: Maintain existing system in service. Disable system only to make switchovers and connections. Obtain permission from the Owner at least 48 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

# 3.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

- A. Demolish and extend existing electrical work under provisions of Division 01, Division 02, and this Division.
- B. Remove, relocate, and extend existing installations to accommodate new construction.
- C. Remove abandoned wiring to source of supply.
- D. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.
- E. Where abandoned conduit is installed below existing slab not scheduled for demolition, remove the conductors, cut conduit flush with floor, and patch surface.
- F. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets which are not removed.
- G. Disconnect and remove abandoned panelboards and distribution equipment.
- H. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.
- I. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.
- J. Repair adjacent construction and finishes damaged during demolition and extension work. Tbar ceiling tiles damaged under normal construction conditions or having voids where junction boxes were removed shall be replaced by the Contractor.
- K. Maintain access to existing electrical installations which remain active.
- L. Extend existing installations using materials and methods as specified.
- M. Where materials or equipment are to be turned over to Owner or reused and installed by the Contractor, it shall be the Contractor's responsibility to maintain condition of materials and equipment equal to the existing condition of the equipment before the work began. Repair or replace damaged materials or equipment at no additional cost to the Owner.
- N. Relocate existing lighting fixtures as indicated on Drawings. Test fixture to see if it is in good working condition before installation at new location.
- O. Contractor to field verify conduits and electrical items in walls to be demolished prior to start of work. Demolish conduits, boxes, devices, equipment, etc. In walls that are scheduled for demolition. Where conduits pass through the walls or circuits are shared with equipment that is existing to remain, provide all work necessary (including extending and re-routing conduits) to maintain access and provide electrical continuity to existing systems and circuitry.

### 3.04 EXISTING PANELBOARDS

- A. Ring out circuits in existing panel affected by the Work. Where additional circuits are needed, reuse circuits available for reuse.
- B. Tag unused circuits as spare.
- C. Where existing circuits are indicated to be reused, use sensing measuring devices to verify circuits feeding Project area or are not in use.
- D. Remove existing wire no longer in use from panel to equipment.
- E. Provide new updated directories where more than three circuits have been modified or rewired.

## 3.05 CLEANING AND REPAIR

- A. Clean and repair existing materials and equipment which remain or are to be reused.
- B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions.

**C.** Luminaires: Remove existing luminaires for cleaning. Use mild detergent to clean all exterior and interior surfaces, rinse with clean water and wipe dry. Replace lamps, ballasts, drivers and broken electrical parts.

# 3.06 INSTALLATION

A. Install relocated materials and equipment under the provisions of Division 01.

# 3.07 DISPOSAL

A. Dispose of all hazardous waste in accordance with all local, State and Federal requirements.

# END OF SECTION 26 0505

### SECTION 26 0519 LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

## PART 1 GENERAL

## 1.01 SECTION INCLUDES

- A. Building Wire.
- B. Cable.
- C. Wiring Connections and Terminations.

## 1.02 RELATED SECTIONS

- A. Section 26 0126 Maintenance Testing of Electrical Systems.
- B. Section 26 0553 Identification for Electrical Systems.
- C. Division 31 Trenching.
- D. Division 31 Backfill.

## 1.03 REFERENCES

- A. ANSI/NEMA WC 70-2021 Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy.
- B. NETA ATS Acceptance testing specifications for Electrical Power Distribution and Systems.
- C. NFPA 262 Standard Method of test for flame travel and smoke of wires and cables for use in air-handling spaces.
- D. UL 83 Thermoplastic Insulated Wire and Cable.
- E. UL 1063 Standard for Machine and Tool Wire and Cable.
- F. UL 1424 Standard for Cables for Power-Limited Fire Alarm.
- G. UL 1479 Standard for Fire Tests of Through Wall Penetration Fire Stops.
- H. UL 1569 Standard for Metal Clad Cable.
- I. UL 1581 Reference Standard for Electrical Wires, Cables and Flexible Cords.

### 1.04 SUBMITTALS

- A. Submit data under provisions of Division 01 and Section 26 0500.
- B. Product Data: Submit product data for all components provided which fall under this section showing configurations, finishes, and dimensions. Each catalog sheet should be clearly marked to indicate exact part number provided, including all options and accessories.

## 1.05 QUALITY ASSURANCE

A. Provide wiring materials located in plenums with peak optical density not greater than 0.5, average optical density not greater than 0.15, and flame spread not greater than 5 feet (1.5m) when tested in accordance with NFPA 262.

## PART 2 PRODUCTS

#### 2.01 BUILDING WIRE

- A. Thermoplastic-insulated Building Wire: NEMA WC 70.
- B. Feeders and Branch Circuits Larger Than 6 AWG: Copper, stranded conductor.
- C. Feeders and Branch Circuits 6 AWG and Smaller: Copper conductor, 6 and 8 AWG, stranded conductor; smaller than 8 AWG, solid or stranded conductor.
- D. Insulation Type: 600 volt insulation.
  - 1. Interior Locations: THHN/THWN or XHHW-2. THW may be used for feeders and branch circuits larger than 6AWG.

- 2. Exterior Locations: XHHW-2.
- E. Branch Circuit Wire Color Code:
  - 1. Color code wires by line or phase as follows:
    - a. Black, red, blue and white for 120/208V systems.
    - b. Brown, orange, yellow and gray for 277/480V systems.
  - 2. For conductors 6 AWG and smaller, insulation shall be colored. For conductors 4 AWG and larger, identify with colored phase tape at all terminals, splices, and boxes.
  - 3. Grounding conductors 6 AWG and smaller shall have green colored insulation. For 4 AWG and larger, use green tape at both ends and at all other visible points in between, including pull and junction boxes.
- F. Control Circuits: Copper, stranded conductor 600 volt insulation, THHN/THNN or XHHW-2.
- G. Fire Alarm Notification Appliance Circuits: Copper, solid or stranded conductor 600 volt insulation, THHN/THNN or XHHW-2.

### 2.02 METAL CLAD CABLE

- A. UL 83, 1063, 1479, 1569, and 1581 listed, meets Federal Specification A-A-59544 (formerly J-C-30B). UL rated for installation in cable trays and environmental air handling spaces. Fire wall rated for 1, 2, and 3-hour through penetrations.
- B. Type MC Cable, Size 12 Through 10 AWG: Solid copper conductor, 600 volt thermoplastic insulation, rated 90° C dry, 75° wet, insulated green grounding conductor, and galvanized steel or aluminum armor over mylar.
- C. Type MC Cable, Size 8 Through 1 AWG: Stranded copper conductor, 600 volt thermoplastic insulation, rated 90° C dry, 75° wet, insulated green grounding conductor, and galvanized steel or aluminum armor over mylar.
- D. Fire Alarm/Control Type MC Cable, Size 18 through 12 AWG: Complying with UL 66, 83, 1424, 1479, 1569, 1581, and NFPA 262 (formerly UL 910), solid copper conductor, 300 volt thermoplastic insulation, rated 90°C, insulated green grounding conductor, and red-striped galvanized steel armor over mylar. Conductor insulation shall be color-coded in accordance with Section 28 31 00.
- E. 0-10V Dimming/Power MC Cable (Type MC-PCS), Size 12 Through 10 AWG With 16-2 Control Cables: Solid copper conductor, 600 volt thermoplastic insulation, rated 90° C dry, 75° wet, insulated green grounding conductor, and galvanized steel or aluminum armor over mylar
- F. All metal clad cable shall be provided with color-coded insulation on all ungrounded conductors in accordance with NEC 210.5(C) and Part 3 of this section.
- G. IF MC cable is used. Health care listed MC cabling shall be provided in patient care location.

## 2.03 REMOTE CONTROL AND SIGNAL CABLE

- A. Control Cable for Class 1 Remote Control and Signal Circuits: Copper conductor, 600 volt insulation, rated 90° C, individual conductors twisted together, shielded, and covered with an overall PVC jacket; UL listed.
- B. Control Cable for Class 2 or Class 3 Remote Control and Signal Circuits: Copper conductor, 300 volt insulation, rated 90° C, individual conductors twisted together, shielded or unshielded (as required), and covered with a PVC jacket; UL listed.
- C. Plenum Cable for Class 2 or Class 3 Remote Control and Signal Circuits: Copper conductor, 300 volt insulation, rated 90° C, individual conductors twisted together, shielded or unshielded (as required), and covered with a nonmetallic jacket; UL listed for use in air handling ducts, hollow spaces used as ducts, and plenums.

# 2.04 WIRING CONNECTIONS AND TERMINATIONS

- A. For conductors 8 AWG and smaller:
  - 1. Dry interior areas: Spring wire connectors, pre-insulated "twist-on" rated 105 degrees C per UL 468C. Where stranded conductors are terminated on screw type terminals, install crimp insulated fork or ring terminals. Thomas & Betts Sta-Kon or equal.
  - 2. Motor connections: Spring wire connectors, pre-insulated "twist-on" rated 105 degrees C per UL 468C. Provide a minimum of 8 wraps of Scotch 33+ electrical tape around conductors and connector to eliminate connector back off.
  - 3. Wet or exterior: Spring wire connectors, pre-insulated "twist-on", resin filled rated for direct burial per UL 486D.
  - 4. Luminaires: UL listed, 4A, 600V, luminaire disconnect with tin-plated brass contacts, fingersafe polycarbonate female housing, 105° C temperature rating, and two or three-pole configuration to match load served.
- B. For conductors 6 AWG and larger:
  - 1. Bus lugs and bolted connections: 600 V, 90 degrees C., two hole long barrel irreversible compression copper tin plated. Thomas & Betts or approved equal.
  - 2. Motor connection: 600 V, 90 degrees C., copper tin plated compression motor pigtail connector, quick connect/disconnect, slip on insulator. Thomas & Betts or approved equal.
  - 3. Two way connector for splices or taps: 600 V, 90 degrees C., compression long barrel, copper tin plated. Thomas & Betts or approved equal. Insulate with Scotch 23 rubber insulating base covering and Scotch 33+ outer wrap.

### PART 3 EXECUTION

## 3.01 GENERAL WIRING METHODS

- A. Use no wire smaller than 12 AWG for power and lighting circuits, and no smaller than 18 AWG for control wiring.
- B. Use 10 AWG conductor for 20 ampere, 120 volt branch circuit home runs longer than 75 feet, and for 20 ampere, 277 volt branch circuit home runs longer than 200 feet.
- C. Splice only in junction or outlet boxes.
- D. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- E. Make Conductor lengths for parallel circuits equal.
- F. Wiring in lighting fixture channels shall be rated for 90° C minimum.
- G. Do not share neutral conductors. Provide a dedicated neutral conductor for each branch circuit that requires a neutral.

## 3.02 WIRING INSTALLATION IN RACEWAYS

- A. Pull all conductors into a raceway at the same time. Verify that raceway is complete and properly supported prior to pulling conductors. Use UL listed wire pulling lubricant for pulling 4 AWG and larger wires.
- B. Install wire in raceway after interior of building has been physically protected from the weather and all mechanical work likely to injure conductors has been completed.
- C. Do not install XHHW-2 conductors when ambient temperatures are below 23F and THHN/THWN conductors when ambient temperatures are below 32F.
- D. Conductors shall be carefully inspected for insulation defects and protected from damage as they are installed in the raceway. Where the insulation is defective or damaged, the cable section shall be repaired or replaced at the discretion of the Owner and at no additional cost to the Owner.
- E. Place an equal number of conductors for each phase of a circuit in same raceway or cable.

- F. Route conductors from each system in independent raceway system and not intermix in the same raceway, enclosure, junction box, wireway, or gutter as another system unless otherwise shown on the plans.
- G. No more than six current carrying conductors shall be installed in any homerun unless otherwise indicated on the drawings or without prior approval from the Engineer.
- H. Completely and thoroughly swab raceway system before installing conductors.
- I. When two or more neutrals are installed in one conduit, identify each with the proper circuit number in accordance with Section 26 0553.

## 3.03 CABLE INSTALLATION

- A. Provide protection for exposed cables where subject to damage.
- B. Support cables above accessible ceilings; do not rest on ceiling tiles. Use spring metal clips or cable ties to support cables from structure. Do not support cables from ceiling suspension system. Include bridle rings or drive rings.
- C. Use suitable cable fittings and connectors.

### 3.04 WIRING CONNECTIONS AND TERMINATIONS

- A. Stranded wire shall not be wrapped around screw terminals.
- B. Splice only in accessible junction boxes.
- C. Thoroughly clean wires before installing lugs and connectors.
- D. Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.
- E. Terminate spare conductors with twist on connectors or heat shrink insulation to proper voltage rating.
- F. Control systems wiring in conjunction with mechanical, electrical or miscellaneous equipment to be identified in accordance with wiring diagrams furnished with equipment.
- G. Code sound and signal systems wiring and any special equipment in accordance with manufacturer's diagrams or recommendations.
- H. Do not exceed manufacturer's recommended pull tensions.

#### 3.05 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Division 01 and Section 26 0126.
- B. Inspect wire and cable for physical damage and proper connection.
- C. Torque conductor connections and terminations to manufacturer's recommended values.

## 3.06 WIRE AND CABLE INSTALLATION SCHEDULE

- A. All Locations: Building wire and/or remote control and signal cable in raceways.
- B. At the Contractor's option, Metal Clad cable may be used for branch circuit wiring in dry locations other than homeruns. Homeruns shall be building wire in raceway. Metal Clad cable used for branch circuit wiring from a light switch to the light fixture shall include a neutral conductor and 0-10V dimming cables.
- C. At the Contractor's option, portions of the fire alarm wiring in dry, concealed locations may be installed in Fire Alarm Metal Clad cable.

# END OF SECTION 26 0519

#### SECTION 26 0526 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

- A. Power System Grounding.
- B. Communication System Grounding.
- C. Electronic Safety and Security System Grounding.
- D. Electrical Equipment and Raceway Grounding and Bonding.

### 1.02 RELATED SECTIONS

- A. The Work under this section is subject to requirements of the Contract Documents including the General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements, Section 26 0500 – Common Work Results for Electrical, Division 27 and Division 28.
- B. Section 26 0126 Maintenance Testing of Electrical Systems.
- C. Section 26 0519 Low-Voltage Electrical Power Conductors and Cables.
- D. Section 41 3619 Joining Equipment: Welding, Structural.

### 1.03 REFERENCE STANDARDS

- A. ANSI/NEMA GR-1, Ground Rod Electrodes and Ground Rod Electrode Couplings.
- B. ASTM B 3 Standard Specification for Soft or Annealed Copper Wire.
- C. AWS A5.8/A5.8M Specification for Filler Metals for Brazing and Braze Welding.
- D. IEEE Std 81 Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System.
- E. IEEE Std 142 Recommended Practice for Grounding of Industrial and Commercial Power System.
- F. UL 467 Standard for Grounding and Bonding Equipment.

### 1.04 SYSTEM DESCRIPTION

A. Provide a complete grounding system for services and equipment as required by State and Local Codes, NEC, applicable portions of other NFPA codes, and as indicated herein.

#### 1.05 SUBMITTALS

A. Product Data: Submit product data for all components provided, showing material type and dimensions. Each catalog sheet should be clearly marked to indicate exact part number provided, including all options and accessories.

## 1.06 CLOSEOUT SUBMITTALS

- A. Test Reports
  - 1. See Section 26 0126 Maintenance Testing of Electrical Systems for Grounding System Tests.
  - 2. Each test report shall include:
    - a. Date of test, soil moisture content, and soil temperature.
    - b. Test operator.
    - c. Instrument or other test equipment used.
    - d. Electrode designation or location matching that shown on shop drawings.
    - e. Ground impedance in ohms.

f. Assumptions made - if required.

### 1.07 COORDINATION

- A. Division 01 Administrative Requirements: Requirements for Coordination.
- B. Complete grounding and bonding of building reinforcing steel prior to concrete placement.

## PART 2 PRODUCTS

#### 2.01 MATERIALS

- A. Solid Ground Rods: ANSI/NEMA GR-1, copper-encased steel, <sup>3</sup>/<sub>4</sub> inch diameter, minimum length 10 feet. Ground rods shall be clean and smooth.
- B. Bonding Conductors: Solid bare copper wire for sizes No. 8 AWG and smaller diameter. Stranded bare copper wire for sizes No. 6 AWG and larger diameter. Conductors may be insulated conductors if used provide green insulation.
- C. Grounding Conductors: Copper conductor bare or green insulated.
- D. Telecommunications Bonding Backbone: Bare copper, 2 AWG, stranded conductor.
- E. Telecommunications Bonding Busbar: As specified in Section 27 1000.
- F. Mechanical Grounding and Bonding Connectors: Non-reversible crimp type lugs only. Use factory made compression lug for all terminations.
- G. In external locations, clamping shall be used only where a disconnect type of connection is required. Connection device may utilize threaded fasteners and shall be constructed such that positive contact pressure shall be maintained at all times. Machine bolts with lock washers shall be used.

## PART 3 EXECUTION

#### 3.01 INSTALLATION

- A. Provide a separate, insulated equipment-grounding conductor in all feeder and branch circuits. Terminate each end on a grounding lug, bus, or bushing. Multiple conductors on single lug not permitted. Each grounding conductor shall terminate on its own terminal lug.
- B. Connect grounding electrode conductors to metal water pipe using a suitable ground clamp. Make connections to flanged piping at street side of flange. Provide bonding jumper around water meter and back flow preventors.
- C. Supplementary Grounding Electrode: Use driven ground rod on exterior of building in main service equipment area.
- D. Telecommunications Bonding Backbone: Terminate at the electrical service entrance and at the ground bar or grounding lug on telecommunications backboard.
- E. Provide grounding and bonding at Utility Company's metering equipment.
- F. Bond together system neutrals, service equipment enclosures, exposed non-current carrying metal parts of electrical equipment, metal raceway systems, grounding conductor in raceways and cables, receptacle ground connectors, and plumbing and fuel systems.
- G. Grounding conductors for branch circuits shall be sized in accordance with NEC, except minimum size grounding conductor shall be No. 12 AWG.
- H. Grounding conductor is in addition to neutral conductor and in no case shall neutral conductor serve as grounding means.
- I. Ground rods shall be installed so that the top of the rod is not less than 18 inches below finished grade. Conceal after inspection.

# 3.02 FIELD QUALITY CONTROL

- A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.
- B. Perform system ground test as specified in Section 26 0126 Maintenance Testing of Electrical Systems.
- C. Continuity Test: Continuity test shall be performed on all power receptacles to ensure that the ground terminals are properly grounded to the facility ground system.

## END OF SECTION 26 0526

#### SECTION 26 0529 HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

- A. Section included hangers and supports for Power Systems, Communication Systems and Electronic Safety and Security Systems.
- B. Conduit Supports.
- C. Formed Steel Channel.
- D. Spring Steel Clips.
- E. Sleeves.
- F. Mechanical Sleeve Seals.
- G. Equipment Bases and Supports.

### 1.02 RELATED SECTIONS

- A. The Work under this section is subject to requirements of the Contract Documents including the General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements, and Section 26 0500 – Common Work Results for Electrical, Division 27 and Division 28.
- B. Division 03 Cast-In-Place Concrete: Product requirements for concrete for placement by this section.
- C. Section 26 0548 Vibration and Seismic Controls for Electrical Systems.

#### 1.03 REFERENCES

A. International Building Code (IBC), Chapter 16 – Structural Design.

## 1.04 SUBMITTALS

- A. Division 01: Requirements for submittals.
- B. Product Data: Submit product data for specialty supports.

#### COORDINATION

C. Coordinate size, shape and location of concrete pads with Division 03.

#### 1.05 QUALITY ASSURANCE

- A. Support systems shall be adequate for weight of equipment and conduit, including wiring, which they carry.
- B. Perform Work in accordance with State of Alaska Standard Specifications.

## PART 2 PRODUCTS

## 2.01 CONDUIT SUPPORTS

- A. Manufacturers:
  - 1. Allied Tube & Conduit Corp.
  - 2. Minerallac Fastening Systems.
  - 3. O-Z Gedney Co.
  - 4. Substitutions: per Division 01
- B. Hanger Rods: Threaded high tensile strength galvanized carbon steel with free running threads.
- C. Beam Clamps: Malleable Iron, with tapered hole in base and back to accept either bolt or hanger rod. Set screw: hardened steel.

- D. Conduit clamps for trapeze hangers: Galvanized steel, notched to fit trapeze with single bolt to tighten.
- E. Conduit clamps general purpose: One-hole malleable iron for surface mounted conduits.
- F. Cable Ties: High strength nylon temperature rated to 185 degrees F. self-locking.

## 2.02 FORMED STEEL CHANNEL

- A. Manufacturers:
  - 1. B-Line Systems.
  - 2. Allied Tube & Conduit Corp.
  - 3. Unistrut Corp.
  - 4. Substitutions: per Division 01.
- B. Product Description: Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.

#### 2.03 SLEEVES

- A. Sleeves Through Non-fire Rated Floors: 18 gage thick galvanized steel.
- B. Sleeves Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.
- C. Sleeves Through Fire Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire rated sleeves including seals, UL listed.
- D. Fire-stopping Insulation: Glass fiber type, non-combustible.

#### 2.04 MECHANICAL SLEEVE SEALS

A. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

## PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Division 01: Verification of existing conditions before starting work.
- B. Verify openings are ready to receive sleeves.

#### 3.02 PREPARATION

- A. Obtain permission from Owner's Representative before using powder-actuated anchors.
- B. Obtain permission from Owner's Representative before drilling or cutting structural members.

#### 3.03 INSTALLATION - GENERAL

- A. Fasten hanger rods, conduit clamps, and outlet and junction boxes to building structure using precast insert system, expansion anchors, preset inserts, beam clamps, or spring steel clips.
- B. Use toggle bolts or hollow wall fasteners in hollow masonry partitions and walls; expansion anchors or preset inserts in solid masonry walls; self-drilling anchors or expansion anchor on concrete surfaces; sheet metal screws in sheet metal studs; and wood screws in wood construction.
- C. Do not support raceways, low voltage pathways, cables, telecommunication pathways or boxes from ceiling suspension wires or suspended ceiling systems. Provide support from building structure independently to allow ceiling removal and replacement without removal of electrical system. If dedicated support wires are used, wires and wire clips must be painted or color-coded. Exception: Outlet boxes for ceiling-mounted light fixtures, speakers, motion sensors, CCTV cameras, and smoke detectors may be mounted in the ceiling system.

- D. Do not fasten supports to piping, ductwork, mechanical equipment, conduit, or ceiling suspension system.
- E. Do not penetrate by drilling or screwing into metal roof decking. All penetrations into metal roof decking must be approved by the Project Manager in writing.
- F. Fabricate supports from structural steel or steel channel, rigidly welded or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.
- G. In wet locations install free-standing electrical equipment on concrete pads. Pad top shall be a minimum of 3 ½" above the surrounding grade and shall be reinforced in accordance with Division 03 of these specifications.
- H. Install surface-mounted cabinets and panelboards with minimum of four anchors.
- I. Bridge studs top and bottom with channels to support flush-mounted cabinets and panelboards in stud walls.
- J. Securely fasten fixtures and equipment to building structure in accordance with manufacturer's recommendations and to provide necessary earthquake anchorage.
- K. Provide wall attached fixtures and equipment weighing less than 50 pounds with backing plates of at least 1/8" x 10" sheet steel or 2" x 10" fire retardant treated wood securely built into the structural walls. Submit attachment details of heavier equipment for approval.
- L. Earthquake Anchorages:
  - 1. Equipment weighing more than 50 pounds shall be adequately anchored to the building structure to resist lateral earthquake forces.
  - 2. Total lateral (earthquake) forces shall be 1.5 times the equipment weight acting laterally in any direction through the equipment center of gravity. Provide adequate backing at structural attachment points to accept the forces involved.
- M. Provide one seismic support wire for all fixtures weighing less than 10lbs. two minimum colorcoded dedicated seismic support wires for each ceiling mounted light fixture weighing less than 50 pounds. Attach support wires to building structure independent from ceiling system and on opposing corners of the light fixtures to not allow fixture to drop more than 6 inches upon ceiling failure. Secure each end with three tight wraps within 1 inch at each end of the wire. Provide four supports on fixtures >50 lbs.
- N. Attach the supporting cables for all pendant fixtures to both the building structure and to the ceiling grid which they pass through.

## 3.04 INSTALLATION - SLEEVES

- A. Exterior watertight entries: Seal with adjustable interlocking rubber links.
- B. Conduit penetrations not required to be watertight: Sleeve and fill with silicon foam.
- C. Set sleeves in position in forms. Provide reinforcing around sleeves.
- D. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- E. Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves.
- F. Where conduit or raceway penetrates floor, ceiling, or wall, close off space between conduit or raceway and adjacent work with fire stopping insulation and caulk . Provide close fitting metal collar or escutcheon covers at both sides of penetration.
- G. Install chrome plated steel escutcheons at finished surfaces.

## END OF SECTION 26 0529

## SECTION 26 0533 RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

## PART 1 GENERAL

# 1.01 SECTION INCLUDES

- A. Conduit.
- B. Boxes.
- C. Wireway

# 1.02 RELATED SECTIONS

- A. The Work under this section is subject to requirements of the Contract Documents including the General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements, Division 26, Division 27 and Division 28.
- B. Division 07 Thermal and Moisture Protection.
- C. Division 08 Openings: Access Doors and Frames.
- D. Section 26 0519 Low-Voltage Electrical Power Conductors and Cables.
- E. Section 26 0526 Grounding and Bonding for Electrical Systems.
- F. Section 26 0529 Hangers and Supports for Electrical Systems.
- G. Section 26 0553 Identification for Electrical Systems.
- H. Section 26 2726 Wiring Devices.
- I. Section 27 0528 Pathways for Communications Systems.
- J. Section 27 1000 Structured Cabling.

# 1.03 REFERENCES

- A. American National Standards Institute (ANSI):
  - 1. ANSI C80.1 Rigid Steel Conduit, Zinc Coated.
  - 2. ANSI C80.3 Electrical Metallic Tubing, Zinc Coated.
- B. American Society for Testing and Materials (ASTM):
  - 1. ASTM A 123 Specification for Zinc Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars and Strip.
- C. National Electrical Manufacturers Association (NEMA):
  - 1. NEMA FB 1 Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
  - 2. NEMA OS 1 Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
  - 3. NEMA RN 1 Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
  - 4. NEMA TC 3 PVC Fittings for Use with Rigid PVC Conduit and Tubing.
  - 5. NEMA TC 7 Smooth-Wall Coilable Polyethylene Electrical Plastic Conduit.
  - 6. UL651B Continuous Length HDPE Conduit.
  - 7. NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum).
- D. Telecommunications Industry Association (TIA) and Electronics Industries Association (EIA):
  - 1. ANSI/TIA/EIA 568 Commercial Building Telecommunications Cabling Standard.
- E. Building Industry Consulting Service International (BICSI):
  - 1. BICSI Telecommunication Design Methods Manual.

## 1.04 RACEWAY AND BOX INSTALLATION SCHEDULE

- A. Underground more than 5 feet from foundation wall:
  - 1. Raceway: Provide rigid steel conduit, intermediate metal conduit, PVC or HDPE. Schedule 40 PVC or HDPE shall be used in non-traffic areas, schedule 80 shall be used where subject to vehicle traffic.
  - 2. Boxes and Enclosures: Provide concrete type 1A handhole.
- B. Under or in concrete slab, or underground within 5 feet of foundation wall:
  - 1. Raceway: Provide rigid steel conduit, intermediate metal conduit, PVC or HDPE. All metal conduit in contact with concrete or block shall be rigid steel conduit half lapped wrapped with pipe wrap or be plastic-coated conduit. Provide transition to rigid steel conduit 12 inches prior to exit penetration through foundations, concrete walls, or block walls. Provide transition to rigid steel conduit elbow and riser for penetration through slab. Arrange raceway so the curved portion of bend is not visible above finished slab.
  - 2. Boxes and Enclosures: Provide concrete tight cast and listed sheet metal boxes.
- C. In or through CMU walls:
  - 1. Raceway: Provide rigid steel conduit or intermediate metal conduit. EMT conduit may penetrate through CMU walls where the EMT is installed in a sleeve and does not come in direct contact with the CMU. All conduit in contact with concrete or block shall be rigid steel conduit half lapped wrapped with pipe wrap or be plastic-coated conduit.
  - 2. Boxes and Enclosures: Provide concrete tight cast and listed sheet metal boxes.
- D. Outdoor Above Grade, Damp or Wet Interior Locations:
  - 1. Raceway: Provide rigid steel conduit or intermediate metal conduit.
  - 2. Boxes and Enclosures: Provide weatherproof malleable iron for branch circuit junction and outlet boxes. Provide weatherproof NEMA 3R sheet metal enclosures for safety and disconnect switches and NEMA 4 sheet metal enclosures with gaskets for motor controllers and control panels.
  - 3. Fittings: Provide galvanized malleable iron with gaskets. Provide Myers threaded hubs for all conduit entries into top and side of sheet metal enclosures.
- E. Concealed Dry Locations:
  - 1. Raceway: Provide rigid steel conduit, intermediate metal conduit, or electrical metallic tubing.
  - 2. Boxes and Enclosures: Provide sheet-metal boxes. Provide vapor barrier boxes in exterior walls and the ceiling.
  - 3. Fittings: Provide galvanized malleable iron and steel.
- F. Exposed Dry Locations:
  - 1. Raceway: Provide rigid steel conduit, intermediate metal conduit, or electrical metallic tubing. EMT conduit shall not be used where subject to physical damage or where exposed 6 ft below finished floor.
  - 2. Boxes and Enclosures: Provide sheet-metal boxes with raised steel covers.
  - 3. Fittings: Provide galvanized malleable iron and steel.
  - 4. Surface Raceway and Boxes: Where specifically noted on the Drawings, provide surface raceway and boxes.
- G. Telecommunication Grounding:
  - 1. Raceway: Provide aluminum or PVC conduit (non-ferrous) where the grounding conductor is not concealed within the wall or ceiling; or if the grounding conductor is exposed to physical damage.

- 2. Boxes and Enclosure: Provide non-ferrous as required.
- 3. Fittings: Provide non-ferrous as required.
- H. Equipment Connections: Provide short extensions (three feet maximum) of flexible metal conduit for connections to light fixtures, motors, transformers, vibrating equipment or equipment that requires removal for maintenance or replacement. Use Liquidtight flexible conduit and fittings for motors and equipment in damp or wet locations or subject to spilling of liquids as at pumps, kitchen equipment, in mechanical rooms, boiler rooms, pump rooms, etc.
- I. Liquidtight flexible nonmetallic conduit and electrical nonmetallic tubing are <u>not</u> approved raceway systems for this project.

#### 1.05 DESIGN REQUIREMENTS

- A. Raceway Minimum Size:
  - 1. Below Grade: Provide 1 inch minimum, unless otherwise noted.
  - 2. Above Grade or Within Slab: Provide 1/2 inch minimum, unless otherwise noted.
  - 3. Line Voltage Circuits: Raceway is sized on the drawings for copper conductors with 600-Volt type XHHW insulation, unless otherwise noted. Where a raceway size is not shown on the drawings, it shall be calculated to not exceed the percentage fill specified in the NEC Table 1, Chapter 9 using the conduit dimensions of the NEC Table 4, Chapter 9 and conductor properties of the NEC Table 5, Chapter 9.
  - 4. Fire Alarm, Telecom, Intercom and other Low-Voltage Circuits: Raceway size shall be calculated to not exceed the percentage fill specified in the NEC Table 1, Chapter 9, using the conduit dimensions of the NEC Table 4, Chapter 9, and cable diameter provided by the manufacturer.
- B. Box Minimum Size: Provide all boxes sized and configured per NEC Article 370 and as specified in this section.
- C. Seismic Support: Provide support in accordance with Section 26 0548 Vibration and Seismic Controls for Electrical Systems.
- D. Telecommunication Pathways Layout and Configuration: BICSI Telecommunication Design Methods Manual and ANSI/TIA/EIA 568 Commercial Building Telecommunications Cabling Standard.

# 1.06 SUBMITTALS

- A. Submit product data under provisions of Division 01.
- B. Product Data: Submit data for products.

#### 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
- B. Protect PVC conduit from sunlight.

#### PART 2 PRODUCTS

#### 2.01 RIGID METAL CONDUIT (RMC)

- A. Rigid Steel Conduit: ANSI C80.1, UL 6.
- B. Rigid Aluminum Conduit: ANSI C80.5.
- C. Fittings and Conduit Bodies: NEMA FB 1, UL 514B; Galvanized malleable iron with threaded hubs for all conduit entries. Provide threaded connections and couplings only. Set Screw and running thread fittings are not permitted. Provide copper free aluminum fittings and conduit bodies with Aluminum Conduit.
- D. Provide insulated throat bushings at all conduit terminations.

# 2.02 PVC COATED RIGID METAL CONDUIT

- A. Product Description: NEMA RN 1; rigid steel conduit with external 40-mil PVC coating and internal galvanized surface.
- B. Fittings and Conduit Bodies: NEMA FB 1; steel fittings with insulated throat bushings and external PVC coating to match conduit.

## 2.03 INTERMEDIATE METAL CONDUIT (IMC)

- A. Product Description: ANSI C80.6, UL 1242; Galvanized Steel Conduit.
- B. Fittings and Conduit Bodies: NEMA FB 1, UL 514B; use fittings and conduit bodies specified above for rigid steel conduit.
- C. Provide insulated throat bushings at all conduit terminations.

### 2.04 FLEXIBLE METAL CONDUIT (FMC)

- A. Product Description: UL 1, FS WW-C-566; galvanized or zinc-coated flexible steel, full-wall or reduced wall thickness.
- B. Fittings and Conduit Bodies: ANSI/NEMA FB 1; steel or malleable iron with insulated throat bushings. Die cast zinc or threaded inside throat fittings are not acceptable.

## 2.05 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

- A. Product Description: UL 360, flexible metal conduit with interlocked steel construction and PVC jacket.
- B. Fittings and Conduit Bodies: ANSI/NEMA FB 1; liquid tight steel or malleable iron with insulated throat bushings. Die cast fittings are not acceptable.

### 2.06 ELECTRICAL METALLIC TUBING (EMT)

- A. Product Description: ANSI C80.3, UL 797; galvanized steel tubing.
- B. Fire Alarm EMT: Provide EMT with factory or field-applied red topcoating.
- C. Fittings and Conduit Bodies: ANSI/NEMA FB 1; steel or malleable iron, compression or set screw type with insulated throat bushings. Zinc die cast or indentor fittings are not acceptable.
- D. Provide factory elbows on sizes 1-1/2" and larger.

## 2.07 POLYVINYL CHLORIDE CONDUIT (PVC)

- A. Product Description: NEMA TC 2; Schedule 40 or 80 PVC, rated for 90<sup>o</sup> C cable.
- B. Fittings and Conduit Bodies: NEMA TC 3.
- C. Provide PVC-coated rigid steel factory elbows for bends in all PVC conduit runs, regardless of length.

## 2.08 HIGH DENSITY POLYETHYLENE CONDUIT (HDPE)

- A. Conduit: NEMA TC 7; HDPE conduit rated for 90<sup>o</sup> C cable. Provide Schedule 40 conduit for trade sizes up to 2" and Schedule 80 conduit for trade sizes above 2".
- B. Provide conduit with pullstring installed.
- C. Fittings and Conduit Bodies: NEMA TC 7.
- D. HDPE to RMC Couplings: Basis of design is Duraline "Shur-Lock II" or equal.
- E. HDPE to HDPE Couplings: Butt-fusion, electro-fusion couplers, self-threading couplings, or drive-on couplings. All couplings shall be UL listed for the intended purpose.

## 2.09 FLEXIBLE NONMETALLIC OPTICAL FIBER RACEWAY

- A. Product Description: UL2024 Plenum Rated; Indoor, corrugated, 1-inch in diameter. Color Orange.
- B. Fittings: By same manufacturer as optical fiber raceway. Plenum Rated.

## 2.10 SURFACE METAL RACEWAY

- A. General Requirements: Surface steel raceway with ivory finish, fitted snap-on cover, and steel accessories, suitable for use as multi-outlet assembly. Keep data and power conductors separate at all times. Provide radius fittings and all other accessories as required for a complete installation. Raceway covers with knockouts for accessories or cable entries are not acceptable. Device spacing shall be as indicated on the Drawings.
- B. Dual-Channel, Power and Data: Basis of Design is Wiremold V4000 series.
- C. Single-Channel, Power and Data: Basis of Design is Wiremold V2000 series.
- D. Single-Channel, Fire Alarm and Security: Basis of Design is Wiremold V700 series.

## 2.11 OUTLET BOXES

- A. Sheet Metal Outlet Boxes: ANSI/NEMA OS 1, UL514A galvanized steel, with plaster ring where applicable.
  - 1. Minimum Size: 4 inches square or octagonal, 1-1/2 inches deep, unless otherwise noted.
  - 2. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; furnish 1/2 inch male fixture studs where required. Minimum Size: 4 inches square or octagonal, 2-1/8 inches deep.
  - 3. Concrete and Masonry: Concrete type with field installed tape cover to prevent concrete entry to raceway system. Minimum Size: 4 inches square, 2-1/8 inches deep.
  - 4. Telecommunications Outlets: Minimum size 4-11/16 inches square, 2-1/8 inches deep.
  - 5. Cut-In Boxes: Minimum size 2" x 3" x 2-1/2" deep. Provide cut-in outlet boxes where required for installation in existing walls.
- B. Vapor Barrier Boxes: Airtight box with vapor barrier flange and integral wire entry seal. Lessco, NuTek or approved equal.
- C. Cast Boxes: NEMA FB 1, Type FD, galvanized malleable iron or copper-free cast aluminum. Furnish gasketed cover by box manufacturer. Furnish threaded hubs. "Bell" boxes are not allowed.
- D. Wall Plates: As specified in Section 26 27 26 Wiring Devices.
- E. TV Audio/Video Boxes Recessed 2-gang combination power/data/A/V box suitable to install a flat screen TV flush to the wall. Hubbell #NSAV62M or approved equal with white steel cover.

## 2.12 PULL AND JUNCTION BOXES

- A. Sheet Metal Pull and Junction Boxes: ANSI/NEMA OS 1, UL514A galvanized steel.
  - 1. Minimum Size: 4 inches square or octagonal, 1-1/2 inches deep, unless otherwise noted.
- B. Sheet Metal Boxes Larger Than 12 Inches in Any Dimension: Hoffman or approved equal.
- C. Boxes for Outdoor and Wet Location Installations: NEMA 250, Type 3R; flat-flanged, surface mounted junction box:
  - 1. Material: Galvanized cast iron Type 316 stainless steel.
  - 2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover and screws.
- D. Type 1A Junction Box: Fiberglass Concrete composite Type 1A Handholes: Die-molded glassfiber concrete composite hand holes with pre-cut 6 x 6 inch cable entrance at center bottom of each side:
  - 1. Cover: Glass-fiber concrete composite, weatherproof cover with non-skid finish.
  - 2. Cover Legend: "ELECTRIC, LIGHTING, or COMM" to match load shown on plans.
- E. Polymer Concrete Junction Boxes for Underground Installations: Polymer concrete consisting of sand and aggregate bound together with a polymer resin. Internal reinforcement shall be

provided by means of steel, fiberglass or a combination of the two. The installed enclosure shall be rated for a minimum test load of 7500 pounds distributed over a 10 inch by 10 inch area and used in occasional, non-deliberate vehicular traffic or pedestrian traffic application. All hardware shall be stainless steel.

# 2.13 FLOOR BOXES

- A. Acceptable manufacturers:
  - 1. Legrand.
  - 2. Hubbell.
  - 3. Substitutions under provision of Division 01.
- B. Floor Boxes for Installation in Cast-In-Place Concrete Floors: Full adjustable, cast iron, or formed steel.
- C. Concealed Service Floor Boxes for use in non-gym areas: Wiremold #Evolution series or approved equal fully adjustable box with cast iron base and PVC housing constructed in accordance with UL514A/C. Box shall contain 6 enclosed wiring compartments capable of accommodating duplex receptacles, GFCI receptacles, modular telecom jacks, audio-visual jacks, etc. Provide with all faceplates required to accommodate installed devices. Provide with flush aluminum cover with carpet insert.
- D. Concealed Service Floor Boxes for use in gym areas: Wiremold #RFBA series or approved equal fully adjustable box with steel base and housing constructed in accordance with UL514A/C. Box shall contain 2 enclosed wiring compartments capable of accommodating duplex receptacles, GFCI receptacles, modular telecom jacks etc. Provide with all faceplates required to accommodate installed devices with a blank top and flanged cover.
- E. Poke-Through Fittings: Wiremold #Evolution series or approved equal UL514/a and/or UL514C listed poke-through fitting, suitable for use in 1, 1-1/2, or 2-hour rated floors, with combination power/data/low voltage fittings as shown on Plan. Provide 6" or 8" diameter as required to accommodate the fittings shown on Plans. Provide with flush aluminum cover.

# 2.14 EXPANSION FITTINGS

A. Galvanized malleable iron, galvanized with grounding bond jumper.

## 2.15 BUSHINGS

- A. Non-grounding: Threaded impact resistant plastic.
- B. Grounding: Insulated galvanized malleable iron/steel with hardened screw bond to raceway and conductor lug.

## 2.16 LOCKNUTS

A. Threaded Electro Zinc Plated Steel designed to cut through protective coatings for ground continuity.

# 2.17 WIREWAY

- A. Product Description: General purpose type wireway.
- B. Size per NEC minimum fill capacity unless otherwise indicated on Drawings.
- C. Knockouts: Field-installed, no factory knockouts acceptable.
- D. Cover: Screw cover. Provide raintight where installed outdoors.
- E. Fittings and Accessories: Include factory couplings, offsets, elbows, adapters and support straps required for a complete system. Provide internal ground bonding jumper bonded to each section.
# PART 3 EXECUTION

## 3.01 INSTALLATION

- A. Ground and bond raceway and boxes in accordance with Section 26 0526.
- B. Provide support and fasten raceway and box supports to structure and finishes in accordance with Section 26 0529.
- C. Identify raceway and boxes in accordance with Section 26 0553.
- D. Unless otherwise noted, do not inter-mix conductors from separate panelboards or any other system in the same raceway system or junction boxes.

## 3.02 INSTALLATION - GENERAL RACEWAY

- A. Install raceway for all systems, unless otherwise noted.
- B. Install an equipment grounding conductor inside of all raceways containing line voltage conductors.
- C. Provide raceways concealed in construction unless specifically noted otherwise, or where installed at surface cabinets, motor and equipment connections and in Mechanical and Electrical Equipment rooms. Do not route conduits on roofs, outside of exterior walls, or along the surface of interior finished walls unless specifically noted on the plans.
- D. Raceway routing and boxes are shown in approximate locations unless dimensioned. Where raceway routing is not denoted, field-coordinate to provide complete wiring system.
- E. Do not route raceways on floor. Where surface raceways are allowed in equipment rooms, arrange raceway and boxes to maintain a minimum of 6 feet 6 inches of headroom and present a neat appearance. Install raceways level and square. Route exposed raceways and raceways above accessible ceilings parallel and perpendicular to walls, ceiling, and adjacent piping.
- F. Maintain minimum 6-inch clearance between raceway and mechanical and piping and ductwork. Maintain 12-inch clearance between raceway and heat sources such as flues, steam pipes, heating pipes, heating appliances, and other surfaces with temperatures exceeding 104 degrees F.
- G. Do not install raceway embedded in spray applied fire proofing.
- H. Route raceway through roof openings for piping and ductwork where possible; otherwise, route through roof jack with pitch pocket. Coordinate all requirements with Division 07 of these specifications.
- I. Where raceway penetrates fire-rated walls and floors, seal raceway penetrations of fire-rated walls, ceilings, floors in accordance with the requirements of Section 26 05 00 and Division 07.
- J. Raceways and boxes penetrating vapor barriers or penetrating areas from cold to warm shall be taped and sealed with a non-hardening duct sealing compound to prevent the accumulation of moisture, and shall include a vapor barrier on the outside.
- K. Conduit embedded in concrete or solid masonry shall not be larger than 1/3 the thickness of the wall or slab and shall be spaced not less than three diameters apart. No cutting of reinforcing bars shall be permitted unless specifically approved. Should structural members prevent the installation of conduit or equipment, notify the Owner or Contracting Officer before proceeding.
- L. Route conduits in slabs to have 1 inch minimum cover. Conduits in slab shall not compromise the structural integrity of the slab.
- M. Field coordinate the installation of all conduit installed in or through concrete slabs containing radiant heating piping to avoid conflict with the piping prior to the concrete being poured. Core drilling of slabs with radiant heat piping installed is not allowed.
- N. Arrange raceway supports to prevent misalignment during wiring installation.

- O. Do not attach raceway to ceiling support wires or other piping systems and do not fasten raceway with wire or perforated pipe straps. Remove all wire used for temporary raceway support during construction, before conductors are pulled. Raceway shall be installed to permit ready removal of equipment, piping, ductwork, or ceiling tiles.
- P. Group raceway in parallel runs where practical and use conduit rack constructed of steel channel with conduit straps or clamps, as specified in Section 26 05 29. Provide space on each rack for 25 percent additional raceway.
- Q. Cut conduit square; de-burr cut ends. Bring conduit to the shoulder of fittings and couplings and fasten securely.
- R. Use threaded raintight conduit hubs for fastening conduit to cast boxes, and for fastening conduit to sheet metal boxes in damp or wet locations. Sealing locknuts are not acceptable.
- S. Install no more than 360-degrees of bends between boxes.
- T. Install conduit bodies to make sharp changes in direction, such as around beams. "Goosenecks" in conduits are not acceptable.
- U. Use hydraulic one-shot conduit bender or factory elbows for bends in conduit larger than 2 inch size.
- V. Provide protective plastic bushings or insulated throat bushings at each raceway termination not installed to an enclosure. Bushings shall be threaded to the raceway end or connector.
- W. Avoid moisture traps; install junction box with drain fitting at low points in raceway system.
- X. Install fittings and flexible metal conduit to accommodate 3-axis movements where raceway crosses seismic joints.
- Y. Install fittings designed and listed to accommodate expansion and contraction where raceway crosses control and expansion joints.
- Z. Stub a minimum of 2 inches above floor all raceways terminated beneath free standing service equipment, pad mounted equipment, etc.
- AA. Provide weatherhead or threaded cap on all raceway stub ups which are outdoors and do not terminate into equipment.
- BB. Use cable sealing fittings forming a watertight non-slip connection to pass cords and cables into conduit. Size cable sealing fitting for the conductor outside diameter. Use Appleton CG series or equal cable sealing fittings.
- CC. Use suitable caps to protect installed raceway against entrance of dirt and moisture.
- DD. Provide nylon "jet-line" or approved equal pull string in empty raceway, except sleeves and nipples.
- EE. Paint all exposed conduit in finished spaces to match surface to which it is attached or crosses. Clean greasy or dirty conduit prior to painting in accordance with paint manufacturer's instructions. Where raceway penetrates non-rated ceilings, floors or walls, provide patching, paint and trim to retain architectural aesthetics similar to surroundings.
- FF. Coat non-ferrous conduit threads with grease antioxidant prior to joining with conductive metallic material.
- GG. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area that will be inserted into fitting. Let joint cure for 20 minutes minimum.

## 3.03 REUSE OF EXISTING CONDUITS

- A. Existing conduits may be used, that is only applicable if the existing conduit meets the following minimum criteria:
  - 1. Conduit is sized per minimum NEC requirements.

- 2. Conduit is properly supported as required in the Contract Documents.
- 3. Conduit is in good, useable condition and is not deformed, damaged or showing signs of corrosion.
- 4. Conduit is of the type specified and allowable in the Contract Documents.

# 3.04 INSTALLATION – GENERAL BOXES

- A. Provide electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and code compliance. All electrical box locations shown on Drawings are approximate unless dimensioned.
- B. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only. Where installation is inaccessible, install outlet and junction boxes no more than 6 inches from ceiling access panel. Coordinate locations and sizes of required access doors with Division 08.
- C. Coordinate layout and installation of boxes to provide adequate headroom and working clearance and to present a neat appearance. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.
- D. Unless otherwise dimensioned on Plans, align wall-mounted outlet boxes for switches, thermostats, and similar devices.
- E. Use multiple-gang boxes where more than one device are mounted together; do not use sectional boxes. Provide barriers to separate wiring of different voltage systems and where normal and emergency power circuits occur in the same box.
- F. Verify location of floor boxes prior to rough-in. Set boxes level and flush with finish flooring material.
- G. Adjust box location up to 6 feet prior to rough-in to accommodate intended purpose.
- H. Unless otherwise specifically noted, locate outlet boxes for light switches within 6 inches of the door jamb on the latch side of the door.
- I. Position outlets to locate luminaires as shown on reflected ceiling plans.
- J. Provide knockout closures for unused openings.
- K. Install boxes in walls without reducing effectiveness of wall insulation or vapor barrier.
- L. Provide recessed outlet boxes in finished areas; secure boxes to interior wall and partition studs, accurately positioning to allow for surface finish thickness.
- M. Use stamped steel stud bridges for flush outlets in hollow stud wall, and adjustable steel channel fasteners for flush ceiling outlet boxes. Accurately position bridges to allow for surface finish thickness.
- N. Do not install flush mounted boxes back-to-back in walls; install with minimum 6 inches separation.
- O. Install with minimum 24 inches separation in fire rated walls. Limit penetrations in fire rated walls to 16 square inches each and a maximum total combined penetration area of 100 square inches in any given 100 square feet of wall. Where penetrations are in excess of these requirements, provide UL listed fire stop wrap acceptable to Authority having Jurisdiction.
- P. Do not fasten boxes to ceiling support wires or other piping systems.
- Q. Support boxes independently of conduit.
- R. Clean interior of boxes to remove dust, debris, and other material and clean exposed surfaces and restore finish.
- S. Provide blank covers or plates for all boxes that do not contain devices.
- T. Paint all exposed boxes in finished spaces to match surface to which it is attached to. Clean greasy or dirty boxes prior to painting in accordance with paint manufacturer's instructions.

# 3.05 INSTALLATION – SURFACE RACEWAY

- A. Install screws, clips, and straps to fasten raceway channel to surfaces; mount plumb and level. Install insulating bushings and inserts at connections to outlets and corner fittings. Provide divider to keep power and data pathways separate at all times. Bond each section together to provide electrically continuous system.
- B. Close ends and unused openings in wireway and surface raceway.
- C. Where wall surface is uneven, installer shall fur out wall section to match surface raceway dimensions and surface boxes dimensions as required. Furring shall be painted to match surface raceway.
- D. Install surface raceway cover with no gaps, scratches, or deformities. Covers not acceptable to Owner shall be replaced by the Contractor at no additional cost.
- E. Cuts: Perform all cuts with raceway base and cover shear specifically designed for installed raceway system.

## 3.06 INSTALLATION – WIREWAY

- A. Bolt wireway to steel channels fastened to the wall or ceiling or in self-supporting structure. Install level.
- B. Mount wireway per manufacturer's installation instructions.

## 3.07 INSTALLATION – BURIED CONDUITS

- A. Excavation and backfilling shall be in accordance with these specifications and the applicable portions of Division 31:
  - 1. Excavate and backfill as necessary for proper installation or work.
  - 2. Provide bracing and shoring as necessary or required.
  - 3. Compact backfill under footings, floor slabs and paving using materials and methods specified under Division 31, Earthwork.
  - 4. All conduits outside the building perimeter shall be buried a minimum of 24 inches below grade or as shown on Plans. Bottom of trench shall be smoothed and all rocks and cobbles 3 inches and larger shall be removed. Provide 3/4 inch minus material 6 inches above and below conduit. Backfill remaining trench with non-frost susceptible material free of debris or rocks greater than 1 inch in diameter. Provide detectable warning tape over raceways per Section 26 0553.
  - 5. Conduits shall be bedded in a minimum of 2 inches of sand and shall have a cover of 2 inches minimum of sand. Trench shall be backfilled with non-frost susceptible material and compacted.
  - 6. Conduits below slab on grade shall be installed in the top 6 inches of classified material.
  - 7. Damage to existing underground utilities shall be repaired immediately by the Contractor at no cost to the Owner.

#### 3.08 INSTALLATION – TELECOMMUNICATION RACEWAYS AND SLEEVES

- A. Provide continuous pathway system for all telecommunication cables. Provide cable pathway support in accordance with Section 26 0529.
- B. Provide separation clearances in accordance with Section 27 1000.
- C. Install the telecommunication pathways in accordance with requirements for Installation of General Conduit and General Boxes above unless superceded by more stringent requirements of this section or ANSI/TIA568-D and the latest published edition of the BICSI Telecommunication Distribution Methods Manual guidelines and recommendations.
- D. Provide pathways for all telecommunication cables with Surface Raceway, Conduit, Cable tray, J-hooks, and chases for the entire length of each cable. Provide pathway capacity throughout

entire system for each telecommunication outlet served sized to accommodate a minimum of four (or more where shown on the Plans) 4-pair 100-Ohm UTP cables from each outlet location to telecommunication room denoted on the plans.

- E. Conduit Pathways:
  - 1. Install pull boxes in continuous straight runs of conduit longer than 100 feet.
  - 2. Maximum allowable continuous conduit section length of 100 feet between pull boxes.
  - 3. Contain no more than two 90-degree bends or de-rate conduit capacity 15% for up to one additional 90-degree bend. Conduits less than 33 feet long, oversized one trade size or with one of the 90-degree bends within 12 inches of a pull box may have up to three 90 degree bends without de-rating.
  - 4. Rate each offset as a 90-degree bend.
  - 5. Bond each conduit to telecommunication ground system.
  - 6. Condulets (LB fittings) shall not be installed in any telecommunications raceway.
  - 7. Do not use flexible metal conduit unless specifically noted on the plans or approved by the engineer where it is the only practical alternative. Increase raceway one trade size above required size where flexible metal conduit is used.
  - 8. Terminate conduits routed to cable trays within 6 inches of tray. Provide conduit support to building structure within 24 inches of cable tray.
  - 9. Terminate conduits and chases that protrude through floor in telecommunication rooms to 3 inches above finished floor. Terminate conduits and chases that protrude through finished ceiling or above within 12 inches of ladder rack, distribution frame or cable organizer.
  - Provide bend radius of 6 times of the internal conduit diameter of conduits up to 2 inches;
    10 times of the internal conduit diameter of conduits above 2 inches and for all fiber optic raceways.
  - 11. Provide conduit pathways through walls with insulated bushings on each end for all wall penetrations of cables.

| Conduit<br>Trade | Conduit Maximum Cable Capacity Based on two 90 degree bends and < 100 ft |         |         |         |         |         |         |         |         |         |  |
|------------------|--------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--|
| size             | (Inches OD of Cable)                                                     |         |         |         |         |         |         |         |         |         |  |
|                  | (0.13")                                                                  | (0.18") | (0.22") | (0.24") | (0.29") | (0.31") | (0.37") | (0.53") | (0.62") | (0.70") |  |
| 0.75"            | 6                                                                        | 5       | 4       | 3       | 2       | 2       | 1       | 0       | 0       | 0       |  |
| 1"               | 8                                                                        | 8       | 7       | 6       | 3       | 3       | 2       | 1       | 0       | 0       |  |
| 1.25"            | 16                                                                       | 14      | 12      | 10      | 6       | 4       | 3       | 1       | 1       | 1       |  |
| 1.5"             | 20                                                                       | 18      | 16      | 15      | 7       | 6       | 4       | 2       | 1       | 1       |  |
| 2"               | 30                                                                       | 26      | 22      | 20      | 14      | 12      | 7       | 4       | 3       | 2       |  |
| 2.5"             | 45                                                                       | 40      | 36      | 30      | 17      | 14      | 12      | 6       | 3       | 3       |  |
| 3"               | 70                                                                       | 60      | 50      | 40      | 20      | 20      | 17      | 7       | 6       | 6       |  |
| 3.5"             |                                                                          |         |         |         |         |         | 22      | 12      | 7       | 6       |  |
| 4"               |                                                                          |         |         |         |         |         | 30      | 14      | 12      | 7       |  |

12. Size all conduits, sleeves and chases according to the following table:

F. Provide J-Hooks in accordance with Section 26 0529 to provide telecommunication pathway anywhere cable tray, conduit, or ladder rack is not denoted on the plans and one or more telecommunication cables are routed.

- G. Provide innerduct the entire length in conduits denoted to contain innerducts. Size innerducts to use entire available capacity of the outer conduit.
- H. Do not install innerduct and other cables in the same raceway.

# 3.09 INSTALLATION – TELECOMMUNICATION BOXES

- A. Boxes:
  - 1. All boxes shall be readily accessible.
  - 2. Do not use boxes for angle pulls or change pathway direction. Locate pull boxes in straight through sections of horizontal conduit pathways.
  - 3. Provide pull boxes for 3/4-inch and 1-inch through pull for horizontal UTP cabling. Provide all other boxes sized per the following table:

| Maximum Trade | Minimum | For each additional |       |                           |  |  |
|---------------|---------|---------------------|-------|---------------------------|--|--|
| Size Conduit  | Width   | Length (direction   | Depth | conduit increase<br>width |  |  |
|               |         | or conduit)         |       | in inches                 |  |  |
| 0.75"         | 4       | 12                  | 3     | 2                         |  |  |
| 1"            | 4       | 16                  | 3     | 2                         |  |  |
| 1.25"         | 6       | 20                  | 3     | 3                         |  |  |
| 1.5"          | 8       | 27                  | 4     | 4                         |  |  |
| 2"            | 8       | 36                  | 4     | 5                         |  |  |
| 2.5"          | 10      | 42                  | 5     | 6                         |  |  |
| 3"            | 12      | 48                  | 5     | 6                         |  |  |
| 3.5"          | 12      | 54                  | 6     | 6                         |  |  |
| 4"            | 15      | 60                  | 8     | 8                         |  |  |

#### SECTION 26 0548 VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

## PART 1 GENERAL

## 1.01 SECTION INCLUDES

A. This section includes requirements for vibration and seismic restraints for electrical equipment installed in seismic categories C, D, E or F.

## 1.02 RELATED SECTIONS

- A. The Work under this section is subject to requirements of the Contract Documents including the General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements, Section 26 0500 – Common Work Results for Electrical, Division 27 and Division 28.
- B. Section 26 0533 Raceway and Boxes for Electrical Systems.
- C. Section 26 0529 Hangers and Supports for Electrical Systems.
- D. Section 26 2200 Low Voltage Transformers.
- E. Section 26 2413 Switchboards.
- F. Section 26 3200 Packaged Generator Assemblies.
- G. Section 26 3353 Static Uninterruptible Power Supply.
- H. Section 26 3623 Automatic Transfer Switches
- I. Section 26 5000 Lighting.

#### 1.03 DESCRIPTION

- A. Provide seismic anchorage and restraint of electrical systems including, equipment, raceways, cable trays, lighting fixtures, etc.
- B. Seismic Category C:
  - 1. Only electrical items that are of Importance Factor (Ip) = 1.5 are required to be seismically braced. This applies to the following:
    - a. The component is required to function for life safety purposes after an earthquake, including fire protection systems, fire alarm systems, emergency lighting, etc.
    - b. The component contains hazardous materials.
    - c. The component is in or attached to an Occupancy Category IV structure (Hospitals, fire station, police station, emergency shelters, etc. per ASCE 7-16, Table 1.5-1) and it is needed for continued operation of the facility or its failure could impair the continued operation of the facility.
  - 2. All other electrical components shall be assigned a component importance factor Ip = 1.0 and are not required to be seismically braced.
- C. Seismic Category D, E and F:
  - 1. All electrical items that are of Importance Factor (Ip) = 1.5 are required to be seismically braced. This applies to the following:
    - a. The component is required to function for life safety purposes after an earthquake, including fire protection systems, fire alarm systems, emergency lighting, etc.
    - b. The component contains hazardous materials.
    - c. The component is in or attached to an Occupancy Category IV structure (Hospitals, fire station, police station, emergency shelters, etc. per ASCE 7-16, Table 1.5-1) and it is needed for continued operation of the facility or its failure could impair the continued operation of the facility.

- D. All other electrical equipment shall be assigned a component importance factor (Ip) = 1.0 and are required to be seismically braced <u>unless</u> one of the following conditions is satisfied:
  - 1. Component is MOUNTED (connection to structure) at less than 4' above the floor (to the center of gravity of the component), and weighs less than 400 lbs.
  - 2. Component is mounted higher than 4' (to the center of gravity of the component), but weighs less than 50 lbs (if it is concealed).
  - 3. Component is mounted higher than 4' (to the center of gravity of the component), but weighs less than 100 lbs (if it is exposed).
  - 4. Flexible connections between the components and associated conduit are provided.
  - 5. All runs or groupings of conduits on or off of trapezes shall be seismically braced, unless the distribution system (including conduit, wiring and fittings) weighs less than 5 pounds per linear foot.
  - 6. Lighting fixtures, lighted signs and ceiling fans that are not rigidly connected to ducts or piping, that are supported by chains or otherwise suspended from structure, are not required to be seismically braced, as long as:
    - a. The attachment points can carry at least 140% of the weight of the fixture, and
    - b. The swinging light will not create a falling debris problem by bumping into ceiling of other finishes, and
    - c. Connections to structure allow for movement of the fixture without damaging the connections.
- E. In accordance with ASCE 7-16 13.6.3, all electrical components with Ip = 1.5 shall also satisfy the following requirements:
  - 1. Provisions shall be made to eliminate seismic impact between components.
  - 2. Loads imposed on the components by attached utility or service lines that are attached to separate structures shall be evaluated.
  - 3. Batteries on racks shall have wrap-around restraints to ensure that the batteries will not fall from the rack. Spacers shall be used between restraints and cells to prevent damage to cases. Racks shall be evaluated for sufficient lateral load capacity.
  - 4. Internal coils of dry type transformers shall be positively attached to their supporting substructure within the transformer enclosure.
  - 5. Electrical control panels, computer equipment, and other items with slide-out components shall have a latching mechanism to hold the components in place.
  - 6. Electrical cabinet design shall comply with the applicable National Electrical Manufacturers Association (NEMA) standards. Cutouts in the lower shear panel that have not been made by the manufacturer and reduce significantly the strength of the cabinet shall be specifically evaluated.
  - 7. The attachments of additional external items weighing more than 100 lbs shall be specifically evaluated if not provided by the manufacturer.
  - 8. Where conduit, cable trays, or similar electrical distribution components are attached to structures that could displace relative to one another and for isolated structures where such components cross the isolation interface, the components shall be designed to accommodate the seismic relative displacements defined in ASCE 7-16 Section 13.3.2.
- F. Unless otherwise exempted above, electrical component supports and the means by which they are attached to the component shall be designed for the Seismic Category they are installed in accordance with ASCE 7-16 Section 13.6.4.

# 1.04 REFERENCE STANDARDS

- A. Seismic anchorage and restraints shall be designed and installed in accordance with codes and standards as enforced by authorities having jurisdiction in Alaska. Authorities shall include Owner's insurance company.
- B. Where applicable, building standards supersede those of other evaluation or listing agencies referenced in specification.
- C. International Building Code (IBC), Chapter 16 Structural Design.
- D. ASCE 7-16 Chapter 13 Minimum Design Loads and Associated Criteria for Buildings and Other Structures.

## 1.05 SUBMITTALS

- A. Provide structurally engineered shop drawings for seismic restraint of all electrical equipment required by the International Building Code (IBC), Chapters 16, 17. Structural design shall be based on the Seismic Use Category and Seismic Design Category as designated in these chapters.
- B. Provide complete calculations, drawings and details.
- C. Shop drawings shall be stamped by a professional engineer registered in the State of Alaska.
- D. Submittals shall be coordinated with building Structural engineer.
- E. Submit for approval, seismic restraint calculations, drawings and details to authorities having jurisdiction as required by those authorities.

## PART 2 PRODUCTS

# 2.01 MATERIALS

- A. Materials and devices shall be in accordance with applicable codes and standards and shall be appropriate for intended use.
- B. Anchors and attachments to building structure shall be as approved by building Structural engineer.
- C. Seismic restraints used in conjunction with vibration isolators may consist of loose cables, telescoping pipes or box sections, angles or sections, flat plates used as limit stops or snubbers, or other types of housing used either integral with or separate from vibration isolators to accomplish necessary seismic restraint.

# 2.02 EQUIPMENT

A. Equipment available with seismic rating shall be provided with rating applicable to seismic zone of project location.

#### PART 3 EXECUTION

#### 3.01 INSTALLATION

- A. Secure stationary equipment, raceways and equipment supports to structure, concrete bases, or special supports to provide protection against earthquakes and to restrain lateral or vertical movement. Where vibration isolators are used, seismic restraints shall be designed to limit lateral or vertical movement during earthquake without short-circuiting vibration isolation system.
- B. Coordinate seismic restraints with building Structural engineer and incorporate building Structural engineer's requirements.
- C. Seismic restraint methods and materials shall be supplementary to support devices specified in other sections of this specification and together shall serve as equipment support criteria.
- D. Installation of devices shall be in accordance with seismic Structural engineer's drawings and details and in accordance with seismic guidelines.
- E. Coordinate installation of devices with other trades and incorporate their requirements.

- F. Modify raceway and equipment locations as required for seismic restraint system.
- G. Seismic restraint systems shall not interfere with installation of other building systems or access.

# SECTION 26 0553 IDENTIFICATION FOR ELECTRICAL SYSTEMS

# PART 1 GENERAL

# 1.01 SECTION INCLUDES

- A. Nameplates
- B. Tape Labels.
- C. Wire and Cable Markers.
- D. Fire Alarm Conduit and Box Identification.
- E. Working Clearance Striping
- F. Underground Warning Tape.
- G. Power One-line Diagram and Panel Map.
- H. Low-voltage One-line Diagrams and System Maps.

# 1.02 RELATED SECTIONS

- A. The Work under this section is subject to requirements of the Contract Documents including the General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements, and Section 26 0500 Common Work Results for Electrical.
- B. Section 26 0519 Low-Voltage Electrical Power Conductors and Cables.
- C. Section 26 0533 Raceway and Boxes for Electrical Systems.
- D. Section 26 2416 Panelboards.
- E. Section 26 2726 Wiring Devices.
- F. Section 27 1000 Structured Cabling.
- G. Section 28 4600 Fire Detection and Alarm.

# 1.03 SUBMITTALS

- A. Division 01 and Section 26 0500 Common Work Results for Electrical.
- B. Product Data:
  - 1. Submit manufacturer's catalog literature for each product required.
  - 2. Submit electrical identification schedule including list of wording, symbols, letter size, color-coding, tag number, location, and function.

# 1.04 CLOSEOUT SUBMITTALS

A. Electrical One-Line Diagrams and Panel Maps: Provide electronically in PDF format, submitted with the O&M manuals.

# 1.05 ENVIRONMENTAL REQUIREMENTS

A. Install labels and nameplates only when ambient temperature and humidity conditions for adhesive are within range recommended by manufacturer.

# PART 2 PRODUCTS

# 2.01 NAMEPLATES

- A. Product Description: Laminated three-layer plastic with engraved white letters on black background. Nameplate for service disconnect shall be engraved white letters on red background.
- B. Letter Size:
  - 1. 1/4-inch high letters for identifying individual panel or equipment.
  - 2. 1/8-inch high letters for remaining lines with 1/8 inch spacing between lines.

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C. Minimum nameplate size: 1/8 inch thick with a consistent length and height for each type of nameplate wherever installed on the project.

## 2.02 TAPE LABELS

- A. Product Description: Adhesive tape labels, with 3/16 inch Bold Black letters on clear background made using Dymo Rhino series label printer or approved equal.
- B. Embossed adhesive tape will <u>not</u> be permitted for any application.

## 2.03 WIRE AND CABLE MARKERS

- A. Power and Lighting Description: Machine printed heat-shrink tubing, cloth or wrap-on type, for all neutrals and Phase conductors.
- B. Low Voltage System Description: Self-adhesive machine printed label with unique wire number that is shown on shop drawing for system.
- C. Telecommunications Cable Markers: Self-laminating vinyl with translucent band and minimum 1"W x .5"H printable area with matte white finish. Brady #B-427 series or approved equal.

# 2.04 FIRE ALARM CONDUIT AND BOX IDENTIFICATION

- A. Product Description: Red spray paint for fire alarm boxes.
- B. Fire alarm conduit shall have red finish, as specified in Section 26 0533.

## 2.05 WORKING CLEARANCE STRIPING

A. Product description: 2" wide epoxy yellow paint with 2 inch high block letters within the clearance area to read: "ELECTRICAL CLEARANCE – NO STORAGE WITHIN THIS ZONE".

#### 2.06 UNDERGROUND WARNING TAPE

- A. Product Description: Red, 6-inch wide, detectable.
- B. Wording to read "Caution Buried Electric Line Below".

#### 2.07 POWER DISTRIBUTION SYSTEM ONE-LINE DIAGRAM AND PANEL MAP

- A. Product Description: One-line diagram and building floor plan panel map. One-line diagram shall show the complete building power system. Panel map shall show the plan view location of all distribution panels and branch panelboards. Minimum size shall be 11"x17" but larger maps are recommended. All text shall be legible without magnification.
- B. Install one-line and panel map behind a Plexiglas cover screwed to wall on four corners, adjacent to each MDP.

## 2.08 LOW-VOLTAGE SYSTEMS ONE-LINE DIAGRAMS AND MAPS

A. Provide one-line diagrams and system maps for low-voltage and special systems, such as fire, security, telecommunications, intercom, etc. Requirements are specified in individual specification sections for each system.

## PART 3 EXECUTION

#### 3.01 GENERAL INSTALLATION

- A. Degrease and clean surfaces to receive nameplates and tape labels.
- B. Install nameplates and tape labels parallel to equipment lines.
- C. Underground Warning Tape Installation: Install underground warning tape along length of each underground conduit, raceway, or cable 6 to 8 inches below finished grade, directly above buried conduit, raceway, or cable.

#### 3.02 NAMEPLATE INSTALLATION

A. Secure nameplates to equipment fronts using machine screws tapped and threaded into panelboard, or using rivets. The use of adhesives is not acceptable. Machine screws to not protrude more than 1/16 inch on back side.

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- B. Service Disconnect Nameplate: Provide nameplate on exterior service disconnect that reads "SERVICE DISCONNECT".
- C. Distribution Panel Nameplates:
  - 1. Provide overall equipment identification.
    - a. Line 1: Distribution panel name.
    - b. Line 2: Source which panelboard is fed.
    - c. Line 3: Voltage, phase and wire configuration.
    - d. Line 4: AIC rating of the panel.
    - e. Line 5: Where applicable, indicate that panel is series-rated.
  - 2. Provide circuit breaker identification for each feeder breaker.
    - a. Line 1: Name of panelboard or equipment served.
    - b. Line 2: Location of served panelboard.
- D. Branch Panelboard Nameplates:
  - 1. Provide nameplate for each panelboard with the following information:
    - a. Line 1: Panelboard name.
    - b. Line 2: Source from which the panelboard is fed.
    - c. Line 3: Voltage, phase and wire configuration.
    - d. Line 4: AIC rating of the panelboard.
- E. Transformers:
  - 1. Provide nameplate for each transformer with the following information:
    - a. Line 1: Transformer name.
    - b. Line 2: Source from which the transformer is fed.
    - c. Line 3: Primary and secondary voltage, phase and wire configuration.
- F. Disconnects, Starters, or Contactors:
  - 1. Provide nameplate for each device with the following information:
    - a. Line 1: Load served.
    - b. Line 2: Panelboard and circuit number from which the device is fed.
    - c. Line 3: Fuse or Circuit amperage and poles. Where fused disconnect is installed, denote the maximum fuse size to be installed.
- G. Control or Low Voltage System Panels:
  - 1. Provide nameplate for each control panel with the following information:
    - a. Line 1: Unique panel name as shown on the shop drawings.
    - b. Line 2: System description such as Fire Alarm, Intercom, BAS, Security, etc.
    - c. Line 3: Panelboard and circuit number from which the panel is fed if applicable.

# 3.03 LABEL INSTALLATION

- A. Conduit Feeder Labels Provide conduit labels on all feeder raceways as follows:
  - 1. Distribution Panels "PANEL xxxx IN ROOM #xxx".
  - 2. Panelboards "PANEL xxxx FED FROM MDP xxx".
- B. Spare Raceways: Provide raceway label on each individual raceway denoting the source and termination point at each end.
- C. Fire Alarm Device Labels: As specified in Section 28 31 00.

D. Low-Voltage System Device Labels: Provide label on each device, denoting device ID or address where applicable. Affix label to device faceplate for ceiling-mounted devices or wall-mounted devices above 8'-0" AFF. Affix label inside backbox for exterior devices.

# 3.04 WIRE IDENTIFICATION

- A. Provide wire markers on each conductor in panelboard gutters, pull boxes, outlet and junction boxes, and at load connection. Identification shall be as follows:
  - 1. Markers shall be located within one inch of each cable end, except at panelboards, where markers for branch circuit conductors shall be visible without removing panel deadfront.
  - 2. Each wire and cable shall carry the same labeled designation over its entire run, regardless of intermediate terminations.
  - 3. Color code phases, neutral, and ground per NEC requirements and Section 26 05 19.
  - 4. Color-code all low-voltage system wires and cables in accordance with the individual sections in which they are specified.
  - 5. For power and lighting circuits, identify with branch circuit or feeder number.
  - 6. Control Circuits: Control wire number as indicated on schematic and shop drawings.
  - 7. Fire Alarm Circuits: Provide cable markers showing NAC or SLC loop identification number at all fire alarm junction boxes and pullboxes.
  - 8. Provide cable markers on each cable, indicating device designation (e.g. "Camera 27") for all security, intercom, door control, CCTV, MATV, and CATV systems. Cables shall be labeled at each end, as well as at any intermediate junction boxes or pullboxes.
- B. Provide pull string markers at each end of all pull strings. Marker shall identify the location of the opposite end of the pull string.

# 3.05 JUNCTION BOX IDENTIFICATION

- A. Fire Alarm: In accessible ceiling spaces, exposed ceiling spaces, mechanical/electrical rooms, and other non-public spaces, paint fire alarm junction boxes and pullboxes with red spray paint. In all finished spaces where fire alarm boxes are visible, they shall be painted to match the surrounding finish. If there are any questions as to whether fire alarm boxes shall be painted red in a specific area, the Contractor shall get clarification from the Owner prior to painting.
- B. Label each lighting and power junction box with the panelboard name and circuit number.
- C. Label all junction boxes for intercom, door control, CCTV, MATV, and CATV systems with the type of system cables contained in the box.
- D. For junction boxes above ceilings, mark the box cover with the circuit or system designation using permanent black marker. For junction boxes in finished areas, mark the inside of the cover with the circuit or system designation using permanent black marker.

## 3.06 DEVICE PLATE IDENTIFICATION

- A. Label each receptacle device plate or point of connection denoting the panelboard name and circuit number.
- B. Install adhesive label on the top of each plate.

# 3.07 PANELBOARD IDENTIFICATION

- A. Provide panelboard circuit directories in accordance with Section 26 2416.
- B. Install one-line and panel map adjacent to each MDP.

# 3.08 LOW-VOLTAGE SYSTEM IDENTIFICATION

A. Install all labeling in accordance with the requirements of this section and of each section where the individual systems are specified.

# 3.09 WORKING CLEARANCE STRIPING

- A. Working clearance striping paint shall be applied in front of panels located in mechanical rooms, electrical rooms, storage rooms, and other non-public areas with exposed concrete floors.
- B. Striping paint shall not be applied in front of panels located in corridors and other public spaces, or spaces with finished floor surfaces (e.g., carpet, tile, vinyl, etc.).

# SECTION 26 0580 HEATING CABLES

# PART 1 GENERAL

## 1.01 SECTION INCLUDES

- A. Self-regulating heating cables (outside pipe).
- B. Self-regulating roof and gutter de-icing cables (inside pipe).
- C. Controls.

## 1.02 RELATED SECTIONS

- A. The Work under this section is subject to requirements of the Contract Documents including the General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements and Section 26 0500 Common Work Results for Electrical.
- B. Division 02 Water and Sewer Piping.
- C. Section 07 7123 Manufactured Gutters and Downspouts.
- D. Divisions 21, 22 and 23.
- E. Section 26 0519 Low-Voltage Electrical Power Conductors and Cables.
- F. Section 26 0533 Raceway and Boxes for Electrical Systems.
- G. Section 26 0553 Identification for Electrical Systems: Nameplates for Heat Trace Controls.
- H. Section 26 0919 Enclosed Contactors: Multi-pole Contactor Control.
- I. Section 26 2726 Wiring Devices: Pilot Light Controls.

## 1.03 SUBMITTALS

- A. Product Data: Provide data for heating cable, terminations, and control components.
- B. Shop Drawings: Indicate heating cable layout, locations of terminations, thermostats, and branch circuit connections.

#### 1.04 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Manuals: Include description of operating controls.
- B. Maintenance Data: Include repair methods, parts list of components, and instructions for testing the insulation resistance.

#### 1.05 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum three years' experience.

#### 1.06 COORDINATION

- A. Coordinate Work under provisions of Division 01.
- B. Coordinate installation of heating cable with installation of roof drain downspout and outfall piping, as well as plumbing VTR penetrations and overflow/roof drains.

#### 1.07 WARRANTY

A. The heat tracing cable shall be warranted against manufacturing defects for 10 years from date of shipment.

# PART 2 PRODUCTS

# 2.01 ACCEPTABLE MANUFACTURERS- SELF REGULATING HEATING CABLE (OUTSIDE PIPE)

- A. Raychem (Pentair).
- B. Thermon.
- C. Chromalox.

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- D. Nelson (Emerson).
- E. Substitutions: Under provisions of Division 01.

## 2.02 SELF-REGULATING HEATING CABLE (OUTSIDE PIPE)

- A. Heating cables installed on outside process piping shall be the self-regulating type, capable of maintaining process temperatures up to 150° F. Typical examples of this type of application would be as follows:
  - 1. Freeze protection for water and sewer piping installed outside the building envelope, installed inside an arctic piping channel.
  - 2. Freeze protection for a vent-through-roof piping installation, where the heating cables are wrapped around the piping.
  - 3. Freeze protection for tank or vessel, where the heating cables are wrapped around the envelope.
- B. The heating cable shall consist of two 16-gauge tin-coated-copper bus wires embedded in parallel in a self-regulating polymer core. Power output shall vary in response to temperature all along its length, allowing the heating cable to be crossed over itself without overheating, to be cut to length in the field. The heating cable shall be covered by a crosslinked dielectric jacket and protected by a tinned-copper braid and a modified polyolefin or fluoropolymer outer jacket.
- C. Self-regulating heating cable be manufactured and tested for a design life of 20 years based on accelerated aging techniques specified in IEEE Standards 1, 98, & 99 and UL Standard 746B.
- D. The heating cable shall be of parallel circuit construction to allow the cable to be spliced if it is inadvertently cut during or after construction, and to be powered from both ends if it becomes advantageous to divide a circuit in two.
- E. The heating cable shall operate on 120 or 277 volts without the use of transformers.
- F. Heating cables installed outside process piping shall have a nominal power output of 5W/ft (watts per foot) at the operating voltage.
- G. The heating cable power connection and end seal terminations shall be made in an above grade in an accessible NEMA 4X junction box.
- H. Accessories shall be listed for use with the heating cable, as recommended by the manufacturer:
  - 1. Power Connection Kit: Nema 4X rated with LED indicator light.
  - 2. End Seal Kit: NEMA 4X rated, above-insulation end seal, cold-applied.
  - 3. Splice or Tee Connection Kit: Cold-applied, low-profile re-enterable slice for in-line connection.

# 2.03 ACCEPTABLE MANUFACTURERS – SELF REGULATING ROOF AND GUTTER DE-ICING CABLE (INSIDE PIPE)

- A. Raychem (Pentair).
- B. Thermon.
- C. Chromalox.
- D. Nelson (Emerson).
- E. Substitutions: Under the provisions of Division 01.

# 2.04 SELF-REGULATING ROOF AND GUTTER DE-ICING CABLE (INSIDE PIPE)

A. Heating cables installed inside roof drains, gutters, or downspout piping shall be the self-regulating type, listed for use as snow and ice de-icing cables. Typical examples of this type of application would be as follows:

- 1. Freeze protection for roof drains and roof overflow drains, where the heating cables are physically installed inside the drain and/or drain piping.
- 2. Freeze protection for downspout gutters, where the heating cables are physically installed inside the drain piping.
- 3. Freeze protection for roof gutters, where the heating cables are physically located inside the gutter.
- B. The heating cable shall consist of two 16-gauge tin-coated-copper bus wires embedded in parallel in a self-regulating polymer core. Power output shall vary in response to temperature all along its length, allowing the heating cable to be crossed over itself without overheating, to be cut to length in the field. The heating cable shall be covered by a crosslinked dielectric jacket and protected by a tinned-copper braid and a modified polyolefin or fluoropolymer outer jacket.
- C. Self-regulating heating cable be manufactured and tested for a design life of 20 years based on accelerated aging techniques specified in IEEE Standards 1, 98, & 99 and UL Standard 746B.
- D. The heating cable shall be of parallel circuit construction to allow the cable to be spliced if it is inadvertently cut during or after construction, and to be powered from both ends if it becomes advantageous to divide a circuit in two.
- E. The heating cable shall operate on 120 or 277 volts without the use of transformers.
- F. Heating cables installed inside roof drains shall have a minimum nominal power output of 12W/ft at the operating voltage.
- G. The heating cable power connection and end seal terminations shall be made in an above grade in an accessible NEMA 4X junction box.
- H. Accessories shall be listed for use with the heating cable, as recommended by the manufacturer:
  - 1. Power Connection Kit: Nema 4X rated or NEMA 1 rated if installed indoors.
  - 2. End Seal Kit: NEMA 4X rated, above-insulation end seal, cold-applied.
  - 3. Splice or Tee Connection Kit: Cold-applied, low-profile re-enterable slice for in-line connection.

# 2.05 CONTROLS

- A. Each heating cable circuit shall be protected by a 30-mA ground-fault protection device and be provided with a disconnecting means capable of being locked in the open position.
- B. Multi-pole lighting contactor as specified in Section 26 0919 Enclosed Contactors.
- C. Lockable pilot light switch as specified in Section 26 2726 Wiring Devices.

# PART 3 EXECUTION

# 3.01 EXAMINATION

- A. Verify that piping is ready to receive work.
- B. Verify field measurements are as shown on shop drawings.
- C. Verify that required utilities are available, in proper location, and ready for use.
- D. Beginning of installation means installer accepts conditions.

#### 3.02 INSTALLATION

- A. Install the self-regulating piping heating cables in the channels inside the water and sewer arctic piping.
- B. Where heating cables are physically attached to piping, secure cables using adhesive backed glass fiber tape at 1-foot intervals.
- C. All power termination junctions shall be installed so they are accessible.

- D. Install the roof and overflow drain de-icing cables looped inside the drain and drain piping with the power termination kit located inside the building in an accessible location.
- E. The heating cable shall be installed according to the manufacturer's recommendations, the instructions supplied with the heating cable and components.
- F. Heating-cable repairs and splices shall be made using a splice kit provided by the manufacturer and specifically approved for the purposes. They shall pass the Megger test after installation.
- G. Install caution signs or markings on maximum 20ft centers along the pipeline or vessel that is heat traced and on or adjacent to equipment in the piping system that requires periodic servicing.
- H. Do not exceed the maximum length allowable by the heat trace manufacturer for the circuit breaker installed.
- I. Clearly label any device controlling heat trace circuits with permanent markings per Section 26 0553 Identification for Electrical Systems.
- J. Mount thermostatic switch outdoors in accordance with the manufacturer's installation instructions in an accessible location not subject to damage or influence from heating vents, etc.

# 3.03 FIELD QUALITY CONTROL

- A. Upon completion of thermal insulation installation the heater cable shall be meggered to verify no damage has occurred. Tests should use at least a 500 VDC megger. Do not use a megger with an excess of 2500 VDC. Minimum acceptable readings should be 20 megohms per circuit, regardless of length. Field megger tests shall be recorded for each heater cable, and certified reports shall be submitted to the Owner.
- B. Each circuit shall be energized and voltage and current measured and documented to verify the installation is properly functioning.
- C. Temperature controls shall be operated to verify they are functioning within the manufacturer's specifications. Initially set to turn heat trace ON when the outdoor temperature falls below 40 degrees F.

## 3.04 DEMONSTRATION

A. Demonstrate operation of heating cable controls.

## SECTION 26 0583 WIRING CONNECTIONS

# PART 1 GENERAL

# 1.01 SECTION INCLUDES

A. Electrical connections to equipment specified under other Sections.

## 1.02 RELATED SECTIONS

- A. Division 01 Administrative Requirements; Summary: Owner-furnished equipment.
- B. Division 08 Overhead Coiling Doors, Overhead Sectional Doors, Automatic Entrances, Revolving Door Entrances, Door Hardware.
- C. Division 10 Visual Display Surfaces, Operable Accordion Partitions, Flagpoles.
- D. Division 11 Loading Dock Equipment, Residential Appliances, Food Services Equipment, Projection Screens, Laboratory Equipment, Basketball Backstops, Waste Compactors and Destructors.
- E. Division 12 Window Treatments, Horizontal Louver Blinds, Drapery and Track Accessories.
- F. Division 13 Swimming Pools, Hot Tubs, Cold Storage Rooms, Saunas, Steam Baths.
- G. Division 14 Electric Elevators, Hydraulic Elevators, Escalators, Wheel Chair Lifts.
- H. Division 21 Fire Suppression Systems.
- I. Division 22 Plumbing Equipment.
- J. Division 23 HVAC Equipment.
- K. Section 26 0519 Low-Voltage Electrical Power Conductors and Cables.
- L. Section 26 0533 Raceway and Boxes for Electrical Systems.
- M. Section 26 2816 Enclosed Switches and Circuit Breakers.
- N. Section 26 2913 Enclosed Controllers.

#### 1.03 REFERENCES

- A. FS W-C-596 Electrical Power Connector, Plug, Receptacle, and Cable Outlet.
- B. National Electrical Manufacturers Association:
  - 1. NEMA WD 1 General Purpose Wiring Devices.
  - 2. NEMA WD 5 Specific-Purpose Wiring Devices.

## 1.04 SUBMITTALS

- A. Submit data under provisions of Division 01 and Section 26 0500.
- B. Product Data: Submit wiring device manufacturer's catalog information showing dimensions, configurations, and construction.

# 1.05 COORDINATION

- A. Division 01 Administrative Requirements: Coordination and project conditions.
- B. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.
- C. Determine connection locations and requirements.
- D. Sequence rough-in of electrical connections to coordinate with installation of equipment.
- E. Sequence electrical connections to coordinate with start-up of equipment.

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# PART 2 PRODUCTS

#### 2.01 CORDS AND CAPS

- A. Straight-blade Attachment Plug: NEMA WD 1.
- B. Locking-blade Attachment Plug: NEMA WD 5.
- C. Attachment Plug Configuration: Match receptacle configuration at outlet provided for equipment.
- D. Cord Construction: Oil-resistant thermoset insulated Type SO multiconductor flexible cord with identified equipment grounding conductor, suitable for extra hard usage in damp locations.
- E. Cord Size: Suitable for connected load of equipment and rating of branch circuit overcurrent protection.

#### PART 3 EXECUTION

#### 3.01 INSPECTION

A. Verify that equipment is ready for electrical connection, wiring, and energization.

#### 3.02 PREPARATION

A. Review equipment submittals prior to installation and electrical rough-in. Verify location, size, and type of connections. Coordinate details of equipment connections with supplier and installer.

#### 3.03 INSTALLATION

- A. Use wire and cable with insulation suitable for temperatures encountered in heat-producing equipment.
- B. Make conduit connections to equipment that is subject to vibration or movement using flexible conduit. Use Liquidtight flexible conduit in damp or wet locations.
- C. Install pre-finished cord set where connection with attachment plug is indicated or specified by the equipment manufacturer's installation instructions, or use attachment plug with suitable strain-relief clamps.
- D. Provide suitable strain-relief clamps for cord connections to outlet boxes and equipment connection boxes.
- E. Make wiring connections in control panel or in wiring compartment of pre-wired equipment in accordance with manufacturer's instructions. Provide interconnecting wiring where required.
- F. Install disconnect switches, controllers, control stations, and control devices such as limit switches and temperature switches and connect with conduit and wiring as indicated in the equipment manufacturer's installation instructions.
- G. Where reconnecting existing equipment, extend connections using materials and methods compatible with existing electrical installations.

#### 3.04 ADJUSTING

A. Cooperate with utilization equipment installers and field service personnel during checkout and starting of equipment to allow testing and balancing and other startup operations. Provide personnel to operate electrical system and checkout wiring connection components and configurations.

# SECTION 26 0800 COMMISSIONING OF ELECTRICAL SYSTEMS

# PART 1 GENERAL

# 1.01 SUMMARY

- A. Section includes Cx process requirements for the following electrical components, systems, assemblies, and equipment:
  - 1. Electrical equipment connected to Normal power systems, including the following:
    - a. Motor-control centers.
    - b. Transformers.
    - c. Primary and secondary service electrical systems.
    - d. Distribution and branch-circuit panelboards.
    - e. Lightning protection systems.
    - f. Grounding systems.
  - 2. Electrical equipment connected to Essential power systems that provide an alternative source of power in the absence of power from the Normal power system.
    - a. Motor-control centers.
    - b. Primary and secondary service electrical systems.
    - c. Distribution and branch-circuit panelboards.
    - d. Lighting protection systems.
    - e. Grounding systems.
    - f. Generators.
    - g. UPS.
  - 3. Controls and instrumentation.
    - a. Equipment monitoring systems.
    - b. Energy monitoring and control systems.
    - c. Electrical metering and metering system.
    - d. Demand response systems.
    - e. Lighting control systems.
    - f. Security systems.
    - g. Fire-alarm systems.
    - h. Security systems.
    - i. Communications.
    - j. <Insert systems>.
  - 4. Systems testing and verification, including [Normal] [and] [Essential] power systems[, and transitions from Normal to Essential power systems and back].
  - 5. <Insert electrical systems>.
- B. Related Requirements:
  - 1. Section <u>01 9113 General Commissioning Requirements</u> for general Cx process requirements and CxA responsibilities.

#### 1.02 DEFINITIONS

- A. BoD: Basis-of-Design Document, as defined in Section <u>01 9113 General Commissioning</u> <u>Requirements</u>.
- B. Cx: Commissioning, as defined in Section 01 9113 General Commissioning Requirements.
- C. CxA: Commissioning Authority, as defined in Section <u>01 9113 General Commissioning</u> <u>Requirements</u>.
- D. Essential Power Systems: A power system that a facility transitions to in the absence of Normal power. This power includes all systems classified as "standby" or "emergency," including "legally required."
- E. Low Voltage: 600 V and below.

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- F. Medium Voltage: 601 V and above.
- G. Normal Power Systems: A power system that provides primary power to a facility.
- H. OPR: Owner's Project Requirements, as defined in Section <u>01 9113 General Commissioning</u> <u>Requirements</u>.
- I. "Systems," "Assemblies," "Subsystems," "Equipment," and "Components": Where these terms are used together or separately, they shall mean "as-built" systems, assemblies, subsystems, equipment, and components.

## **1.03 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For [BAS] [and] [electrical] testing technician.
- B. Prefunctional checklists: Draft prefunctional checklists will be created by CxA for Contractor review.

#### 1.04 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For electrical systems and components to include in operation and maintenance manuals.

## 1.05 QUALITY ASSURANCE

- A. Electrical Testing Technician Qualifications: Technicians to perform electrical prefunctional checklist verification tests, prefunctional checklist verification test demonstrations, Cx tests, and Cx test demonstrations shall have the following minimum qualifications:
  - 1. Journey level or equivalent skill level. Vocational school four-year-program graduate or an Associate's degree in electrical systems, or similar field.
  - 2. Minimum [three years'] <Insert time> experience installing, servicing, and operating systems manufactured by approved manufacturer.
- B. Testing Equipment and Instrumentation Quality and Calibration: For test equipment and instrumentation required to perform electrical Cx work, perform the following:
  - 1. Submit test equipment and instrumentation list. For each equipment or instrument, identify the following:
    - a. Equipment/instrument identification number.
    - b. Planned Cx application or use.
    - c. Manufacturer, make, model, and serial number.
    - d. Calibration history, including certificates from agencies that calibrate the equipment and instrumentation.
  - 2. Test equipment and instrumentation shall meet the following criteria:
    - a. Capable of testing and measuring performance within the specified acceptance criteria.
    - b. Be calibrated at manufacturer's recommended intervals with current calibration tags permanently affixed to the instrument being used.
    - c. Be maintained in good repair and operating condition throughout duration of use on Project.
    - d. Be recalibrated/repaired if dropped or damaged in any way since last calibrated.
- C. Proprietary Test Instrumentation and Tools:
  - 1. Equipment Manufacturer's Proprietary Instrumentation and Tools: For installed equipment included in the Cx process, test instrumentation and tools manufactured or prescribed by equipment manufacturer to service, calibrate, adjust, repair, or otherwise work on its equipment or required as a condition of equipment warranty, perform the following:
    - a. Submit proprietary instrumentation and tools list. For each instrument or tool, identify the following:
      - 1) Instrument or tool identification number.
      - 2) Equipment schedule designation of equipment for which the instrument or tool is required.
      - 3) Manufacturer, make, model, and serial number.

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  - 4) Calibration history, including certificates from agencies that calibrate the instrument or tool, where appropriate.
  - b. Include a separate list of proprietary test instrumentation and tools in operation and maintenance manuals.
  - c. Electrical proprietary test instrumentation and tools become property of Owner at the time of Substantial Completion.

# PART 2 PRODUCTS (Not Used)

## PART 3 EXECUTION

## 3.01 CONSTRUCTION CHECKLIST REVIEW

- A. Review and provide written comments on draft prefunctional checklists. CxA will create required draft prefunctional checklists and provide them to Contractor.
- B. Return draft prefunctional checklist review comments within [10] < Insert number> days of receipt.
- C. When review comments have been resolved, CxA will provide final prefunctional checklists, marked "Approved for Use, (date)."
- D. Use only prefunctional checklists, marked "Approved for Use, (date)."

## 3.02 GENERAL TESTING REQUIREMENTS

- A. Certify that electrical systems, subsystems, and equipment have been installed, calibrated, and started and that they are operating according to the Contract Documents and approved Shop Drawings and submittals.
- B. Certify that electrical instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents and approved Shop Drawings and submittals, and that pretest set points have been recorded.
- C. Set systems, subsystems, and equipment into operating mode to be tested according to approved test procedures (for example, normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).
- D. Measure capacities and effectiveness of systems, assemblies, subsystems, equipment, and components, including operational and control functions to verify compliance with acceptance criteria.
- E. Test systems, assemblies, subsystems, equipment, and components operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and response according to acceptance criteria.
- F. Prefunctional checklists: Prepare and submit detailed prefunctional checklists for electrical systems, subsystems, equipment, and components.
- G. Perform tests using design conditions, whenever possible.
- H. If tests cannot be completed because of a deficiency outside the scope of the electrical system, document the deficiency and report it to Owner. After deficiencies are resolved, reschedule tests.
- I. If seasonal testing is specified, complete appropriate initial performance tests and documentation and schedule seasonal tests.
- J. Coordinate schedule with, and perform Cx activities at the direction of the CxA.
- K. Comply with prefunctional checklist requirements, including material verification, installation checks, startup, and performance tests requirements specified in Sections specifying electrical systems and equipment.
- L. Provide technicians, instrumentation, tools, and equipment to complete and document the following:
  - 1. Performance tests.
  - 2. Demonstration of a sample of performance tests.
  - 3. Cx tests.
  - 4. Cx test demonstrations.

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# 3.03 Cx TESTS FOR ELECTRICAL SYSTEMS

- A. Verification of Normal Power System Operation:
  - 1. Prerequisites: Acceptance of results for prefunctional checklists for Division 26 electrical components associated with Normal power system.
  - 2. Equipment and Systems to Be Tested: Division 26 electrical equipment.
  - 3. Test Purpose: Verify operation of Normal power system.
  - 4. Test Conditions: Energize components of Normal power system, one at a time.
  - 5. Acceptance Criteria: Proper operation of Normal power system over a [24] [48] < Insert number>-hour period.
- B. Verification of Essential Power System Operation:
  - 1. Prerequisites:
    - a. Acceptance of results for prefunctional checklists for Division 26 electrical components associated with Essential power system.
    - b. Completion of "Verification of Normal Power System Operation" tests.
  - 2. Equipment and Systems to Be Tested: Division 26 electrical equipment.
  - 3. Test Purpose: Verify operation of Essential power system.
  - 4. Test Conditions:
    - a. Energize components of Normal power system.
    - b. Simulate a failure of Normal power system.
  - 5. Acceptance Criteria: Transfer of power from Normal to Essential power system within OPR.
- C. Verification of Control and Instrumentation:
  - 1. Prerequisites: Acceptance of results for prefunctional checklists.
- D. Test Purpose: Verify operation of control and monitoring systems for Normal and Essential power systems.
- E. Test Conditions:
  - 1. Energize components of Normal power system.
  - 2. Test operation of equipment.
- F. Acceptance Criteria: Operation of equipment according to OPR.

# SECTION 26 0919 ENCLOSED CONTACTORS

# PART 1 GENERAL

## 1.01 SECTION INCLUDES

A. Enclosed Contactors.

# 1.02 RELATED SECTIONS

- A. The Work under this section is subject to requirements of the Contract Documents including the General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements and Section 26 0500 Common Work Results for Electrical.
- B. Section 26 0526 Grounding and Bonding for Electrical Systems.
- C. Section 26 0548 Vibration and Seismic Controls for Electrical Systems.
- D. Section 26 0553 Identification for Electrical Systems.
- E. Section 26 0580 Heating Cables: Thermostatic Switch Control for Heat Trace Circuits.
- F. Section 26 0923 Lighting Control Devices: Photocell or Timer Control for Lighting Circuits.

## **1.03 REFERENCES STANDARDS**

- A. ANSI/NEMA ICS 6 Enclosures for Industrial Controls and Systems.
- B. NEMA ICS 2 Industrial Control Devices, Controllers, and Assemblies.

## 1.04 SUBMITTALS

- A. Product Data: Submit product data for all components provided, showing electrical characteristics and connection requirements. Each catalog sheet should be clearly marked exact part number provided.
- B. Shop Drawings: Submit shop drawings include outline drawings with dimensions, and equipment ratings for voltage, capacity, and poles.

## 1.05 CLOSEOUT SUBMITTALS

- A. Project Record Drawings: Accurately indicate actual locations of each contactor and indicate circuits controlled.
- B. Operation and Maintenance Manuals: Submit instructions for replacing and maintaining coil and contacts.

#### 1.06 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience and ISO 9000 certified.
- B. Installer: Company specializing in installing products specified in this section with minimum three years' experience.

# PART 2 PRODUCTS

# 2.01 MANUFACTURERS – ENCLOSED CONTACTORS

- A. Schneider/Square D.
- B. Eaton.
- C. ASCO.
- D. Substitutions: Under provisions of Division 01.

#### 2.02 ENCLOSED CONTACTORS

- A. Contactors: NEMA ICS 2; mechanically held, 2 wire control.
- B. Coil Operating Voltage: 120 or 277 Volts, 60 Hertz.

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- C. Multipole Lighting Contactor: NEMA ICS 2; 30A, #poles as indicated on Drawings with coil clearing contacts, Hand-Off-Auto switch and red pilot light. Provide lockable HOA switch where controlling heat trace circuits.
- D. Enclosure: ANSI/NEMA ICS 6; Type 1.
- E. Provide solderless pressure wire terminals.

# PART 3 EXECUTION

# 3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Require marking of terminals and wires landing on terminals.
- C. Locate electrically held contactors where the eventual vibration and noise they will produce will not be objectionable to building occupants.

# 3.02 FIELD QUALITY CONTROL

- A. Verify wiring connections are tight.
- B. Verify movable contact assemblies are not binding and are free to move.
- C. Verify coil voltage is correct.
- D. With load connected energize and observe load current for each circuit installed.

# SECTION 26 0923 LIGHTING CONTROL DEVICES

# PART 1 GENERAL

# 1.01 SECTION INCLUDES

- A. This Section includes stand-alone (non-networked) automatic lighting control devices.
  - 1. Occupancy sensors.
  - 2. Occupancy sensor wall switches.
  - 3. Power Packs and Supplies.
  - 4. Outdoor Photocells.

# 1.02 RELATED SECTIONS

- A. Section 23 0923 Direct-Digital Control System for HVAC.
- B. Section 23 0993 Sequence of Operation for HVAC Controls.
- C. Section 26 0500 Common Work Results for Electrical.
- D. Section 26 0519 Low-Voltage Electrical Power Conductors and Cables.
- E. Section 26 0533 Raceway and Boxes for Electrical Systems.
- F. Section 26 0800 Commissioning of Electrical Systems.
- G. Section 26 0919 Enclosed Contactors.
- H. Section 26 0943 Network Lighting Controls: Networked Occupancy Sensors.
- I. Section 26 2726 Wiring Devices: Manual Light Switches.
- J. Section 26 5000 Lighting.

# 1.03 SUBMITTALS

- A. Product Data: Submit product data for all components provided that are specified in this section showing configurations, finishes, and dimensions. Each catalog sheet should be clearly marked to indicate exact part number provided, including all options and accessories.
- B. Fixture Compatibility: Submitted occupancy sensors shall have wattage ratings to match the circuits on which they are connected and shall be compatible with submitted lamps and ballasts/drivers in the fixtures which they will control.
- C. Submit scaled shop drawings of the occupancy sensor layout, showing coverage areas and any overlap areas. Shop drawings shall be prepared by occupancy sensor manufacturer. The sensors on the Contract Drawings are shown in suggested locations. The final quantity, locations, coverage areas, and aiming directions of all sensors shall be determined by the sensor manufacturer and shown on the shop drawings. Final sensor layout in the rooms shall be coordinated with air diffuser locations to avoid false ON signals. Sensor layout shall also be coordinated with furniture and equipment locations to avoid false OFF signals, due to obstruction of sensors. This coordination is the responsibility of the Contractor.
- D. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals. Include manufacturer's installation and troubleshooting instructions.

# 1.04 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Manuals: Submit manufacturer's instructions for occupancy sensor maintenance and adjustment.

#### 1.05 COORDINATION

A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression system, and partition assemblies.

# 1.06 COMMISSIONING

A. Fully commission all systems, subsystems and equipment provided by this section in accordance with 26 0800 - Electrical Commissioning

# PART 2 PRODUCTS

## 2.01 ACCEPTABLE MANUFACTURERS – OCCUPANCY SENSORS

- A. Wattstopper.
- B. Sensor Switch.
- C. Hubbell.
- D. Leviton.
- E. Substitutions: Under provisions of Division 01.

## 2.02 OCCUPANCY SENSORS

- A. Ceiling-Mounted Dual-Tech Occupancy Sensor: Dual-technology PIR and ultrasonic or microphonic sensor with white housing, self-adjusting settings, automatic dual-mode operation, built-in circadian calendar for testing, red/green LEDs for indication of PIR/ultrasonic or microphonic activity, and non-volatile memory to retain automatic and manual settings during power outages. Provide specific coverage area and either 180° or 360° coverage patterns, as required in the space to prevent unintentional tripping in adjacent spaces. Sensor shall have selectable timer settings. Sensor shall retain all manually adjusted or "learned" settings in event of a power outage.
- B. Ceiling-Mounted Ultrasonic or Microphonic Occupancy Sensor: Ultrasonic or microphonic sensor with white housing, self-adjusting settings, built-in circadian calendar for testing, green LED for indication of ultrasonic or microphonic activity, and non-volatile memory to retain automatic and manual settings during power outages. Provide specific coverage area as required in the space to prevent unintentional tripping in adjacent spaces. Sensor shall have four selectable timer settings. Sensor shall retain all manually adjusted or "learned" settings in event of a power outage. Device color shall match wall switches.
- C. Ceiling-Mounted High-Bay PIR Occupancy Sensor: Passive infrared sensor with white housing, variable coverage area, multiple interchangeable lenses, white housing, self-adjusting settings, built-in circadian calendar for testing, red LED for indication of PIR motion, and non-volatile memory to retain automatic and manual settings during power outages. Provide specific coverage area and either 180° or 360° coverage patterns, as required in the space to prevent unintentional tripping in adjacent spaces. Sensor shall have selectable timer settings. Sensor shall retain all manually adjusted or "learned" settings in event of a power outage. Contractor shall coordinate with manufacturer to determine lens selection and orientation.
- D. Wall-Mounted Dual-Technology Occupancy Sensor: Multi-technology PIR and ultrasonic or microphonic sensor with 1600 sq. ft. coverage area, white housing, self-adjusting settings, automatic dual-mode operation, built-in circadian calendar for testing, red/green LEDs for indication of PIR/ultrasonic or microphonic activity, and non-volatile memory to retain automatic and manual settings during power outages. Provide specific coverage area and either 180° or 360° coverage patterns, as required in the space to prevent unintentional tripping in adjacent spaces. Sensor shall have four selectable timer settings between 30 seconds and 20 minutes. Sensor shall retain all manually adjusted or "learned" settings in event of a power outage.
- E. Wall-Mounted PIR Occupancy Sensor: Passive infrared sensor with white housing, 1600 sq. ft. wide angle coverage area, self-adjusting settings, built-in circadian calendar for testing, red LED for indication of PIR motion, and non-volatile memory to retain automatic and manual settings during power outages. Sensor shall have four selectable timer settings between 30 seconds and 20 minutes. Sensor shall retain all manually adjusted or "learned" settings in event of a power outage.

- F. Single-Relay, Dual-Tech Occupancy Sensor Wall Switch: Decora style, dual-technology, PIR and ultrasonic or microphonic sensor with self-adjusting delayed-OFF time interval, self-adjusting ambient light override, 180° adjustable field of view, manual ON/OFF pushbutton, LED indicator light to verify that detection is active, and non-volatile memory to retain automatic and manual settings during power outages. Sensor shall have selectable timer settings. Device color shall match other switches.
- G. Dual-Relay, Dual-Tech Occupancy Sensor Wall Switch: Decora style dual-technology, PIR and ultrasonic or microphonic sensor suitable for switching two separate banks of lights from a single unit. Sensor shall have self-adjusting delayed-OFF time interval, self-adjusting ambient light override, 180° adjustable field of view, two manual ON/OFF pushbuttons, LED indicator light to verify that detection is active, and non-volatile memory to retain automatic and manual settings during power outages. Sensor shall have selectable timer settings. Device color shall match other switches.
- H. Combination Wall Dimmer/Occupancy Sensor Switch for 0-10V LED Circuits: Decora-style, commercial grade preset wall dimmer switch/PIR occupancy sensor, 0-10V control for 0-10V fluorescent ballasts/LED drivers (50 mA max control current); no power pack required to switch line voltage load (8 A, 120-277 V); adjustable high-end and low-end trim. PIR occupancy sensor with adjustable time, mode and sensitivity settings with no dip switches. Color: White. Handle: Paddle switch for on/off operation with small, discrete, captive linear slide for dimmer adjustment. Provide single pole unless otherwise indicated on Plans. Dimmer shall be fully compatible with all loads connected for smooth operation in accordance with the manufacturer's recommendations. Lutron #Maestro or approved equal.
- I. Sensor Masking: Infrared and dual-technology sensors shall include masking segments for adjusting the coverage of the infrared sensor to avoid false-tripping. If masking is not included with sensor, it shall be provided by Contractor at no additional cost to the Owner.

# 2.03 POWER (RELAY) PACKS AND SUPPLIES

A. Sensor Power Packs: Provide sensor power packs as recommended by the sensor manufacturer and as required for all connected devices and the specified sequence of operation. Note that control of fixtures with multi-level switching may require additional power packs. Power Packs shall be UL listed, plenum rated, and accept 120 or 277 VAC.

# 2.04 ACCEPTABLE MANUFACTURERS – OUTDOOR PHOTOCELLS

- A. Intermatic.
- B. Tork.
- C. Substitutions: Under provisions of Division 01.

# 2.05 OUTDOOR PHOTOCELLS

- A. Dusk-to-dawn lighting control with a delay action.
- B. Sonic-welded polycarbonate case and lens to seal out moisture.
- C. Fully enclosed weatherproof housing.
- D. Rated 15A, 120/277V.
- E. Rated for mounting on building exterior and -40°F temperature operation.

# 2.06 ACCEPTABLE MANUFACTURERS – TIMER SWITCHES

- A. Wattstopper.
- B. Intermatic.
- C. Tork.
- D. Hubbell.
- E. Substitutions: Under provisions of Division 01.

# 2.07 TIMER SWITCHES

A. Digital Timer Switch: Pushbutton operation, luminescent LCD showing timer countdown, optional audible/visual warnings prior to time-out, and white finish. Time-out adjustment range shall be from 5 minutes to 12 hours, in 5-minute increments up to 1 hour then 15-minute increments up to 12 hours. Switch shall be compatible with all electronic ballasts and motor loads, have no minimum load requirement, and shall be suitable for installation in a single-gang box.

## PART 3 EXECUTION

## 3.01 INSTALLATION

- A. Install occupancy sensor wall switches 48 inches above floor.
- B. Unless otherwise noted install wall sensor switches within 6 inches of the door jamb on the strike side, however the final layout shall be coordinated with furniture and equipment locations to avoid false OFF signals, due to obstruction of sensors.
- C. Locate power packs and similar devices in concealed, accessible areas.
- D. Install outdoor photocells on a Nema 4 enclosure and locate on the north side of the building turned away from artificial light sources, in accordance with the manufacturer's installation instructions. Do <u>not</u> install the photocell so that it directly faces the midday sun. Field adjust slider to turn lights On at dusk and OFF at dawn.

# 3.02 SENSOR TESTING AND CALIBRATION

- A. Occupancy Sensors:
  - 1. Activate test setting on sensor. Walk past the room entrance and confirm that the sensor is not picking up unwanted motion from adjacent spaces such as hallways. Provide masking on infrared lens to restrict field of view if necessary and re-test.
  - 2. Walk into room and confirm that the sensor immediately picks up the motion and turns the lights ON.
  - 3. Walk around the room and confirm that the sensor is picking up small motion. Relocate sensor or add additional sensors as required to provide complete coverage throughout the space.
  - 4. Adjust the PIR and ultrasonic or microphonic sensitivity settings as required to avoid false tripping due to air movement.
  - 5. Adjust range on sensor to match room size, as a percentage of total sensor coverage. Example: For a 10' x 10' room, the maximum sensing distance in front of the sensor (40') is adjusted down to the minimum setting of 36% coverage.
  - 6. Confirm that the sensor is performing the lighting control sequence of operation as noted on the Plans. Make adjustments as required until the sequence is met.
  - 7. Put sensor back into normal mode.

# 3.03 LIGHTING CONTROL SEQUENCE OF OPERATIONS

- A. See Plans for lighting control sequence for each space. Provide all programming, adjustment and field changes as required to perform the specified lighting control sequence.
- B. Where no lighting control sequences are shown on the Plans, coordinate with the Owner to determine if the occupancy sensor default factory settings are suitable for their needs in each space and adjust accordingly.

## 3.04 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
  - 1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.

- 2. Operational Test: Verify operation of each lighting control device, and adjust time delays.
- B. Lighting control devices that fail tests and inspections are defective work.

# 3.05 **DEMONSTRATION**

A. Train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices. Refer to Division 01 Section "Demonstration and Training."

## SECTION 26 0943 NETWORK LIGHTING CONTROLS

# PART 1 GENERAL

# 1.01 SECTION INCLUDES

- A. This Section includes the following networked lighting control devices including schedules and automated lighting control sequence for wired, wireless and hybrid systems.:
  - 1. User interface
  - 2. Sensors
  - 3. Distributed load controllers
  - 4. Managers
  - 5. Panel solutions
  - 6. System infrastructure and accessories
  - 7. Integration.
  - 8. Lighting control software
  - 9. Power Packs and Supplies.
  - 10. Wall Switches and Dimmer Switches.

# 1.02 RELATED SECTIONS

- A. The Work under this section is subject to requirements of the Contract Documents including the General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements, and Section 26 0500 – Common Work Results for Electrical
- B. Section 26 0519 Low-Voltage Electrical Power Conductors and Cables.
- C. Section 26 0533 Raceway and Boxes for Electrical Systems.
- D. Section 26 0800 Commissioning of Electrical Systems.
- E. Section 26 0923 Lighting Control Devices
- F. Section 26 5000 Lighting.

#### 1.03 SUBMITTALS

- A. Product Data: For each type of product indicated. Include installation instructions for all sensors and switches, including any detailed programming information.
- B. Shop Drawings: Submit detailed shop drawings with scaled floor plans showing all occupancy sensors, low voltage switches, power packs, etc. Provide one-line diagrams and detailed wiring diagrams for all connections. Floor plans shall be 1/8" scale maximum and shall be clearly legible.
- C. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals. Include manufacturer's installation and troubleshooting instructions. Include software operational documentation.

#### 1.04 CLOSEOUT SUBMITTALS

- A. Project Record Drawings: Indicate actual locations and mounting heights of all power packs, lighting control devices and accessories on the project record drawings.
- B. Operation and Maintenance Manuals:
  - 1. Provide recommended sensor cleaning schedule.
  - 2. Provide detailed bill of materials for all items purchased in this section including distributor's contact name, phone number and pertinent information.
  - 3. Provide lighting control manufacturer's operating and installation instructions and troubleshooting guide.

4. Include any specific warranty information provided by the manufacturer.

# 1.05 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. All network lighting controls shall be programmed and installed by a factory trained technician.

#### **1.06 COORDINATION**

A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression system, and partition assemblies.

## 1.07 COMMISSIONING

A. Fully commission all systems, subsystems and equipment provided by this section in accordance with 26 0800 - Electrical Commissioning.

## PART 2 PRODUCTS

## 2.01 MANUFACTURERS

- A. Acceptable Manufacturer: Throughout this specification, specific manufacturers and manufacturer's catalog numbers are cited. These citations are for the purpose of establishing quality and performance criteria and are not intended to be proprietary. Encelium lighting controls shall be used for lighting controls.
  - 1. Controls: Encelium X Networked Light Management System
  - 2. Sensors: Encelium Sensors, Leviton Mfg. Co., Hubbell Building Automation, Inc., SensorSwitch, Inc., PLC Multipoint Inc., The Watt Stopper, Inc. Cooper Controls or equivalent
  - 3. Sensors: Wireless Sensors, Leviton Mfg. Co., Hubbell Building Automation, Inc., Sensor Switch, Inc., PLC Multipoint Inc., The Watt Stopper, Inc. Cooper Controls or equivalent.

## 2.02 SYSTEM PERFORMANCE REQUIREMENTS

- A. Light Management System: Distributed WAN/LAN network. Global controller/routers, individually addressable system field devices not integral to luminaires, sensors, switches, relays, and ancillary devices required for an operable system.
  - 1. WAN/LAN Start-Up: Control system manufacturer or certified contractors.
  - 2. System: Non-proprietary 0-10V dimming, DALI or fixed output ballasts and/or 0-10V LED drivers, occupancy sensors, daylight sensors, etc.
  - 3. UL 924 Listed Devices: Able to control 120 V, 277 V, and 347 V loads.
  - 4. System Software Interface: Able to notify communication failures to system users
- B. Installation Mode: Test if devices are wired correctly by pressing any button on the Wallstation or sensor which triggers load controllers on the channel to change the dimming level by 25 percent.
- C. Manual Pairing: Pair room or zone devices to gain manual control (on, off and dimming) and occupancy time outs. Holding any button on a Wallstation or sensor for 10 seconds enters system into Manual Pairing mode.
- D. Vacancy Recovery: If sensor times out in manual-on, occupant can turn lights on using occ sensor. Vacancy Recovery Time: Configure during system programming.
- E. Manager Recovery from Power Failure: When power is restored, in 3 seconds lights return to same levels (dimmed setting, full on, or full off) as prior to interruption.
- F. time Clock Scheduling: Programmable for scheduling lights to a specific level.
  - 1. Programming: User friendly, Outlook style interface for schedules.

- 2. Override: Manual adjustments via Wallstations temporarily override status imposed by time clock schedule.
- 3. Response to Power Failure: Time clock will execute schedules that would still be in progress had they begun during the power outage.
- 4. Flick Warning: Prior to a scheduled lights-off event or expiry of a temporary override, system provides 2 short light level drops warning affected occupants. Flick Warning Time: Programmable via software; between 1 and 5 minutes.
- 5. Automatically turn on or wait for an input: A luminaire group can be turn on automatically in response to a scheduled event or a Wallstation signal to turn luminaire group on, and stay on, for remainder of scheduled event.
- 6. Support BMS Schedules/Calendars
- G. Emergency Mode: When activated, will immediately adjust to, and remain at full light output until mode is deactivated. Setting overrides other inputs. Interface with building emergency monitoring system and not require multiple connections.
- H. Programmable Task Tuning:
  - 1. Light level programmability available by individual luminaire.
- I. Continuous Dimming: Over a continuous range; individual or group of luminaires in response to user initiated or system generated signals.
- J. Unoccupied State: When occupancy status is vacant per occupancy sensors.
  - 1. Lights turn off.
  - 2. Lights adjust to configurable dimmed light level.
- K. Occupied State: Create "comfort" or "support" zones ensuring occupants are not isolated by turning off lights in adjacent areas. Light paths to exit premises.
- L. Overlapping Zones: Create to ensure continuous lighting and safety of occupants as they move from one zone to another while minimizing energy use
- M. LAN Operations: Capable of operating independent of building's existing network infrastructure and not rely on tenant supplied PCs for operation.
- O. Network Security: Use firewall technologies and VLAN configuration methods to separate tenants from and ensure integrity of light management network.
- P. Group (Zone) Configuration: Assign individual or group system components to zones via the Software. Rewiring is not needed when reconfiguring or re-zoning. Removal of covers, faceplates, ceiling tiles, etc. is not required.
- Q. Sensor Control Parameters: Occupancy sensor time delays and light level sensor parameters are to be configurable through software.
- R. Automatic Time Adjustment: For leap year, daylight savings time, weekly routine, and holiday scheduling.
- T. A web based dashboard showing real time energy savings data.
- U. Contact Closure Input: System capable of receiving a momentary and sustained contact closure input from third party sources to control lighting zones.
- V. Astronomical Clock: Luminaires switch ON/OFF with sunset and sunrise (option to select offset, depending on geographic location of building. An offset option available to turn schedule ON/OFF up to 12 hours before or after dusk or dawn.
- W. White Light Color Tuning: The system is to be capable of the following.
  - 1. Control correlated color temperature (CCT) individually or by zone for compatible luminaires.

- 2. Manual color tuning through software, User adjusts CCTs through a digital slider.
  - a. CCT adjustment in increment/decrements of 100K using digital slider on GUI.
- 3. OSRAM 2CH DALI 2.0, Type 8 LED driver able to convert CCT value from software to accurate color temperature.
- 4. Recall specific CCT values and raise and lower CCT from a single gang Wallstation based on configurable increments.
- 5. Independent Wallstation for intensity and color temperature control for manual recall.
- 6. Schedule specific CCTs with fade time (in seconds). If system loses power during an active schedule, fixtures will resume scheduled CCT upon power restoration.
- 7. Color schedules to begin or end using sunrise or sunset options based on an astronomical clock.
- 8. A maximum of 64 compatible color tunable fixtures per Manager channel.
- 9. When used with OSRAM Tunable White drives and LED engines, system provides 2700K-6500K tunability. White lighting dimming to reduce intensity to 1 percent
- X. Minimized system down time: Communication bus shall be able to self-diagnose and display communication shorts or open loops resulting in minimum system down time.
- Y. Wireless Networks: Reliable (mesh topology), self-configuring (discovery) and self-healing. Interruptions in network are automatically compensated for by re-directing communication.
  - 1. High level of security by employing logically unbreakable secure encryption methods (e.g., 128-bit encryption).
- Z. Wireless Device (Wallstations and Sensors) Integration: Seamless communication among devices when hybrid wired/wireless control systems are implemented. Hybrid control system refers to devices that communicate over a field bus carrying low voltage control signals and/or wireless medium using non-proprietary open protocol (e.g., ZigBee) for communication. Devices in hybrid control system communicate with devices in the system regardless of the native protocol they are designed to work with.
- AA. Lighting Control System software:
  - 1. Central Lighting Control Software: Interactive, Web-based graphical user interface (GUI) showing floor plans and lighting
  - 2. Navigational features listed below allow user's orientation within the controlled space, geographic heading and/or landmarks:
    - a. Interactive, Vector based, Zoom, Rotate, Pan, and Tilt.
  - 3. Building operator to navigate through facility in two dimensional views, allowing fast and easy navigation.
  - 4. Display single floor views for easier system performance visualization of entire site as well as individual zones or spaces.
  - 5. Software Settings and Properties: Selectable per individual device, room based, floor based, or global building based.
    - a. Lighting Control Software Interface: Provide status and enable configuration of system zones including selected individual luminaire availability, current light level, maximum light level, on/off status, occupancy status, and emergency mode (response to an emergency signal) status.
  - 6. Display lighting system parameters such as Lighting Status (ON/OFF); Lighting Levels, Load Shedding Status, or Lighting Energy Consumption, Occupancy status in a colorized gradient ("weather" map) type of graphical representation
  - 7. Energy Analysis Data: Exportable in CSV file formats.
- 8. Allow import of native AutoCAD files.
- BB. Reporting Feature: Native to lighting control software. Reports to be printable in printer friendly format and downloadable for use in spreadsheet applications, etc.
  - 1. Report the following parameters for each device and zone individually.
    - a. Energy consumption broken down by energy management strategy.
    - b. Energy demand broken down by energy management strategy.
    - c. Occupancy data by zone.
    - d. Building wide occupancy status.
    - e. Time Schedule configuration status.
    - f. Lighting energy consumption in color gradient "weather map" type view

# 2.03 LCD TOUCH SCREEN CONTROLS

- A. General Description
  - 1. Model KX7S: 7 inch (178 mm) touch screen.
    - a. Integrated High-Resolution Capacitive Touch Screen: Full color TFT LCD, Full VGA (400x800 pixels) with 65K colors.
    - b. Flexible configurations for custom buttons, text, and graphics.
    - c. Remote Control Processor: Model XP-6s
      - 1) CPU: 32-bit, 533 MHz
      - 2) Flash Memory: 128 MB of non-volatile
      - 3) Interface: Integrated 10/100Base-T Ethernet port
      - 4) Power: 12 VDC, 1A. Wall-plug supply included.
      - 5) Wall surface mount.
    - d. Control multiple lighting scenes for multi-purpose spaces.
    - e. Page Navigation: Screen swiping
    - f. Appearance: May be personalized for every space.
    - g. CPU: 32 bit, 533 MHz
    - h. Memory: 128 non-volatile flash memory.
    - i. Configuration: Flexible for custom buttons, text, and graphics
    - j. Electrical Input Voltage: Power over Ethernet or 9 to16 VDC, 1A max.
    - k. Communication: Ethernet connection employing TCP/IP protocol.
    - I. Operating Temperature Range: Minus 32 to 122 degrees F (0 to 50 degrees C)
    - m. Relative Humidity: 0 to 95 percent non-condensing. Rated for indoor locations.
    - n. Mechanical: Wall mountable

# 2.04 PANEL SOLUTIONS

- A. Relay Panel and Relay Panel Module:
  - 1. Standards Compliance: Rated for indoor use.
    - a. Energy Management Equipment: UL916 Listed.
    - b. Emergency Lighting and Power Equipment: UL924 Listed
    - c. Radio Interference: FCC Part 15, Class A /ICES-003

- 2. Data Specification: Connects to the polarity independent Encelium X Networked Light Management System via two ports that accept GreenBus II Communication Bus.
- 3. Ambient Temperature: 140 degrees F (60 degrees C) maximum.
- 4. Relay Panel:
  - a. Addressable lighting control panel that fully integrates with the Encelium X Networked Light Management System (LMS)
  - b. Relays: Up to 24 relays in a panel.
    - 1) Individually controlled and configured to meet facility needs.
    - 2) Addressed as individual zones or as part of a larger zone.
  - c. Lighting management strategies: Deployed using of the relay panel; smart time scheduling, and occupancy control.
  - d. Navigation: A floor plan based three-dimensional graphical interface.
  - e. Daisy Chain Multiple Panels: As part of overall Encelium X architecture through the GreenBus II communication network
  - f. Enclosure Dimensions (HxWxD): 19.5 x 18.5 x 4.0 inches (495 x 470 x 102 mm).
  - g. Relay Dimensions (HxWxD): 3.8 x 2.4 x 1.0 inch (97 x 60 x 25 mm),
- 5. Relay Panel Module:
  - a. Electronic retrofit module that enables existing relay panels/boxes to be integrated with the Encelium X Networked Light Management System.
  - b. Relays per Relay Panel Module: 24. Panel modules may be connected to accommodate requirements above 24 relays. Install in accordance with applicable national and local electrical and building codes
  - c. Installation: In most standard relay panels utilizing existing electrical wiring and relays.
    - 1) Mounts in center of existing panel (replaces old circuiting) and wired to existing relays in the panel. This allows each relay to be addressed individually.
  - d. Relay panel module controls 2-wire relays (NAED 45349: RLY-700).
  - e. Input Power Supply: 24 Vac, 50/60 Hz, 1.6 A (40 VA)
  - f. Suitable for 35 mm DIN rail mounting.
  - g. Dimensions (LxHxW): 4.5 x 1.6 x 1.8 inches (368 x 41 x 46 mm)
- B. DALI Panel:
  - 1. DALI Panel Lighting Controls: Simplifies deploying DALI-based lighting controls using Encelium X Networked Light Management System. Consists of 1 Encelium X Wired Manager and 8 DALI bridges that enable control of 512 DALI based LED drivers and 288 GreenBus devices. Contains a Sensor Interface Module (SIM) that can be used for fire alarm contact.
  - 2. Model ECU-DALI-ENC. DALI enclosure. Field Bus: GB2.
  - 3. Standards Compliance:
    - a. FCC Part 15/ICES-003, Class A.
  - 4. Rated for dry, indoor locations only.
  - 5. Power Supply: 100 to 240 VAC, 50/60 Hz, 1.8A. Hardwire connection.
  - 6. The DALI Enclosure Panel Includes:
    - a. Wired Manager with Power Supply: 1.

- b. 8 DALI Bridges: 8.
- c. DALI Bridge Power Supplies: 2.
- d. Sensor Interface Module for Fire Alarm Contact: 1.
- e. Terminal Block for Hardwire Connection: 1.
- 7. Flexibility:
  - a. Enables Encelium system to communicate with DALI devices.
  - b. Each channel can control 64 DALI Drivers and 36 GreenBus devices.
  - c. Works with Encelium X and Encelium X.
- 8. DALI Output: 24V, 250 mA maximum.
- 9. Maximum Number of Drivers: 64 DALI LED Drivers per DALI Bridge.
- 10. Control Compatibilities: Compatible with DALI-compliant LED Drivers.
- 11. Operating Temperature: 32 to 122 degrees F (0 to 50 degrees C).
- 12. Dimensions (H x W x D): 24 x 18 x 6 inch (610 x 457 x 152 mm).
- 13. Weight: 52 lbs (23.6 kg).

# 2.05 INDOOR OCCUPANCY & PHOTOCELL SENSORS

- A. Single-Technology Passive Infra-Red (PIR) Sensors: For small and large spaces when major motion is available.
- B. Multi-Technology: Adds active Ultrasonic (U/S) sensor to PIR sensor increasing minor motion sensitivity in applications like offices and restrooms.
- C. Collect occupancy data from a lighted space and works with Encelium X Networked and Encelium Edge Standalone Wireless Light Management Systems via GreenBus II wire and/or ZigBee standards based mesh network.
- D. Model SCP-0450 PIR: Sensing Angle: 360. Coverage Area: 450 sq ft (42 sq m). Application: Ceiling. Current Required: 20 mA
- E. Model SCP-1500 PIR: Sensing Angle: 360. Coverage Area: 1500 sq ft (140 sq m). Application: Ceiling. Current Required: 20 mA.
- F. Model SCM-0500 PIR and U/S: Sensing Angle: 180. Coverage Area: 500 sq ft (47 sq m). Application: Ceiling. Current Required: 20 mA.
- G. Model SCM-1000 PIR and U/S: Sensing Angle: 360. Coverage Area: 1,000 sq ft (93 sq m). Application: Ceiling. Current Required: 35 mA.
- H. Model SCM-2000 PIR and U/S: Sensing Angle: 360. Coverage Area: 2,000 sq ft (186 sq m). Application: Ceiling. Current Required: 30 mA.
- I. Model SWP-WV00 PIR: Sensing Angle: 110. Coverage Area: 2,500 sq ft (232 sq m). Application: Ceiling. Current Required: 15 mA.
  - 1. Large Motion Ranges: 68 ft (21 m). Small Motion Ranges: 31 ft (9 m)
- J. Model SWM-1200 PIR and U/S: Sensing Angle: 110. Coverage Area: 1,200 sq ft (112 sq m). Application: Wall and Ceiling. Current Required: 25 mA.
  - 1. Large Motion Ranges: 68 ft (21 m). Small Motion Ranges: 31 ft (9 m)
- K. Model SWP-LRNG PIR: Sensing Angle: 26. Coverage Area: 100 x 33 sq ft (31 x 10 sq m). Application: Long range. Current Required: 15 mA
  - 1. Large Motion Ranges: 100 ft (31 m).
- L. Model SWP-HBAY PIR: Sensing Angle: 73. Coverage Area: 55 x 7 sq ft (17 x 2 sq m). Application: High Bay Aisle. Current Required: 15 mA.

- 1. Large Motion Ranges: 55 ft (17 m).
- M. Regulatory cULus Certified. Meets ASHRAE Standard 90.1 and CEC Title 24.
- N. Allow timeouts configurable via system software.
- O. Allow occupancy and vacancy sensor configurations via system software.
- P. Depending on software configuration will switch or dim luminaires.
- Q. Allow overlapping and comfort zone configurations via system software.
- R. Operating Power: From system controller or the devices they are attached to.
- S. Communication: Shall be via Class 2 communication bus
- T. Wireless Communication: Wireless Control Module/Area Lighting Controller.
- U. Any number of sensors can be mapped to any number of zones.
- V. Timeout settings fully configurable.
- W. Able to self-calibrate and retain settings during power interruptions.
- X. Automatically analyze and adjust sensitivity and time delay
- Y. Mechanically Wired: Sensors for ceiling and wall mounts, including corners.
- Z. Operating Temperature Range: 32 to 104 degrees F (0 to 40 degrees C).
- AA. Relative Humidity: 0 to 95 percent, non-condensing. Indoor use only.
- BB. Control:
  - 1. Ultrasonic Sensitivity: 0 to 100 percent; green knob.
  - 2. Passive Infra-Red Sensitivity: 0 to 100 percent; red knob.
  - 3. Time Delay: 30 seconds to 30 minutes; black knob.
- CC. Indicator:
  - 1. Red LED: Motion detected with PIR sensor.
  - 2. Green LED: Motion detected with U/S sensor (U/S models only).
- DD. Base Diameter: 4.2 inch (107 mm) ceiling and wall mounted sensors.
- EE. Ceiling Sensors Height: 1.57 inch (40 mm).
- FF. Overall Length of Wall Sensors: 6.43 inch (163 mm).
- GG. Mounting Height of Ceiling-Mounted Sensors: 8 to 12 ft (2.4 to 3.7 m)
- HH. Mounting Height of Wall-Mounted Sensors: 8 to 10 ft (2.4 to 3 m)
- II. SWP-HBAY Sensors: 10 to 40 ft (3 to 12.2 m)

### 2.06 SENSOR INTERFACE MODULE (SIM): FIELD BUS: GB2. A KEY COMPONENT OF THE ENCELIUM X NETWORKED LIGHT MANAGEMENT SYSTEM (LMS). CONNECTS VIA TWO PORTS THAT ACCEPT PRE-TERMINATED GREENBUS II COMMUNICATION CABLE

- A. Model EN-SIM-AI/SPS-GB2-BK. Modifiers: Black (BK).
- B. Model: EN-SIM-AI/SPS-GB2-BK-DR. Modifiers: Black/Damp-Rated (BK/DR).
- C. Standards Compliance:
  - 1. FCC Part 15/ICES-003
  - 2. Listed: cULus
  - 3. UL 916: Energy Management Equipment.
  - 4. UL 2043: Heat and Smoke Release for Air-Handling Spaces.

- 5. Complies with the following electromagnetic requirements: EN 61000-4-2, EN 61000-4-4, and EN 61000-4-5.
- D. Sensor Agnostic: Provides interface between most low voltage occupancy or photo sensors and the LMS.
- E. Automatically addressed as soon as it is connected to an Encelium X LMS via the GreenBus II Network.
- F. Automatically detects and adjusts to sensor it is wired to and establishes two-way communication.
- G. Individually Addressable. Enables each sensor to be independently configured to best meet facility needs.
- H. No Batteries Required: Provdes power to connected sensors.
- I. Operating Temperature: Minus 40 to 131 degrees F (Minus 40 to 55 degrees C
- J. Dimensions (WxLxH): 1.18 x 2.38 x 0.62 inches (30 x 61 x 15.7 mm)
- K. Mounting: Fixture or junction box in standard 1/2 inch knockout (7/8 inch) dia.

# 2.07 WALL SWITCHES AND DIMMERS

- A. Devices shall recess into single-gang switch box and fit a standard GFI opening.
- B. Two-Button Configuration: A single zone manual controller ideal for conference rooms, private office, classrooms, and other similar spaces. A short press of the upper/ lower buttons turns lighting ON/OFF, while a "press and hold" dim lighting up or down.
- C. Four-Button Configuration: A single zone manual controller ideal for conference rooms, libraries, and other similar spaces. It has a dedicated button for ON, OFF and for raise/lower functionality with intuitive button engraving
- D. Wired Wallstations: Communication Network: GreenBus.
  - 1. Model EN-WS-2B-GB2-WH, 2 Button. Modifiers: White WH
  - 2. Model EN-WS-4B-GB2-WH, 4 Button. Modifiers: White WH
- E. Wireless Wallstations: Communication Network: Zigbee.
  - 1. Model EN-WS-2B-ZB-WH, 2 Button. Modifiers: White WH
  - 2. Model EN-WS-4B-ZB-WH, 4 Button. Modifiers: White WH
- F. Standards Compliance:
  - 1. Listed: cUL and UL 916.
  - 2. FCC Part 15/ICES-003
  - 3. RoHS Compliant
  - 4. Complies with Electromagnetic Compatibility (EMC) Standards: EN 61000-4-2, EN 61000-4-4, and EN 61000-4-5
  - 5. Nema: Meets WD5 and WD1
- G. Features and Characteristics:
  - 1. Rated for dry locations.
  - 2. Simple installation with tool-less mounting.
    - a. Setup and configuration via Polaris software.
  - 3. Ambient Temperature: Ta maximum 140 degrees F (60 degrees C).
  - 4. Operating Temperature: 14 to 104 degrees F (Minus 10 to 40 degrees C).
  - 5. Relative Humidity: 5 to 95 percent non-condensing, for indoor locations.
  - 6. Dimensions  $(H \times W \times D)$ :

- a. J-Box Mounted: 4.5 x 2.8 x 0.9 inch (114 x 70 x 24 mm).
- b. Surface-Mount: 4.5 x 2.8 x 0.5 inch (114 x 70 x 13 mm).
- c. Color: White.
- d. Mounting: Standard size wall box mount.
- e. Mounting: On mounting brackets for low voltage devices.
- f. Mounting: Support for "Decorator" style wall plate installation.

# 2.08 ZONE CONTROL (ZC) WALLSTATIONS

- A. Used to activate or de-activate a lighting zone.
- B. Software configurable lighting control.
- C. ON/OFF switching for multiple lighting zones.
- D. Zone Status: Integrated LED indicators. White: ON. Blue: OFF.
- E. Available in a range of configurations for customized light level control
- F. Wired Wallstations: Low-voltage and connect to Encelium X Lighting Management System through a GreenBus cable with 2-pin connectors.

# 2.09 SCENE CONTROL (SC) WALL STATIONS

- A. Wired wallstation:
  - 1. 3 Scene. Communication Network: GreenBus.
    - a. Model EN-WS-SC3-GB2-WH. Modifiers: White WH
  - 2. 5 Scene. Communication Network: GreenBus
    - a. Model EN-WS-SC5-GB2-WH SC. Modifiers: White WH
- B. Standards Compliance:
  - 1. Listed: cUL and UL 916.
  - 2. FCC Part 15/ICES-003
  - 3. RoHS Compliant
  - 4. Complies with Electromagnetic Compatibility (EMC) Standards: EN 61000-4-2, EN 61000-4-4, and EN 61000-4-5
  - 5. Nema: Meets WD5 and WD1
- C. Features and Characteristics:
  - 1. Rated for dry locations.
  - 2. Pre-programmed light levels or "scenes": Chosen by pushing a button.
    - a. Scene Configuration: Changed via Polaris Software.
    - b. Application of custom commands to individual Wallstation buttons.
    - c. Combined scene and zone in one Wallstation.
  - 3. Simple installation with tool-less mounting.
    - a. Setup and configuration via Polaris software.
  - 4. Ambient Temperature: Ta maximum 140 degrees F (60 degrees C).
  - 5. Operating Temperature: 14 to 104 degrees F (Minus 10 to 40 degrees C).
  - 6. Relative Humidity: 5 to 95 percent non-condensing, for indoor locations.
  - 7. Dimensions  $(H \times W \times D)$ :
    - a. J-Box Mounted: 4.5 x 2.8 x 0.9 inch (114 x 70 x 24 mm).

- b. Surface-Mount: 4.5 x 2.8 x 0.5 inch (114 x 70 x 13 mm).
- 8. Color: White.
- 9. Mounting: Standard size wall box mount
- 10. Mounting: On mounting brackets for low voltage devices
- 11. Mounting: Support for "Decorator" style wall plate installation

# 2.10 TUNABLE WHITE WALLSTATION

- A. Model EN-WS-TWSC3-GB2-WH. TW Wallstation, 3 Button: Greenbus II.
- B. Model KSW-EN-SMK-ZB-WH. Surface-mount kit.
- C. Standards Compliance:
  - 1. Electromagnetic: EN 61000-4-2, EN 61000-4-4, and EN 61000-4-5.
  - 2. FCC Part 15/ICES-003.
  - 3. Listed: cULus. Energy Management Equipment: UL 916.
  - 4. RoHS Compliant.
  - 5. Meets Nema WD 6 and WD 1.
- D. Single-gang form factor in stainless steel housing.
- E. Connects to Encelium X Network Light Management System (LMS).
- F. Polaris Software:
  - 1. Combined scene & zone in one Wallstation.
  - 2. Application of custom commands to individual Wallstation buttons.
- G. Location: Entry points. Used to "activate" or "de-activate" a lighting zone.
- H. Class 2 low voltage device.
- I. Power: External DC power supply.
- J. Operating Temperature: 14 to 104 degrees F (Minus 10 to 40 degrees C).
- K. Maximum Ambient Temperature: 140 degrees F (60 degrees C).
- L. Relative Humidity: 5 to 95 percent non-condensing for indoor locations.
- M. Dimensions (HxWxD):
  - 1. J-Box Mounted: 4.5 x 2.8 x 0.9 inch (114 x 70.1 x 24 mm).
  - 2. Surface Mount: 4.5 x 2.8 x 0.5 inch (114 x 70.1 x 13 mm).
- N. Mounting: In Standard size wall box of 2.4 inches (61 mm) minimum.
- O. Mounting: On mounting brackets for low voltage devices.
- P. Mounting: Support for "Decorator" style wall plate installation

# 2.11 SENSORS

- A. GreenBus Sensor (GBS): Ceiling / surface mount sensors providing a range of networked sensor solutions for applications with finished ceilings (e.g., ceiling tiles, sheetrock, plaster). They combine passive infrared (PIR) and photocell sensing in a single compact form factor.
- B. GreenBus Sensors: Technology: PIR/Photo. Sensing Angle: 360 degrees.
  - 1. Model: EN-SCPPH-0450-ZB. Mounting Height: 8 to 12 ft (2.4 to 3.7 m). Coverage: 450 sq ft (42 sq m).
  - 2. Model: EN-SCPPH-1500-ZB. Mounting Height: 8 to 12 ft (2.4 to 3.7 m). Coverage: 1500 sq ft (140 sq m)
  - 3. Model: EN-SCPPH-HB-ZB.

- a. Mounting Height: 20 ft (6 m). Coverage: 1100 sq ft (102 sq m)
- b. Mounting Height: 30 ft (9 m). Coverage: 1800 sq ft (167 sq m)
- c. Mounting Height: 40 ft (12 m). Coverage: 2800 sq ft (260 sq m)
- C. Regulatory:
  - 1. Listed: cULus and UL 916.
  - 2. Meets ASHRAE Standard 90.1 and CEC Title 24 requirements.
  - 3. Meets FCC Part 15/ICES-003
- D. Tool-less mounting options for a variety of applications.
  - 1. Quickly test installation of entire floor by pressing a single button on the sensor.
  - 2. Enables local pairing of load controllers to enable occupancy.
- E. Masking options to maximize control flexibility.
- F. Features and Characteristics
  - 1. Light Sensor: 0 to 1,000 Lux. Shields included. No opening of sensor required.
  - 2. Coverage Options:
    - a. Micro-Motion Sensitivity Range: 450 sq ft (42 sq m).
    - b. High Sensitivity Core Range: 1,500 sq ft (140 sq m).
  - 3. LED status indicator.
  - 4. Configurability via Polaris Software:
    - a. Any number of sensors can be mapped to any number of zones.
    - b. Timeout settings fully configurable.
    - c. Occupancy time delays, photocell set-points
    - d. Remotely upgradable firmware
    - e. Association of single sensor to multiple zones/spaces
  - 5. Power Supply: Operating voltage: 12 to 24V from GreenBus bus.
  - 6. Operating Temperature Range:
    - a. Standard and Extended Range Sensors: 32 to 104 degrees F (0 to 40 degrees C).
    - b. High Bay (HB) Sensors: 32 to 140 degrees F (0 to 60 degrees C).
  - 7. Relative Humidity: 0 to 95 percent non-condensing. For indoor use only.

# 2.12 DISTRIBUTED LOAD CONTROLLERS

- A. Product: ZBHA-CLM-DIM-ENC. Description: CLM DIM.
  - 1. Communication Network: Zigbee Wireless Encelium Network.
  - 2. Dimming Protocol: 0-10V, DALI, DEXAL, DALI Type 8 LED driver.
- B. Regulatory:
  - 1. UL916 (Energy Management Equipment)
  - 2. UL924 cUL US Listed (Emergency Lighting Equipment)
  - 3. UL2043 Plenum Rated Environmental Protection: Rated for damp location (IP54); RoHS compliant.
  - 4. Radio Interference: FCC Part 15
  - 5. RoHS compliant.

- 6. Complies with Electromagnetic Requirements: EN 61000-4-2, EN 61000-4-4, and EN 61000-4-5
- C. Performance:
  - 1. Control Options: Continuous 0 to 10V dimming
  - 2. Group Control: 0 to 10V ballasts and LED drivers.
  - 3. Used to extend wireless network capability.
  - 4. Memory: Retains system settings in non-volatile memory.
- D. Enable wireless connectivity to individual or group of luminaires with 0-10V Dimming ballasts and/or 0-10V LED Drivers.
- E. Wireless Network Communication: Via protocol based on ZigBee standard
  - 1. Reliable(mesh topology), self-configuring (discovery) and self-healing. Compensates interruptions in network by re-directing communication
  - 2. High security level employing secure encryption (128 bit) methods.
- F. Addresses to Luminaire Integrated Modules: Assigned during system start-up.
  - 1. Upon establishing two way communication with the Wireless Manager, these individually addressable modules enable individual or group control and configuration of lighting components.
    - a. Addressing: Connected Lighting Modules to be individually addressable.
    - b. System automatically addresses individual modules during start-up eliminating need to pre-address devices or record serial numbers during installation.
- G. Wireless Range: 150 ft (45.7 m) line of sight, 50 ft (15.2 m) standard walls.
- H. LED Drivers: Each CLM is capable of handling 4 DEXAL drivers in parallel connection.
- I. Dimming Output: Single 0 to 10 V dimming output per IEC 60929 Annex E. Capable of sinking 3 mA (Equivalent to 10 typical dimming ballasts/drivers).
  - 1. DALI and DALI Type 8 for Tunable White.
- J. Input Voltage: 12 VDC. Power: Delivered by OPTOTRONIC LED drivers with DEXAL Technology
  - 1. Input Current: Typically, Less than 40 mA
  - 2. Radio Frequency: 2.4 GHz
- K. Material: Plenum rated plastic (UL2043)
- L. Operating Temperature: Minus 40 to 140 degrees F (Minus 40 to 60 degrees C).
- M. Relative Humidity: 5 to 95 percent non-condensing. Rated for indoor locations.
- N. Dimensions (HxWxD): 5.47 x 3.34 x 1.77 inch (135 x 85 x 45 mm)
- O. Mounting: In standard 1/2 inch knockout present on virtually every luminaire.

# 2.13 WIRELESS CONTROL MODULES (WCM)

- A. Model EN-WCM2-ZB-DR: Encelium X Damp Rated
- B. Model EN-WCM2-ZB: Encelium X
- C. Individually Addressable: Enables ballasts or LED drivers to be independently controlled and configured to best meet the needs of the facility.
- D. Switches a fixture ON or OFF via a relay contained in the module and delivers a low voltage dimming signal to any 0-10V dimming ballast/driver.
- E. When connected to the Encelium X LMS:
  - 1. Enables low-voltage products via the GreenBus II port on the device.

- 2. Enhances flexibility of Encelium X System to include phase-cut dimming, area lighting control, low voltage wallstations, key switches, Sensor Interface Module (SIM) and relay panel control.
- F. Standards Compliance:
  - 1. Energy Management Equipment: UL 916 Listed.
  - 2. Emergency Lighting Equipment: UL 924 Listed.
  - 3. Heat and Smoke Release for Air Handling Spaces: UL 2043 Listed.
  - 4. Radio Interference: FCC Part 15/ICES-003.
- G. Electrical: Maximum Ratings. Voltage tolerance is plus or minus 10 percent.
  - 1. Ballast/LED Driver (max. 2 LED driver/fixtures): 4.5A 120-347 Vac.
  - 2. General Purpose: 9.0A 120-347 Vac.
- H. Control Options:
  - 1. Single 0-10V dimming output (IEC 60929 Annex E). Capable of sinking 10 mA (Equivalent to 10 typical dimming ballasts/drivers).
  - 2. 0-10V or DALI connectivity.
  - 3. Occupancy sensors.
  - 4. GreenBus II connection port for GreenBus II devices.
    - a. Area Lighting Control (ALC) Module.
    - b. Phase Cut Dimming Module.
    - c. Relay Panel.
- I. Wireless: Radio Frequency: 2.4 GHz.
  - 1. Range: 100 ft (30480 mm) line of sight, 50 ft (15240 mm) through standard walls when mounted outside of the junction box. Range decreases 50 percent when mounted inside luminaire.
- J. Operating temperature range: Minus 40 to 140 degrees F (Minus 40 to 60 degrees C)
- K. Relative Humidity: 5 to 95 percent non-condensing rated for indoor locations.
- L. Mechanical:
  - 1. Dimensions: 3.2 x 1.7 x 1.7 inches (83 x 43 x 43 mm).
  - 2. Standard Units are for indoor use only or for mounting inside waterproof enclosure.
  - 3. Damp-rated units may be used in damp locations.
  - 4. Material: Plenum rated black plastic (UL2043).

# 2.14 ENCELIUM SYSTEM AND SOFTWARE

- A. Polaris Software:
  - 1. Polaris Monitor Software:
    - a. For facilities managers. Software is intuitive and easy to use due to new workflows, multi-device access, and other enhancements.
      - 1) Serves as the day-to-day window into all aspects of your Encelium X system.
        - a) Enables user to monitor conditions, get insights, and make any necessary changes quickly and easily.
      - B. Web-based: Runs on HTML5 compatible browsers; Microsoft Edge, Google Chrome, Mozilla Firefox, and Safari.
      - C. Supports Multiple Platforms and Devices: Runs from tablet, desktop, laptop, or

smartphone.

- D. User Interface: Touch gestures; pinch to zoom, drag to pan, etc.
- E. HTTPS. Industry-standard certificate-based encryption and authentication for security.
- F. Functionality listed below must be available via a single application.
  - 1) System Navigation and Status Reporting:
    - a) Using graphical floor plan view.
    - b) Graphical Floor Plan View: Pan and zoom allows easy navigation; dynamically adjust details presented based on zoom level.
  - 2) Individual Light Adjustment:
    - a) Monitored for on/off status.
    - b) Turned on/off or set to a specific level.
  - 3) Zone/Area Light Adjustments:
    - a) Monitored for on/off status.
    - b) Turned on/off or set to specific level.
    - c) Areas may be set to predefined lighting scenes.
    - d) Scenes can be renamed and modified in real-time,
  - 4) Area Occupancy:
    - a) Can be monitored or disabled to override occupancy control or in case of occupancy sensor problems.
  - 5) Scheduling: Using time of day and astronomic time clock events.
    - a) Adjust or disable occurrence of repeating scheduled event.
    - b) Monitor and adjust scheduled events with weekly calendar view.
  - 6) Reporting Capability: Allow building manager to gather real-time and historical information about the system as follows:
    - Energy Reports: Compare cumulative energy used over a period of time for one or more areas. Capable of displaying: Current savings in percent and kW, Historic energy savings in kWh saved, Historical Views and Period Comparison: In days, weeks, months, and years
  - 7) Power Reports: Show power usage trend over a period of time for one or more areas.
  - 8) Energy Savings by Strategy Report: Show for any area broken down by strategy (tuning, occupancy, daylighting, scheduled events, and load shedding.
- b. Diagnostics : Allow building manager to check the status of equipment in the lighting control system
  - 1) Wallstation Lock/Unlock: Allow building manager to lock Wallstations preventing building occupants from activating their programming (button presses), until they are unlocked.
- B. Polaris Config Software:
  - 1. Manages system configuration of Encelium X light management system.
    - a. Allows installer or user to:
      - 1) Implement System Design:

- a) Create floor plan layout. Define control zone. Locate luminaires.
- 2) Define Configuration for the Following in Each Area:
  - a) Lighting scenes. System Integrations. Occupancy timeouts Scheduling. Partitioning. Emergency lighting.
- b. Startup: Map field devices to floorplan, deploy configuration and verify system operation
- 2. Manages changes, enhancements, or expansion of Encelium X system.
- 3. Navigation: Floor plan views are used to navigate an entire building.
  - a. Monitor conditions and adjust as needed.
- 4. Runs on any windows 10 based workstation.

## 2.15 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 16 Section "Conductors and Cables."
- B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Division 27 Section "Communications."
- C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 14 AWG. Comply with requirements in Division 27 Section "Communications."
- D. Cat 5 Cable: As recommended by the manufacturer for connection to lighting control devices. Comply with requirements in Division 27 Section "Communications Horizontal Cabling".
- E. GreenBus Cable and GreenBus Connector. The GreenBus II bus system is a communication technology designed specifically for controlling lighting to achieve maximum energy savings and optimum lighting comfort.
  - 1. Model: EN-PTC-20FT-GB2. Field Bus: GB2. Cable Length: 20 ft
  - 2. Model: EN-BC-1000FT-GB2. Field Bus: GB2. Cable Length: 1000 ft
  - 3. Standards Compliance:
    - a. Flame rated jacket for plenum use; NFPA 262 (UL: FT6, CSA: CMP).
  - 4. Class 2 communication bus pre-terminated with connectors.
  - 5. Topology independent connection.
  - 6. Typical number of devices (nodes) per channel: 100.
  - 7. GreenBus II Communication Network:
    - a. Cabling Two pre-terminated 18 AWG conductors. GreenBus II is a Class 2, polarity independent communication bus that connects to the Encelium X Networked Light Management System. The maximum connected length of wiring is 2500 ft. per channel.
    - b. Enables, individual dimming control of fixtures in a building. Integrates peripheral devices; occupancy and photo sensors, relay based controls, switch packs, and low voltage wall controls, into a programmable lighting control system.
    - c. Each Channel: Originates at an Encelium X Manager and propagates in a daisychain fashion from device to device.
      - 1) Topology free and "T" connections are acceptable.
    - d. A Class 2 network. Provides low voltage power to devices on the network eliminating need for external power supplies and power packs for devices.
    - e. Allows flexible daisy chain wiring topologies and the ability to add fixtures or control devices in-circuit at any time.

f. Automatic addressing of individual nodes during system commissioning simplifies installation by eliminating the need to pre-address devices or record serial numbers during the process

# PART 3 EXECUTION

# 3.01 INSTALLATION

- A. Provide all cabling, equipment, programming and support to allow for access via internet for remote diagnostics.
- B. Install occupancy sensor wall switches 48 inches above floor.
- C. Unless otherwise noted install wall sensor switches within 6 inches of the door jamb on the strike side, however the final layout shall be coordinated with furniture and equipment locations to avoid false OFF signals, due to obstruction of sensors.
- D. Locate power packs and similar devices in concealed, accessible areas.
- E. Install outdoor photocells on a Nema 4 enclosure and locate on the north side of the building turned away from artificial light sources, in accordance with the manufacturer's installation instructions. Do <u>not</u> install the photocell so that it directly faces the midday sun. Field adjust slider to turn lights On at dusk and OFF at dawn.

## 3.02 WIRING INSTALLATION

- A. Wiring Method: Comply with Division 26 Section "Common Work Results for Electrical."
- B. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

# 3.03 IDENTIFICATION

- A. Identify components and power and control wiring according to Division 26 Section "Common Work Results for Electrical."
  - 1. Identify controlled circuits in lighting contactors or power packs.
  - 2. Identify circuits or luminaries controlled by photoelectric and occupancy sensors at each sensor when more than one light fixture is being controlled.
- B. Label all low voltage conductors for daylight/dimming system in accordance with the manufacturer's shop drawings.

# 3.04 SENSOR TESTING AND CALIBRATION

- A. Occupancy Sensors:
  - 1. Activate test setting on sensor. Walk past the room entrance and confirm that the sensor is not picking up unwanted motion from adjacent spaces such as hallways. Provide masking on infrared lens to restrict field of view if necessary and re-test.
  - 2. Walk into room and confirm that the sensor immediately picks up the motion and turns the lights ON.
  - 3. Walk around the room and confirm that the sensor is picking up small motion. Relocate sensor or add additional sensors as required to provide complete coverage throughout the space.
  - 4. Adjust the PIR and ultrasonic or microphonic sensitivity settings as required to avoid false tripping due to air movement.
  - 5. Adjust range on sensor to match room size, as a percentage of total sensor coverage. Example: For a 10' x 10' room, the maximum sensing distance in front of the sensor (40') is adjusted down to the minimum setting of 36% coverage.
  - 6. Confirm that the sensor is performing the lighting control sequence of operation as noted on the Plans. Make adjustments as required until the sequence is met.

7. Put sensor back into normal mode [and document the final settings on all occupancy sensor (time delay, PIR sensitivity, occupancy logic and trigger settings, etc.) in tabular form and include in the Project Record Drawings].

# 3.05 LIGHTING CONTROL SEQUENCE OF OPERATIONS

- 1. See Plans for lighting control sequence for each space. Provide all programming, adjustment and field changes as required to perform the specified lighting control sequence.
- 2. Where no lighting control sequences are shown on the Plans, coordinate with the Owner to determine if the occupancy sensor default factory settings are suitable for their needs in each space and adjust accordingly.

## 3.06 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
  - 1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
  - 2. Operational Test: Verify operation of each lighting control device, and adjust time delays.
- B. Lighting control devices that fail tests and inspections are defective work.
- C. Provide written or computer-generated documentation on the commissioning of the system including room by room description including:
  - 1. Sensor parameters, time delays, sensitivities, and daylighting setpoints.
  - 2. Sequence of operation, (e.g. manual ON, Auto OFF. etc.)
  - 3. Load Parameters (e.g. blink warning, etc.)

## 3.07 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit occupied conditions.

# 3.08 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices. Refer to Division 01 Section "Demonstration and Training."

# END OF SECTION 26 0943

## SECTION 26 2100 LOW-VOLTAGE ELECTRICAL SERVICE ENTRANCE

## PART 1 GENERAL

## 1.01 SECTION INCLUDES

- A. Arrangement with Utility Company for permanent electric service including payment of Utility Company charges for service.
- B. Underground service entrance.

## 1.02 RELATED SECTIONS

- A. The Work under this section is subject to requirements of the Contract Documents including the General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements and Section 26 0500 Common Work Results for Electrical.
- B. Division 03 Concrete Work.
- C. Section 26 0526 Grounding and Bonding for Electrical System.
- D. Section 26 0533 Raceway and Boxes for Electrical Systems.
- E. Section 26 0548 Vibration and Seismic Controls for Electrical Systems.
- F. Section 26 0553 Identifications for Electrical Systems.
- G. Section 31 2316.13 Trenching.

## 1.03 REFERENCE STANDARDS

- A. NEMA 250 2003 Enclosures for Electrical Equipment (1000 Volts Maximum).
- B. UL 50 1995 Enclosures for Electrical Equipment.
- C. UL 414 1999 Standard for Meter Sockets.

### **1.04 SYSTEM DESCRIPTION**

- A. System Voltage: 480 volts, three phase, four- wire, 60 Hertz.
- B. Service Entrance: Underground.

### 1.05 SUBMITTALS

- A. Product Data: Submit product data for all components provided, showing electrical characteristics, material, finishes, and dimensions. Each catalog sheet should be clearly marked to indicate exact part number provided, including all options and accessories.
- B. Shop Drawings: Submit shop drawings and manufacturer's literature for transformer rated meter base and current transformer cabinet.

## 1.06 CLOSEOUT SUBMITTALS

# 1.07 QUALITY ASSURANCE

- A. Utility Company: Matanuska Electric Association (MEA).
- B. Install service entrance in accordance with Utility Company's rules and regulations.

### PART 2 PRODUCTS

### 2.01 METERING EQUIPMENT

- A. Meter: Furnished and installed by the Utility Company.
- B. Transformer Rated Meter Base: NEMA 3R, 13-terminal, transformer rated 20 amperes, 600 volts with mounting provisions to accommodate a covered test switch with test switch cover sealing provisions. The test switch mounting provisions shall accept a 10 pole covered test switch with a base dimension of 9.5 inches in width and a depth (the dimension from the rear edge of the test switch base to the top of the cover sealing stud) of no less than 3.375 inches. The lower cover of the meter socket shall seat fully with a covered test switch in place. Meet

requirements of NEMA standards for watthour meter sockets-NEMA EI17-1978 (similar to EUSERC Drawing No. 339). The utility company will furnish and install the test switch and CT wiring.

- C. Current Transformer Cabinet: NEMA 3R, UL 414 listed, to be integrated into service switchgear and pad mounted on concrete pad. All current transformer cabinets and compartments shall have hinged front cover access to the current transformers. The hinged front cover shall be lockable and shall accept a padlock with a shackle diameter of not less than 5/16 inch. Current transformer cabinets for services from 801 Amperes to 2,500 Amperes shall have side gutters sized as shown on the shop drawings and removable bus links.
- D. Concrete Pad for Transformer: Sized to extend a minimum of 4" beyond the footprint of the equipment. Provide structural engineering for pad as required.
- E. All removable covers for compartments containing un-metered conductors shall be sealable or lockable with sealable latches, stud and wing-nuts, sealing screws, or slot and tab devices. All top cover panels, side cover panels and rear cover panels providing access to un-metered conductors shall be secured in place with devices that cannot be loosened from the outside, screws or bolts requiring special tools for installation or removal are not acceptable alternates. No removable panel or cover requiring sealing or locking shall be located behind other panels, covers or doors except for rain-tight enclosures. Hinged cover panels shall be lockable on the side opposite the hinges. Hinged panel covers shall accept a padlock with a shackle diameter of not less than 5/16 inch. Stud and wing-nut sealing assemblies shall consist of a ¼ inch x 20 (minimum) stud and associated wing-nut, each drilled 0.0635 inch (minimum) for sealing purposes. The stud shall be securely attached so as to not loosen or back out when being fastened. Sealing screws shall be drilled 0.0635 inch (minimum) for sealing purposes. All securing screws for removable panel covers shall be captive.
- F. Current Transformer: Provided by Utility.

# PART 3 EXECUTION

# 3.01 INSTALLATION

- A. Make arrangements with Utility Company to obtain permanent electric service to the Project.
- B. Underground: Install service entrance conduits from Utility Company's pad-mounted transformer to building service entrance equipment. Utility Company will connect service lateral conductors to service entrance conductors.
- C. Concrete Pad for Transformer: Provided by Utility.
- D. Meter sockets shall be installed with the centerline of the socket opening no more than 72 inches and no less than 60 inches above finished grade. The meter socket shall be installed with a minimum 10 inches of side clearance to each side of the socket. On current transformer rated meter sockets, the conduit connecting the meter socket and the current transformer cabinet shall be rigid steel or IMC and have a minimum diameter of 1 inch, shall not be longer than 25 feet, shall have no access points (junction boxes, condulets, etc.), and shall connect to the meter socket at a factory supplied knockout located below the test switch mounting provisions.
- E. Current transformer cabinets shall not be used as a junction point to service other metered services or as a splicing chamber.
- F. All service entrance equipment shall have signage for arc hazard installed. The marking shall be located to be clearly visible to qualified personnel before examination, adjustment, servicing or maintenance of the equipment. At a minimum the signage shall state the following:

### Warning

Arc Flash and Shock Hazard Appropriate PPE Required

## SECTION 26 2200 LOW-VOLTAGE TRANSFORMERS

## PART 1 GENERAL

## 1.01 SECTION INCLUDES

A. Dry Type Two Winding Transformers.

## 1.02 RELATED SECTIONS

- A. The Work under this section is subject to requirements of the Contract Documents including the General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements and Section 26 0500 Common Work Results for Electrical.
- B. Section 26 0526 Grounding and Bonding for Electrical System.
- C. Section 26 0533 Raceway and Boxes for Electrical Systems.
- D. Section 26 0548 Vibration and Seismic Controls for Electrical Systems.
- E. Section 26 0553 Identifications for Electrical Systems.

## 1.03 REFERENCES

- A. ANSI/NEMA ST 1 Specialty Transformers.
- B. ANSI/NEMA ST 20 Dry Type Transformers for General Applications.

## 1.04 SUBMITTALS

- A. Submit product data under provisions of Division 01.
- B. Include outline and support point dimensions of enclosures and accessories, unit weight, voltage, KVA, and impedance ratings and characteristics, loss data, efficiency at 25, 50, 75 and 100 percent rated load, sound level, tap configurations, insulation system type, and rated temperature rise.

### 1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store and protect products under provisions of Division 01.
- B. Store in a warm, dry location with uniform temperature. Cover ventilating openings to keep out dust.
- C. Handle transformers using only lifting eyes and brackets provided for that purpose. Protect units against entrance of rain, sleet, or snow if handled in inclement weather.

### PART 2 PRODUCTS

# 2.01 ACCEPTABLE MANUFACTURERS - DRY TYPE TWO WINDING TRANSFORMERS

- A. Schneider/Square D.
- B. Eaton.
- C. General Electric.
- D. Substitutions: Under provisions of Division 01.

### 2.02 DRY TYPE TWO WINDING TRANSFORMERS

- A. Dry Type Transformers: ANSI/NEMA ST 20; factory-assembled, air cooled dry type transformers; ratings as shown on the Drawings.
- B. Insulation system and average winding temperature rise for rated KVA as follows:

| Rating | Class | Rise (º C) |
|--------|-------|------------|
| 1-15   | 185   | 80         |
| 16-500 | 220   | 80         |

- C. Case temperature shall not exceed 35°C rise above ambient at its warmest point.
- D. Winding Taps, Transformers Less than 15 KVA: Two 5 percent below rated voltage, full capacity taps on primary winding.
- E. Winding Taps, Transformers 15 KVA and Larger: ANSI/NEMA ST 20.
- F. Sound Levels: per ANSI/NEMA ST 20 as follows:

| KVA Rating | Sound Level |
|------------|-------------|
| 1-9        | 40 dB       |
| 10-50      | 45 dB       |
| 51-150     | 50 dB       |
| 151-300    | 55 dB       |
| 301-500    | 60 dB       |
| 501-700    | 62 dB       |

- G. Basic Impulse Level: 10 KV.
- H. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.
- I. Mounting: Transformers 75 KVA and less shall be suitable for wall, floor, or trapeze mounting; transformers larger than 75 KVA shall be suitable for floor or trapeze mounting.
- J. Coil Conductors: Continuous copper windings with terminations brazed or welded.
- K. Enclosure: ANSI/NEMA ST 20; Type 1. Provide lifting eyes or brackets.
- L. Isolate core and coil from enclosure using vibration- absorbing mounts.
- M. Nameplate: Include transformer connection data.

# PART 3 EXECUTION

### 3.01 INSTALLATION

- A. Set transformer plumb and level.
- B. Use flexible conduit, 2 ft. minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.
- C. Mount transformers on vibration isolating pads suitable for isolating the transformer noise from the building structure.
- D. Provide seismic restraints.
- E. All dry type transformers shall have signage for arc hazard installed. The marking shall be located to be clearly visible to qualified personnel before examination, adjustment, servicing or maintenance of the equipment. At a minimum the signage shall state the following:

### Warning

### Arc Flash and Shock Hazard

### Appropriate PPE Required

### 3.02 FIELD QUALITY CONTROL

- A. Check for damage and tight connections prior to energizing transformer.
- B. Measure primary and secondary voltages under normal building and make appropriate tap adjustments.

# END OF SECTION 26 2200

### SECTION 26 2413 SWITCHBOARDS

# PART 1 GENERAL

## 1.01 SUMMARY

A. Section includes service and main distribution switchboards.

# 1.02 RELATED SECTIONS:

- A. Section 03 3000 Cast-In-Place Concrete.
- B. Section 26 0526 Grounding and Bonding for Electrical Systems.
- C. Section 26 0548 Vibration and Seismic Controls for Electrical Systems.
- D. Section 26 0553 Identification for Electrical Systems.
- E. Section 33 7173 Electrical Utility Services.

# 1.03 REFERENCES

- A. American National Standards Institute:
  - 1. ANSI C12.1 Code for Electricity Metering.
  - 2. ANSI C39.1 Requirements, Electrical Analog Indicating Instruments.
- B. Institute of Electrical and Electronics Engineers:
  - 1. IEEE C57.13 Standard Requirements for Instrument Transformers.
  - 2. IEEE C62.41 Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.
- C. National Electrical Manufacturers Association:
  - 1. NEMA FU 1 Low Voltage Cartridge Fuses.
  - 2. NEMA KS 1 Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
  - 3. NEMA PB 2 Deadfront Distribution Switchboards.
  - 4. NEMA PB 2.1 General Instructions for Proper Handling, Installation, Operation, and Maintenance of Deadfront Distribution Switchboards Rated 600 Volts or Less.
- D. International Electrical Testing Association:
  - 1. NETA ATS Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
- E. Underwriters Laboratories Inc.:
  - 1. UL 489 Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures.
  - 2. UL 891 Dead-Front Switchboards.

### 1.04 SUBMITTALS

- A. Submit product data under provisions of Division 01 and Section 26 0500.
- B. Shop Drawings: Indicate front and side views of enclosures with overall dimensions shown; conduit entrance locations and requirements; nameplate legends; size and number of bus bars for each phase, neutral, and ground; and switchboard instrument details. Provide wiring diagrams showing all factory wired components to include, but not limited to, ground fault protection equipment, transient voltage surge suppression devices, arc-flash reduction devices, metering, shunt trip/remote close devices, etc.
- C. Product Data: Submit electrical characteristics including voltage, frame size and trip ratings, fault current withstand ratings, and time-current curves of equipment and components.

D. Submit structurally engineered shop drawings as specified in Section 26 0548 – Vibration and Seismic Controls for Electrical Systems for seismic restraint of all equipment required by the 2021 IBC. Equipment requiring structural shop drawings includes, but is not limited to the following: Free-standing or pad mounted distribution switchboards.

# 1.05 CLOSEOUT SUBMITTALS

- A. Submit closeout submittals under provisions of Section 26 0500 Common Work Results for Electrical and General Conditions in MASSB and Supplementary Conditions to the Contract.
- B. Project Record Documents: Record actual locations, configurations, and ratings of switchboards and their components on single line diagrams and plan layouts.
- C. Operation and Maintenance Data: Submit spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

# 1.06 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

# 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store and protect products under provisions of Division 01.
- B. Deliver in 72-inch maximum width shipping splits, individually wrapped for protection and mounted on shipping skids.
- C. Accept switchboards on site. Inspect for damage.
- D. Store in clean, dry space. Maintain factory wrapping or provide additional canvas or plastic cover to protect units from dirt, water, construction debris, and traffic.
- E. Handle in accordance with NEMA PB 2.1. Lift only with lugs provided. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

# 1.08 MAINTENANCE MATERIALS

A. Furnish two of each key, if applicable.

# PART 2 PRODUCTS

# 2.01 SERVICE AND MAIN DISTRIBUTION SWITCHBOARDS

- A. Manufacturers:
  - 1. Schneider/Square D as basis of design.
  - 2. Substitutions: Under provisions of Division 01 and 26 0500.
- B. Product Description: NEMA PB 2, enclosed switchboard with electrical ratings and configurations as indicated on Drawings.
- C. Device Mounting as shown on the Drawings.
- D. Bus:
  - 1. Material: Copper with silver or tin plating, standard size.
  - 2. Connections: Bolted, accessible from front for maintenance.
- E. Ground Bus: Extend length of switchboard.
- F. Minimum Short Circuit Rating: As shown on the Drawings
- G. Line and Load Terminations: Accessible from front only of switchboard, suitable for conductor materials and sizes as indicated on Drawings.
- H. Future Provisions: Fully equip spaces for future devices with bussing and bus connections, insulated and braced for short circuit currents. Furnish continuous current ratings.
- I. Enclosure: NEMA type as indicated on Drawings.

J. Finish: Manufacturer's standard light gray enamel over external surfaces. Coat internal surfaces with minimum one coat corrosion-resisting paint, or plate with cadmium or zinc.

### 2.02 MOLDED CASE CIRCUIT BREAKER

- A. Manufacturers:
  - 1. Same manufacturer as Switchboards.
- B. Product Description: UL 489, molded-case circuit breaker.
- C. Field-Adjustable Trip Circuit Breaker: Circuit breakers with frame sizes 400 amperes and larger have mechanism for adjusting long time, short time, instantaneous, and ground fault (if required) current pickup setting for automatic operation.
- D. Solid-State Circuit Breaker: Electronic sensing, timing, and tripping circuits for adjustable current settings; ground fault trip with integral ground fault.
- E. Provide additional circuit breaker accessories as noted on the Drawings.

# 2.03 GROUND FAULT DEVICES

- A. Manufacturers:
  - 1. Same manufacturer as Switchboards.
- B. Ground Fault Sensor: Provide integral to breaker where shown on the Drawings.
- C. Ground Fault Relay: Adjustable ground fault sensitivity from 200 to 1200 amperes, time delay adjustable from 0 to 15 seconds. Furnish monitor panel with lamp to indicate relay operation, TEST and RESET control switches.

## 2.04 SURGE PROTECTIVE DEVICES

- A. Manufacturers:
  - 1. Same manufacturer as Switchboards.
- B. Product Description: IEEE C62.41, factory-mounted transient voltage surge suppressor, selected to meet requirements for medium exposure and to coordinate with system circuit voltage.

### 2.05 ARC ENERGY REDUCTION

- A. Manufacturers:
  - 1. Same manufacturer as Switchboards.
- B. Where the highest continuous trip setting of a circuit breaker is rated or adjustable to 1200 amps or higher, provide an energy reducing maintenance switch (ERMS) with local status indicator in accordance with NEC 240.87.

### PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify surface is suitable for switchboard installation.

### 3.02 PREPARATION

A. Concrete Pad: Comply with requirements of Section 03 3000 – Cast-in-Place Concrete.

### 3.03 INSTALLATION

- A. Install in accordance with NEMA PB 2.1.
- B. Tighten accessible bus connections and mechanical fasteners after placing switchboard.
- C. Install engraved plastic nameplates in accordance with Section 26 0553 Identification for Electrical Systems.
- D. Install breaker circuit directory for main and distribution switchboards.

E. Ground and bond switchboards in accordance with Section 26 0526 – Grounding and Bonding for Electrical Systems.

## 3.04 FIELD QUALITY CONTROL

- A. Section 26 0126 Maintenance Testing of Electrical Systems.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.1.
- D. Provide performance testing on all ground fault protection systems in accordance with NEC 230.95. This test shall be conducted by qualified persons using a test process of primary current injection.
- E. Provide performance testing on all arc energy reduction protection systems in accordance with NEC 240.97(C). This test shall be conducted by qualified persons in accordance with the manufacturer's instructions using a test process of primary current injection.

### 3.05 ADJUSTING

- A. Adjust operating mechanisms for free mechanical movement.
- B. Tighten bolted bus connections.
- C. Adjust circuit breaker trip and time delay settings to values as recommended by the manufacturer based upon project Drawings.

## 3.06 CLEANING

A. Touch up scratched or marred surfaces to match original finish.

# END OF SECTION 26 2413

## SECTION 26 2416 PANELBOARDS

## PART 1 GENERAL

## 1.01 SECTION INCLUDES

- A. Service and Distribution Panelboards.
- B. Branch Circuit Panelboards.
- C. Surge Protective Devices.

## 1.02 RELATED SECTIONS

- A. The Work under this section is subject to requirements of the Contract Documents including the General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements, and Section 26 0500 Common Work Results for Electrical.
- B. Section 26 0526 Grounding and Bonding for Electrical Systems.
- C. Section 26 0553 Identification for Electrical Systems.
- D. Section 26 0548 Vibration and Seismic Control for Electrical Systems.
- E. Section 26 2916 Enclosed Contactors.

# 1.03 REFERENCES

- A. NEMA AB 1 Molded Case Circuit Breakers.
- B. NEMA KS 1 Enclosed Switches.
- C. NEMA PB 1 Panelboards.
- D. NEMA PB 1.1 Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.
- E. NEMA PB 2.2 Application Guide for Ground-fault Protective Devices for Equipment.
- F. UL 50 Enclosures for Electrical Equipment.
- G. UL 67 Panelboards.
- H. UL 98 Enclosed and Dead-front Switches.
- I. UL 489 Molded Case Circuit Breakers and Circuit Breaker Enclosures.
- J. Federal Specification W-C-375B/Gen Circuit Breakers, Molded Case, Branch Circuit and Service.
- K. Federal Specification W-C-865C Fusible Switches.

# 1.04 SUBMITTALS

- A. Submit data under provisions of Division 01 and Section 26 0500.
- B. Product Data: Submit product data for all components provided which fall under this section showing configurations, finishes, and dimensions. Each catalog sheet should be clearly marked to indicate exact part number provided, including all options and accessories.
- C. Shop drawings: Submit shop drawings for each panelboard indicating features and device arrangement and size. Include outline and support point dimensions, voltage, main bus ampacity, and integrated short circuit ampere rating.

## 1.05 CLOSEOUT SUBMITTALS

- A. Project Record Drawings: Submit final record panel schedules as hardcopy and in Microsoft Excel format. Submit under Section 26 0500.
- B. Operation and Maintenance Manuals: Provide product data and shop drawing information including replacement parts list. Provide installation, operation and maintenance information per manufacturer.

C. Panel Schedules: Prior to Substantial Completion, submit copies of all panel schedules for review by the Owner. The Owner will note any changes to the room numbers/names and the Contractor shall provide revised typed panel schedules to reflect all changes, at no additional cost to the Owner.

# 1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to site under provisions of Division 01.
- B. Upon arrival at the site inspect equipment and report on any damage.
- C. Handle carefully on site to avoid any damage to internal components, enclosures and finishes.
- D. Store in a clean, dry environment. Maintain factory packaging and provide an additional heavy canvas or plastic cover to protect enclosures from dirt, water, construction debris and traffic.

## 1.07 WARRANTY

A. Manufacturer shall warrant specified equipment to be free of defects for a period of one year from the date of installation.

## 1.08 SPARE PARTS

A. Keys: Furnish 2 each to Owner.

# PART 2 PRODUCTS

# 2.01 MANUFACTURERS - PANELBOARDS

- A. Schneider/Square D.
- B. Eaton.
- C. General Electric.
- D. Siemens.
- E. Substitutions: Under provisions of Division 01.

# 2.02 DISTRIBUTION CIRCUIT BREAKER PANELBOARDS

- A. Panelboards: NEMA PB 1; circuit breaker type.
- B. Enclosure: NEMA PB 1; Type 1 or 3R. As indicated on the drawings. Cabinet size: 6 inches deep; 24 inches wide minimum.
- C. Provide cabinet front with door-in-door cover and hinged door with flush lock Finish in manufacturer's standard gray enamel.
- D. Interior trim shall be dead-front construction to shield user from all energized parts.
- E. Panelboard bussing shall be fully rated with sequential phase distribution. Bussing shall be copper.
- F. Provide UL Listed short circuit current ratings as indicated on the drawings. Minimum short circuit rating shall be 10,000 amperes RMS symmetrical for 250 volt panelboards; 14,000 amperes RMS symmetrical for 600 volt panelboards.
- G. A solidly bonded copper equipment ground bar shall be provided.
- H. Solid neutral bus bars shall be provided. Neutral bus shall be of same material as the phase busses. Solid neutral bars shall be equipped with a full capacity bonding strap for service entrance applications. Gutter mounted neutrals will not be accepted.
- I. Panelboards shall have nameplates containing the following information:
  - 1. Catalog number.
  - 2. Factory order number.
  - 3. UL Listed Label.
  - 4. Short Circuit Current Rating.

- 5. Main Circuit Breaker or Main Lug Rating.
- 6. System Voltage.
- J. Main circuit breakers shall be UL listed for use with the following accessories:
  - 1. Shunt Trip.
  - 2. Under Voltage Trip.
  - 3. Ground Fault Shunt Trip.
  - 4. Auxiliary Switch.
  - 5. Alarm Switch.
  - 6. Mechanical Lug Kits.
  - 7. Compression Lug Kits.
- K. Thermal Magnetic Molded Case Circuit Breakers: NEMA AB 1; provide circuit breakers with integral thermal and instantaneous magnetic trip in each pole. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits. Breaker ampacity and AIC rating shall be visible on breaker without removing panel deadfront or cover.
- L. Thermal Magnetic Current-Limiting Molded Case Circuit Breakers: NEMA AB 1; provide bolt-on type circuit breakers with integral thermal and instantaneous magnetic trip in each pole, coordinated with replaceable automatically resetting current-limiting elements in each pole. Interrupting rating 100,000 symmetrical amperes, let-through current and energy level less than permitted for same size Class RK-5 fuse.

## 2.03 BRANCH CIRCUIT PANELBOARDS

- A. Branch Circuit Panelboards: NEMA PB 1; circuit breaker type.
- B. Enclosure: NEMA PB 1; Type 1 or 3R as indicated on Drawings. Boxes shall be galvanized steel constructed in accordance with UL50 requirements. Interiors shall be field convertible for top or bottom incoming feed. Interior leveling provisions shall be provided for flush mounted applications.
- C. Cabinet Size: 6 inches deep; 20 inches wide minimum.
- D. Provide flush or surface cabinet front as indicated on the Drawings with door-in-door cover concealed trim clamps, concealed hinge and flush lock all keyed alike. Finish in manufacturer's standard gray enamel.
- E. Provide panelboards with copper bus, ratings as scheduled on Drawings. Provide one continuous bus bar per phase each. Panelboards shall have sequentially phased branch circuit connectors suitable for bolt-on branch circuit breakers. Bussing shall be fully rated.
- F. Integrated Short Circuit Rating: Provide panelboards with short circuit ratings as shown on the Drawings. Minimum ratings shall be 10,000 amperes RMS symmetrical for 250 volt panelboards; 14,000 amperes RMS symmetrical for 600 volt panelboards.
- G. Main/Sub Feed Circuit Breakers: NEMA AB 1; Provide vertical mount main and/or sub feed circuit breaker in panelboards as shown on the drawings.
  - Circuit breakers shall be operated by a toggle-type handle and shall have a quick-make, quick-break over-center switching mechanism that is mechanically trip-free. Automatic tripping of the breaker shall be clearly indicated by the handle position. Contacts shall be non-welding silver alloy and arc extinction shall be accomplished by means of DE-ION arc chutes. A push-to-trip button on the front of the circuit breaker shall provide a local manual means to exercise the trip mechanism.
  - Lugs shall be UL Listed to accept copper and aluminum conductors and shall be suitable for 90°C rated wire, sized according to the 75 °C temperature rating per NEC Table 310-16. Lug body shall be bolted in place.

- H. Branch Circuit Breakers: NEMA AB 1; Provide panelboards with bolt-on type thermal magnetic trip circuit breakers.
  - 1. Circuit breakers shall be operated by a toggle-type handle and shall have a quick-make, quick-break over-center switching mechanism that is mechanically trip-free with common trip handle for all poles.
  - Lugs shall be UL Listed to accept copper and aluminum conductors and shall be suitable for 90°C rated wire, sized according to the 75 °C temperature rating per NEC Table 310-16. Lug body shall be bolted in place.
  - 3. Provide circuit breakers UL listed as Type SWD for lighting circuits.
  - 4. Provide circuit breakers UL listed as type HACR for use with heating, air conditioning and refrigeration equipment.
  - 5. Provide UL Class A ground fault interrupter circuit breakers where scheduled on Drawings.

# 2.04 PANELBOARD IDENTIFICATION

- A. For each panelboard each new panelboard and each existing panelboard where circuits are added or modified, provide typed schedule denoting each circuit load by the load type and final name and room number actually in use in the facility. Schedule shall not be typed with names shown on the Contract Drawings unless names are acceptable to the Owner.
- B. Provide panel schedule in O&M manual for every new panelboard and every existing panelboard where circuits are added or modified.
- C. Where more than one nominal voltage system is present on the premises, the conductor colorcoding legend shall be permanently posted at each branch circuit and distribution panelboard per NEC requirements.
- D. All panelboards shall have signage for arc hazard installed. The marking shall be located to be clearly visible to qualified personnel before examination, adjustment, servicing or maintenance of the equipment. At a minimum the signage shall state the following:

### Warning

### Arc Flash and Shock Hazard

### Appropriate PPE Required

E. Provide electronic copies of all panel schedules in Microsoft Excel format, submitted with the O&M manuals.

# 2.05 SURGE PROTECTIVE DEVICES (SPD)

- A. Integral Surge Protective Device:
  - 1. The manufacturer of the SPD shall be the same as the manufacturer of the distribution equipment in which the devices are installed and shipped. Also, this distribution equipment shall be fully tested and certified to the following UL standards:

### UL 67 = Panelboards,

UL 891 = Switchboards,

### UL 1558 = Low Voltage Switchgear.

- 2. Component recognized in accordance with UL 1449 and UL 1283.
- 3. Independently tested with category C3 high exposure waveform (20 kV-1.2/50us, 10kA-8/20 us) per IEEE C62.41.
- 4. Furnish copper bus bars for surge current path.
- 5. Construct using surge current modules (MOV based). Each module fused with user replaceable 200,000 AIR rated fuses. Status of each module monitored on front cover of panelboard enclosure and on module.

- 6. Furnish with audible alarm activated when one of surge current modules has failed. Furnish alarm on/off to silence alarm and alarm push-to-test switch to test alarm. Locate switches and alarm on front cover of panelboard enclosure.
- 7. Meet or exceed the following criteria:
  - a. Minimum surge current rating shall be 160 kA per phase (80 kA per mode) for service entrance and 80 kA per phase (40 kA per mode) for distribution applications.
  - b. Pulse Lift Test: Capable of protecting against and surviving 5000 IEEE C62.41 Category C transients without failure or degradation.
  - c. UL 1449 clamping voltage must not exceed the following:

| <u>VOLTAGE</u> | <u>L-N</u> | <u>L-G</u> | <u>N-G</u> |
|----------------|------------|------------|------------|
| 240/120        | 800/400V   | 800/400V   | 400V       |
| 208Y/120       | 400V       | 400V       | 400V       |
| 480Y/277       | 800V       | 800V       | 800V       |

- 8. Furnish response time no greater than five nanoseconds for individual protection modes.
- 9. Designed to withstand maximum continuous operating voltage (MCOV) of not less than 115 percent of nominal RMS voltage.
- 10. Furnish visible indication of proper suppresser connection and operation. Lights indicate operable phase and module.
- 11. Furnish minimum EFI/RFI filtering of 34 dB at 100 kHz with insertion loss ratio of 50: 1 using Mil Std. 220A methodology.
- B. Panelboard Mounted:
  - 1. UL 67 listed, and SPD shall be UL 1449 Component Recognized. Furnish panelboard markings with clamp voltage at SPD terminals and clamp voltage at panelboard line terminals.
  - 2. Construct box of galvanized steel. Box size as indicated on Drawings.
  - 3. Main bus constructed of copper and rated for load current.
  - 4. Furnish interior with branch circuit breakers if not bus mounted type. Furnish one circuit breaker for each SPD, with appropriate number of poles, as dedicated disconnect for SPD.
  - 5. Furnish with insulated ground bus and safety ground bus.
- C. Enclosure Mounted:
  - 1. UL 67 listed and SPD shall be UL 1449 Component Recognized.
  - 2. Provide with flush mounted NEMA Type 1 enclosure. Construct box of galvanized steel. Box size as required for SPD unit and in compliance with NFPA 70.
  - 3. Provide panelboard-mounted circuit breakers with appropriate number of poles and manufacturer required ampacity, as dedicated disconnect for SPD.

# PART 3 EXECUTION

# 3.01 INSTALLATION

- A. Install panelboards plumb and flush with wall finishes, in conformance with NEMA PB 1.1.
- B. Height: 6 feet, 6 inches to top of panelboard.
- C. Provide filler plates for unused spaces in panelboards.
- D. Panel Schedules: Revise schedules to reflect circuiting changes required to balance phase loads.

E. Stub 5 empty one inch conduits to accessible location above ceiling out of each recessed panelboard.

## 3.02 FIELD QUALITY CONTROL

- A. Measure steady state load currents at each panelboard feeder. Should the difference at any panelboard between phases exceed 20 percent, rearrange circuits in the panelboard to balance the phase loads within 20 percent. Take care to maintain proper phasing for multi-wire branch circuits.
- B. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers.

# END OF SECTION 26 2416

## SECTION 26 2726 WIRING DEVICES

## PART 1 GENERAL

## 1.01 SECTION INCLUDES

- A. Wall Switches.
- B. Wall Dimmers.
- C. Receptacles.
- D. Device Plates and Box Covers.

## 1.02 RELATED SECTIONS

- A. The Work under this section is subject to requirements of the Contract Documents including the General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements and Section 26 0500 Common Work Results for Electrical.
- B. Section 26 0526 Grounding and Bonding for Electrical Systems.
- C. Section 26 0533 Raceway and Boxes for Electrical Systems.
- D. Section 26 0553 Identification for Electrical Systems.

## 1.03 REFERENCE STANDARDS

- A. FS W-C-596 Federal Specification for Electrical Power Connector, Plug, Receptacle, and Cable Outlet.
- B. FS W-S-896 Federal Specification for Switches, Toggle (Toggle and Lock), Flush Mounted.
- C. NEMA WD 1 General Color Requirements for Wiring Devices.
- D. ANSI/NEMA WD 6 Wiring Devices Dimensional Requirement.
- E. UL 20 General-Use Snap Switches.
- F. UL 498 Attachment Plugs and Receptacles.
- G. UL 943 Ground-Fault-Circuit-Interrupters.

# 1.04 SUBMITTALS

A. Product Data: Submit product data for all components provided that are specified in this section showing configurations, finishes, and dimensions. Each catalog sheet should be clearly marked to indicate exact part number provided, including all options and accessories.

## PART 2 PRODUCTS

# 2.01 ACCEPTABLE MANUFACTURERS - WALL SWITCHES

- A. Hubbell.
- B. Leviton.
- C. Pass & Seymour.
- D. Arrow Hart
- E. Substitutions: Under provisions of Division 01.

# 2.02 WALL SWITCHES

- A. Wall Switches for Lighting Circuits: UL 20; ANSI/NEMA WD-6; and Federal Specification FS W-S-896 AC industrial grade snap switch with toggle handle, rated 20 amperes and 120-277 volts AC. Handle: White nylon. Provide single-pole, 3-way, or 4-way switches as indicated on Plans.
- B. Pilot Light Type: UL 20; ANSI/NEMA WD-6; and Federal Specification FS W-S-896 AC industrial grade snap switch, rated 20 amperes and 120-277 volts AC. Handle: Red pilot light toggle (illuminated when load is on). Provide single pole unless otherwise indicated on Plans.

# 2.03 ACCEPTABLE MANUFACTURERS - WALL DIMMERS

- A. Lutron.
- B. Leviton.
- C. Substitutions: Under provisions of Division 01.

### 2.04 WALL DIMMERS

A. Wall Dimmers for 0-10V Loads: UL 1472; ANSI/NEMA WD-6; Decora-style, commercial grade preset wall dimmer switch, 0-10V control for LED drivers (8 A, 120-277 V); adjustable high-end and low-end trim. Color: White. Handle: Paddle switch for on/off operation with small, discrete, captive linear slide for dimmer adjustment. Provide single pole unless otherwise indicated on Plans. Provide power pack as required to accommodate loads larger than 8 A. Dimmer shall be fully compatible with all loads connected for smooth, flicker-free dimming operation.

# 2.05 ACCEPTABLE MANUFACTURERS - RECEPTACLES

- A. Hubbell.
- B. Leviton.
- C. Pass & Seymour.
- D. Arrow Hart
- E. Substitutions: Under provisions of Division 01.

### 2.06 RECEPTACLES

- A. Convenience and Straight-blade Receptacles: UL 498, ANSI/NEMA WD-6 and Federal Specification FS W-C-596 industrial grade receptacle.
- B. Locking-Blade Receptacles: NEMA WD 5.
- C. Convenience Receptacle Configuration: ANSI/NEMA WD-6; Type 5-20R, white nylon face.
- D. Specific-use Receptacle Configuration: NEMA WD 5; type as indicated on Drawings, black phenolic face.
- E. GFCI Receptacles: ANSI/NEMA WD-6; 20A, duplex convenience receptacle with integral class 'A' ground fault current interrupter, LED indicator lamp and integral lockout.
- F. Tamper-Resistant Receptacles: ANSI/NEMA WD-6; Complying with the requirements of UL 498 (section 131) and NEC 406.12-14.
- G. Weather-Resistant Receptacles: ANSI/NEMA WD-6; Listed to the weather-resistant supplement of UL498 and complying with the requirements of NEC 406.9.

## 2.07 DEVICE PLATES

- A. Decorative Cover Plate: Smooth 430 or 302 stainless steel. White impact resistant thermoplastic with metal, counter sunk screws to match device plate.
- B. Weatherproof Cover Plate: UL listed, cast aluminum, hinged outlet cover/enclosure, with gasket between the enclosure and the mounting surface, suitable for wet locations while in use and identified as "Extra Duty" per NEC 406.9 (B)(1).
- C. Exposed Work Cover Plate: 1/2 inch raised, square, pressed, galvanized or cadmium plated steel cover plate supporting devices independent of the outlet box.

# PART 3 EXECUTION

# 3.01 INSTALLATION

- A. Install wall switches 48 inches above floor, OFF position down.
- B. Unless otherwise noted install wall switches within 6 inches of the door jamb on the strike side.
- C. Install wall dimmers 48 inches above floor; derate ganged dimmers as instructed by manufacturer; do not use common neutral.

- D. Install convenience receptacles 18 inches above floor, 4 inches above counters or backsplash, grounding pole on bottom.
- E. Healthcare Facilities: Install tamperproof receptacles at all locations as required by NEC 406.12.
- F. Install specific-use receptacles at heights shown on Contract Drawings.
- G. Unless otherwise noted, mounting heights are for finished floor to center line of outlet.
- H. Drill opening for poke-through fitting installation in accordance with manufacturer's instructions.
- I. Install decorative plates on switch, receptacle, and blank outlets in finished areas. Use midsize or jumbo plates for outlets installed in masonry walls, where required to cover up imperfections in the wall opening.
- J. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface-mounted outlets.
- K. Install devices and wall plates flush and level.
- L. Ground receptacles to boxes with a grounding wire. Grounding through the yoke or screw contact is not an acceptable alternate to the ground wire.
- M. Install circuit label on each receptacle and light switch in accordance with Section 26 0553.

## END OF SECTION 26 2726

## SECTION 26 2816 ENCLOSED SWITCHES AND CIRCUIT BREAKERS

# PART 1 GENERAL

## 1.01 SECTION INCLUDES

- A. Enclosed Switches.
- B. Enclosed Double Throw Switches.
- C. Fuses.
- D. Enclosed Circuit Breakers
- E. Enclosures.

# 1.02 RELATED SECTIONS

- A. The Work under this section is subject to requirements of the Contract Documents including the General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements and Section 26 0500 Common Work Results for Electrical.
- B. Section 01 4000 Quality Requirements.
- C. Section 26 0526 Grounding and Bonding for Electrical Systems.
- D. Section 26 0548 Vibration and Seismic Controls for Electrical Systems.
- E. Section 26 0553 Identification for Electrical Systems.

## 1.03 REFERENCE STANDARDS

- A. ANSI/UL 198C High-Intensity Capacity Fuses; Current Limiting Types.
- B. ANSI/UL 198E Class R Fuses.
- C. ANSI/UL 98 Enclosed and Dead Front Switches.
- D. NEMA KS 1 Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
- E. NEMA FU 1 Low Voltage Cartridge Fuses.
- F. UL 489 Molded Case Circuit Breakers and Circuit Breaker Enclosures.
- G. NEMA AB-1 Molded Case Circuit Breakers and Molded Case Switches.
- H. NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum).
- I. NETA ATS Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

## 1.04 SUBMITTALS

- A. Product Data: Submit product data for all components provided, showing electrical characteristics, material, and dimensions. Each catalog sheet should be clearly marked to indicate exact part number provided, including all options and accessories.
- B. Shop Drawings: Submit shop drawings include outline drawings with dimensions, and equipment ratings for voltage, capacity, horsepower, and short circuit current interrupting rating.

### 1.05 CLOSEOUT SUBMITTALS

A. Project Record Drawings: Accurately indicate actual location of enclosed switches, circuit breakers and ratings of actual installed fuses.

## **1.06 QUALITY ASSURANCE**

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

# 1.07 EXTRA STOCK

- A. Provide extra stock under provisions of Division 01.
- B. Fuses: Provide one set of 3 fuses of each size and type of fuse installed.

# PART 2 PRODUCTS

# 2.01 ACCEPTABLE MANUFACTURERS - ENCLOSED SWITCHES

- A. Schneider/Square D.
- B. Siemens.
- C. Eaton.
- D. General Electric.
- E. Substitutions: Under provisions of Division 01.

# 2.02 ENCLOSED SWITCHES

- A. Fusible Switch Assemblies: NEMA KS 1; Heavy Duty type; quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position. Fuse Clips: Designed to accommodate Class R fuses and reject all other classes of fuse.
- B. Nonfusible Switch Assemblies: NEMA KS 1; Heavy Duty type; quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position.
- C. Enclosures: NEMA KS 1; Type 1, 3R or 4 as indicated on Drawings.
- D. Disconnect Switches For Elevators: Fusible switch assembly, as specified above, with one normally open and one normally closed electrical interlock contact.

# 2.03 ENCLOSED DOUBLE THROW SWITCHES

- A. Fusible Switch Assemblies: NEMA KS 1; Heavy Duty type; quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in either ON position. Handle lockable in center OFF position. Fuse Clips: Designed to accommodate Class R fuses and reject all other classes of fuse.
- B. Nonfusible Switch Assemblies: NEMA KS 1; Heavy Duty type; quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in either ON position. Handle lockable in center OFF position.
- C. Manual Transfer switch: Suitable for use as non-load break / non-load make manual transfer switch.
- D. Enclosures: NEMA KS 1; Type 1, 3R or 4 as indicated on Drawings.

# 2.04 ACCEPTABLE MANUFACTURERS - FUSES

- A. Eaton (Bussmann).
- B. Mersen (Ferraz-Shawmut).
- C. Littelfuse.
- D. Substitutions: Under provisions of Division 01.

# 2.05 FUSES

- A. Fuses 600 Amperes and Less: ANSI/UL 198E, Class RK1; RK5; dual element, current limiting, time delay, one-time fuse 600 volt.
- B. Interrupting Rating: 200,000 rms amperes.

# 2.06 ACCEPTABLE MANUFACTURERS – ENCLOSED CIRCUIT BREAKERS

A. Square D.

- B. Siemens Energy & Automation.
- C. Cutler Hammer.
- D. Substitutions: Under provisions of Division 01.

## 2.07 MOLDED CASE CIRCUIT BREAKERS

- A. Molded case circuit breakers shall provide circuit overcurrent protection with inverse time and instantaneous tripping characteristics.
- B. All circuit breakers shall have a quick-make, quick break over center toggle type mechanism and the handle mechanism shall be trip free to prevent holding contacts closed against a short circuit or sustained overload. All circuit breaker handles shall assume a position between "ON" and "OFF" when tripped automatically. Multiple pole circuit breakers shall be common trip such that an overload or short circuit on any one pole will result in all poles opening simultaneously. Arc extinction is to be accomplished by magnetic arc chutes. All ratings are to be clearly visible.
- C. Circuit breakers shall have a minimum symmetrical interrupting capacity as indicated on the drawings. The interrupting rating of the circuit breakers shall be at least equal to the available short circuit current at the line terminals of the circuit breaker. Where indicated or allowed, circuit breakers shall be UL listed for series application.
- D. Where indicated, circuit breakers shall be current limiting. Current limiting circuit breakers shall limit the let-through l<sup>2</sup>t to a value less than the l<sup>2</sup>t of one-half cycle wave of the symmetrical prospective current without any fusible elements when operating within its current range.
- E. Where combination motor control is indicated on the drawings, instantaneous only circuit breakers shall be furnished as the means to provide short circuit protection. The magnetic trip settings for each phase shall be individually adjustable from the front of each circuit breaker.
- F. Unless otherwise noted on the drawings, all circuit breakers 250A ampere frame and below shall have thermal-magnetic trip units, with inverse time-current characteristics.
  - 1. Automatic operation of all circuit breakers shall be obtained by means of thermal-magnetic tripping devices located in each pole providing inverse time delay and instantaneous circuit protection. Instantaneous pick-up settings for each phase shall be individually adjustable on all frames 250A and above.
  - 2. Circuit breakers shall be ambient compensating in that, as the ambient temperature increases over 40° C, the circuit breaker automatically derates itself to better protect its associated conductor.
  - 3. Circuit breakers from 250 to 2000A frames shall have thermal magnetic interchangeable trip units. When reverse feed is indicated on the drawings, in accordance with UL, circuit breakers with sealed trip units shall be supplied.

### 2.08 INTERNAL ACCESSORIES

- A. Unless otherwise noted, mechanical lugs shall be provided with all Molded Case Breakers.
- B. Compression lugs shall be provided on 1200A frame and below circuit breakers. All compression lugs shall be supplied by the circuit breaker manufacturer.
- C. Provide shunt trip and auxiliary switches as shown on the contract drawings.
- D. All accessories shall be UL Listed for field installation.
- E. Provide strip heater to prevent condensation in extreme cold climate.

## 2.09 ENCLOSURES

A. Enclosed circuit breaker shall have NEMA 1 general-purpose ratings unless otherwise noted. Provide enclosure suitable for locations as indicated on drawings.

# PART 3 EXECUTION

# 3.01 INSTALLATION

- A. Install enclosed switches and circuit breakers where indicated on Drawings, and where required for NEC required disconnect of equipment specified under other divisions, but installed under Division 26.
- B. Install fuses in fusible disconnect switches.
- C. All enclosed switches and enclosed breakers shall have signage for arc hazard installed. The marking shall be located to be clearly visible to qualified personnel before examination, adjustment, servicing or maintenance of the equipment. At a minimum the signage shall state the following:

### Warning

Arc Flash and Shock Hazard

### Appropriate PPE Required

### 3.02 FIELD QUALITY CONTROL

- A. Field inspecting, testing, adjusting and balancing.
- B. Inspect and test in accordance with NETA ATS, exception Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.5.

# 3.03 ADJUSTMENTS

A. The Contractor shall perform necessary field adjustments of the circuit breakers to place the equipment in final operating condition. The settings shall be in accordance with the approved protective device coordination study or as directed by the Engineer.

# END OF SECTION 26 2816

## SECTION 26 2913 ENCLOSED CONTROLLERS

## PART 1 GENERAL

## 1.01 SECTION INCLUDES

- A. Manual Motor Starters.
- B. Magnetic Motor Starters.
- C. Combination Magnetic Motor Starters.

## 1.02 RELATED SECTIONS

- A. Division 21 Fire Suppression.
- B. Division 22 Plumbing.
- C. Division 23 Heating, Ventilating, and Air Conditioning (HVAC).
- D. Section 26 0548 Vibration and Seismic Controls for Electrical Systems.
- E. Section 26 0529 Hangers and Supports for Electrical Systems.
- F. Section 26 0553 Identification for Electrical Systems.

## 1.03 REFERENCES

- A. The Work under this section is subject to requirements of the Contract Documents including the General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements.
- B. ANSI/NEMA ICS 6 Enclosures for Industrial Controls and Systems.
- C. ANSI/UL 198C High-Intensity Capacity Fuses; Current- Limiting Types.
- D. ANSI/UL 198E Class R Fuses.
- E. NEMA AB 1 Molded Case Circuit Breakers.
- F. NEMA KS 1 Enclosed Switches.

### 1.04 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Division 01.
- B. Provide product data on motor starters and combination motor starters, relays, pilot devices, and switching and overcurrent protective devices.

### 1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Include recommended maintenance procedures and intervals.

### PART 2 PRODUCTS

### 2.01 ACCEPTABLE MANUFACTURERS - MOTOR STARTERS

- A. Schneider/Square D.
- B. Allen Bradley.
- C. Siemens.
- D. Eaton.
- E. Substitutions: Under provisions of Division 01.

### 2.02 MANUAL MOTOR STARTERS

A. Manual Motor Starter: NEMA ICS 2; size and number of poles as required by the load served, AC general-purpose Class A manually operated non-reversing full-voltage controller for induction motors rated in horsepower, with overload relay, red LED pilot light, NO auxiliary contact, and push button operator.
- B. Fractional Horsepower Manual Starter: NEMA ICS 2; AC general-purpose Class A manually operated, number of poles as required by the load served, full-voltage controller for fractional horsepower induction motors, with thermal overload unit, red pilot light, and toggle operator.
- C. Motor Starting Switch: NEMA ICS 2; AC general-purpose Class A manually operated 2 pole, full-voltage controller for fractional horsepower induction motors, without thermal overload unit, red pilot light, NO auxiliary contact, toggle operator.
- D. Enclosure: ANSI/NEMA ICS 6; Type 1, 3R or 4. As indicated on the Drawings.

### 2.03 MAGNETIC MOTOR STARTERS

- A. Magnetic Motor Starters: NEMA ICS 2; AC general-purpose Class A magnetic controller for induction motors rated in horsepower.
- B. Full Voltage Starting: Non-reversing type.
- C. Coil Operating Voltage: 120 or 480 volts, 60 Hertz.
- D. Size: NEMA ICS 2; size as required by the load served.
- E. Overload Relay: NEMA ICS 2; bimetal.
- F. Enclosure: NEMA ICS 6; Type 1 or 3R as shown on the drawings.
- G. Combination Motor Starters: Combine motor starters motor circuit protector, non-fusible switch disconnect in common enclosure.
- H. Auxiliary Contacts: NEMA ICS 2; two field convertible contacts in addition to seal-in contact.
- I. Indicating Lights: NEMA ICS 2; RUN: red LED light in front cover.
- J. Selector Switches: NEMA ICS 2; HAND/OFF/AUTO, in front cover.
- K. Control Power Transformers: 120 volt secondary, VA capacity as required by the load served in each motor starter.
- L. Power Monitor: Include a three-phase power monitor in each magnetic starter connected to shut down the motor on loss of any phase, phase reversal, or low voltage on any phase. Power monitor shall automatically reset and restart motor when phase and voltage conditions return to normal. Provide oversize starter enclosures as required to install power monitor.

#### 2.04 CONTROLLER OVERCURRENT PROTECTION AND DISCONNECTING MEANS

- A. Molded Case Thermal-Magnetic Circuit Breakers: NEMA AB 1; circuit breakers with integral thermal and instantaneous magnetic trip in each pole.
- B. Motor Circuit Protector: NEMA AB 1; circuit breakers with integral instantaneous magnetic trip in each pole.
- C. Nonfusible Switch Assemblies: NEMA KS 1; quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle. Provide interlock to prevent opening front cover with switch in ON position. Handle lockable in OFF position.

### 2.05 ACCEPTABLE MANUFACTURERS - FUSES

- A. Eaton (Bussmann).
- B. Mersen (Ferraz-Shawmut).
- C. Littelfuse.
- D. Substitutions: Under provisions of Division 01.

#### 2.06 FUSES

- A. Fuses: ANSI/UL 198E, Class RK1current limiting one-time fuse, 600 volt.
- B. Interrupting Rating: 200,000 rms amperes.

## PART 3 EXECUTION

### 3.01 INSTALLATION

- A. Install motor control equipment in accordance with manufacturer's instructions.
- B. Install fuses in fusible switches.
- C. Select and install heater elements in motor starters to match installed motor characteristics.
- D. Motor Data: Provide neatly typed label inside each motor starter enclosure door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating.
- E. After final connections are made, check and correct the rotation of all motors.
- F. Field adjust the trip settings of all motor starter magnetic trip only circuit breakers to approximately 11 times motor full load current. Determine full load current from motor nameplate following installation.
- G. Motor starting equipment shall be listed for use with the motors specified under Division 23.

# END OF SECTION 26 2913

### SECTION 26 3200 PACKAGED GENERATOR ASSEMBLIES

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

- A. Contractor designed and installed packaged, pre-wired, turnkey generator power distribution system within a walk-in enclosure. This is a performance type specification describing the minimum acceptable packaged engine generator system. The Contractor shall design and install the packaged engine generator system and power distribution system in accordance with the requirements of NFPA 70, NFPA 110 and IBC. The packaged engine generator, power distribution system, and walk-in enclosure shown on the drawings are shown in suggested locations and suggested dimensions. The final layout, location and dimensions of equipment and devices shall be solely determined by the Contractor and shall be in accordance with NFPA 70, NFPA 110 and IBC:
  - 1. Packaged engine generator systems.
  - 2. Walk-in enclosure and associated Electrical, Mechanical, Fire Suppression, and Fire Detection and Alarm Systems.
  - 3. Genset accessories.

### 1.02 RELATED SECTIONS

- A. Division 03 Cast-In-Place Concrete.
- B. Section 26 0500 Common Work Results for Electrical.
- C. Section 26 0519 Low Voltage Electrical Power Conductors and Cables.
- D. Section 26 0526 Grounding and Bonding for Electrical Systems.
- E. Section 26 0529 Hangers and Supports for Electrical Systems.
- F. Section 26 0533 Raceway and Boxes for Electrical Systems.
- G. Section 26 0548 Vibration and Seismic Controls for Electrical Systems.
- H. Section 26 0553 Identification for Electrical Systems.
- I. Section 26 0800 Electrical Systems Commissioning.
- J. Section 26 2726 Wiring Devices.
- K. Section 26 5000 Lighting.
- L. Section 26 3600 Automatic transfer switches.
- M. Section 28 3100 Fire Detection and Alarm.

## 1.03 REFERENCES

- A. ASCE 7 Chapter 13.
- B. ANSI/NEMA AB 1 Molded Case Circuit Breakers.
- C. ANSI/NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum).
- D. ANSI/NEMA MG 1 Motors and Generators.
- E. ANSI/NFPA 70 National Electrical Code.
- F. ANSI/NFPA 110 Emergency and Standby Power Systems.
- G. ASTM A36 Specification for Carbon Structural Steel.
- H. ASTM A653 Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- I. ASTM E84 Test Method for Surface Burning Characteristics of Building Materials.
- J. IBC, Chapter 16 Structural Design.

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- K. IEEE446 Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications.
- L. ISO 8528 Reciprocating Internal Combustion Engine Driven Alternating Current Generating Sets.
- M. UL 2200 Stationary Engine Generator Assemblies.
- N. UL 142 Aboveground Flammable Storage Tanks

### **1.04 SYSTEM DESCRIPTION**

- A. Engine generator system to provide source of standby power for the Drawings entire facility. The engine generator assembly shall be listed in accordance with UL 2200.
- A. System Capacity: 2MW, emergency/standby rated at elevation of 1000 feet above sea level, and ambient temperature between -4 and 104° F.
- B. Operation: In accordance with ANSI/NFPA 110.
- C. The Packaged Generator Assembly, enclosure, all dimensions, and performance data are based on Kohler model: KD2000 The CONTRACTOR shall make all necessary modifications required for other manufacturers, at no additional cost to the OWNER, if Kohler Generation's equipment is not supplied.

### 1.05 SUBMITTALS

- A. Submit shop drawings, product data, and manufacturer's installation instructions under provisions of Division 01.
- B. Submit shop drawings showing plan and elevation views with overall and interconnection point dimensions, fuel consumption rate curves at various loads, ventilation and combustion air requirements, and electrical diagrams including schematic and interconnection diagrams.
- C. Submit product data showing dimensions, weights, ratings, interconnection points, and internal wiring diagrams for engine, generator, enclosure, control panel, battery, battery rack, battery charger, exhaust silencer, vibration isolators, sub-base fuel day tank, remote radiator, and remote annunciator.
- D. Provide structurally engineered shop drawings as specified in Section 26 05 48 for seismic restraint of all equipment required by the 2018 IBC, Chapter 16 (1621).
- E. Submit shop drawings, product data and calculations for the walk-in enclosure and all associated equipment. Shop drawings shall include dimensioned layout of all equipment in plan view and elevation view. Drawings and calculations shall show compliance with IBC seismic, wind, and snow loading criteria specific to the Project location, and shall be stamped by a Licensed Professional Structural Engineer in the State of Alaska.
- F. Submit technical data including features, performance, electrical characteristics, physical characteristics, ratings and finishes for the load bank and controller. Shop drawings shall include dimensional plans and mounting details sufficient to properly install the load bank. Load bus configuration and load connections and load termination area shall be clearly identified. Electrical schematic drawings shall be provided to detail the operation of the load bank and the provided safety circuits. Over-current protection and control devices shall be identified and their ratings marked. A system interconnection drawing shall be included for control wiring related to the load bank

## 1.06 PROJECT RECORD DOCUMENTS

- A. Submit record documents under provisions of Division 01.
- B. Accurately record location of packaged generator assembly, load bank, and all external mechanical and electrical connections. Provide dimensioned routing of underground utilities from building to enclosure, as applicable.
- C. Submit onsite test records showing the results of the testing per Part 3.3 below.

## 1.07 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data under provisions of Division 01.
- B. Include instructions for the following:
  - 1. Normal operation.
  - 2. Routine maintenance requirements, including replacement of filters.
  - 3. Starting battery inspection/maintenance.
  - 4. System coolant and other fluid inspection and replacement.
  - 5. Oil sampling and analysis for engine wear.
  - 6. Emergency maintenance procedures.
- C. Provide manufacturer's service manuals for all equipment, including but not limited to the following: Engine, generator, radiator, and fuel tank.

### **1.08 QUALIFICATIONS**

- A. Manufacturer: Company specializing in packaged generator assemblies with a minimum of five years of documented experience.
- B. Supplier: Authorized distributor of the packaged generator assembly with service facilities in the greater Palmer/Wasilla area or Anchorage, AK. Supplier shall be authorized by the manufacturer to maintain and administer the warranty and employ factory certified mechanics to perform warranty work.

### 1.09 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site under provisions of Division 01.
- B. Store and protect products under provisions of Division 01.
- C. Accept packaged engine generator set and accessories on site in crates and verify damage.
- D. Protect equipment from dirt and moisture by securely wrapping in heavy plastic.

#### 1.10 WARRANTY

A. Under the provisions of Division 01, the complete electrical power system (generator sets, enclosure, controls, automatic transfer switches and associated switches and accessories) shall be warranted by the manufacturer against defects in materials and workmanship for a period of two years or 1500 hours from the date of generator commissioning, whichever occurs first. Warranty shall include parts, labor, travel expenses and labor to remove/reinstall equipment. There shall be no deductibles applied to the warranty.

### 1.11 MAINTENANCE SERVICE

A. Furnish service and maintenance of packaged engine generator system for two years from Date of Substantial Completion. The maintenance service shall include two semi-annual inspections and test run the engine to perform manufacturers recommended preventative maintenance service on the equipment furnished.

### 1.12 EXTRA MATERIALS

- A. Submit maintenance materials under provisions of Division 01.
- B. Furnish one set of tools required for preventative maintenance of the engine generator system. Package tools in adequately sized metal toolbox.
- C. Provide two additional sets of each fuel, oil, and air filter element required for the engine generator system.

## PART 2 PRODUCTS

#### 2.01 MANUFACTURERS

A. (Kohler Basis of Design).

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B. Substitutions: Under provisions of Division 01.

### 2.02 ENGINES

- A. Type: Liquid-cooled inline or V-type, four stroke cycle, compression ignition, internal combustion engine.
- B. Rating: Emergency/Standby power rated per ISO 8528 at specified elevation and ambient limits.
- C. Fuel System: Appropriate for use of #2 fuel oil.
- D. Engine Speed: 1800 rpm.
- E. Governor: Isochronous type to maintain engine speed within 0.5 percent, steady state, and 5 percent, no load to full load, with recovery to steady state within 2 seconds following sudden load changes.
- F. Safety Devices: Engine shutdown on high water temperature, high lube oil temperature, low oil pressure, overspeed, and engine overcrank. Limits as selected by manufacturer.
- G. Engine Starting: Electric DC starting system capable of three complete cranking cycles without overheating. Starters shall have positive engagement, number, and voltage of starter motors in accordance with manufacturer's instructions. Include remote starting control circuit, with MANUAL-OFF-REMOTE selector switch on engine-generator control panel.
- H. Engine Jacket Heater: UL listed and labeled thermal circulation type water heater with integral thermostatic control, sized to maintain engine jacket water at 90° F, and suitable for operation on 120 volts AC.
- Radiator: Engine mounted radiator using 50/50 glycol coolant, with blower type fan, sized to maintain safe engine temperature in ambient temperature of 104° F and freeze protection to -34°F. Radiator Air Flow Restriction: 0.5 inches of water, maximum. Rotating parts shall be guarded against accidental contact.
- J. Engine Accessories:
  - 1. Oil Pump: Positive displacement, mechanical, full pressure, lubrication oil pump.
  - 2. Fuel Pump: An engine driven, mechanical, positive displacement fuel pump. Include fuel priming pump.
  - 3. Fuel filter with a replaceable spin-on canister element. Provide Racor or approved equal pre-filter, with water shutdown sensor tied to control panel.
  - 4. Replaceable dry element air cleaner with restriction indicator.
  - 5. Water pump.
  - 6. Lube oil cooler.
  - Lube Oil Drain: Extend the lube oil drain to the outside of the generator skid using Areoequip fittings. Install a Nibco T - 113 shut off valve on the hose at an accessible location of the unit and cap the end of the hose with a <sup>3</sup>/<sub>4</sub>" NPT cap.
- K. Mounting: Provide structural steel base for mounting the genset. Include vibration isolators between the genset and skid base per the manufacturer's IBC Seismic Certified package requirements.

### 2.03 GENERATORS

- A. Generator: ANSI/NEMA MG 1; three-phase, four-pole, reconnectible brushless synchronous generator with brushless PMG excitation.
- B. Rating: 2000kW, 2500kVA, at 0.8 power factor, 480Y/277 volts, 60Hz at 1800 rpm. Rating shall be based on an elevation of 1000 feet above sea level and ambient temperature between -4° F and 104° F.
- C. Insulation and Temperature Rise: ANSI/NEMA MG 1, Class F, 130° C, standby.

- D. Enclosure: ANSI/NEMA MG 1; open drip proof.
- E. Voltage Regulation: Include generator-mounted volts per Hertz exciter-regulator to match engine and generator characteristics, with voltage regulation +/- one percent from no load to full load. Include manual controls to adjust voltage drop +/- 5 percent voltage level, and voltage gain.
- F. 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 5 seconds. On application of a 100% load step, the generator set shall recover to stable voltage within 10 seconds.
- G. Frequency Regulation: Isochronous from steady state no load to steady state rated load. Random frequency variation with any steady load from no load to full load shall not exceed plus or minus 0.25%.
- H. Transient Frequency Performance: Not more than 15 percent variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within 5 seconds. On application of 100% load step, the generator set shall recover to stable frequency within 10 seconds.
- I. Output Waveform: The alternator shall produce a clean AC voltage waveform, with not more than 5% total harmonic distortion at full linear load, when measured from line to neutral, and with not more than 3% in any single harmonic. Telephone influence factor shall not exceed 50 in accordance with NEMA MG 1.
- J. Sustained Short-Circuit Current: For a 3-phase bolted short circuit at system output terminals, the generator set shall supply a minimum of 300 percent of rated full-load current for not less than 8 seconds without damage to the generator system components. For a single-phase bolted short circuit at system output terminals, the system shall regulate both voltage and current to prevent over-voltage conditions on the non-faulted phases.
- K. Start Time: Comply with NFPA 110, Level 2, Type 10 system requirements.
- L. Generator Leads: The generator leads shall be brought out and terminated on a unit-mounted generator circuit breaker. The generator leads shall have sufficient length to allow for any connection configuration.

## 2.04 WALK-IN ENCLOSURE

- A. Manufacturer: Enclosure manufacturer shall be qualified to perform the work under this section with a minimum of five (5) years documented experience with similar enclosures. The walk-in enclosure and all associated equipment shall be furnished as an integral unit, packaged, turnkey with generator by a single supplier.
- B. The building structural design shall meet the seismic, wind, and snow loads as required by the IBC for the specific project area. The building structure shall comply with the requirements for the rain test and accumulation of water under abnormal conditions for NEMA 3R enclosures.
- C. Structural design shall be stamped and signed by a Licensed Professional Engineer in the State of Alaska.
- D. Structural Framing:
  - 1. Framing consists of rolled structural shapes in accordance with ASTM-A36 specifications.
  - 2. All connections shall be of all welded design in accordance with the International Building Code (IBC) latest edition and amendments.
  - 3. The roof shall be shed type and sloped 2" in one direction away from the door.
  - 4. All structural steel shall be primed with a marine alkyd primer proceeding fabrication. No top coat is applied.
- E. Walls and Roof:

- 1. Exterior wall panels of the module shall be formed and welded 14-gauge galvanneal Satin Coat per ASTM-A653.
- 2. Roof shall be 12-gauge galvanneal Satin Coat per ASTM-A653 and is fully seam-welded, guaranteed not to leak.
- 3. Walls insulated with 5" mineral wool (R20) and lined 22 gauge perforated galvanized steel sheets mechanically fastened to the framing members.
- 4. Roof insulated with 5" mineral wool (R20) and lined 22 gauge perforated galvanized steel sheets mechanically fastened to the framing members.
- 5. Two (2) Fall Restraint pads shall be provided on the roof.
- 6. Enclosure paint system shall require exterior wall panels surface prep to SSPC-SP1: Solvent Clean. Prime with two-part epoxy primer to 2.0 to 4.0 mils dft. Finish coat two-part aliphatic urethane to 2.0 to 4.0 mils dft. High Standard Power Systems standard paint system color shall be per the project Architect. Sub-Base Tank shall be surface prep to SSPC-SP6: Commercial Blast. Prime with two-part epoxy primer to 3.0 to 5.0 mils dft. Finish coat two-part aliphatic urethane to 3.0 to 5.0 mils dft. Color shall match the enclosure color.
- 7. Exterior Doors shall be High Standard Power Systems Standard formed and welded 14-gauge galvanneal Satin Coat to ASTM-A653 construction with an insulated core. Doors shall be flush on the exterior and sealed with neoprene "Bulb Seal" to NEMA 3R and shall have the same finish as the exterior of the building. Doors insulated with 5" mineral wool (R20) lined with 22 gauge perforated galvanized steel sheets mechanically fastened to the framing members.
- F. Support Baseframe:
  - 1. The generator sets and all ancillaries shall be supported on the prefabricated steel baseframe designed to withstand the forces of damage fatigue as a result of transportation and placement at site.
  - 2. All frame structural material shall be in accordance with ASTM A36. Galvanized steel shall be Grade 30 in accordance with ASTM A653. Tolerances shall be +/- 1/8".
  - 3. There shall be two longitudinal wide flange beams provided as the main support positioned inward of the perimeter and to provide skidding as required. Provide 4" polyurethane foam on the underside, covered with 22 gauge galvanized belly pan.
  - 4. Floor plate shall consist of 3/16" steel checkerplate, epoxy coated, properly braced and stiffened to prevent "oil canning." Fully seam weld floor plate with a 3" containment lip for generator fluid containment.
  - 5. Four lifting eyes shall be provided in relation to the center of gravity.
- G. Enclosure Access Stairs:
  - 1. Provide stair access and landing at building entrance(s). Provide number of steps as required to meet IBC requirements and suitable for site conditions. Stairs and landing shall be manufactured from structural grade aluminum or stainless steel grip strut. Provide aluminum or stainless steel handrails as required per the IBC.
- H. Electrical:
  - 1. The following electrical components shall be supplied and installed in accordance with the applicable project Specification Sections, the National Electric Code (NEC), and as shown on the Drawings.
  - 2. 225 Amp, 120/208V, 3-phase, 4W lighting and service panel complete with 100 Amp main breaker and required branch circuit breakers. Reference Section 26 2416 Panelboards.
  - 3. Provide interior LED fixtures, Lithonia #FEM L48 or equal, to provide an average lighting level of 30 footcandles throughout the enclosure. Reference Section 26 5000 Lighting.

Provide light switch at entries to the enclosure to control interior lights. Reference Section 26 27 26 Wiring Devices.

- 4. Provide interior emergency lighting via LED dual lamp emergency fixtures with integral battery backup, Lithonia ELM4L or equal. Reference Section 26 5000 Lighting.
- Provide exterior LED fixtures with integral photocell and driver rated to -40° F at each door, Lithonia TWR1 LED P2 40K PE DDBTXD or equal. Reference Section 26 5000 Lighting. Provide one light switch at an entry for manual control exterior lights. Reference Section 26 2726 Wiring Devices.
- 6. A minimum of three interior duplex receptacles in addition to those required to operate the battery charger and engine block heater. A minimum of one GFCI protected exterior duplex receptacle with an "In-Use" listed weatherproof cover. Reference Section 26 2726 Wiring Devices.
- 7. All components shall be installed, wired, and tested in accordance with the applicable Division 26 Specifications and the NEC.
- 8. Providing labeling on all equipment as required by Section 26 0553 Identification for Electrical Systems.
- I. Ventilation:
  - 1. All motor operated dampers and motors shall be provided and pre-wired to a relay panel with controls.
  - All openings shall include weatherhoods and birdscreens. Coordinate hood locations and configuration with site and building layout. Intake openings shall be a minimum of 72" Above finished grade.
  - 3. Intake dampers shall be provided to minimize thermal shock during winter and prevent snow infiltration. For summer operation, include motor operated dampers at the opposite side of the engine generator room to provide suitable cross flow ventilation. Provide dampers in accordance with the requirements of specification Section 23 3300.
  - 4. Ventilation of the walk-in enclosure shall be designed with a recirculating air plenum for the engine sized accordingly for the air flow requirements.
  - 5. The temperature of the room shall be monitored by a thermostat which shall operate a modulating damper assembly which in turn shall be connected to the radiator discharge and the recirculating air plenum. The plenum shall allow the warm air from the radiator discharge to enter back into the enclosure to mix with incoming cold air.
- J. Heating:
  - Fan-forced electric unit heaters shall be provided to heat generator enclosure and maintain a minimum space temperature of 50° F when the exterior ambient temperature is -40° F and the generator is not running.
- K. Temperature Control System:
  - Temperature controls shall be provided to operate electric unit heaters and generator dampers to maintain a minimum space temperature of 50° F when the exterior ambient temperature is -40° F. Generator dampers shall operate in accordance with the Sequence of Operation, Specification Section 23 0993.
- L. Insulation:
  - 1. Insulate all ductwork, engine exhaust piping and muffler.
- M. Fire Suppression, Detection, and Alarm System:
  - 1. Provide a minimum of one Class ABC fire extinguisher mounted near the entrance door to the enclosure.

- 2. Provide packaged aerosol fire suppression system for protection of walk-in enclosure, Stat-X or approved equal. Provide turnkey system as part of the walk-in enclosure.
- 3. Provide a minimum of 2 heat detectors for cross zoned protection, 2 manual pull stations, 2 abort stations, 1 interior horn/strobe, and 1 exterior horn/strobe. Pre-wire all devices to Fire Alarm/Suppression Panel mounted within walk-in enclosure.
- 4. Provide for integration of fire alarm detection and release system with the Main Building Fire alarm and detection system.

### 2.05 ACCESSORIES

- A. Sub-Base Tanks: Double-wall, all-welded construction, base-mounted fuel tank with a minimum capacity for 36-hour runtime. The tank outside dimensions shall not exceed the dimensions of the generator framework and shall be mounted inside of the walk-in enclosure. The tank shall have foundation to ground clearance for visual secondary leak detection, shall have the structural integrity to support the engine-generator set, shall be supplied by the engine-generator set manufacturer, and shall be installed before shipment. The tank shall be UL 142 listed for both primary and secondary containment and shall meet all of the requirements of NFPA for the intended use. The tank shall have the following features: vent connections, tank-mounted fuel gauge, flexible fuel line connections, and high/low fuel level alarm contacts. Provide tank leak detection and alarm in accordance with UL 142 requirements and pre-wire signals to generator control panel. All appurtenances shall meet all state and local codes.
- B. Exhaust Silencers: Nelson Special "400" or approved supercritical type silencer, with a minimum overall attenuation level of 40 dB(A) and a maximum exhaust pressure drop not to exceed the engine manufacturer's recommendations at the rated engine exhaust gas flow rate and temperature. Provide with ANSI 150# companion flanges and flexible stainless steel exhaust fitting, suitable for horizontal orientation with side entry and end exit, sized in accordance with engine manufacturer's instructions. Dual exhaust engines shall be provided with one silencer similar to the above combining the two exhaust outlets into a single outlet.
- C. Batteries: Heavy duty, diesel starting type lead-acid storage batteries, sized as recommended by the engine/generator set manufacturer for starting the set at 0°F ambient. Match battery voltage to starting system. Include necessary cables and clamps.
- D. Battery Trays: Non-metallic battery boxes with covers and hold-downs, treated for electrolyte resistance and constructed to contain spillage of electrolyte. Provide with seismic restraints to secure batteries during earthquakes. The battery housing shall be accessible for maintenance.
- E. Battery Chargers: Dual-rate, 12-Amp, current limiting type designed to float at 2.17 volts per cell and equalize at 2.33 volts per cell. Provide overload protection, full wave rectifier, DC voltmeter and ammeter, and 120 volts AC fused input. Provide wall-mounted enclosure to meet ANSI/NEMA 250, Type 1 requirements. Operational monitors shall provide visual output along with individual form C contacts rated at 4 Amp, 120 VAC, 30 VDC for remote indication of:
  - 1. Loss of AC power: Red light.
  - 2. Low battery voltage: Red light.
  - 3. High battery voltage: Red light.
  - 4. Power on: Green light, no relay contact.
- F. Line Circuit Breaker: NEMA AB 1 molded case circuit breaker on generator output with integral thermal and instantaneous magnetic trip in each pole; sized in accordance with ANSI/NFPA 70. Include battery-voltage operated shunt trip, connection to open circuit breaker on engine failure. Mount unit in enclosure to meet ANSI/NEMA 250, Type 1 requirements.
- G. Engine-Generator Control Panel: NEMA 250, Type 1 generator-mounted control panel enclosure with UL508 listed and labeled microprocessor-based control, designed to provide automatic starting, monitoring and control functions. Include provision for padlock and provide the following equipment and features:

- 1. Digital Frequency Meter: 45-65 Hz range, LED display.
- 2. AC Output Digital Voltmeter: LED display, 2 percent accuracy, with phase selector switch.
- 3. AC Output Digital Ammeter: LED display, 2 percent accuracy, with phase selector switch.
- 4. AC Output Digital Kilowatt Meter: LED display, 2% accuracy.
- 5. Output Voltage Adjustment: Via touchpad on control panel.
- 6. Push-to-test indicator lamps, one each for low oil pressure shutdown, high water temperature shutdown, high oil temperature shutdown overspeed shutdown, overcrank shutdown, low water shutdown, low oil pressure pre-alarm and high water temperature pre-alarm, battery charger malfunction, low water temperature, and low fuel level.
- 7. Engine manual-off-remote selector switch.
- 8. Engine running time meter.
- 9. Oil pressure gauge.
- 10. Water temperature gauge.
- 11. Fuel pressure gauge.
- 12. Generator Control Wiring Monitoring Device to issue visual and audible annunciation and start the generator upon loss of generator control wiring integrity.
- 13. Auxiliary Relay: 3PDT, operates when engine runs, with contact terminals prewired to terminal strip.
- 14. Remote Alarm Contacts: Pre-wire SPDT contacts to terminal strip for remote alarm functions.
- 15. Leak detection monitoring.
- 16. Overcrank protection with manual reset.
- 17. Trouble horn with silencing switch, red indicating light and reset switch.
- Auxiliary Relay for Building Automation System Monitoring: Provide dry contact relays for monitoring of Generator Status and General Alarm by BAS. Coordinate with Specification Section 23 0923.
- H. Remote Annunciator Panels: Provide flush [surface] mounted remote alarm annunciator panel, located as shown on the Drawings. The remote annunciator shall provide all the audible and visual alarms called for by NFPA Standard 110 for Level 1 systems. Annunciator shall be labeled with the specified functions. Provide lamp test switch, as applicable. Provide spare lamps, as applicable, for user configurable visual indications. Provide alarm horn silent switch. Alarm horn shall be switchable for all annunciation points. Alarm horn (when switched on) shall sound for first fault, and all subsequent faults, regardless of whether first fault has been cleared, in compliance with NFPA 110. The interconnecting wiring between the annunciator and other system components shall be monitored and failure of the interconnection between components shall be displayed on the annunciator panel. Provide visual/audible indication for the functions as noted below:

| Condition                                                                                                                                                                                     | Indication Type                                                                                                                                 |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| Overcrank                                                                                                                                                                                     | Audible and Visual                                                                                                                              |
| High Engine Temperature Pre-Alarm<br>High Engine Temperature<br>Low Lube-Oil Pressure<br>Overspeed<br>Low Fuel Level<br>Low Coolant Level<br>Generator Supplying Load<br>Controls Not-In-Auto | Audible and Visual<br>Audible and Visual<br>Audible and Visual<br>Audible and Visual<br>Audible and Visual<br>Visual Only<br>Audible and Visual |
|                                                                                                                                                                                               |                                                                                                                                                 |

| High Battery Voltage                            | Visual Only        |
|-------------------------------------------------|--------------------|
| Low Cranking Voltage                            | Audible and Visual |
| Low Battery Voltage                             | Visual Only        |
| Battery Charger AC Failure                      | Visual Only        |
| Local/Remote Common Alarm                       | Audible and Visual |
| Overload Alarm/Load Shed Contact                | Audible and Visual |
| Loss of Generator Control Wiring                | Audible and Visual |
| Low Starting Air Pressure (as applicable)       | Audible and Visual |
| Low Starting Hydraulic Pressure (as applicable) | Audible and Visual |
| Air Shutdown Damper (as applicable)             | Audible and Visual |
| (4) Spare – User Configurable                   | Visual Only        |

- I. Heaters: Provide manufacturer's recommended heaters with thermostatic controls to keep engine oil pan, engine block, generator controls, and generator windings within manufacturer's recommended temperature at 30°F. Provide immersion type coolant heater in remote radiator to keep radiator within manufacturer's recommended temperature at -20°F.
- J. Mounting: The complete engine/generator package shall be mounted on a common, self-supporting, low profile, structural steel skid base with rubber in shear vibration isolators between the engine and base and between the base and the enclosure. Provide spring type vibration isolators where required per IBC requirements. The base shall extend from the rear end of the generator to the most forward point of the engine and shall be predrilled to accept a #2 AWG 250 kCMIL copper grounding conductor.
- K. Load bank and Automatic Load Bank Controller:
  - 1. Stationary Remote-Mounted Load Banks:
    - a. Capacity 1000 kW, 1.0 power factor.
    - b. Ratings: 480V, 3-phase, 3-wire, 60 Hz, Continuous Duty.
    - c. Load Steps: 10kW step resolution.
    - d. Airflow Requirements: Forced air, CFM as required by manufacturer. Provide factory wired internal fan to match load bank voltage/phase configuration.
    - e. Control Power: Internal from generator, fused circuits, controls operate at 120V via internal control power transformer.
    - f. Load Elements and Control: Open wire, helically wound, chromium alloy, UL recognized component. Provide branch circuit magnetic contactors with current limiting fused short circuit protection.
    - g. Wiring: Power wiring rated for 150 degrees C connected to power distribution block with compression terminals. Control wiring rated for 105 degrees C.
    - h. System Protection: Fan failure, fan motor overload, high exhaust temperature, high intake temperature, and airflow pressure differential switch. Circuits to disconnect load bank on alarm with alarms to display on Controller.
    - i. Interior Heater: Provide anti-condensation heater with thermostatic control, factory or field wired.
    - j. Enclosure: NEMA 3R, outdoor/weatherproof, powder-coated steel enclosure with removable access panels, and suitable for pad-mounting.
  - 2. Automatic Load Bank Controller:
    - a. Controller shall be capable of manual and automatic load control with PLC based color touchscreen with programmable softkeys.
    - b. Automatic load leveling and load regulation shall maintain total generator load within a preset bandwidth. PLC controller senses generator load and automatically

adds/subtracts load bank steps in order to maintain total generator load at a desired level.

- c. Auto Exercise option shall provide automatic incremental load step addition and subtraction during generator exercise.
- d. Controller senses amperes. Adjustable level and delay. Provide with control power on/off switch, manual/off/automatic load step switches, master load control switch, overtemp indicator and normal operation indicator.
- e. Mounting and Enclosure: Local, mounted on unit within weatherproof cover., manufacturer mounted within Walk-In Enclosure.

## PART 3 EXECUTION

### 3.01 PRE-SHIPPING INSPECTION AND TESTING

A. The generator and walk-in enclosure shall be constructed complete and tested at the manufacturing facility prior to shipment to the project site. This factory testing shall be witnessed by the Project Electrical and/or Mechanical engineer and approved prior to shipment.

### 3.02 EXAMINATION

- A. Verify that surfaces are ready to receive work and field dimensions are as shown on Drawings.
- B. Verify that required utilities are available in proper location and ready for use.
- C. Beginning of installation means installer accepts existing conditions.

### 3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Ground and bond generator and other electrical system components in accordance with NEC requirements.

#### 3.04 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Division 01.
- B. Generator system on-site testing shall be performed in accordance with NFPA 110 requirements for Level 2 Systems. Provide a generator manufacturer authorize representative to perform onsite inspection and testing activities. Coordinate scheduling of testing with Owner and Authority Having Jurisdiction a minimum of seven (7) days prior to testing.
- C. Pre-Test Verifications:
  - 1. Provide evidence of no known deficiencies and that the generator has run prior to final inspection and testing. Make any necessary adjustments to the generator as required for proper operation.
  - 2. Verify all generator accessories and enclosure components/systems are operational.
  - 3. Verify the load bank and controller are operational.
  - 4. Verify O&M Manuals are on hand and Owner training has been completed.
  - 5. Note the fuel tank level at beginning of the test.
- D. Perform an initial 1.5-hour minimum on-site acceptance test utilizing all loads per NFPA 110 7.13.4.1. Simulate power failure by opening the normal source to all transfer switches. Observe, verify, and record the following:
  - 1. Time delay on start up.
  - 2. Cranking time until the prime mover starts and runs.
  - 3. Time to reach operating speed.
  - 4. Verify engine start function by verifying operation of the initiating circuit on all transfer switches supplying EPSS loads.

- 5. Time to achieve a steady-state generator condition after all transfer switches have transferred to the emergency position.
- 6. Record real power, apparent power, voltage, frequency, amperage, oil pressure, and coolant temperature at 15-minute intervals throughout the test.
- 7. Time delay on retransfer to normal power for all transfer switches.
- 8. Time delay on generator cooldown and shutdown.
- E. Upon completion of the initial acceptance test, allow the generator to cool for a minimum of 5 minutes before beginning the full load test below.
- F. Provide a 2-hour full-load test utilizing the integrated load bank, as applicable, and a portable load bank. Building loads may be utilized during this full load test if approved by the Owner prior to testing. Simulate power failure including operation of each transfer switch. Full-load testing shall be done as follows:
  - 1. 30 minutes at 50% rated load.
  - 2. 30 minutes at 75% rated load.
  - 3. 1 hour at 100% rated load.
  - 4. Record real power, apparent power, voltage, frequency, amperage, oil pressure, and coolant temperature at 15 minute intervals throughout the test.
- G. Upon completion of the full-load test, perform the following tests/verifications in the presence of the Owner and/or Owner's representative:
  - 1. Test shutdown controls per NFPA 110 Part 5.6.5.4(3) and Part 5.6.5.5. Note, it shall be permitted to submit factory test results to document overcrank, high engine temperature, low lube-oil pressure and overspeed safeties prior to shipment.
  - 2. Test alarm indications per NFPA 110 Part 5.6.5.4(4) and Table 5.6.5.4.
  - 3. Test manual and automatic operation of the load bank. Demonstrate load leveling, load regulation, and automatic exercising capabilities.

## 3.05 MANUFACTURER'S FIELD SERVICES

A. Provide generator manufacturer authorized representative to prepare, start, test, and adjust systems under provisions of Division 01 and this specification.

#### 3.06 ADJUSTING

- A. Adjust work under provisions of Division 01.
- B. Adjust generator output voltage and engine speed.

## 3.07 CLEANING

- A. Clean work under provisions of Division 01.
- B. Clean engine and generator surfaces. Replace oil and fuel filters.

#### 3.08 DEMONSTRATION

- A. Provide systems demonstration under provisions of Division 01.
- B. Describe loads connected to standby system and restrictions for future load additions.
- C. Provide onsite training for Owner's personnel to adjust, operate, and maintain the Packaged Generator Assembly. Demonstrate all automatic and manual operational capabilities of the system.

#### END OF SECTION 26 3200

### SECTION 26 3353 STATIC UNINTERRUPTIBLE POWER SUPPLY

### PART 1 GENERAL

### 1.01 RELATED DOCUMENTS

- A. The Work under this section is subject to requirements of the Contract Documents including the General Conditions, Supplementary Conditions, and sections under Division 01 - General Requirements and Section 26 0500 – Common Work Results for Electrical.
- B. Section 26 0519 Low-Voltage Electrical Power Conductors and Cables.
- C. Section 26 0526 Grounding and Bonding for Electrical Systems.
- D. Section 26 0529 Hangers and Supports for Electrical Systems.
- E. Section 26 0536 Cable Trays for Electrical Systems.
- F. Section 26 0548 Vibration and Seismic Controls for Electrical Systems.
- G. Section 26 0553 Identification for Electrical Systems.

#### 1.02 SUMMARY

A. This specification describes a three-phase continuous duty, on-line, double conversion, solidstate uninterruptible power system, hereafter referred to as the UPS. The UPS shall operate in conjunction with the existing building electrical system to provide power conditioning, back-up and distribution for the entire data center electrical load. The UPS system shall consist of individual UPS units with power modules, batteries, static and external maintenance bypass capability, and other features as described in this specification.

### 1.03 REFERENCES

- A. Institute of Electrical and Electronics Engineers:
  - 1. IEEE 1184 Guide for the Selection and Sizing of Batteries for Uninterruptible Power Systems.
- B. National Electrical Manufacturers Association:
  - 1. NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum).
  - 2. NEMA PE 1 Uninterruptible Power Systems.
- C. Underwriter's Laboratory
  - 1. UL 1778 Standard for Uninterruptible Power Supply Equipment.

## 1.04 SUBMITTALS

- A. Submit under the provisions of Division 01.
- B. Product Data: Submit catalog sheets and technical data sheets to indicate physical data and electrical performance, electrical characteristics, and connection requirements.
- C. Shop Drawings: Indicate electrical characteristics and connection requirements. Indicate battery cabinet dimensions; battery type, size, dimensions, and weight; detailed equipment outlines, weight, and dimensions; location of conduit entry and exit; single-line diagram indicating control and external wiring requirements; heat rejection and air flow requirements.
- D. Wiring Diagrams: Submit wiring diagrams detailing power, signal, and control systems, clearly differentiating between manufacturer-installed wiring and field-installed wiring, and between components provided by the manufacturer and those provided by others. Indicate voltage and device rating information where applicable.
- E. Submit system single-line operation diagram.
- F. Sample Test Reports: Submit sample test report showing all alarms and functions that will be tested as part of the startup process.

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G. Factory Acceptance Test Report: As a deferred submittal when the UPS is shipped, provide documentation of the standard factory acceptance test results for each unit.

### 1.05 INFORMATIONAL SUBMITTALS

- A. Manufacturer Seismic Qualification Certification: Submit certification that UPS, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Section 26 0548 "Vibration and Seismic Controls for Electrical Systems." Include the following:
  - 1. Basis of Certification: Indicate withstand certification is based on actual test of assembled components.
    - 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 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.

### 1.06 CLOSEOUT SUBMITTALS

- A. In addition to documents listed in Division 01, provide the following Closeout Documents:
  - 1. Project Record Drawings: Update the UPS shop drawings to indicate actual dimensions, relay and trip settings, and configurations on the project.
  - 2. Operation and Maintenance Manuals: Submit manufacturer's instructions for UPS system maintenance and adjustment.

### 1.07 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years documented experience with ISO 9001 certification.
- B. Support: The UPS manufacturer shall maintain a call center for technical and emergency support, and shall directly employ a nationwide field service department staffed by factory-trained field service engineers dedicated to startup, maintenance, and repair of UPS equipment.
- C. Product Options: Drawings indicating size and dimensional requirements of UPS are based on information provided by the three approved UPS manufacturers. Refer to Section 01 6000 "Product Requirements."
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a nationally recognized testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- E. Comply with NFPA 70.

## 1.08 DELIVERY, STORAGE, AND HANDLING

- A. Store and protect products under provisions of Division 01.
- B. Protect equipment from extreme temperature and humidity by storing in conditioned space as required by UPS Manufacturer.
- C. Protect equipment from dust and debris by wrapping unit in dust tight cover and storing away from construction activity.
- D. Deliver batteries no sooner than 7 days before charging.

#### 1.09 COORDINATION

A. Coordinate layout and installation of UPS and components with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required clearances for workspace and equipment access doors and panels.

## 1.10 PROJECT CONDITIONS

A. Installation Pathway: Remove and replace access doors and structures to provide pathway for moving UPS sections into place.

### 1.11 WARRANTY

- UPS: Provide standard 1 year warranty from date of factory-assisted UPS startup, with an additional 12-month comprehensive coverage (parts, labor, and travel), and (1) preventative maintenance visit during the 2<sup>nd</sup> year of ownership.
- B. Batteries:
  - 1. Base Warranty: The battery manufacturer's base warranty shall have a minimum period of three (3) years from the date of product start-up. This warranty covers repairing or replacing any defective parts, including on-site labor and travel.

### 1.12 INSTRUCTION OF OPERATING PERSONNEL

- A. In accordance with the requirements of Division 01, Division 26, and this section, provide services of qualified representative of the UPS manufacturer to instruct designated personnel of Owner in operation and maintenance of the UPS system.
- B. Provide two training sessions of (2) hours each, for a total of (4) hours of instruction, which shall include the following:
  - 1. Routine operation of the UPS under normal and standby power conditions.
  - 2. Operation of the UPS Remote Display Panel functions.
  - 3. Emergency operation and Emergency Power Off (EPO) functions.
  - 4. Recovery from an EPO event.
  - 5. Battery maintenance and replacement.
- C. Certify that a Wasilla, Anchorage, or Seattle based authorized service organization regularly carries complete stock of repair parts for listed equipment or systems, that organization is available and will furnish service within 48 hours after request. Include name, address, and telephone number of service organization.
- D. Have approved operation and maintenance manuals and parts lists for all equipment on hand at time of instruction.

#### **PART 2 PRODUCTS**

#### 2.01 STATIC UNINTERRUPTIBLE POWER SUPPLY

- A. Acceptable Manufacturers:
  - 1. Schneider/APC Galaxy VL series.
  - 2. Eaton 93PM series.
  - 3. Vertiv/Liebert EXL-S1 series.
  - 4. Alternate Brand Request or Substitution Request required.
- B. System Characteristics
  - 1. System Capacity: 50W frame capacity with (10) 5kW power modules installed, for a total output capacity of 50W per UPS.
  - 2. Efficiency: Minimum 96%.
  - 3. Runtime: The UPS system shall have a minimum runtime of 25 minutes at 50kW.
  - 4. Enclosure: Free-standing floor cabinet with locking front doors, leveling feet, and seismic anchors. Cabinet shall be suitable for installation on slab floor and shall be designed to exhaust warm air at the top of the cabinet, with no back or side clearance/access required. An air filter shall be mounted in the front door of the UPS cabinet.

- 5. UPS Input:
  - a. AC Input Nominal Voltage: 208V, 3-phase, 3-wire + ground, 60Hz.
  - b. AC Input Voltage Window:  $\pm 15\%$  while providing nominal charging to the battery system
  - c. Short Circuit Withstand Rating: Minimum 65k AIC
  - d. Input Power Factor: 0.99 at loads greater than 25%.
  - e. Input Current Total Harmonic Distortion with no Additional Filters: Less than 5% at 100% load.
  - f. Power Walk-in: Shall be linear from 0% to 100% input current and shall not exhibit inrush. Time shall be selectable in 1-second increments up to 300 seconds. Coordinate with UPS manufacturer for recommended walk-in time setting.
- 6. UPS Output:
  - a. AC Output Nominal Voltage: 208V, 3-phase, 3-wire + ground, 60Hz.
  - b. AC Output Voltage Regulation: +1% for 100% linear load.
  - c. Voltage Transient Response: +5% maximum for 100% linear load step.
  - d. Voltage Transient Recovery: Within less than 60ms.
  - e. Output Voltage Harmonic Distortion:
    - 1) Less than 2%THD for 100% linear load
    - 2) Less than 5%THD for 100% non-linear load
  - f. Output PF rating: Unity (1.0). Able to support 0.8 leading to 0.8 lagging without derating.
- 7. System Protection:
  - a. The UPS shall have built-in protection against surges, sags, and overvoltage from the AC source.
  - b. The UPS shall be protected against sudden changes in output load and overload at the output terminals.
- C. Modes of Operation
  - 1. Utility Power: The input converter and output inverter will operate in an on-line manner to continuously regulate power to the critical load. The input and output converters are capable of full battery recharge while simultaneously providing regulated power to the load for all line and load conditions within the range of the UPS specifications.
  - 2. Battery: Upon failure of the utility input source, the critical load will continue being supplied by the output inverter, which will derive its power from the battery system. There will be no interruption in power to the critical load during both transfers to battery operation and retransfers from battery to normal operation.
  - 3. Standby Power: Upon generator startup and transfer, the UPS system will optimize its operation with the generator by reducing the battery recharge current and smooth application of load. There will be no interruption in power to the critical load during transfer from battery operation to standby power operation
  - 4. Recharge: Upon restoration of the utility source, the UPS will simultaneously recharge the battery at the manufacturer-recommended rate, and provide regulated power to the critical load.
  - 5. Static Bypass: The static bypass is used to provide transfer of critical load from the inverter output to the bypass source. This transfer, along with its retransfer, takes place with no power interruption to the critical load. In the event of an emergency, this transfer is

an automatic function. The UPS will recharge the batteries while supplying full power to the load via the static bypass switch.

- 6. External Maintenance Bypass: The external maintenance bypass is used to electrically isolate the UPS during routine maintenance and service. This operation is a closed transition make-before-break process.
- D. Input Power Converter
  - 1. General: The input power converters of the system shall be housed within the parallel connected, removable power modules, and shall constantly control the power imported from the mains input of the system, to provide the necessary UPS power for precise regulation of the DC bus voltage, battery charging, and main inverter regulated output power.
  - 2. Input Current Total Harmonic Distortion: The input current THDI shall be held to 5 percent or less at full system load, while providing conditioned power to the critical load bus, and charging the batteries under steady state operating conditions. This shall be true while supporting loads of both a linear and non-linear type. This shall be accomplished with no additional filters, magnetic devices, or other components.
  - 3. Power Walk-In Operation: As a standard feature, the UPS shall contain walk-in functionality, capable of limiting the input current from 0 percent to 100 percent of the nominal input over an adjustable time period, when returning to the AC utility or standby source from battery operation. The change in current over the change in time shall take place in a linear manner throughout the entire operation.
  - 4. Magnetization Inrush Current: The UPS shall exhibit zero inrush current as a standard product.
  - 5. Redundancy: The UPS shall be configured with redundant input converters, each with semiconductor fusing, and logic-controlled contactors to remove a failed module from the input bus.
  - 6. Charging:
    - a. The battery charging shall keep the DC bus float voltage at ±1 percent.
    - b. The battery charging circuit shall contain a temperature compensation circuit, which shall regulate the battery charging to optimize battery life.
    - c. The battery charging circuit shall remain active when in static bypass and in normal operation.
  - 7. Back-Feed Protection: The logic-controlled input contactor shall provide the back-feed protection required by UL 1778.
- E. Output Inverter
  - 1. General: The UPS output inverter shall constantly recreate the UPS output voltage waveform by converting the DC bus voltage to AC voltage through a set of IGBT driven power converters. In both normal operation and battery operation, the output inverters shall create an output voltage independent of the mains input voltage. Input voltage anomalies such as brown-outs, spikes, surges, sags, and outages shall not affect the amplitude or sinusoidal nature of the recreated output voltage sine wave delivered by the output inverters.
  - 2. Overload Capability: The inverter shall be capable of 200 percent for short circuit conditions, including phase-to-phase, phase-to-ground and three-phase faults. Steady state overload conditions, of up to 150 percent of system capacity shall be sustained by the inverter for a minimum of 30 seconds at nominal voltage and temperature. Should overloads persist past the outlined time limitation the critical load shall be switched to the automatic static bypass output of the UPS.
  - 3. Battery Protection: The inverter shall be provided with monitoring and control circuits to limit the level of discharge on the battery system.

- 4. Redundancy: The UPS shall be configured with redundant output inverters, each with semiconductor fusing, and logic-controlled contactors to remove a failed component from the input, DC, and output critical bus.
- F. Static Bypass
  - 1. General: As part of each UPS unit, a system static bypass cabinet shall be provided. The static bypass shall provide no break transfer of the critical load from the inverter output to the static bypass input source during times where maintenance is required, or the inverter cannot support the critical bus. Such times may be due to prolonged or severe overloads, or UPS failure. The UPS and static bypass switch shall constantly monitor the auxiliary contacts of their respective circuit breakers, as well as the bypass source voltage, and inhibit potentially unsuccessful transfers to static bypass from taking place.
  - 2. Design: The design of the static switch power path shall consist of silicon-controlled rectifiers (SCR) with a continuous duty rating of 125 percent of the UPS output rating.
  - 3. Automatic Transfers: An automatic transfer of load to static bypass shall take place whenever the load on the critical bus exceeds the overload rating of the UPS. Automatic transfers of the critical load from static bypass back to normal operation shall take place when the overload condition is removed from the critical output bus of the system. Automatic transfers of load to static bypass shall also take place if for any reason the UPS cannot support the critical bus.
  - 4. Manual Transfers: Manually initiated transfers to and from static bypass shall be initiated through the UPS display interface.
  - 5. Overloads: The static bypass shall be rated and capable of handling overloads equal to or less than 125 percent of the rated system output continuously. For instantaneous overloads caused by inrush current from magnetic devices, or short circuit conditions, the static bypass shall be capable of sustaining overloads of 1000 percent of system capacity for periods of up to 500 milliseconds.
  - 6. Modular: The static bypass switch shall be of modular design.
  - 7. System Protection: As a requirement of UL 1778, back-feed protection in the static bypass circuit shall also be incorporated in the system design. To achieve back-feed protection, a mechanical contactor in series with the bypass SCR(s) shall be controlled by the UPS/static switch, to open immediately upon sensing a condition where back-feeding of the static switch by any source connected to the critical output bus of the system is occurring. One such condition could be a result of a shorted SCR.
- G. External Maintenance Bypass
  - External Maintenance Bypass: The external maintenance bypass cabinet (MBC) shall be a floor-mounted switchboard style enclosure. The MBC shall have a fully rated connection to each UPS unit and shall completely isolate both the UPS input and output connections during routine maintenance and service. The MBC shall utilize breakers rated for 100% continuous duty, with electronic trip modules sized to match the rating on the input fuses. The MBC shall have a 2-key "Kirk" interlock with indicator lamp between the MIB/MBB breakers.
- H. Display and Controls
  - 1. Display Unit: A color LCD touch-sensitive display unit shall be located on the front of the system.
  - 2. Metering: The metering screen shall show voltages currents, temperatures, kW, kVA, and power factor for the UPS input, output, bypass source, and battery. Color coded (green, amber, red) bar graph indicators shall accompany power and temperature measurements.
  - 3. Controls: The controls screen shall provide touch sensitive button controls, with a confirm prompt, for turning the UPS on and off, transfer to/from bypass, enabling or disabling the

battery charger, initiating/programming a remote shutdown, and initiating/programming a battery test. This screen or another shall also show when the UPS is on generator power.

- 4. Alarm and Event Logs: The log screen shall include an alarm/event queue, active alarms and alarm history, events, status changes and commands, all time-indexed for tracking and analysis
- 5. Potential Free (Dry) Contacts: The following potential free contacts shall be available on an optional relay interface board:
  - a. Normal operation.
  - b. Battery operation.
  - c. Generator operation
  - d. Bypass operation.
  - e. Common fault.
  - f. Low battery.
  - g. UPS off.
- 6. Communication Interface: For purposes of remote communications with the UPS the following shall be available and contained within the UPS on a removable, hot-swappable interface card:
  - a. RJ-45 interface port for remote communications with a network via web browser.
  - b. RS-232 Serial Port.
- I. Batteries
  - 1. The UPS system shall be provided with a lithium-ion battery plant that includes Ownerreplaceable fused battery modules. Basis of design is Samsung.
  - 2. Battery Cabinet: <u>UL9540A compliant</u>, NEMA 1 enclosure with front door, side covers and rear cover, suitable for installation in a front-access application. The cabinet shall accommodate cabling installed overhead. Cable installation shall not require removal of batteries or any other battery rack assemblies.
  - 3. Battery Disconnect Breaker: Each battery cabinet shall have a DC rated shunt trip circuit breaker disconnect in the top of the cabinet for protecting the battery string(s) within the cabinet. The circuit breaker shall be capable of isolating the batteries from the UPS, and from other battery cabinets.
  - 4. Battery Management System (BMS): The Lithium-ion battery system shall be equipped with a standard battery management system (BMS) that monitors temperature, voltage, and cabinet status, and acts independently of the UPS to protect itself. The BMS shall have the ability to automatically open the battery disconnect if conditions require.
  - 5. Battery Runtime: As specified in Paragraph 2.01.B above.
- J. Remote UPS Monitoring and Control: The UPS shall have the following methods of remote monitoring and Control:
  - 1. UPS Web Monitoring: Remote monitoring via a web browser.
  - 2. Remote Display Panel: Surface-mounted enclosure with LCD screen or LED status lights to monitor input and output parameters for the UPS and batteries. Panel shall have audible alarm with silence function to warn of fault conditions.
  - 3. Remote Emergency Power Off (EPO) Switch: Push-pull, maintained contact, latching type mushroom switch. Mount EPO switch in surface enclosure under hinged clear protective cover. Basis of design is STI Stopper series. Pushing switch shall shut down UPS, bypass, and batteries. Coordinate with UPS manufacturer to confirm if remote EPO is included with unit as an accessory, or provided separately.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. General: Preparation and installation shall be in accordance with reviewed product data, final shop drawings, and manufacturer's written recommendations, and as indicated on the Drawings.
- B. Examine elements and surfaces to receive UPS for compliance with installation tolerances and other conditions affecting performance of the work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.
- D. Verify HVAC Systems are operational to maintain specified environmental conditions.

### 3.02 INSTALLATION

A. Comply with mounting and anchoring requirements specified in Section 26 0548 "Vibration and Seismic Controls for Electrical Systems."

### 3.03 IDENTIFICATION

- A. Identify UPS, field-installed conductors, interconnecting wiring, and components; provide warning signs complying with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems."
- B. Provide label on front of each battery that indicates the date when put into service.
- C. EPO Recovery: Provide a written instruction list for restarting the UPS after an EPO event.

### 3.04 CONNECTIONS

- A. Ground equipment according to Section 26 0526 "Grounding and Bonding for Electrical Systems."
- B. Connect wiring according to Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables."
- C. Verify tightness and torque all accessible bolted electrical connections to manufacturer's specified values using calibrated torque wrench. Provide a list of all torqued connections and values.

#### 3.05 FIELD QUALITY CONTROL

- A. Field testing shall be performed under provisions of Division 01.
- B. All field testing shall be performed in the presence of the Owner.
- C. Factory-Assisted Start-Up: Provide (1) factory-assisted UPS startup trip, as noted in the phasing schedule on sheet E1.01. Note that depending on UAF outage schedules, the startup and testing may <u>not</u> occur during normal business hours. Assume startup trip will be up to 7 days, and testing may occur any time during the day or night (7x24).
- D. Startup shall be done per manufacturer recommendations and, in general, shall include the following:
  - 1. Visual inspection: Visually inspect all equipment for signs of damage or foreign materials. Vacuum dirt and debris; do not use compressed air to assist in cleaning.
  - 2. Mechanical inspection: Check all power and control connections for tightness. Verify all battery module connections for proper torque.
  - 3. Electrical pre-check inspection: Check the DC bus for possible short circuit. Check the input and bypass power for proper voltages and phase rotation. Check all lamp test functions. Verify and record all battery system float voltages and current settings.
  - 4. Initial UPS startup: Energize the UPS module and verify the proper DC, walk-up, and AC phase on. Check the DC link holding voltage, AC output voltages, DC link voltage, inverter AC output, and synchronization. Check for voltage differences between inverter output and bypass source.

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- 5. Site testing and commissioning:
  - a. Verify specification performance criteria.
  - b. Measure battery discharge and recharge times.
  - c. Simulate fault in each system component and utility power.
  - d. Test operation of the UPS when connected to existing standby power system.
  - e. Test emergency power off (EPO) shunt trip function.
  - f. Test operation of remote display panel.
- 6. Load Bank Testing: After each UPS is installed, test the unit and the associated battery cabinets with a portable "suitcase" load bank that has a minimum rating of 100kW. Test period shall be 30 minutes for each UPS unit.
- 7. On-site operational training: Provide as specified in Article 1.12 of this section.
- E. Perform other tests as recommended by manufacturer.

# 3.06 ADJUSTING

- A. Adjust work under provisions of Division 01.
- B. Adjust output voltage to within 1 percent of nominal.
- C. Adjust output frequency to within 0.6 percent of nominal.

# 3.07 CLEANING

A. On completion of installation, repair any damaged finishes.

# 3.08 DEMONSTRATION

- A. Provide systems demonstration under provisions of Division 01.
- B. Describe loads connected to system and restrictions for future load additions.
- C. Demonstrate alarms and functions as noted on the submitted and approved sample test report.
- D. Simulate power outage by interrupting normal source, and demonstrate that system operates on battery and then retransfers to AC standby power, with no interruption of service.

## END OF SECTION 26 3353

### SECTION 26 3623 AUTOMATIC TRANSFER SWITCHES

### PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Complete factory assembled Automatic Transfer Switch (ATS).

### 1.02 RELATED SECTIONS

- A. Section 26 0553 Identification for Electrical Systems: Engraved Nameplates.
- B. Section 26 3200 Packaged Generator Assemblies.

### 1.03 REFERENCES

- A. The Work under this section is subject to requirements of the Contract Documents including the General Conditions, Supplementary Conditions, and sections under Division 01 - General Requirements and Section 26 0500 – Common Work Results for Electrical.
- B. NFPA 70 National Electrical Code.
- C. NFPA 110 Emergency and Standby Power Systems.
- D. NEMA ICS 1 General Standards for Industrial Control and Systems.
- E. NEMA ICS 2 Standards for Industrial Control Devices, Controllers, and Assemblies.
- F. NEMA ICS 6 Enclosures for Industrial Controls and Systems.
- G. NEMA ICS 10 Industrial Control and Systems: AC Transfer Switch Equipment.
- H. NEMA 250 (National Electrical Manufacturers Association) Enclosures for Electrical Equipment (1000 Volts Maximum).
- I. IEEE 446 Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications.
- J. IEC 947-6-1 Low-voltage Switchgear and Control gear; Multifunction equipment; Transfer Switching Equipment.
- K. NETA ATS Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
- L. UL 508 Industrial Control Equipment.
- M. UL1008 Standard for Transfer Switch Equipment.

## 1.04 SUBMITTALS

- A. Product Data: Provide catalog sheets showing voltage, switch size, ratings and size of switching devices, operating logic, short circuit ratings, dimensions, enclosure details and all option provided.
- B. Factory Test Report: Provide copy of factory operational test on the transfer switch prior to shipping from the factory. A certified test report shall be included in the packing list with the transfer switch. The test process shall include calibration of voltage sensors.

#### 1.05 CLOSEOUT SUBMITTALS

- A. Project Record Drawings: Indicate actual locations and mounting heights of transfer switches on the project record drawings. Submit under Section 26 0500.
- B. O&M Manuals:
  - 1. Provide project adjusted shop drawings indicating the final wiring and terminations with the O&M manuals.
  - 2. Provide printout or spreadsheet indicating final settings and adjusted values of the transfer switch.

- 3. Include instructions for operating equipment. Include instructions for operating equipment under emergency conditions when engine generator is running.
- 4. Include routine preventative maintenance and lubrication schedule. List special tools, maintenance materials, and replacement parts.

### **1.06 QUALIFICATIONS**

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience. Manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation and service in accordance with ISO 9001.
- B. Supplier: Authorized distributor of specified manufacturer with minimum three years documented experience.

### 1.07 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Conform to requirements of NFPA 110 for a Level 2 system.
- C. Furnish products listed and classified by UL as suitable for purpose specified and indicated.

### 1.08 DELIVERY, STORAGE, AND HANDLING

- A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- B. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to internal components, enclosure and finish.

### 1.09 FIELD MEASUREMENTS

A. Verify that field measurements are as instructed by manufacturer.

#### 1.10 MAINTENANCE SERVICE

A. Furnish service and maintenance of transfer switch for one year from Date of Substantial Completion.

#### 1.11 WARRANTY

A. Provide three-year manufacturer warranty of all components, parts, and assemblies against defects in materials and workmanship, with no deductible for all components.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

- A. ASCO.
- B. Cummins/Onan.
- C. Kohler.
- D. Caterpillar.
- E. Substitutions: Under provisions of Division 01.

#### 2.02 AUTOMATIC TRANSFER SWITCH

- A. Description: NEMA ICS 2, UL 1008 listed automatic transfer switch.
- B. Configuration: Double throw, electrically operated, electrically and mechanically interlocked and mechanically held transfer switch. The transfer switch shall be specifically designed so that it cannot stop in a neutral position.
- C. Closed Transition type:
  - 1. The CTTS shall transfer the load without interruption (closed transition) by momentarily connecting both sources of power only when both sources are present and acceptable. The maximum interconnection time is 100 milliseconds. The CTTS shall operate as a

conventional break-before-make (open transition) switch when the power source serving the load fails.

- 2. Source differential sensing shall be provided for the closed transition operating mode. The sensor shall enable transfer/re-transfer between live sources in the closed transition mode only when the two sources have a maximum voltage differential of 5%, frequency differential of 0.2 Hz and are within 5 electrical degrees.
- 3. Closed transition transfer shall be accomplished with no power interruption and without altering or actively controlling standby generator set.
- D. Bypass-Isolation Switch:
  - 1. A two-way bypass-isolation switch shall provide manual bypass of the load to either source and permit isolation of the automatic transfer switch from all source and load power conductors. All main contacts shall be manually driven.
  - 2. Power interconnections shall be silver-plated copper bus bar. The only field installed power connections shall be at the service and load terminals of the bypass-isolation switch. All control interconnecting wiring shall be provided with disconnect plugs.
  - 3. Separate bypass and isolation handles shall be utilized to provide clear distinction between the functions. Handles shall be permanently affixed and operable without opening the enclosure door. Designs requiring insertion of loose operating handles or opening of the enclosure door to operate are not acceptable.
  - 4. Bypass to the load-carrying source shall be accomplished with no interruption of power to the load (make before break contacts). Designs which disconnect the load when bypassing are not acceptable. The bypass handle shall have three operating modes: "Bypass to Normal," "Automatic," and "Bypass to Emergency." The operating speed of the bypass contacts shall be the same as the associated transfer switch and shall be independent of the speed at which the manual handle is operated. In the "Automatic" mode, the bypass contacts shall be out of the power circuit so that they will not be subjected to fault currents to which the system may be subjected.
  - 5. The isolation handle shall provide three operating modes: "Closed," "Test," and "Open." The "Test" mode shall permit testing of the entire emergency power system, including the automatic transfer switches with no interruption of power to the load. The "Open" mode shall completely isolate the automatic transfer switch from all source and load power conductors. When in the "Open" mode, it shall be possible to completely withdraw the automatic transfer switch for inspection or maintenance to conform to code requirements without removal of power conductors or the use of any tools.
  - 6. When the isolation switch is in the "Test" or "Open" mode, the bypass switch shall function as a manual transfer switch.
  - 7. Designs requiring operation of key interlocks for bypass isolation or ATS's which cannot be completely withdrawn when isolated are not acceptable.
  - 8. Operability: Constructed so load bypass and transfer-switch isolation can be performed by 1 person.

## 2.03 SERVICE CONDITIONS

- A. Service Conditions: NEMA ICS 1.
- B. Operating Temperature: minus -40°F to plus 140°F.
- C. Altitude: 400 feet.

#### 2.04 RATINGS

- A. Furnish and install Automatic Transfer Switches with voltage, amperage, and number of switched poles as shown on project one-line drawing.
- B. Load Inrush Rating: Combination load.

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- C. Continuous Rating: As noted on the Drawings.
- D. Interrupting Capacity: 250 percent of continuous rating.
- E. Withstand Current Rating: The switch shall be rated to withstand the fault current as shown on the Drawings. Transfer switch withstand ratings shall be applicable for ANY manufacturer's breakers. Withstand ratings utilizing specific manufacturer's breakers will only be accepted if coordinated in advance by the Contractor to ensure the existing/new breaker upstream of the transfer switch complies with the "specific breaker" listing.

#### 2.05 PRODUCT OPTIONS AND FEATURES

- A. ATS Controls: Microprocessor controls with digital display for status information.
- B. Main switch contacts shall be high-pressure silver alloy. Contact assemblies shall have arc chutes for positive arc extinguishing. Arc chutes shall have insulating covers to prevent interphase flashover.
- C. Transfer switch internal wiring shall be composed of pre-manufactured harnesses that are permanently marked for source and destination. Harnesses shall be connected to the control system by means of locking disconnect plug(s) to allow the control system to be disconnected and service without disconnecting power from the transfer switch mechanism.
- D. Field control connections shall be made on a common terminal block that is clearly and permanently labeled.
- E. Transfer switch shall be provided with AL/CU mechanical lugs sized to accept the full output rating of the switch or the number and size of conductors shown on the drawings, whichever is larger.
- F. Operator Panel: Provide with a control panel to allow the operator to view the status and control the operation of the transfer switch. The operator panel shall be a sealed membrane panel rated NEMA 3R that is permanently labeled for switch and control functions. The operator panel shall be provided with the following features and capabilities:
  - 1. High intensity LED lamps to indicate the source that the load is connected to and which sources are available. Source available LED indicators shall operate from the control microprocessor to indicate the true condition of the sources as sensed by the control.
  - 2. High intensity LED lamps or control panel display to indicate that the transfer switch in "Not in Auto" and "Test/Exercise Active" to indicate that the control system is testing or exercising the generator set.
  - 3. "OVERIDE" pushbutton to cause the transfer switch to bypass any active time delays for start, transfer, and retransfer and immediately proceed with its next logical operation.
  - 4. "TEST" pushbutton to initiate a preprogrammed test sequence for the generator set and transfer switch. The transfer switch shall be programmable for test with load or test without load.
  - 5. Security key switch or controller password protection to allow the user to inhibit adjustments, manual operation or testing of the transfer switch unless the key is in place and operated.
  - 6. Analog or digital AC meter display panel to display 3-phase AC Amps, 3-phase AC Volts, Hz, kW/kVA load level, and load power factor. Line to line, line to neutral, average, minimum, and maximum values shall be available via the control panel display and the Modbus registers.
  - 7. Alphanumeric display panel with pushbutton navigation switches. The display shall be clearly visible in both bright (sunlight) and no light conditions. It shall be visible over an angle of at least 120 degrees. The alphanumeric display panel shall be capable of providing the following functions and capabilities:

- a. Display source condition information, including AC voltage for each phase of normal and emergency source, frequency of each source. Voltage for all three phases shall be displayed on a single screen.
- b. Display source status to indicate source is connected or not connected.
- c. Display load data including 3-phase AC voltage, 3-phase AC current, frequency, kW, kVA, and power factor. Voltage and current data for all phases shall be displayed on a single screen.
- d. The display panel shall allow the operator to view and make the following adjustments in the control system after entering an access code:
  - 1) Set nominal voltage and frequency for the transfer switch.
  - 2) Adjust voltage and frequency sensor operation set points.
  - 3) Set up time clock functions.
  - 4) Set up load sequence functions.
  - 5) Enable or disable control functions in the transfer switch, including program transition.
  - 6) Set up exercise and load test operation conditions, normal system time delays for transfer time, time delay for start, stop transfer and retransfer.
- e. Display real time clock data, including date, and time in hours, minutes and seconds. The real time clock shall incorporate provisions for automatic daylight savings time and leap year adjustments. The control shall also log total operating hours for the control system.
- f. Display service history for the transfer switch. Display source connected hours to indicate the total number of hours connected to each source. Display number of times transferred and total number of times each source has failed.
- G. Provide RMS voltage sensing and metering that is accurate to within plus or minimum 1% of nominal voltage level. Frequency sensing shall be accurate to within plus or minus 0.2%. Voltage sensing shall be monitored based on the normal voltage at the site.
- H. Transfer switch voltage sensors shall be close differential type providing source availability information to the control system based on the following functions:
  - 1. Monitoring all phases of the normal source for under voltage conditions (adjustable for pickup in a range of 85 to 98% of the normal voltage leave and dropout in a range of 75 to 98% of normal voltage level).
  - 2. Monitoring all phases of the standby source for under voltage conditions (adjustable for pickup in a range of 85 to 98% of the normal voltage leave and dropout in a range of 75 to 98% of pickup voltage level).
  - 3. Monitoring all phases of the normal and standby sources for voltage imbalance.
  - 4. Monitoring all phases of the normal and standby sources for loss of a single phase.
  - 5. Monitoring all phases of the normal and standby sources for phase rotation.
  - Monitoring all phases of the normal and standby sources for over voltage conditions (adjustable for dropout over a range of 105 to 135% or normal voltage and pickup at 95 – 99% of dropout voltage level).
  - 7. Monitoring of all phases of the normal and standby sources for over or under frequency conditions.
- I. Communications Module: Provide remote interface module to support monitoring of vendor's transfer switch, controller and optional power meter. Module shall provide status, analog parameters, event logs, equipment settings & configurations over embedded webpage and open protocol. Module shall allow for the initiating of transfers, retransfers, bypassing of active

timers and the activating/deactivating of engine start signal shall be available over the embedded webpage and to the transfer switch vendor's monitoring equipment. The transfer switch shall incorporate adjustable time delays for generator set start (adjustable in a range from 0 - 6 seconds, set at 5 seconds); transfer (adjustable in a range from 0 - 120 seconds, set at 2 seconds); retransfer (adjustable in a range from 0 - 30 minutes, set at 5 minutes); and generator stop (cool down) (adjustable in a range of 0 - 30 minutes, set at 5 minutes).

- J. The control shall have optically isolated logic inputs, high isolation transformers for AC inputs, and relays on all outputs to provide optimum protection form line voltage surges, RFI and EMI.
- K. The transfer switch shall provide an isolated relay contact for starting of the generator set. The relay shall be normally held open, and close to start the generator set. Output contacts shall be form C.
- L. Provide one set of Form C auxiliary contacts on both sides operated by transfer switch position, rated 10 Amps, 250 VAC.
- M. Generator set exercise (test) with load mode: The control system shall be configurable to test the generator set under load. In this mode the transfer switch shall control the generator set in the following sequence:
  - 1. Transfer switch shall initiate the exercise sequence at a time indicated in the exercise timer program or when manually initiated by the operator.
  - 2. When the control system senses the generator set at rated voltage and frequency it shall operate to connect the load to the generator set.
  - 3. The generator set shall operate connected to the load for the duration of the exercise period. If the generator set fails during this period the transfer switch shall automatically reconnect the load to the normal source.
  - 4. At the completion of the exercise period the transfer switch shall operate to connect the load to the normal source.
  - 5. The transfer switch shall operate the generator set unloaded for the programmed cool down period and then remove the start signal from the generator set. If the normal source fails at any time when the generator set is running the transfer switch shall immediately connect the load to the generator set.
- N. Generator set exercise (test) without load mode: The control system shall be configurable to test the generator set without transfer switch load connected. In this mode the transfer switch shall control the generator set in the following sequence:
  - 1. Transfer switch shall initiate the exercise sequence at a time indicated in the exercise timer program or when manually initiated by the operator.
  - 2. When the control system senses the generator set at rated voltage and frequency it shall operate the generator set unloaded for the duration of the exercise period.
  - 3. At the completion of the exercise period the transfer switch shall remove the start signal from the generator set and shut the generator down. If the normal source fails at any time when the generator set is running the transfer switch shall immediately connect the load to the generator set.
- O. Elevator Pre-Transfer Delay Relay: Provide relay and NO/NC contact outputs to delay transfer or retransfer for a specified time to give warning to an elevator controller that a transfer or retransfer is about to occur. This time delay shall be adjustable over a range of 0 to 60 seconds, set to 20 seconds or as recommended by elevator manufacturer.

## 2.06 ENCLOSURE

A. Enclosure shall be ICS 10 and UL listed NEMA 3R. The enclosure shall provide wire bend space in compliance to the latest version of NFPA 70. The cabinet door shall include permanently mounted key type latches.

- B. Enclosure shall be configured to require front access for maintenance.
- C. Enclosure to be concrete pad mounted.
- D. Manual operating handles and all control switches (other than key operated switches) shall be accessible to authorized personnel only by opening the key locking cabinet door.
- E. For NEMA 3R outdoor installations, provide transfer switch with 125W strip heater properly designed and sized to prevent condensation.

## PART 3 EXECUTION

## 3.01 EXAMINATION

A. Verify that surface is suitable for transfer switch installation.

## 3.02 INSTALLATION

- A. Install transfer switches in accordance with manufacturer's instructions.
- B. Provide engraved plastic nameplates under the provisions of Section 26 0553.
- C. Provide start-up control signal wiring between transfer switch and emergency/standby diesel generator system to start generator upon local loss of power.
- D. Provide reinforced concrete pad(s) for floor mounted transfer switch.
- E. All transfer switches shall have signage for arc hazard installed. The marking shall be located to be clearly visible to qualified personnel before examination, adjustment, servicing or maintenance of the equipment. At a minimum the signage shall state the following:

#### Warning

### Arc Flash and Shock Hazard

### Appropriate PPE Required

#### 3.03 MANUFACTURER'S SERVICES

A. The transfer switch manufacturer shall perform a complete operational test on the transfer switch prior to shipping from the factory. A certified test report shall be included in the packing list with the transfer switch. The test process shall include calibration of voltage sensors.

## 3.04 DEMONSTRATION

- A. Visual and Mechanical Inspection:
  - 1. Compare equipment nameplate data with drawings and specifications.
  - 2. Inspect physical and mechanical condition.
  - 3. Verify manual transfer warnings are attached and visible.
  - 4. Verify tightness of control connections.
  - 5. Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data.
  - 6. Perform manual transfer operation.
  - 7. Verify positive mechanical interlocking between normal and alternative sources.
  - 8. Inspect anchorage, alignment, grounding and required clearances.
- B. Electrical Tests:
  - 1. Measure contact-resistance.
  - 2. Perform insulation-resistance tests, phase-to-phase and phase-to-ground, with switch in both source positions. Test duration shall be one minute. Use a test voltage in accordance with manufacturer's published data. For control devices that cannot tolerate test voltage follow manufacturer's recommendation.
  - 3. Verify settings and operation of control devices.

- 4. Calibrate and set relays and timers in accordance with manufacturer's published data.
- 5. Verify phase rotation, phasing and synchronized operation as required by the application.
- 6. Perform automatic transfer tests:
  - a. Simulate loss of normal power.
  - b. Return to normal power.
  - c. Simulate loss of emergency power.
  - d. Simulate all forms of single-phase conditions.
- 7. Verify correct operation and timing of following functions:
  - a. Normal source voltage-sensing relays.
  - b. Engine start sequence.
  - c. Time delay upon transfer.
  - d. Alternate source voltage-sensing relays.
  - e. Automatic transfer operation.
  - f. Interlocks and limit switch function.
  - g. Time delay and retransfer upon normal power restoration.
  - h. Engine cool down and shutdown feature.

# END OF SECTION 26 3623

### SECTION 26 4300 SURGE PROTECTIVE DEVICES

### PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Transient Voltage Surge Suppression Devices (TVSS) or Surge Protection Device (SPD).

### 1.02 RELATED SECTIONS

- A. The Work under this section is subject to requirements of the Contract Documents including the General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements and Section 26 0500 Common Work Results for Electrical.
- B. Section 26 0519 Low-Voltage Electrical Power Conductors and Cables.
- C. Section 26 2416 Panelboards.
- D. Section 26 2419 Motor-Control Centers.

### 1.03 REFERENCES STANDARDS

- A. ANSI/IEEE Std C62.41-1991 Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.
- B. ANSI/IEEE Std C62.45-1992 IEEE Guide on Surge Testing for Equipment Connected to Low-Voltage AC Power Circuits.
- C. ANSI/NFPA 70 National Electrical Code Article 285.
- D. IEEE Std 142-1991 IEEE Recommended Practice for Grounding of Industrial and Commercial Power Systems (IEEE Green Book).
- E. IEEE Std 1100-1999 IEEE Recommended Practice for Power and Grounding Sensitive Electronic Equipment (IEEE Emerald Book).
- F. FIPS Pub 94 Federal Information Processing Standards Publication Guideline on Electrical Power for ADP Installations.
- G. NEMA LS-1 1992 Low Voltage Surge Protective Devices.
- H. UL 1449 most recent edition, Standard for Safety Transient Voltage Surge Suppressor.
- I. UL 1283 Standard for Safety Electromagnetic Interference Filters.
- J. ISO 9001:1994, Quality Systems Model for Quality Assurance in Design, Development, Production, Installation and Servicing.

### 1.04 SYSTEM DESCRIPTION

A. Provide surge protective devices and equipment required for the protection of all AC electrical circuits and electronic equipment from the effects of lightning induced voltages, external switching transients and internally generated switching transient, and as indicated herein.

#### 1.05 SUBMITTALS

- A. Product Data: Submit product data for all components provided, showing electrical characteristics and connection requirements. Each catalog sheet should be clearly marked exact part number provided, including all options and accessories. Provide verification that SPD device complies with the required UL 1449 (IEEE C62.42 Cat. C1 6kV, 500A Surge Voltage Ratings (SVR)).
- B. Shop Drawings: Provide enclosure and support point dimensions, voltage, surge current per phase, surge current per mode and performance characteristics. List and detail all protection systems such as fuses, disconnecting means and protective materials.
- C. Test Reports: Provide third party test reports in compliance with NEMA LS1 from a recognized independent testing laboratory verifying the suppressor components can survive published

surge current rating on both a per mode and per phase basis using the IEEE C62.42, 8 x 20 microsecond current wave.

#### 1.06 CLOSEOUT SUBMITTALS

- A. Project Record Drawings:
  - 1. Accurately indicate actual location of each SPD device on the power one-line diagram.
  - 2. Show SPD wiring, bonding, and grounding connections shall be indicated on the wiring diagram for each system.
- B. Operation and Maintenance Manuals:
  - 1. Submit manufacturer's instruction leaflets and instruction bulletins for the complete assembly and each major component.
  - 2. Include installation details demonstrating mechanical and electrical connections to equipment to be protected.

### 1.07 QUALIFICATIONS

- A. All surge protective devices for service entrance, distribution, and branch circuit protection within a facility shall be provided by a single manufacturer.
- B. The manufacturer must be regularly engaged in the manufacture of surge suppression products for the specified categories for no less than three documented years.

### 1.08 WARRANTY

- A. The SPD and supporting components shall be guaranteed by the manufacturer to be free of defects in material and workmanship for a period of twenty (20) years from the date of substantial completion of service and activation of the system to which the suppressor is attached. Any additional diagnostic circuits (LEDs, surge counter, etc.) must meet a warranty period of ten (10) years.
- B. An SPD that shows evidence of failure or incorrect operation during the warranty period shall be replaced free of charge. Since "Acts of Nature" or similar statements typically include the threat of lightning to which the SPDs shall be exposed, any such clause limiting warranty responsibility in the general conditions of this specification shall not apply to this section. That is, the warranty is to cover the effects of lightning, single phasing, and all other electrical anomalies. The warranty shall cover the entire device, not just various components, such as modules only.
- C. The installation of SPDs in or on electrical distribution equipment shall in no way compromise or violate equipment listing, labeling, or warranty of the distribution equipment.

#### **1.09 QUALITY ASSURANCE**

- A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years documented experience and ISO 9000 certified.
- B. Installer: Company specializing in installing the products specified in this section with minimum three years documented experience.

## 1.10 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Furnish products listed and classified by UL as suitable for purpose specified and indicated.

## PART 2 PRODUCTS

#### 2.01 MANUFACTURERS

- A. Eaton Clipper MAG Series.
- B. Schneider/Square D SurgeLogic XGA Series.
- C. Siemens Sentron TPS Series.

D. Substitution: Under provisions of Division 01.

### 2.02 SURGE PROTECTIVE DEVICES

- A. The Maximum Continuous Operating Voltage (MCOV) shall be greater than 115% of the nominal system operating voltage.
- B. The suppression system shall incorporate a hybrid designed Metal-Oxide Varistor (MOV) surge suppressor. The suppression system shall not utilize silicon avalanche diodes, selenium cell, air gaps or other components that may crowbar the system voltage.
- C. Minimum surge current capability (single-pulse rated) shall be 250 kA per phase, 125 kA per mode, and a 10 kA Surge Withstand Capability in accordance with NEMA LS 1 and ANSI/IEEE C62.42.
- D. The SPD shall incorporate copper bus bars for the surge current path. Small gauge round wiring or plug-in connections shall not be used in the path for surge current diversion. All internal components shall be hardwired with connections utilizing low impedance conductors and compression fittings. Surge current diversion module shall be bolted directly to the bus bars of the panelboard.
- E. The SPD shall be a self-contained module design. Each suppression element shall be MOV based. Each MOV shall be individually fused via a copper fuse trace to allow protection during high surge (kA) events. MOV's shall be equipped with thermal fuse spring or equivalent technology to allow the disconnection of the MOV to prevent overheating during temporary over voltage conditions. All overcurrent protection components shall be tested in compliance with UL 1449 2<sup>nd</sup> Edition Limited Current Test and AIC rating Test.
- F. Protection Modes: For a wye configured system, the device shall have directly connected suppression elements between line and neutral (L-N), line and ground (L-G), and neutral and ground (N-G). For a delta configured system, the device shall have suppression elements between line to line (L-L) and line to ground (L-G).
- G. UL 1449 2<sup>nd</sup> Edition Suppressed Voltage Rating: The maximum UL 1449 2<sup>nd</sup> Edition (IEEE C62.42 Cat. 6kV, 500A) SVR for the device shall not exceed the following:

| <u>Modes</u>  | <u>208Y120</u> | <u>480Y277</u> |
|---------------|----------------|----------------|
| L-N; L-G; N-G | 800 V          | 1200 V         |
| L-L           | 1200V          | 1800 V         |

H. ANSI/IEEE Cat. C3 Let Through Voltage: The let through voltage based on ANSI/IEEE C62.42 and C62.45 recommended procedures for Category C3 (20kV, 10kA) shall be less than the following:

| <u>Modes</u> | <u>208Y120</u> | <u>480Y277</u> |
|--------------|----------------|----------------|
| L-N          | 560 V          | 960 V          |

I. ANSI/IEEE Cat. B3 Let Through Voltage: The let through voltage based on ANSI/IEEE C62.41 and C62.45 recommended procedures for Category B3 Ringwave (6kV, 500 amps) shall be less than the following:

| <u>Modes</u> | <u>208Y120</u> | <u>480Y277</u> |
|--------------|----------------|----------------|
| L-N          | 160 V          | 165 V          |

J. All units shall be tested to the specified surge ratings to ensure the devices will achieve the required life expectancy and reliability. Test data shall be provided from an independent test lab capable of producing 250kA surge current waveforms using the ANSI/IEEE C62.42 impulse waveform (8x20 microsecond). The suppression system shall be repetitively surge tested in each mode utilizing a 1.2 x 50 µsec, 20 kV open circuit voltage and an 8 x 20 µsec, 10 kA short circuit current Category C3 bi-wave at one minute intervals without suffering either performance degradation or more than 10% deviation of clamping voltage at the specified surge current. The minimum repetitive surge current capability as per ANSI/IEEE C62.42 and ANSI/IEEE

C62.45 shall be 12000 impulse per mode. Withstand testing shall be provided on a per mode and per phase basis.

- K. The SPD shall provide visual indication of properly performing protection. Indicator lights shall provide full-time visual diagnostic monitoring of the operational status of each phase of the surge current diversion module. Separate Indicator lights shall be provided to show fully operational suppression capability, reduced suppression capability, and total loss of suppression capability. The SPD shall provide an audible alarm with a reset pushbutton that will activate under any fault condition. No other test equipment shall be required for SPD monitoring or testing before or after installation. The SPD shall be equipped with an LCD display system designed to indicate how many surges, sags, swells and outages have occurred at the location. The event counter shall trigger each time under each respective category after a significant event occurs and shall be equipped with a reset pushbutton to allow the counters to be zeroed. The SPD shall display the true RMS voltage on each L-N protection mode for wye connected systems and L-L protection mode for delta connected systems. The SPD shall non-volatile memory to save at least 1000 events.
- L. SPD shall provide full cycle tracking circuitry to provide tight transient clamping regardless of the transient position on the sine wave.
- M. SPD shall have UL 1283 EMI/RFI filtering with minimum attenuation of -50dB at 100kHz.

# PART 3 INSTALLATION

## 3.01 INSTALLATION

- A. Install SPD in accordance with NEMA standards.
- B. SPD shall be housed in a NEMA rated enclosure appropriate to the application, surface mounted to match the panel to which it is connected. SPD shall be factory installed in the main switchboard and the branch panelboards shown on the plans. The SPD shall be installed immediately on the load side of the main breaker (for panelbaords equipped with main breakers) and shall be connected directly to the busbars.
- C. Provide a 30 Ampere disconnect for the SPD. The disconnect shall be directly integrated to the suppressor and assembly bus using bolted bus bar connections.
- D. All monitoring diagnostics features, such as indicator lights, trouble alarms, etc., shall be visible from the front of the panelboard or switchboard.
- E. Install SPD plumb. Provide supports in accordance with Section 26 0529.
- F. Provide engraved plastic nameplates under the provisions of Section 26 0553.
- G. All conductors of the SPD shall be grouped together up to their point of connection. Lead lengths shall be as short as possible and shall avoid sharp bends. Leads shall be kept to a maximum of 18 inches from the point of connection to the SPD.
- H. SPD shall be mounted directly adjacent to the protected panel. Size overcurrent protection in accordance with manufacturer's recommendations.

## 3.02 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Division 01.
- B. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding.

# END OF SECTION 26 4300

### SECTION 26 5000 LIGHTING

## PART 1 GENERAL

## 1.01 SECTION INCLUDES

- A. Interior and Exterior Luminaires and Accessories.
- B. Lamp Modules.
- C. Drivers.
- D. Light Poles
- E. Exit Signs
- F. Emergency Driver Power Supplies.
- G. Emergency Lighting Inverters.
- H. Electronically Controlled Prefabricated Lighting Unit Assembly With Appearance Of A Window

# 1.02 RELATED SECTIONS

- A. The Work under this section is subject to requirements of the Contract Documents including the General Conditions, Supplementary Conditions, and sections under General Conditions of the Contract General Requirements, and Section 26 0500 Common Work Results for Electrical.
- B. Division 09 Finishes: Painting and Ceilings.
- C. Section 26 0519 Low Voltage Electrical Power Conductors and Cables.
- D. Section 26 0526 Grounding and Bonding for Electrical Systems.
- E. Section 26 0529 Hangers and Supports for Electrical Systems: General Supports for Luminaires.
- F. Section 26 0533 Raceway and Boxes for Electrical Systems.
- G. Section 26 0548 Vibration and Seismic Controls for Electrical Systems: Seismic Supports for Luminaires.
- H. Section 26 0553 Identification for Electrical Systems.
- I. Section 26 0919 Enclosed Contactors.
- J. Section 26 0923 Lighting Control Devices: Compatibility with Dimming Switches.
- K. Section 26 0943 Network Lighting Controls
- L. Section 26 2726 Wiring Devices.

# 1.03 DEFINITIONS

- A. CCT: Correlated Color Temperature.
- B. CRI: Color Rendering Index.
- C. Driver: LED Power Supply.
- D. Fixture: See "Luminaire."
- E. IES: Illuminating Engineering Society of North America
- F. IP: International Protection or Ingress Protection Rating.
- G. Lamp Module: Replaceable LED board array/light engine including a plug-in connector.
- H. LED: Light-emitting diode.
- I. Lumen: Measured output of lamp and luminaire, or both.
- J. Luminaire: Complete lighting unit, including lamp or lamp module, driver, reflector, and housing.
K. THD: Total Harmonic Distortion.

# 1.04 REFERENCE STANDARDS

- A. NECA/IESNA 500 Recommended Practice for Installation Indoor Commercial Lighting System.
- B. IES TM-21-11 Projecting Long Term Lumen Maintenance of LED Light Sources.
- C. IES LM-80 IES Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays and Modules.
- D. UL 924 Emergency Lighting and Power Equipment.

### 1.05 SUBMITTALS

- A. Product Data: Submit the following:
  - 1. Luminaires: Include manufacturer's product data sheets and/or shop drawings including outline drawings showing support points, weights, and accessory information for each luminaire type. Clearly indicate all options being provided. Arrange data for luminaires in the order of fixture designation.
  - 2. Prior to preparing submittals, coordinate with the reflected ceiling plan for ceiling finishes and provide all necessary kits, brackets, stems, trim, etc. to install the specified fixtures in the ceilings provided. Clearly note these configurations on the product data sheets.
- B. Shop Drawings: Provide detailed shop drawings for specialty luminaires as required by the manufacturer.
- C. Warranty: Provide copies of manufacturer's warranty information for each luminaire. If warranty information is the same for a group of manufacturer's luminaires, provide a letter or schedule clearly indicating what warranty applies to each fixture.
- D. LED Luminaire Substitutions: Due to the constantly evolving technology, it is difficult to evaluate a true "equal" LED luminaire since the wattage, LED life, lumen output, etc. vary significantly from fixture to fixture, even for luminaires that have a similar shape and style. The luminaires shown on the Plans in the Fixture Schedule are not intended to be sole sourced but are considered a Basis of Design. If a substitution is proposed by the contractor, it will be evaluated based on the following criteria:
  - 1. Does it have the same basic shape/style and characteristics? Note that there may be space constraints above the ceiling.
  - 2. Does the luminaire have the same (or superior) light output and distribution? If not, would it still produce enough light to illuminate the space per minimum IES recommendations or other project specific lighting levels? Note that the Engineer may request .ies files or lighting calculations be provided by the Contractor to evaluate substitution requests.
  - 3. Does it use the same (or less) wattage than the specified fixture? If it uses slightly more power, does it provide enough value to the Owner by adding additional light to offset the additional power used? Is that appropriate for the project compliance requirements. (LEED, ASHRAE 90.1, etc.)
  - 4. Does it have the same nominal color temperature and CRI values? Note that for certain luminaires this may be more important where medical procedures are being performed or where artwork or merchandise is illuminated.
  - 5. Does it have an equal or better lamp life as calculated in accordance with IES TM-21 and LM-80?
  - 6. Does the manufacturer offer an equal or better warranty than the specified fixture?
  - 7. Are the LED lamps modules and LED boards field changeable? What guarantees does the manufacturer have that replacement parts will be available in the future?

### 1.06 CLOSEOUT SUBMITTALS

- A. Project Record Drawings: Indicate actual locations and mounting heights of all lighting fixtures and accessories on the project record drawings. Update part numbers and description on the Lighting Fixture Schedule to match the actual luminaires installed. Submit under Section 26 0500.
- B. Operation and Maintenance Manuals:
  - 1. Provide recommended luminaire cleaning and re-lamping schedule. If any luminaire lenses require special lubricants for cleaning, include this in the schedule.
  - 2. Provide detailed bill of materials for all items purchased in this section including distributor's contact name, phone number and pertinent information.
  - 3. Provide luminaire manufacturer's installation instructions.
  - 4. Provide manufacturer's step-by-step installation instructions showing how to replace the LED lamp modules and drivers for each luminaire.
  - 5. Include any specific warranty information provided by the manufacturer for luminaires, LED boards and drivers.

#### 1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site, store and protect in a clean, dry environment under provisions of General Conditions of the Contract.

#### **1.08 EXTRA MATERIALS**

- A. Provide spare parts under provisions of Division 01.
- B. Drivers: One of each size and type installed.

#### PART 2 PRODUCTS

#### 2.01 INTERIOR AND EXTERIOR LUMINAIRES AND ACCESSORIES

- A. Luminaires: Provide UL listed luminaires as scheduled on the drawings or as approved equal.
- B. Listing: Luminaires shall be listed for use in the environment in which they are installed. For example, luminaires installed in return air plenums, direct contact with insulation, or in hazardous, wet, damp, or corrosive locations shall be UL listed for such application.
- C. Accessories: Provide all mounting kits, supports, interconnecting wiring, power supplies, trim kits, gaskets, etc. for a complete installation.
- D. Housing:
  - 1. Metal parts shall be free of burrs and sharp corners and edges. Form and support to prevent warping and sagging.
  - 2. Doors, Frames and Other Internal Access: Smooth operating, free of light leakage under operating conditions. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
  - 3. Luminaires shall be factory painted and free of discoloration. Color as scheduled.

#### 2.02 LAMP MODULES – LED

- A. All LED's shall be nominal degrees Kelvin (nominal) as specified on drawings within a 3-step MacAdam Ellipse unless special circumstances require a different color temperature application, see Luminaire Schedule on Plans.
- B. Color Rendering: Minimum CRI as scheduled on the Plans for each fixture. Under no circumstances shall the CRI be less than 70.
- C. Lamp Life: Minimum lamp life shall be calculated in accordance with IES LM-80. Lamp life for each luminaire shall be equal or greater than scheduled on the Plans. Under no circumstances

shall an interior luminaire have a minimum rated life (L70) less than 50,000 hours at 75 degrees F average indoor ambient temperature and an outdoor luminaire less than 75,000 hours at 40 degrees F average outdoor ambient temperature.

- D. Replaceable: Unless otherwise scheduled, all LED modules shall be field replaceable with quick disconnect connections.
- E. Luminaires and lamps installed outdoors shall be rated for starting and operating at a minimum of -40F.

# 2.03 DRIVERS - LED

- A. LED Driver: Provide UL listed power supply as recommended by the LED fixture manufacturer for operation of the specified LED lamps. Power supply shall be integral to the luminaire unless otherwise noted on the Plans. Power supply shall be dual voltage (120/277V) where available or operate at the supply voltage indicated on the Plans.
- B. LED Dimming Driver: UL listed 0-10V dimming driver as recommended by the LED fixture manufacturer for operation of the specified LED lamps, fully compatible with the dimming system or dimming switch controlling the fixture. Driver shall be integral to the fixture and capable of dimming the luminaire down to 1% output unless otherwise scheduled on the Plans. Power supply shall be dual voltage (120/277V) where available and operate at the supply voltage indicated on the Plans.

## 2.04 ACCEPTABLE MANUFACTURERS – POLES

- A. Lithonia.
- B. Valmont.
- C. Union Metal.
- D. Substitutions: Under provisions of Division 01.

#### 2.05 LIGHTING POLES

- A. Metal Poles: Square steel lighting pole with anchor base. Factory prime paint and field finish under Division 09. See plans for pole height.
- B. Wind Load: 130 mph velocity with a gust factor of 1.3 per AASHTO standard specifications for structural supports for highway signs, luminaries and traffic signals with luminaries and brackets mounted.
- C. Hand Hole: Drilled hand access hole at manufacturer's standard location. Provide matching gasketed cover plate.
- D. Pole Top: [Provide [\_\_\_] inch diameter slipfitter.]
- E. Anchor Bolts: As recommended by pole manufacturer. Provide template, flat washers, lock washers, and hex nuts for each pole.
- F. Pole Base Cover: Shall match pole finish and shall extend down to cap over pole base to completely cover anchor bolts and flange between pole and driven pile.

#### 2.06 EXIT SIGNS

A. Luminaires: Provide UL listed exit signs as scheduled on the drawings or as approved equal.

## 2.07 EMERGENCY DRIVERS

- A. LED Unit: UL listed self-contained emergency LED driver with automatic transfer to battery supply on power failure, optional test switch, AC ON pilot light, fully-automatic two-rate charger, Ni-cad battery, and power supply capable of operating an LED load of up to the rated fixture wattage (as shown on the Plans) at rated current (700mA) for a minimum of 90 minutes. Bodine #BSL series or approved equal.
- B. Test Switches:
  - 1. Standard and Low-Profile Units:

- a. Recessed Linear led Fixtures: Mount test switch in driver channel so that it is accessible from below. Affix red driver identification label (supplied with driver) to door trim on fixture to denote location of emergency driver.
- b. Pendant Fixtures: Mount test switch in end cap of fixture, at end closest to driver. Affix red driver identification label (supplied with driver) to bottom of fixture housing below test switch to denote location of emergency driver.
- 2. High Output Unit: Self-testing, as specified above.
- 3. Recessed Downlights: Mount test switch in ceiling, in recessed single-gang box adjacent to downlight.

# 2.08 ACCEPTABLE MANUFACTURERS- EMERGENCY LIGHTING INVERTERS

- A. Bodine.
- B. lota.
- C. Isolite.
- D. Dual-lite.
- E. Substitutions: Under provisions of Division 01.

# 2.09 EMERGENCY LIGHTING INVERTERS

- A. UL 924 compliant, full output emergency lighting inverter capable of operating the lamps at >90% lumen output for 90 minutes with field selectable 120 or 277 volt input and output, with pure sinusoidal wave output suitable for use with LED luminaires, maintenance free lead calcium batteries, low voltage battery disconnect, test button, LED indicators, with or surface mounting and minimum wattage as indicated on Plans.
- B. The inverter unit shall allow for connected emergency fixture(s) to be normally on, normally off, switched or dimmed without affecting lamp operation during a power failure. Upon utility power loss, the inverter unit shall deliver 100% of its rated output to the emergency fixtures regardless of the local switch or dimmer position, and shall provide power to emergency fixtures at distances of up to 250 feet for inverters sized under 100W and 1,000 feet for inverter 100W and greater.

## 2.10 SIMULATED WINDOW SYSTEM

- A. Basis-of-Design Product: Subject to compliance with requirements, provide LIGHTGLASS; Simulated Window System or comparable product by one of the following:
  - 1. Coelux.
  - 2. Innerscene.
  - 3. Or equal.
- B. Description: Manufacturer's standard factory-fabricated lighting unit assembly, including integrated extruded aluminum frame, clear laminated glass, gasketing, diffuser, and dimmable LED light engine.
  - 1. Unit Height: As shown on drawings.
  - 2. Unit Width: As shown on drawings.
  - 3. Unit Depth: 3.75 inches.
  - 4. Frame Width: 2 inch.
  - 5. Frame Color: [Clear Anodized] [Dark Bronze Powder Coat] [White Powder Coat]
  - 6. Lighting Color Temperature: [2200 K] [2700 K] [3500 K] [4000 K] [5000 K] [6500 K] [Tunable White] [with Automatic Daylight Simulation].
  - 7. Lighting Driver: Integral with DALI or 2-Channel 0-10V.
  - 8. Unit Mounting: Recessed.

- C. Fasteners: Manufacturer's standard fasteners to attach lighting unit assembly to support substrate.
- D. Wire Hangers and Ties: Manufacturer's standard galvanized steel uncoated wire rope and looping gripper ties as required to attach lighting unit assembly to support substrate

# PART 3 EXECUTION

### 3.01 INSTALLATION

- A. Coordinate layout and installation of ceiling-mounted devices with other construction items that penetrate ceilings or are supported by them, including luminaires, occupancy sensors, HVAC equipment, smoke detectors, fire-suppression system, IP video cameras, and partition assemblies. Adjust locations as required.
- B. Unless otherwise noted on Plans, provide drivers integral to luminaires, pre-wired and installed at the factory, suitable for use with the selected LED lamps.
- C. Support surface-mounted luminaires directly from building structure. Install level and parallel/perpendicular with ceiling or wall surfaces.
- D. Install recessed luminaires to permit removal from below. Use plaster frames in hard ceilings.
- E. Support luminaires in suspended ceilings from structure above in accordance with Section 26 0529.
- F. Rigidly align continuous rows of lighting fixtures for true in-line appearance.
- G. Provide luminaire disconnecting means in the wiring compartment of each luminaire. Where the luminaire is fed from a multi-wire branch circuit, provide multi-pole disconnect to simultaneously break all supply conductors to the ballast, including the grounded conductor.
- H. LED Power Supplies: Install power supplies to be readily accessible. Where power supplies are installed in plenum areas, provide plenum rated listing. Where remote power supplies are used, install in concealed, accessible locations or in utility room that provides adequate sound dampening. Locate driver to allow free air movement in accordance with manufacturer's installation instructions and securely mount to structure.
- I. Mechanical Rooms: Lighting fixture locations shown on Plans in mechanical and electrical equipment rooms are approximate. Coordinate mounting height and location of lighting fixtures to clear mechanical, electrical and plumbing equipment and to adequately illuminate meters, gauges and equipment. Support all lighting fixtures independently of duct work or piping.
- J. Tandem wiring: Provide factory harness for all tandem mounted light fixtures.
- K. Support exterior surface-mounted luminaires directly from building structure. Maintain wall waterproofing.
- L. Luminaire Pole Bases: Size and constructed as indicated on Drawings. Project anchor bolts 2 inches minimum above base. Install poles on bases plumb; provide double nuts for adjustment and pole base covers. After adjusting of pole to be vertical, pack grout under pole base to provide full contact with the foundation.
- M. Use belt slings or non-chafing ropes to raise and set pre-finished luminaire poles.
- N. Aim directional lampheads of emergency lighting units to illuminate the path of egress.
- O. Install emergency driver in the driver channel of the fixtures or the mounting tray of downlight fixtures indicated on the drawings. Provide an unswitched source of power to the emergency driver from the same circuit that powers the fixture the driver is installed in.
- P. Coordinate location of wall mounted emergency lighting units with mechanical equipment, ductwork, piping, or any other obstruction that would impact the lighting output.
- Q. Wiring installed between a luminaire and an emergency lighting inverter or remote emergency driver is considered "emergency" wiring and shall be separated from the normal wiring and installed in a dedicated raceway per NEC Article 700.

R. Unless specifically noted otherwise on the Plans, where a luminaire is powered from an emergency source (intended for general illumination) and is located in a room or area with normal lighting, provide a Generator Transfer Device or other UL924 listed device to allow the luminaire to be switched with the normal lighting in the room or area.

## 3.02 RELAMPING

A. Re-lamp or replace luminaires that have failed lamps at completion of work.

### 3.03 ADJUSTING AND CLEANING

- A. Align luminaires and clean lenses and diffusers at completion of work. Clean paint splatters, dirt, and debris from installed luminaires.
- B. Touch up luminaire finish at completion of work.

### 3.04 FIELD QUALITY CONTROL

- A. Tests: Perform tests listed below according to manufacturer's written instructions. Test unit functions, operations, and protective features. Adjust to ensure operation complies with Specifications. Perform tests required by NFPA 70, Articles 700 and 701. Perform tests on completion of unit installation and after building circuits have been energized. Provide instruments to permit accurate observation of tests. Include the following tests:
  - 1. Simulate power outage: Verify proper operation of each individual emergency power supply.
  - 2. Verify emergency supply duration.
  - 3. Verify operation of remote test switches.
  - 4. Provide reports for load test conducted on individual batteries.
- B. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.

#### 3.05 ADJUSTING

- A. Aim lamps on wall-mounted emergency lighting units to obtain the following illumination of egress pathway:
  - 1. An average of 1 foot-candle.
  - 2. A minimum at any point of 0.1 foot-candle measured along the path of egress at floor level.
  - 3. Maximum-to-minimum illumination uniformity ratio of 40 to 1 shall not be exceeded.
- B. Test emergency lighting equipment in accordance with the manufacturer's instructions and NECA/IESNA 500.

# 3.06 DEMONSTRATION

A. Walk owner's representative through the emergency lighting system. Note how to maintain, test and troubleshoot all units. Provide maintenance schedule for NFPA required testing and note locations of remote test switches, and which units have self-diagnostic features.

## END OF SECTION 26 5000

# SECTION 27 0528 PATHWAYS FOR COMMUNICATION SYSTEMS

# PART 1 GENERAL

# 1.01 SECTION INCLUDES

- A. Cable Trays.
- B. Cable Tray Accessories.
- C. Cable Runway.
- D. J-Hooks.
- E. Fire-rated Cable Pathway Device.

# 1.02 RELATED SECTIONS

- A. Section 26 0533 Raceway and Boxes for Electrical Systems.
- B. Section 26 0529 Hangers and Supports for Electrical Systems
- C. Section 26 0526 Grounding and Bonding of Electrical Systems.
- D. Section 27 1000 Structured Cabling.

# 1.03 REFERENCES

- A. NEMA VE 1 Cable Tray Systems.
- B. National Electric Code (NFPA 70) Article 250 Grounding.
- C. National Electric Code (NFPA 70) Article 770 Optical Fiber Cables and Raceways.
- D. National Electric Code (NFPA 70) Article 800 Communications Circuits.
- E. ANSI/TIA/EIA-568-B -- Commercial Building Telecommunications Cabling Standards.
- F. BICSI Telecommunications Distribution Methods Manual Latest published edition.
- G. UL Standards UL 94HB, UL 723, and UL 2043.

## 1.04 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Division 01.
- B. Indicate tray type, dimensions, support points, and finishes.
- C. Shop Drawings: Indicate support type, dimensions, support locations, and cable capacity. Information shall be included on the telecommunications system shop drawings required in Section 27 10 00, including RCDD stamp.

## 1.05 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data under provisions of Division 01.
- B. Include cleaning and bolt-tightening procedures for cable tray.

## 1.06 PROJECT RECORD DRAWINGS

A. Record actual routing of cable tray on "As-built" drawings required in Section 27 1000.

## PART 2 PRODUCTS

## 2.01 MANUFACTURERS - CABLE TRAY

- A. B-Line.
- B. Square D.
- C. Cablofil "EZ-Tray".
- D. Substitutions: Under provisions of Division 01.

# 2.02 LADDER-TYPE CABLE TRAYS

- A. Tray: NEMA VE 1 with the next higher NEMC Class designation for the proposed support span length and working load adequate for the actual cable installed plus a 25 percent additional weight allowance for future cables all with a safety factor of 2.
- B. Material and Finish of Tray, Fittings, and Accessories: Aluminum.
- C. Inside Width: [[6] [12] [18] [24] [30] [36] inches. [As indicated.]
- D. Inside Depth: [3] [4] [5] [6] inches.] [As indicated.]
- E. Straight Section Rung Spacing: [6] [9] [12] [18] inches on center.
- F. Inside Radii of Fittings: [[12] [24] [36] inches.] [As indicated.]
- G. Accessories and Fittings: Manufacturer's standard clamps, hangers, brackets, splice plates, reducer plates, blind ends, barrier strips, connectors, elbows, tees, crosses, risers, grounding straps and other accessories as required for a complete system.
- H. Covers: [Flanged,] [Non-flanged,] [solid] [ventilated] [flush] [raised] cover.

### 2.03 WIRE MESH CABLE TRAYS

- A. Tray: NEMA VE 1; Class 20C.
- B. Material and Finish of Tray, Fittings, and Accessories: [Steel, hot-dipped galvanized [before] [after] fabrication.] [Aluminum.]
- C. Inside Width: [6] [12] [18] [24] [30] [36] inches.] [As indicated.]
- D. Inside Depth: [3] [4] [5] [6] inches.] [As indicated.]
- E. Inside Radii of Fittings: [12] [24] [36] inches.] [As indicated.]
- F. Accessories and Fittings: Manufacturer's standard clamps, hangers, brackets, splice plates, reducer plates, blind ends, barrier strips, connectors, and grounding straps.
- G. Covers: [Flanged,] [Non-flanged,] [solid] [ventilated] [flush] [raised] cover.

#### 2.04 WARNING SIGNS

A. Engraved Nameplates: <sup>1</sup>/<sub>2</sub> inch high black letters on yellow laminated plastic nameplate, engraved with the following wording:

WARNING! DO NOT USE CABLE TRAY AS SUPPORT. USE ONLY AS MECHANICAL SUPPORT FOR CABLES AND TUBING!

### 2.05 J-HOOKS

A. All cables not installed in conduit shall be supported using Caddy CableCat series or approved equal J-hooks with galvanized finish. J-hooks shall have a cable retainer strap to provide containment of cables within the hanger. The cable retainer strap shall be removable and reusable and be suitable for use in air handling spaces. The minimum J-hook size shall be equivalent to Caddy #Cat32. Size all J-hooks to support the quantity of cables installed, plus a minimum of 25% spare capacity. Fiber optic cables shall be routed in 1" innerduct that is supported on a separate J-hook above the J-hook supporting the copper cables.

#### 2.06 FIRE-RATED CABLE PATHWAY DEVICE

A. UL Classified enclosed fire-rated pathway device with built-in fire sealing system sufficient to maintain the hourly fire rating of the barrier being penetrated. The self-contained sealing system shall automatically adjust to the installed cable loading and shall permit cables to be installed or removed without the need to adjust, remove, or reinstall firestop or smoke sealing materials. Device shall maintain up to a 4-hour fire rating when used in walls or floors. Provide all associated brackets and fittings for a complete installation. For ganged pathways in gypsum wallboard assemblies, provide either a grid system designed to transfer the pathway load to the studs or a UL System permitting more than one device to be ganged or clustered. Device

dimensions shall be suited for the pathway they serve and a minimum be the same size as the cable tray abutting it. STI "EZ-PATH Series 33 or Series 44 system or approved equal.

### PART 3 EXECUTION

#### 3.01 INSTALLATION – GENERAL

- A. Provide continuous pathway system for all low voltage cable systems. Where multiple cable systems (e.g. telecom, security, intercom) are installed along the same J-hook pathway, provide separate J-hooks for each system. J-hooks may utilize the same vertical support.
- B. Coordinate all pathway runs with other trades prior to installation. Report conflicts to Owner.
- C. Maintain a minimum EMI separation clearance in conformance with Section 27 1000.
- D. Support pathway from building to support structure or sub structure in accordance with Section 26 0529. Do not support pathway from ceiling tiles, ceiling grid, hanger wires, ductwork, piping, or other equipment hangers that are not part of the cable pathway support system.
- E. In classrooms and other areas with accessible ceilings where cable is not installed in cable tray, provide J-hooks spaced every 4 to 5 feet, varying the distance between each support.
- F. Provide a minimum of 12 inches headroom above all types of cable supports.
- G. Provide a minimum of 3 inches clear vertical space above ceiling system at cable lowest point.
- H. Provide cable support within 18 inches of each transition of pathway system types. This includes transitioning from any one to any other of the following cable support systems such as raceway, sleeves, chases, cable trays, cable runways, or J-hooks.
- I. Set J-hooks so that changes in direction do not exceed 45 degrees.
- J. Install firestopping in accordance with Division 07 to sustain ratings when passing cable tray through fire-rated elements.
- K. Install fire-rated cable pathway devices [from corridors into each telecom room,] as shown on the Drawings.

#### 3.02 INSTALLATION - CABLE TRAY

- A. Note: In many corridor areas, the cable tray will be routed through very congested spaces and the Contractor shall carefully coordinate with all traces to ensure that there are no conflicts and that all cable tray sections remain accessible, without being blocked by mechanical piping or ductwork. It is understood that there may be short sections (3' or less) where piping and ductwork crossings may make tray access difficult but tray shall be accessible on either side of these areas for pulling cable.
- B. Installation: In conformance with NEMA VE 1 requirements and in accordance with manufacturer's instructions.
- C. Assemble cable trays so that joints are not made at support brackets. Install trays level, straight and true to line or grade within plus or minus 1/8 inch in 10 feet and within an accumulative maximum of ½ inch. Make vertical structures plum within a tolerance of 1/8 inch. Install trays to leave no exposed raw edges.
- D. Use expansion connectors where indicated in NEMA VE 1.
- E. Cut standard straight sections to length in field. Cut wires in one clean cut using side action bolt cutters to eliminate grinding or touch-up.
- F. Provide bonding continuity between cable tray sections and fittings in accordance with manufacturer's instructions.
- G. Lay all wire parallel and straight in the tray
- H. Securely fasten all wires, cables, and bundles to the tray with nylon cable straps to maintain their relative positions in the trays. On horizontal runs, install the fastenings at a maximum interval of 15 feet. On vertical runs, the maximum interval shall be 5 feet.

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- I. Where multiple cable systems are installed in a horizontal cable tray, separate each set of cables and loosely bundle each set using Velcro "One-Wrap" or approved equal reusable straps with a minimum <sup>3</sup>/<sub>4</sub> inch width.
- J. Where cable tray penetrates fire rated floors, ceilings, or walls, firestop the opening in accordance with Section 26 0500 and Division 07.

#### 3.03 INSTALLATION – CABLE RUNWAY

- A. Provide cable runway above each row of telecom racks, with a tee runway to the telecom backboard.
- B. Support to wall with triangular support bracket.
- C. Provide bonding of cable runway system to provide electrically continuous system. Bond runway to telecommunications main grounding busbar (TMGB) in accordance with Section 26 0526 and as indicated on the Drawings.
- D. Provide protective end caps for all exposed cable runway ends.
- E. Provide cable runway radius drop protective plates (waterfalls) at each point where cables route down from the cable runway to a rack, or where there is a change in elevation between cable runways.

## END OF SECTION 27 0528

### SECTION 27 1000 STRUCTURED CABLING

#### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

A. Requirements for the design and installation of a complete and functional telecommunications cabling system including communications cable, equipment racks, patch panels, telecommunications jacks, raceways, and other equipment or components as required to achieve the specified function.

# 1.02 RELATED SECTIONS

- A. Section 26 0536 Cable Trays for Electrical Systems.
- B. Section 26 0533 Raceway and Boxes for Electrical Systems.
- C. Section 26 0529 Hangers and Supports for Electrical Systems.
- D. Section 26 0553 Identification for Electrical Systems.

### 1.03 PROJECT RECORD DOCUMENTS

- A. Submit documents under the provisions of Division 01.
- B. Accurately record location of jacks, pull boxes and equipment racks, routing of all telecommunications raceways and cables, numbering scheme and identification number of all cables and jacks.
- C. Provide AutoCAD drawings of the facility on contract size sheets and on CD showing the following:
  - 1. On a separate layer show each telecommunication jack location and indicate each jack and cable number by the jack location.
  - 2. Show all cable counts at all cable junction boxes, sleeves, and J-hook intersections.
  - 3. On a separate layer show the cable path from the telecommunications equipment room to the end jack location.
- D. Submit test results for all cables prior to Substantial Completion.

## 1.04 WARRANTY

- A. A minimum fifteen (15) year manufacturer channel warranty shall be provided. This warranty shall guarantee that the installed system:
  - 1. Will be free from defects in materials, workmanship and installation labor provided or carried out by the Certified Installer.
  - 2. Will exceed applicable ANSI/TIA and ISO/IEC specifications in force at the time of installation and will comply with design and performance requirements for recognized cabling media installed in the system.
  - 3. Will support, at a minimum, 100 Base-T, 1000 Base-T (1Gb/s), or any other current or future application that is designed for transmission over a cabling system as defined by the above referenced standards and manufacturers data sheet in effect at the time of the installation.
- B. Proof of pre-project warranty registration with manufacturer shall be provided. The Contractor shall also provide proof of manufacturer's acceptance of warranty after completion of project.

#### 1.05 LISTINGS AND STANDARDS

- A. Furnish products listed and classified by Underwriters Laboratories, Inc. and suitable for purpose specified and indicated.
- B. Where a UL Standard is in effect equipment shall meet that standard and shall bear the UL label.

## 1.06 REFERENCE CODES AND STANDARDS

- A. The publications listed below form a part of the specification to the extent referenced. The publications are referred to in the text by basic designation only. The reference codes and standards are minimum requirements:
  - 1. ANSI/NFPA 70 National Electrical Code, latest adopted version.
  - 2. BICSI Telecommunications Distributions Methods Manual, current version.
  - 3. ANSI/TIA 568-C Commercial Building Telecommunications Cable Standard, current version.
  - 4. ANSI/TIA 569-C Commercial Building Standard for Telecommunications Pathways and Spaces, current version.
  - 5. ANSI/TIA 606-A Administration Standards for the Telecommunications Infrastructure of Commercial Buildings, current version.
  - 6. J-STD-607-A Commercial Building Grounding and Bonding Requirements for Telecommunications, current version.

## 1.07 QUALITY ASSURANCE

- A. Telephone Utility Company: Matanuska Telecommunications Association (MTA)
- B. Install telephone service entrance in accordance with Telephone Utility Company's Rules and regulations.
- C. Install all work in accordance with the above reference standards and codes. The Owner reserves the right to reject all or a portion of the work performed either on technical or aesthetic grounds.
- D. All workmen employed for installation of equipment and cabling specified under this section shall be specifically trained and certified in the installation of the specified Category 6 UTP and fiber optic cabling systems, and shall have at least three years' experience installing, terminating, and testing Category 6 UTP and fiber optic cable on this size and complexity of project.
- E. The intended function of the telecommunications cable system is to transmit voice and data signals from a central location to individual telecommunications outlet locations. Upon completion of the work, the UTP cable system shall be capable of transmitting a data signal that meets and exceeds the following requirements:
  - 1. Category 6A: Supports data rates up to and including 10 Gb/s.
  - 2. Multimode Fiber: Supports data rates of 10 Gb/s at 850 nm and 1300 nm up to 300 meters. The loss of each strand of fiber shall not exceed 3.5/1.5 dB per kilometer at 850/1300 nm and the loss of each connector pair shall not exceed .75 dB.

### 1.08 SUBMITTALS

- A. Submit product data under provisions of Division 01. Provide factory test results for cables and connectors. Provide product data for the following products:
  - 1. Telecommunications rack and associated rack hardware.
  - 2. UTP and Fiber Telecommunications Cable.
  - 3. UTP Telecommunications Jacks and Faceplates.
  - 4. Fiber Connectors.
  - 5. UTP Modular Patch Panel.
  - 6. Fiber Connector Housings and Panels.
  - 7. UTP and Fiber Patch Cables.
  - 8. Cable Management Panels.

- 9. UTP and Fiber Telecommunications Cable Tester.
- 10. UTP and Fiber Sample Test Report (with all required testing parameters shown).
- B. Submit qualifications and certifications to install the specified cabling system.
- C. Submit contract-size scaled shop drawings that include the following information:
  - 1. Locations of all telecommunications jacks, equipment racks, telecommunications pullboxes, raceway, J-hook or cable tray routing, and sleeves/penetrations. Fire-rated penetrations shall be specifically noted.
  - 2. Drawings shall show jack labels and cable counts. Provide a complete schedule of all telecommunications jacks with their jack numbers and associated cable number. All text on the drawings shall be legible without magnification when the shop drawings are reduced to 11" x 17".
  - 3. Submit elevations of each equipment rack, showing all patch panels, cable management panels, and other specified equipment.
  - 4. Shop drawings shall be approved prior to installation of any portion of the telecommunications system. Electronic AutoCAD® drawings of the facility are available upon request for preparation of the shop drawings.

## 1.09 PROJECT RECORD DRAWINGS

- A. Submit documents under provisions of Division 01.
- B. The approved shop drawings shall be updated to reflect any field changes made during construction.
- C. Include one 11"x17" set of the project record drawings in the Operation and Maintenance Manual.
- D. Provide one 11"x17" set of the project record drawings in each telecom room.

## 1.10 LABELING SYSTEM

- A. Labeling shall conform to ANSI/TIA-606 standards, Section 26 0553, and this Section.
- B. Telecommunications Outlets:
  - 1. Labels on all outlets shall have minimum 1/8-in. high characters and shall be installed behind recessed clear plastic covers on faceplate.
  - 2. Label room outlets with two labels on the faceplate as follows:
    - a. Top Label: Shows the telecommunication room the cable is run to (TR1, TR2, etc), followed by rack number (1, 2, etc.) followed by patch panel identification expressed as a letter (A), followed by port in patch panel the outlet is located (xx). Example: TR1-2B:38 (where TR1 indicates closet, 2 is the second rack, B is the second patch panel in the rack, 38 is the port in patch panel).
    - b. Bottom Label: Shows the room number (room 103), followed by the jack/outlet number (J2) from the left when entering the room, followed by the quantity of ports within the outlet faceplate (1-6). Example: 103 J2:1 (where 103 is the room number, J2 is the 2nd jack/outlet from the left in the room, and 1 is the single port in the faceplate). Where the faceplate has multiple ports, the last part of the ID shall indicate the quantity. Example: 103 J2:1-4 (where 103 is the room number, J2 is the 2nd jack/outlet from the left in the room, and 1-4 represents the four ports in the faceplate).
- C. Copper Patch Panels:
  - 1. Label each patch panel with each unique patch panel name, expressed as a letter. Example: A for 1st patch panel, B for 2nd, C for third, etc.
  - 2. Label each port on the patch panels with a 1-line identifier as follows:

- a. Show the room number (room 103), followed by the jack/outlet number (J2) from the left when entering the room, followed by the port number within the outlet faceplate (1-6). Example: 103 J2:3 (where 103 is the room number, J2 is the 2nd jack/outlet from the left in the room, and 3 is the 3rd port in the faceplate).
- D. Fiber Patch Panels:
  - 1. Label connectors in fiber patch panels with rack designation at both ends of the backbone cable. Example: TR1-1 TR6-2.
- E. Telecommunications Closet:
  - 1. Label cable with wire number to denote the station outlet with appended cable number at each end. Cable ID tags shall be attached within 2 inches of cable end so that ID tag is visible within box.
  - 2. Provide an updated floor plan and list of telecommunication outlets cross-referenced to the rack, patch panel and port. Mount behind Plexiglas cover as specified in Section 26 0553.
- F. Copper Horizontal Cable:
  - 1. Label the end of each cable with the same designation used on the equipment where the cable is terminated (i.e. the patch panel or telecommunications outlet). Labels shall be installed within one inch of the end of the cable insulation, after the insulation has been cut back to allow for termination.
- G. Provide computer-generated Project Record Drawing drawings showing outlet locations, type, and designation. Turn these drawings over to the Owner's Representative two (2) weeks prior to substantial completion, to allow the Owner's Personnel to connect and test Owner-provided equipment in a timely fashion.

## PART 2 PRODUCTS

## 2.01 ACCEPTABLE MANUFACTURERS – STRUCTURED CABLING SYSTEM

- A. Throughout this specification, specific manufacturers and manufacturer's catalog numbers are cited. These citations are for the purpose of establishing quality and performance criteria and are not intended to be proprietary. All products in the structured cabling system shall be provided from one of the approved manufacturing partnerships listed below, or an alternate system shall be substituted under the provisions of Division 01. All decisions regarding approval of non-specified manufacturers and products will be at the discretion of the Owner.
  - 1. Belden.
  - 2. Ortronics/Superior Essex.
  - 3. CommScope Uniprise.
  - 4. Corning Cable Systems (fiber products).
  - 5. Hubbell/Mohawk.
  - 6. Leviton/Berk-Tek.
  - 7. TE Connectivity (formerly ADC/Krone/Amp).
  - 8. Substitutions: Under provisions of Division 01.
- B. Structured Category 6 cabling systems shall include, but not be limited to, UTP and fiber telecommunications cable, UTP jacks, faceplates, modular patch panels, fiber connector panels, and UTP and fiber patch cables.

# 2.02 TELECOMMUNICATIONS BACKBOARD

- A. Material: ACX Plywood, painted to match the surrounding walls with fire-rated paint.
- B. Size: As indicated, <sup>3</sup>/<sub>4</sub>" thick.
- C. Grounding Busbar: Wall-mounted, solid copper, 12 inch by 4 inch by <sup>1</sup>/<sub>4</sub> inch thick busbar with two insulators and standoff brackets. Chatsworth #40153-012 or approved equal.
- D. Cable Support: Provide cable management rings and cable support straps for all cables routed on backboard.

### 2.03 TELEPHONE PUNCHDOWN BLOCKS

- A. Wall-mounted type 66 block for cross-connect with incoming telephone utility cable: 50-pair capacity with cable management.
  - 1. Siemon S66B3-50 or approved equal with S20A cable management.
- B. Wall-mounted type 110 wiring block with 100-pair capacity and standoff legs for cross-connect of intra-building telephone backbone cables. Use 5-pair connecting blocks.
  - 1. Ortronics #OR-30200145 or approved equal.

### 2.04 TELECOMMUNICATIONS EQUIPMENT RACKS

- A. Acceptable Manufacturers Rack Equipment.
  - 1. Chatsworth.
  - 2. Cooper B-Line.
  - 3. Hubbell.
  - 4. Ortronics.
  - 5. Substitutions: Under provisions of Division 01.
- B. 2 Post Floor Racks: Chatsworth #46353-703 or approved equal, seven-foot high, selfsupporting, floor mounted, pre-drilled and tapped, 19 inch, aluminum EIA equipment rack with black finish. The floor rack shall have the following features:
  - 1. Vertical Cable Manager:
    - a. In Between Racks: Chatsworth "Evolution Series" #35573-703 or approved equal double-sided 10" wide vertical cable manager with black finish.
    - b. Ends of Rack Rows: One Chatsworth "Evolution Series" #35571-703 or approved equal double-sided 6" wide vertical cable manager with black finish on each side of the rack.
  - 2. Rack Numbering: Provide RMU numbering on the rack.
  - 3. Provide 12" wide cable tray (as specified in Section 27 05 28) above each rack row and from rack row(s) to wall. Provide waterfall drops into back of each rack or cabinet.
  - 4. Provide Chatsworth #10562-001 or approved equal universal earthquake bracing kit, along with all associated hardware required to seismically brace racks to wall.
  - 5. One Chatsworth #40172-001 or approved equal vertical rack ground bar kit with prepunched ground mounting holes. Mount the grounding bar along the front vertical rail of the equipment rack.
  - 6. One Tripp-Lite #ISOBAR12-20ULTRA or approved equal rack-mounted surge protective outlet strip with 2 NEMA 5-15R outlets (front), 10 NEMA 5-20R outlets (rear), guarded On/Off switch, integral 15-amp circuit breaker, 15-foot cord, and black housing. Outlet strip shall have 3840 joules/96,000 amp network-grade AC surge suppression with EMI/RFI filtering. Mount outlet strip at base of rack.
- C. 4-Post Racks: Where specifically noted on the plans, provide Chatsworth #15212-7-03 or approved equal, seven-foot high, self-supporting, floor mounted, pre-drilled and tapped,

adjustable depth 23"-29" 4-post aluminum equipment rack with black finish. Include vertical cable management and accessories similar to the 2-post racks

### 2.05 UTP TELECOMMUNICATIONS CABLE

- A. Category 6A: All UTP telecommunications cables that stay within the building envelope shall be UL listed, plenum-rated CL2P, Category 6A, 4 pair, 16-20 AWG, solid copper conductor.
  - 1. Superior Essex "10GAIN" CMP or approved equal.
- B. All UTP telecommunications cables that exit the building envelope or are run in underslab raceway shall be UL listed, outside plant rated, Category 6A, 4 pair, 16-20 AWG, solid copper conductor cable, injected with water-resistant flooding compound and jacketed with UV-resistant polyethylene jacket.
  - 1. Superior Essex "OSP Cat 6A" or approved equal.

### 2.06 UTP TELECOMMUNICATIONS JACKS

- A. All UTP telecommunications jacks shall be Category 6A, T568A/B, 8P8C, single, white finish, telecommunications jack with flush exit. Unless otherwise noted on the drawings, install each telecommunications jack in a single gang faceplate at each telecommunications outlet. The quantity of faceplate openings shall match the quantity of jacks at each location. The Contractor shall verify the actual wiring configuration (T568A or 568B) with the Owner prior to submittal.
- B. UTP Jacks:
  - 1. Ortronics "TracJack Clarity 6A" #OR-TJ6A or approved equal.

### 2.07 TELECOMMUNICATIONS OUTLET FACEPLATES

- A. Unless otherwise noted, all faceplates shall be single-gang plastic faceplates with white finish. The number of openings in each faceplate shall match the jack count of each outlet shown on the Drawings. (x in part numbers = designation for number of openings in faceplate).
  - 1. Ortronics "TracJack" #OR-4030054x or approved equal.

#### 2.08 UTP MODULAR PATCH PANEL

- A. Provide and install high-density, unloaded angled patch panels in each equipment rack. The patch panels shall be populated with T568A/B, 8P8C Category 6A compliant jacks upon cable termination. The jacks shall be factory wired to a 110 type IDC connector. The complete assembly shall exceed the requirements of TIA/EIA 568-B (Category 6A), and be factory tested to 1000 Mbps data rates. Install the number of patch panels in each equipment rack as shown on the drawings or as required to terminate all UTP cables at the rack plus 25% spare capacity. The Contractor shall verify the actual wiring configuration (T568A or 568B) with the Owner prior to submittal.
  - 1. 48-port Panel: Ortronics #OR-PHAHJU48 or approved equal.

## 2.09 UTP CABLE MANAGEMENT PANELS

A. Horizontal Cable Manager: Chatsworth "Evolution Series" #35441-702 or approved equal 2RMU horizontal cable manager with black finish.

#### 2.10 UTP PATCH CABLES

- A. All patch cables shall be factory manufactured to match the applicable cable/connectivity solution (i.e. the Ortronics/Superior Essex system shall use Ortronics manufactured patch cords, etc.).
- B. Telephone Cross-Connect: Provide 7-foot Category 6 patch cables with white jacket for crossconnect between the telephone patch panel and the telecommunications patch panels. Provide one patch cable for each port in all the telephone patch panels.
  - 1. Ortronics #OR-MC607-09 or approved equal.

- C. Network Equipment Connections: Provide Category 6A patch cables with blue jacket for installation between network equipment in the rack and dedicated data ports in the telecommunications patch panels. Provide one patch cable for each port in all the telecommunications patch panels. Where the patch panels and switches are in the same rack, provide 7' cables. Where the patch panels and switches are in different racks, provide 15' (14' for CommScope) cables. (xx in part numbers = cable length).
  - 1. Ortronics #OR-MC6Axx-06 or approved equal.
- D. VoIP Connections: Provide 7-foot Category 6 patch cables with yellow jacket for crossconnect between the VoIP switch ports and the telecommunications patch panels. Provide patch cables for each 48-port patch panel installed.
  - 1. Ortronics #OR-MC607-04 or approved equal.
- E. Wireless Access Point Connections: Provide 7-foot Category 6A patch cables with white jacket for connection to wireless access points. Provide one patch cable for each access point location shown on the Drawings.
  - 1. Access Point Connection: Ortronics #OR-MC6A03-09 or approved equal.
  - Network Equipment Connection: Ortronics #OR-MC6Axx-09 or approved equal. Where the wireless controller and network switches are in the same rack, provide 7' cables. Where the wireless controller and network switches are in different racks, provide 15' cables. (xx in part numbers = cable length).
- F. Computer Connections: Provide 9-foot Category 6A patch cable with white jacket for installation between the data jacks in each telecommunications outlet and the Owner-provided computers. Provide one patch cable for each data jack in all the telecommunications outlets, plus 25% additional cables for future expansion or replacement cables.
  - 1. Ortronics #OR-MC6A03-09 or approved equal.

## 2.11 VOICE BACKBONE CABLE

- A. Unless otherwise noted on the drawings provide and install plenum-rated CL2P riser-rated CL2, Category 3, 24 AWG, solid copper conductor multi-pair telephone backbone cable. (xx in part numbers = pair count, as shown on Drawings)
  - 1. Superior Essex #18-xxx-xx or approved equal.

## 2.12 MULTIMODE FIBER OPTIC BACKBONE CABLE

- A. Indoor Multimode Fiber Cables: All multimode fiber optic cables that stay within the building envelope shall be UL listed, plenum-rated, tight buffered, 50/125 micron laser optimized OM3, 10G/300, indoor fiber optic cable meeting National Electrical Code plenum (OFNP) standards. Cables shall have a flame-resistant outer jacket and operate in a range from -20°C to 70°C. (xx in part numbers = fiber count, as shown on Drawings)
  - 1. Superior Essex #440xxNK01 or approved equal.
- B. Indoor/Outdoor Multimode Fiber Cables: All multimode fiber optic backbone cables that exit the building envelope shall be UL listed, plenum-rated, loose tube, 50/125 micron laser optimized OM3, indoor/outdoor, fiber optic cable meeting National Electrical Code plenum (OFNP) standards. The cable shall utilize dry water-blocking technology, have a UV-stabilized, flame-resistant PVC outer jacket, and operate in a range from -40°C to 70°C. (xx in part numbers = fiber count, as shown on Drawings)
  - 1. Corning "FREEDM" series #0xxTWP-T4180D20 or approved equal.

## 2.13 FIBER CONNECTORS

- A. All fibers shall be field-installable with duplex LC type connectors with ceramic ferrule.
  - 1. 50 Micron Multimode: Ortronics "OptiMo" #205KAS9GA-50T or approved equal.
  - 2. Singlemode: Ortronics "OptiMo" #205KAS9GA-09 or approved equal.

## 2.14 FIBER CONNECTOR PANELS

- A. All fiber connector panels shall be field-installable with duplex LC fiber adapters with ceramic sleeve and fiber designation strip. For multimode fibers, the quantity of adapters per panel shall be determined by the number of fibers being terminated.
  - 1. Multimode:
    - a. 6-12 Fibers: Ortronics #OR-OFP-LCD12LC or approved equal panel with 12 duplex adapters.
    - b. More than 12 Fibers: Ortronics #OR-OFP-LCQ24LC or approved equal panel with 6 quad adapters.

### 2.15 FIBER CONNECTOR HOUSINGS

- A. Single-drawer housing with space for horizontally mounted connector panels. Housing shall have slide-out drawer with label sheet, smoked shatterproof polycarbonate door with latch, and deep front shelf area to provide adequate strain relief for cables.
  - 1. 1RMU Housing: Ortronics #OR-FC01U-P or approved equal housing with capacity for three adapter panels to terminate up to 36 LC fibers.
  - 2. 2RMU Housing: Ortronics #OR-FC02U-P or approved equal housing with capacity for six adapter panels to terminate up to 72 LC fibers.

### 2.16 FIBER STORAGE RING

A. Leviton #48900-IFR or approved equal 12-inch diameter inside plant fiber storage ring with Velcro retaining loops. Provide one storage ring in each closet, adjacent to the rack where the fiber cables are terminated.

#### 2.17 FIBER PATCH CORDS

- A. Where the fiber connector housings and network switches are in the same rack, provide 2meter cords. Where the fiber connector housings and network switches are in different racks, provide 3 or 4-meter cords as required. (x in part numbers = cable length)
- B. All multimode fiber optic patch cords shall be UL listed, 50/125 micron laser optimized OM3, multimode fiber cords with flame-resistant PVC outer jacket. Cords shall have duplex LC type connectors with ceramic ferrule. Patch cords shall be factory terminated and tested to 10 Gb/s data rates.
  - 1. Ortronics #OR-P1DF2LRGZGZ00xM or approved equal.
- C. All singlemode fiber optic patch cords shall be UL listed, 3-meter fiber cords with flameresistant PVC outer jacket. Cables shall have duplex LC type connectors with ceramic ferrule. Patch cords shall be factory terminated and tested to 10 Gb/s data rates. Include copy of factory test report with submittal.
  - 1. Ortronics #OR-P1DC2IRSZSZ00xM or approved equal.

#### 2.18 CABLE SUPPORT

- A. All cables not installed in conduit shall be supported in accordance with Section 27 05 28.
- B. All cables not installed in conduit shall be supported using J-hooks, Caddy CableCat series or approved equal, with a minimum J-hook size equivalent to Caddy #Cat32 or approved equal. Size all J-hooks to support the quantity of cables installed, plus a minimum of 25% spare capacity. Fiber optic cables shall be routed in 1" innerduct that is supported on a separate J-hook above the J-hook supporting the copper cables.
- C. Cables shall be bundled using Velcro "One-Wrap" or approved equal reusable straps with a minimum <sup>3</sup>/<sub>4</sub> inch width. Plastic tie-wraps or cinch-straps are not allowed.

## 2.19 EXTRA MATERIALS

A. Furnish to the owner the following spares parts:

- 1. Five (5) percent of each type of UTP telecommunications jack.
- 2. Five (5) percent of each type of telecommunications faceplate.

# PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify that surfaces are ready to receive work.

### 3.02 GENERAL INSTALLATION

- A. Incoming outside plant telephone cable shall be terminated on punchdown blocks located on the telecommunications backboard. One or more multi-pair cables shall be routed from the cross-connect blocks to the telephone patch panel in the telecommunications rack. Patch cords shall be used between the telephone and telecommunications patch panels to connect a telephone line to a specific jack in the building.
- B. Follow cable manufacturer's specification regarding handling methods, retaining/support methods, bending radius and maximum pulling tension limitations. Where manufacturer does not provide bending radius information, minimum bending radius shall be 10 times the diameter of the cable. Use a tension-monitoring device to ensure that the maximum pulling tension that may be applied to the cable to be pulled into a conduit section is not exceeded. Provide replacement cable if cable manufacturer's maximum pulling tension is exceeded at any time during a pull.
- C. Cable shall be carefully inspected for sheath defects or other irregularities as it is paid out from the reel. When defects are detected, pulling shall stop immediately and the cable section shall be repaired or replaced at the discretion of the Contracting Agency. A system of communications shall be maintained between pulling and feed locations so that pulling can be stopped instantly, when required.
- D. Adequate care shall be exercised when handling and storing reels of cable to prevent damage to the cable. Cable with dents, flat spots, or other sheath distortions shall not be installed.
- E. Install termination backboards plumb, and attach securely at each corner.
- F. Store a maximum of one foot of slack UTP cable for each UTP jack at each telecommunications outlet.
- G. In the telecommunications closet, ten feet of slack UTP cable shall be provided at the racks. Route the service loop around the cable runway above the racks. No cables shall encroach or interfere with rack equipment space. All cables shall be protected from physical damage and should not be routed on the floor. Coiling the slack cable adjacent to the rack is not acceptable. The intent of this installation method is to provide slack cable for future work without causing increased inductance by coiling the cables.
- H. In the telecommunications closet, a twenty-foot service loop for each fiber cable shall be provided on the fiber storage ring adjacent to the rack. All incoming fiber cables shall be stored on this ring to maintain the minimum bending radius of the fiber cable.
- I. All cabling shall be run continuous with no splices from each telecommunications jack to the cable connector at the patch panels. Telecommunications cables shall be terminated at each end on their respective jack. No cable run shall exceed 90 meters (295 feet) in length from the jack on the peripheral end to the patch panel.
- J. All fiber optic cables shall be run continuous with no splices from rack to rack.
- K. All cable shall be routed in such a way as to minimize EMI and RFI interference. Cables shall be routed to maintain the following minimum distances from noise producing devices:
  - 1. Open or Nonmetallic Communications Pathways:
    - a. 12 inches from electrical equipment and power lines of 3 kVA or less.
    - b. 18 inches from fluorescent and HID ballasts.

- c. 36 from electrical equipment and power lines greater than 5 kVA.
- d. 48 inches from transformers and motors.
- 2. Grounded Metal Conduit Communications Pathways:
  - a. 3 inches from electrical equipment and power lines of 2 kVA or less.
  - b. 6 inches from electrical equipment and power lines of 2 kVA to 5 kVA.
  - c. 12 inches from 5 kVA or greater power lines.

# 3.03 TERMINATIONS

- A. All strands of all fiber cables shall be terminated at each end on their respective connectors.
- B. The jacket of UTP cables shall be maintained to a point within one inch of the telecommunications jack. The twists on the individual pairs shall be maintained as close as possible to the contacts of the termination points but shall in no case exceed 1/2 inch.
- C. Pairs from each cable shall be terminated sequentially from left to right, top to bottom starting with the lowest assigned number at the upper left-hand corner of the panel.
- D. Fibers shall be terminated sequentially from left to right in connector housing, based on standard color code sequence of individual fiber coatings.

## 3.04 PATHWAYS AND RACEWAYS

- A. Unless otherwise noted, all cables shall be installed in conduit from the telecommunications jack to thespace above the accessible ceiling, within 18" of the J-hook or cable tray pathway. Portions of cables not installed in conduit shall be supported in accordance with ANSI/TIA standards at intervals not exceeding four (4) feet in length using J-hooks. The cable shall not be supported from ducts, pipes, conduits, ceiling grid hangar wires, etc. At any point where the cable changes direction, slack shall be provided to prevent rubbing or binding on the corner supports. Extreme care shall be taken to ensure that the cable is not compressed, kinked or otherwise deformed during installation. Any cable that is stretched, compressed, kinked or otherwise deformed shall be replaced at no cost to the Owner.
- B. Cables to be installed in raceway, cable tray, continuous cable support system or J-hooks (as specified above) for the entire length of each cable. Provide raceway through areas that will not be accessible for future cable replacement or additions.
- C. Provide pathway capacity throughout entire system for each telecommunication outlet served, sized to accommodate a minimum of four 4-pair cables from each outlet location to the designated telecommunication room, as shown on the plans.
- D. Telecommunication cables shall not be installed in the same raceway or pathway as power cables.
- E. Provide dedicated optical fiber raceway pathway for all optical fiber cable.
- F. Install polyethylene pulling string in each empty conduit containing a bend or over 10 feet in length.
- G. Install all telecommunications outlets in outlet boxes under the provisions of Section 26 0533. Unless otherwise noted on the Drawings or in the Specifications, outlets shall be mounted at 18 inches above floor, 4 inches above counters or backsplash, with the jacks oriented in the standard "pins down" position.
- H. Support raceways, cable tray, outlet boxes, junction boxes and equipment racks under the provisions of Section 26 0529.

## 3.05 LABELING

- A. Label equipment racks as noted here-in and under the provisions of Section 26 0553.
- B. Furnish and install labels and documentation to identify all cables, jacks, and connections in accordance with ANSI/TIA standards, as shown on the Drawings, and under the provisions of

Section 26 0553. As a minimum each jack in each faceplate shall have a unique identifier that matches the identifier at the patch panel. Identifiers shall be installed on the front of the telecommunications faceplate, on the cable behind the faceplate, and on the front of the patch panel at the associated jack.

## 3.06 GROUNDING

- A. Provide and install a #2 AWG, copper telecommunications bonding backbone (TBB) conductor from the wall-mounted telecom main grounding busbar (TMGB) in the telecom room to the ground bus in the main switchboard.
- B. The TBB shall be routed along the telecom backbone pathway. In areas above accessible ceilings, the TBB conductor may be routed exposed. In inaccessible areas, the TBB conductor shall be routed in conduit and shall be bonded at both ends. All grounding and bonding shall be done in accordance with ANSI/TIA standards.
- C. Provide and install a #2 AWG, copper telecommunications bonding backbone (TBB) conductor from the ground bar in each telecom rack (TGB) to the wall-mounted telecom main grounding busbar (TMGB). Do not connect racks in series.

# 3.07 CABLE ACCEPTANCE TESTING

- A. Each UTP cable shall be tested for compliance with ANSI/TIA 568C Category 6 standards after installation using a Fluke #DTX or approved equal tester that has been calibrated within the last year. At a minimum, the Contractor shall perform the following tests with the maximum frequency of the tester set at 350MHz:
  - 1. Signal Attenuation / Insertion Loss.
  - 2. Near End Cross Talk (NEXT).
  - 3. Power Sum Near End Cross Talk (PS-NEXT).
  - 4. Attenuation to Crosstalk Ratio Near End (ACR-N)
  - 5. Attenuation to Crosstalk Ratio Far End (ACR-F).
  - 6. Power Sum Attenuation to Crosstalk Ratio Near End (PSACR-N).
  - 7. Power Sum Attenuation to Crosstalk Ratio Far End (PSACR-F).
  - 8. Propagation Delay.
  - 9. Delay Skew.
  - 10. Return Loss.
  - 11. Wiremap.
  - 12. Overall Cable Length.
- B. Test, analyze, and record compliance for the following network protocols:
  - 1. 10 Base-T.
  - 2. 100 Base-T.
  - 3. 1000 Base-T (1 Gb/s).
  - 4. 10 Gb/s (fiber).
- C. The Contractor shall provide 100% testing for each "permanent link" (i.e. from the work area outlet to the patch panel). Provide test results for all tests noted above in the form of printouts from the test equipment and provide an electronic copy of the test data for each cable on CD. If proprietary software is used, the submitted CD shall include any necessary software required to view test results. If the results are delivered in a standard format such as Excel or Access, the viewing software need not be provided. At the front of the test report, the Contractor shall provide an index showing the pass/fail results of each cable, along with the cable length and a corresponding cable label.

- D. Initially test each fiber optic cable with a light source and power meter, utilizing procedures as stated in ANSI/TIA-526-14A: OFSTP-14A Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant and ANSI/TIA-526-7 (currently Standard Proposal Number 2974-B). Measured results shall be plus/minus 1dB of submitted loss budget calculations. If loss figures are outside this range, test cable with an Optical Time Domain Reflectometer (OTDR) in accordance with ANSI/TIA 455-61 to determine the cause of variation. Improper terminations shall be re-done and damaged cable shall be replaced at no additional cost to the Owner. The maximum acceptable signal loss through the entire fiber path, including cable, couplings, and jumpers shall not exceed ANSI/TIA 568-B.3 standards. Test each multimode cable in both directions for signal attenuation at 850 and 1300 nm, using "Method B" One jumper reference.
- E. Where any portion of the system does not meet the Specifications, the Contractor shall correct the deviation and repeat any applicable testing at no additional cost to the Owner.
- F. Provide three working days advance notice of tests. The Owner's Representative shall reserve the right to be present during the testing of any or all cables in the system. Submit a copy of the test report for each cable prior to substantial completion of the project.
- G. Acceptance of the telecommunications system shall be based on the results of the above tests, functionality, and the receipt of documentation.
- H. Prior to Substantial Completion, submit the measured values for the telecommunications rack AC ground resistance and the voltage at the dedicated plug strip on the telecommunications rack.

# END OF SECTION 27 1000

#### SECTION 27 5123 INTERCOMMUNICATIONS AND PROGRAM SYSTEMS

### PART 1 GENERAL

### 1.01 SUMMARY

- A. Section includes intercom equipment, cable, and accessories.
- B. Related Sections:
  - 1. Section 26 0519 Low-Voltage Electrical Power Conductors and Cables.
  - 2. Section 27 0526 Grounding and Bonding for Communications Systems.
  - 3. Section 27 0553 Identification for Communications Systems.

### 1.02 SYSTEM DESCRIPTION

- A. Description: One way voice communication between the IP phone system and speakers at locations indicated.
- B. System Capacity: 32 paging zone groups system with interfacing IP phone system.
- C. Sequence of Operation: Master selects paging zones by entering the number associated from any IP phone on the buildings network.

## 1.03 SUBMITTALS

- A. Division 01 Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate electrical characteristics and connection requirements; cable routing; connection diagrams; and equipment arrangement.
- C. Product Data: Submit catalog data showing electrical characteristics and connection requirements.

# 1.04 CLOSEOUT SUBMITTALS

- A. Division 01 Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of each item of equipment and show interconnecting wiring.
- C. Operation and Maintenance Data: Submit operator instructions for each required mode of operation, routine troubleshooting procedures, and manufacturer's operation and maintenance manual for each item of equipment and accessory.

#### 1.05 QUALIFICATIONS

- A. Manufacturer: The design and specifications are based on a Bogen, Analog, one way paging system. If substituted the manufacturer shall be a company specializing in manufacturing products specified in this section with minimum three years' experience.
- B. Supplier: Authorized distributor of specified manufacturer with minimum three years' experience.

#### 1.06 MAINTENANCE SERVICE

- A. Division 01 Execution and Closeout Requirements: Maintenance service.
- B. Furnish service and maintenance of intercom equipment for one year from Date of Substantial Completion.

## PART 2 PRODUCTS

## 2.01 INTERCOM CONTROL UNIT

- A. Manufacturers:
  - 1. Bogen, Model PCM2000
  - 2. Substitutions: Division 01 Product Requirements.

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- B. Product Description: Surface wall mounted intercom control unit. Providing telephone system access up to 32 zone groups of one-way paging and ability to conduct an emergency page override for priority messages.
- C. Provide Power supply, telephone interface module, zone paging module and talkback module.
- D. Sequence of Operation:
  - 1. Intercom Control Unit connects calling station to remote stations.
  - 2. Zoned per drawings, program phone system

### 2.02 ANALOG TELEPHONE ADAPTER

- A. Manufacturers:
  - 1. Grandstream, Model HT801
  - 2. Cisco SPA112
  - 3. Substitutions: Division 01 Product Requirements

## 2.03 AMPLIFIED CEILING MOUNT 8" ROUND SPEAKER

- A. Manufacturers:
  - 1. Bogen, Model CS1EZ.
  - 2. Substitutions: Division 01 Product Requirements.
- B. Product Description: 8-inch One-Way Round Ceiling Speaker that generates high quality voice paging and emergency alerts for indoor areas. Designed for quick and easy installation.
- C. Power supply: 70Vdc power supplies as required for complete functional installation.
- D. Construction: Steel grille with powder coat finish and acoustically treated backbox
- E. Finish: Manufacturer's standard.
- F. Output Rating: 95 dB at four ft on axis of speaker.
- G. Contractor to provide all baffles, backboxes, and mounting hardware required for a complete system.

#### 2.04 AMPLIFIED WALL MOUNT ANGLED SPEAKER

- A. Manufacturers:
  - 1. Bogen, Model MB8STSQ.
  - 2. Substitutions: Division 01 Product Requirements.
- B. Product Description: One-Way Angled Wall Speaker that generates high quality voice paging and emergency alerts for indoor areas. Includes mounting bracket for quick and easy installation.
- C. Power supply: 70Vdc power supplies as required for complete functional installation.
- D. Construction: All steel surface mount enclosure.
- E. Output Rating: 96 dB at four ft on axis of speaker.

#### 2.05 MIXER-AMPLIFIER

- A. Manufacturers:
  - 1. Bogen, Model TPU 250.
  - 2. Substitutions: Division 01 Product Requirements.
- B. 25V, 70V output.
- C. Music Input Jack
- D. Signal-activated paging channel automatically mutes background music.

# PART 3 EXECUTION

### 3.01 EXISTING WORK

- A. Remove exposed abandoned cable, including abandoned cable above accessible ceiling finishes. Cut flush with walls and floors, and patch surfaces.
- B. Disconnect and remove abandoned intercom equipment.
- C. Extend existing intercom installations using materials and methods compatible with existing installations, or as specified.
- D. Coordinate with owners IT personnel for network access.
- E. Clean and repair existing intercom components remaining or are to be reinstalled.

### 3.02 INSTALLATION

- A. Install engraved plastic nameplates in accordance with Section 27 0553.
- B. Ground and bond intercom equipment and circuits in accordance with Section 27 0526.
- C. Install all equipment per manufacturer installation instructions.

### 3.03 FIELD QUALITY CONTROL

- A. Section 01 4000 Quality Requirements and 01 7000 Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Perform operational test on completed installation to verify proper operation.
- C. Provide new equipment, components, and wiring to eliminate audible noise, clicks, pops, or hum when system is in standby or operation.

#### 3.04 ADJUSTING

- A. Section 01 7000 Execution and Closeout Requirements: Testing, adjusting, and balancing.
- B. Adjust controls to achieve proper operation.
- C. Preform walkthrough of building and test all speakers for intelligibility and adjust volume as need.

#### 3.05 DEMONSTRATION AND TRAINING

A. Furnish (4) hours of instruction each owner representative persons, to be conducted at project site with manufacturer's representative.

## END OF SECTION 27 5123

### SECTION 27 5319 DISTRIBUTED ANTENNA SYSTEM

## PART 1 GENERAL

# 1.01 SECTION INCLUDES

A. Distributed Antenna System for Cell Phone Signal Boosting.

# 1.02 RELATED SECTIONS

- A. Section 26 0533 Raceway and Boxes for Electrical Systems.
- B. Section 26 0529 Hangers and Supports for Electrical Systems
- C. Section 26 0526 Grounding and Bonding of Electrical Systems.
- D. Section 27 1000 Structured Cabling.

# 1.03 REFERENCES

- A. NEMA VE 1 Cable Tray Systems.
- B. National Electric Code (NFPA 70) Article 250 Grounding.
- C. National Electric Code (NFPA 70) Article 800 Communications Circuits.
- D. ANSI/TIA/EIA-568-B -- Commercial Building Telecommunications Cabling Standards.
- E. BICSI Telecommunications Distribution Methods Manual Latest published edition.

## 1.04 SYSTEM DESCRIPTION

- A. Services: Upon commissioning, the DAS shall provide coverage for the WSPs listed below on all frequencies currently being used by the designated WSPs
  - 1. AT&T Wireless
  - 2. GCI
  - 3. T-Mobile
  - 4. Verizon
  - 5. Public Safety According local requirements. Example: 800 MHz PSN coverage, city of Grapevine, TX Ordinance No. 109.2
- B. The system shall be able to transport and integrate in the DAS solution the PSN frequencies according the local requirements and ordinances.
- C. Expansion: Without replacing the Passive DAS Infrastructure, the DAS shall have expansion capabilities to support the following WSP and PSN frequencies deployed in a SISO antenna environment. Any additional Components required for system expansion shall comply with all specifications of this Section.

| Service  | Uplink, MHz | Downlink, MHz |
|----------|-------------|---------------|
| Cellular | 824 - 849   | 869 - 894     |
| PCS      | 1850 - 1915 | 1930 - 1995   |

D. Contractor is responsible for providing complete coverage throughout building. Drawings shall be taken as a basis of design to aid the DAS designer.

## 1.05 SUBMITTALS

A. Submit shop drawings and product data under provisions of Division 01.

## **1.06 OPERATION AND MAINTENANCE DATA**

A. Submit operation and maintenance data under provisions of Division 01.

# 1.07 PERFORMANCE REQUIREMENTS

- A. WSP DAS
  - 1. On a per channel basis, the downlink RSL for each frequency band shall meet or exceed the criteria in Table 1

| Parameters                                        | Unit | Lower 700<br>MHz,<br>BRS/EBS | Cellular, PCS,<br>AWS,<br>Commercial<br>800/900 MHz | Public Safety<br>380 - 512, 700,<br>800 MHz |
|---------------------------------------------------|------|------------------------------|-----------------------------------------------------|---------------------------------------------|
| Minimum<br>downlink receive<br>signal level (RSL) | dBm  | -77                          | -85                                                 | -95                                         |

|  | Table 1 | System | Parameters |
|--|---------|--------|------------|
|--|---------|--------|------------|

Contractor in their response shall identify the specific market criteria requested by each respective WSP. Those have to be highlighted and the impact in the project quantified separately from the basic requirements requested in table 1. Ultimately it is the Contractor's responsibility to confirm that all design requirements for each respective WSP are met with their proposed solution. For example, in certain markets the WSP has a specific requirement for RSSI of -65 dBm at the windows

- 2. Contractor shall state the assumed channel loading and frequency bands for the proposed WSP in-building coverage. Prior to installation, contractors shall confirm the channel loading and frequency use in the serving area, and shall guarantee coverage for these channels per the criteria in Table 1
- 3. The DAS shall deliver coverage per the criteria in Table 1 throughout 95% of the building. Unless stated separately in the floor plans it is expected coverage including stairwells, elevators, basement and garage. Total Number of Floors: (BLANK) Square Footage: Per Floor: (BLANK) Square Footage Total: (BLANK).
- 4. The contractor shall explain the method used to avoid downlink and uplink interference
- B. PSN DAS:
  - 1. The PSN DAS shall comply with NFPA-1 2012 Edition
  - 2. Where the in-building coverage requirements include 700 800 MHz public safety system and commercial wireless in-building coverage, the two systems shall be able to operate over a unified Passive Cable and Coverage Antenna Infrastructure.
  - 3. Contractors shall state the assumed channel count for the PSN Frequency Bands identified above in Section 1.04 with submittal of bid response. Prior to installation, contractors shall confirm the channel count and frequencies with the AHJ, and shall guarantee coverage for these channels per the criteria stated above.
  - 4. The DAS shall be capable of upgrade, without additional hardware or software, to allow for changes to system frequencies within the deployed frequency band in order to maintain radio system coverage as originally designed.
  - 5. The contractor shall explain the method used to avoid downlink and uplink interference.

# PART 2 PRODUCTS

# 2.01 MANUFACTURERS

- A. Sure Call
- B. Andrews
- C. Substitutions: Under provisions of Division 01.

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## 2.02 ANTENNAS

- A. Multiband design, accommodating cellular, PCS, LMR, and AWS frequencies in a single antenna
  - 1. Electrical:
    - a. Frequency bands, 806 960 MHz and 1710 2200 MHz
    - b. VSWR ≤ 1.8
    - c. Gain: 806-960 ≥ 10.5 dBi, 1710 2200 ≥ 12 dBi
    - d. Maximum input power: 100 watts
    - e. Polarization: Vertical f. Front-to-back ratio: 806 960 ≥ 18 dB, 1710 2200 ≥ 20 dB
    - f. Impedance: 50 Ω
    - g. Azimuth Pattern: As proposed by the manufacturer to meet the performance specifications in this Section.
  - 2. Mechanical:
    - a. Radome material: UV-protected ABS
    - b. Pigtail cable: RG58, plenum rated 8
    - c. Connector: 50 Ω N Type Female d. Mounting: Pole
  - 3. Environmental:
    - a. Temperature: -40 °C to +60 °C
    - b. Lighting protection: Direct ground
    - c. Waterproof level: IP 66
    - d. Wind Speed, maximum: 125 mph
  - 4. Approved Manufacturer: Andrew CELLMAX-EXT-CPU or equivalent
- B. 700 MHz LMR Yagi Donor Antennas:
  - 1. Electrical:
    - a. Frequency band, 746 806 MHz
    - b. VSWR ≤ 1.5:1
    - c. Gain: ≥ 1 1.1 dBi
    - d. Maximum input power: 100 watts
    - e. Polarization: Vertical
    - f. Front-to-back ratio: ≥ 15 dB
    - g. Impedance: 50  $\Omega$  h. Beamwidth, Horizontal, degrees: 60
    - h. Azimuth Pattern: As proposed by the manufacturer to meet the performance specifications in this Section.
  - 2. Mechanical:
    - a. Connector: 50  $\Omega$  N Type Female
    - b. Mounting: Pole
  - 3. Environmental:
    - a. Temperature: -40 °C to +60 °C
    - b. Lighting protection: Direct ground
    - c. Waterproof level: IP 66
    - d. Wind Speed, maximum: 125 mph

- e. Approved Manufacturer: Andrew DB498-PS or equivalent in accordance with Section 2.01
- C. Omni-Directional Coverage: Omni-Directional Coverage antennas shall feature a multi-band design, accommodating multiple frequency bands in a single small antenna.
  - 1. Electrical Band 1:
    - a. Frequency Band: 698 800 MHz
    - b. VSWR: ≤ 1.8:1
    - c. Gain:  $\geq$  1.5 dBi d. Maximum input power:
    - d. Impedance: 50 Ω f. Beamwidth, Horizontal: 360° omnidirectional
    - e. Beamwidth, Vertical: 80° nominal
    - f. Return Loss: 10.9 dB
  - 2. Electrical Band 2:
    - a. Frequency Band: 1710 2700 MHz and 800 960 MHz
    - b. VSWR: ≤ 1.5:1
    - c. Gain: ≥ 1.5 dBi @ 800–960 MHz and ≥ 5.0 dBi @ 1710 2700 MHz
    - d. Maximum input power:
    - e. Impedance:  $50 \Omega 9$
    - f. Beamwidth, Horizontal: 360° omnidirectional
    - g. Beamwidth, Vertical: 65° nominal
    - h. Return Loss: ≤ 13.9 dB
  - 3. Mechanical:
    - a. Connector: 50 Ω N Type Female
    - b. Mounting: Thru-hole ceiling mount
    - c. Radome material: ABS, UV resistant
    - d. Pigtail cable: KSR195, plenum rated
  - 4. Environmental:
    - a. Application: Indoor
    - b. Operating Temperature: 40 °C to +60 °C (40 °F to +140 °F)
    - c. Relative Humidity: Up to 100%
  - 5. Regulatory Compliance/Certifications: RoHS 2002/95/EC
  - 6. Approved Manufacturer: Andrew CELLMAX-O-CPUSE, CELLMAX-D-CPUSE or equivalent, in accordance with Section 2.01

# PART 3 EXECUTION

## 3.01 INSTALLATION – GENERAL

- A. The contractor shall design, install, commission and test the DAS in accordance with the manufacturer's instructions and recommendations.
- B. The contractor shall install the DAS in accordance with the accepted SOW.

## 3.02 ACCEPTANCE TESTING

A. Acceptance testing will be performed confirming the requirements of Section 1.07 have been met.

## END OF SECTION 27 5319

### SECTION 28 1000 ELECTRONIC ACCESS CONTROL AND INTRUSION DETECTION

### PART 1 GENERAL

## 1.01 SECTION INCLUDES

- A. Contractor Designed and Installed Security Control System.
- B. Security System Wire and Cable.
- C. Security System Identification and Labeling.
- D. Security System Testing.

## 1.02 RELATED WORK

- A. Section 26 0500 Common Work Results for Electrical.
- B. Section 26 0519 Low-Voltage Electrical Power Conductors and Cables.
- C. Section 26 0533 Raceway and Boxes for Electrical Systems.
- D. Section 26 0553 Identification for Electrical Systems.
- E. Section 28 3100 Fire Detection and Alarm.

### 1.03 SUMMARY OF WORK

- A. Provide all equipment, materials, labor, documentation and services necessary to furnish, install, calibrate, adjust, and test a complete and operational Integrated Security System, as required herein and as indicated on the Drawings. The system shall consist of a fully automated and integrated computer-based Security System, including, but not limited to the following functions and capabilities:
  - 1. Security Alarm Monitoring and Reporting of alarm and trouble conditions detected by individual devices in local and remote locations.
  - 2. Global system access for administration, programming, monitoring, and maintenance.
- B. The system equipment and installation shall comply with all provisions and requirements of this specification, as well as any and all applicable national, state and local codes and standards.

#### 1.04 SYSTEM DESCRIPTION

- A. Access Control System: Control access to selected areas using encoded cards.
- B. Field devices such as card readers, alarm inputs, control points, etc. shall be connected to fully distributed intelligent field controllers or directly through a Software Development Kit or Web Services and be capable of operating without host computer intervention. All objects within the SMS, i.e. doors, readers, time intervals, etc. shall be addressed by a unique name as opposed to point numbering or mnemonics. The SMS shall have badge generation tools to create and manage badges using a graphical interface and convenient query features to manage large numbers of badges.
- C. System Graphic Maps: Graphic maps of the school shall be programmed into the system server. The graphic maps shall have the following characteristics:
  - 1. Map Layout: All background floor plans shall be imported from the scaled AutoCAD plans used to develop the shop drawings. All room names shall match the Contract Drawings. The screen colors for walls, background, and other elements shall be approved by the Owner prior to programming.
  - 2. Map Size: Maps shall be partitioned into separate screens either by section or security zones to maintain a minimum scale of 1/16"=1'-0". Additional screens may be necessary where there are multiple field devices concentrated in one area of the building. Icons shall not be crowded or overlapped on the screen and shall appear on the map at approximately

the same location where they are physically installed. All graphic maps shall be viewable on the screen without requiring the use of scroll bars.

- 3. Icon Size/Shape: Match existing screens in the system. Copy all standard symbols for field devices.
- 4. Final layout of all graphic screens shall be approved by the Owner during the submittal review process. The Contractor shall make any necessary changes to the screens at no additional cost to the Owner.

### 1.05 REGULATORY REQUIREMENTS

- A. All systems shall comply with applicable federal, state, and local building codes. Conduit and wire installation shall comply with all of the provisions of Division 26.
- B. All equipment <u>and assemblies</u> shall be Underwriters Laboratories approved if applicable. All of the ACAM equipment, including file servers, workstations, ACUs, keypads, RIMs, and RRMs shall be listed by Underwriters Laboratories as conforming to UL 1076 and UL 294.

## **1.06 QUALIFICATIONS**

- A. The Access Controls Systems Integrator shall submit qualifications in accordance with Division 01. Qualifications shall include the following:
  - 1. The entire security system shall be installed and programmed by a single Systems Integrator. The Systems Integrator shall have a minimum of five years documented experience installing and programming access controls systems in the State of Alaska. Documentation of previous experience shall include at least three (3) similar projects where a security system of this type has been installed.
  - 2. Where the Access Controls Integrator is a branch office or other division of a larger organization, the qualifications of the branch office or other division shall meet the requirements of the Contract Documents.
  - 3. The certified field installer shall submit weekly inspection reports detailing all deficiencies and project completion levels.

## 1.07 SUBMITTALS

- A. Submit product data and shop drawings under provisions of Division 01 and Division 26.
- B. Provide manufacturer's data sheets on all equipment proposed for use on this project.
- C. Electronic AutoCad® drawings of the building floor plans are available upon request for preparation of the shop drawings. All device locations shall be field verified by the Contractor prior to completion of the shop drawings.
- D. Provide contract-size shop drawings that include the following information:
  - 1. Locations of all equipment and field devices, as well as routing of all cables with the number and size of conductors in each run. Scale of floor plan shall match Contract Drawings.
  - 2. Minimum 1/4-inch enlarged plan of each equipment room. Plan must be large enough to show actual equipment layouts and to show that all equipment will fit in the intended space with no conflicts.
  - 3. Locations and sizes of all raceways, sleeves, and penetrations. Fire rated penetrations shall be specifically noted.
  - 4. Provide a one-line diagram for each facility that shows the signal relationships of all devices within the system.
  - 5. Provide voltage drop calculations for all ACU panels, all 12VDC RIM panels, all field device circuits, and all 24VDC RIM power circuits. Provide battery calculations for all ACUs, including all connected devices. Calculations shall include estimated time system will run without utility AC power in non-alarm state. All calculations shall be shown on the Drawings.

- 6. For each major component, such as an ACU or RIM, show a typical detail of all wiring connections to the equipment. This detail shall include all wire/cable color-coding and all identification tags where applicable.
- Indicate electrical characteristics and connection requirements, including line voltage and low voltage wiring, and logic diagrams or block diagrams where required. All text on the drawings shall be legible without magnification when the shop drawings are reduced to 11" x 17".
- E. System Software Submittal
  - 1. All room names, icon labels, and event descriptions on all graphic maps shall be approved by the Owner. As part of the Software Submittal, the Contractor shall submit the following:
    - a. An electronic copy of an I/O points table in Microsoft® Excel® spreadsheet format. This table shall include all points controlled or monitored by the system and the Owner's Representatives shall assign meaningful names to the points.
    - b. Provide 8.5" x 11" color printouts of all facility graphic maps and other customized screens. Graphic maps shall clearly show samples of all colors and positions of items such as alarm points that change color on the screen when activated.
  - 2. After the Engineer and Owner have completed the review, the Owner will provide the Contractor with a list of modifications to the I/O Points Table, Event List, and the graphic maps that are deemed appropriate for the proper operation of the system. The Contractor shall make all modifications at no additional cost to the Owner.

## 1.08 PROJECT RECORD DRAWINGS

- A. Submit documents under provisions of Division 01.
- B. Accurately indicate actual location of all security devices and controlling equipment, including ACUs, RIM, and RRM modules, power supplies, magnetic contacts, relays, electric door strikes, magnetic locks, etc. All field devices shall be shown with their actual device addresses.
- C. Show the location and routing of all conduit and cables, including locations of major pull and junction boxes.
- D. Include a reduced set (11" x 17") set of the project record drawings in the Operation and Maintenance Manual.
- E. After review and approval of the Project Record Drawings by the Owner, the Contractor shall provide the following documents:
  - 1. One 8.5" x 11" zone map that shows each door within the building. Map shall be used by staff and central station monitoring company.

## 1.09 OPERATION AND MAINTENANCE MANUAL

- A. Submit documents under provisions of Division 01.
- B. Operation and Maintenance Data: Include bound copies of operating and maintenance data with programming instructions.
- C. Provide operation and maintenance instructions including detailed electronic schematic drawings, detailed parts list and exploded view of all equipment, detailed troubleshooting instructions and a reduced set of the project record drawings.
- D. Provide completed copies of the System Test Reports.
- E. Provide detailed instructions on system start-up, including instructions on re-starting the file server after a system failure/lock-up.
- F. Provide detailed instructions on downloading/uploading system software updates and on replacement of defective components in the file server or workstation computer.

G. Program Documentation: Provide two electronic copies of the System Software Program for each facility to aid in future maintenance, troubleshooting and modification of the security system.

### 1.10 INSTRUCTION OF OPERATING PERSONNEL

- A. In accordance with the requirements of Division 1 and this section, provide hands-on operational training for on-site facility staff. Class shall be held at a location to be determined by the Owner and shall consist of four (4) hours of classroom instruction and hands-on training. Training shall include basic operation of the system. At the end of the class, the participants shall be capable of arming/disarming the system and scrolling through the menus to determine where active alarm points (i.e. open doors) are located in the building. The training shall include the following elements:
  - 1. Explain identification system, diagrams, signals and alarms.
  - 2. Managing door sequencing and reviewing event logs.
  - 3. Provide training in accordance with Division 01.

### 1.11 COORDINATION

- A. The necessity to coordinate this work with the Owner and the Contracting Agency is emphasized. The Contractor shall be responsible for any omissions, delays and additional cost due to lack of coordination or approval from the same.
- B. Coordinate all work with lighting, power, ventilation, sprinklers and other systems in the areas of work to avoid interferences.

### 1.12 QUALITY ASSURANCE

- A. Provide complete testing of the access control system in accordance with this section.
- B. After installation, and before termination, all wiring shall be checked and tested to ensure there are no grounds, opens, or shorts on any conductors or shields. The Contractor shall maintain a complete log of all such quality assurance tests and make them available for inspection by the Owner at any time during the construction phase. At the completion of the installation all test results shall become part of the maintenance documentation.
- C. Inspection:
  - 1. The Contractor shall carry out the inspection requirements of the Contract and shall provide the Owner with documentation to the effect that off-site work is being properly fabricated, and in accordance with the contract documents.
  - 2. The Contractor shall notify the Owner sufficiently in advance of the time when quality control tests are to be performed so that the Owner or their designee may witness such tests, if desired. The presence or absence of the Owner from these tests shall not relieve the Contractor from completing the tests in accordance with the contract documents. Contractors QA documentation and practices shall be subject to Engineer or Owner inspection at any time. The field-certified installer must be present during final testing and calibration.

# 1.13 WARRANTY AND MAINTENANCE CONTRACT

A. Warrant all materials and equipment to be new and free from defects in material and workmanship for a period of one year under provisions of Division 01.

#### 1.14 EXTRA MATERIALS

A. No spare parts are required.

## PART 2 PRODUCTS

#### 2.01 MATERIALS AND MANUFACTURERS

A. Throughout this specification, specific manufacturers and manufacturer's catalog numbers are cited. All components of the GE Security "Diamond II" security system shall be as specified with

<u>no substitutions</u>, in order that they can properly interface with the existing system. Where products are listed as "or approved equal", these citations are for the purpose of establishing quality and performance criteria and are not intended to be proprietary. All decisions regarding approval of non-specified manufacturers and products will be at the discretion of the ASD Project Manager.

- B. Where no manufacturer is specified, provide products of manufacturers in compliance with requirements. Any item of equipment or material not specifically addressed on the drawings or in this document and required to provide a complete installation shall be provided in a level of quality consistent with other specified items.
- C. The Contractor shall provide the latest product model and software version available from each manufacturer at the time of installation. No "beta version" or "test software" products will be accepted. All proposed and provided equipment and/or products shall be from the specified and approved manufacturers only, unless previously approved by the Engineer and/or Owner.
- D. All products and materials are to be new and free of defects, damage and corrosion. All materials shall be in compliance to all applicable codes and designed specifically for the function intended.
- E. Quantity and location of all devices and equipment shall be as specified in Contract Documents or as required for a complete and operable system.

## 2.02 SYSTEM SOFTWARE

A. The new system shall integrate with the existing and shall be a Lenel S2 "OnGaurd".

## 2.03 ACCESS CONTROL UNIT (ACU)

- A. Lenel #LNL-X3300.
- B. Unit shall have direct LAN/WAN connection and shall be capable of supervising up to 64 input points through the use of RIM or RRE modules.
- C. Firmware: The ACU shall be provided with the most current version of the firmware.
- D. Battery Backup: Each ACU shall have a UL Listed uninterruptible power supply (UPS) mounted within the ACU enclosure to provide normal operation for all connected equipment including RRE modules, RIMs, RRMs, card readers, etc. for a minimum of four (4) hours of normal operation. Clock circuit shall have dedicated on-board backup battery.
- E. ACU enclosure shall have tamper switch and flushlock keyed to match all other security system cabinets.
- F. Enclosure shall have a custom termination drawing/point list affixed to the inside panel front that shows connection details of each RIM/RRM, as well as all local input/output points. The documentation shall be specific to each cabinet.
- G. Quantity and locations of all ACUs shall be as specified as required for a complete and operable system.

## 2.04 REMOTE INPUT MODULE (RIM)

- A. Lenel #LNL-1320 or #LNL-1200 as required for specific door.
- B. Each RIM shall support 8 supervised input points, 2 unsupervised input points, and 6 Form C output relays. The status of each input point shall be indicated by a tri-state LED.
- C. Power Supply: Provide 8-Amp, 12-Volt DC power supply in a Hoffman or approved equal enclosure directly adjacent to the RIM. Provide terminal blocks in cabinet for terminating all field wiring and all interconnecting wiring between the power supply and RIM. Cabinet size for single power supplies shall be no larger than 24"x24" to minimize footprint of security system equipment on wall. Use 30"x30" cabinet for multiple power supplies.
- D. If required for correct system operation, provide a 4-port DIN-mount 10/100 Ethernet switch in the power supply cabinet at the system head-end to interface between the 10Mbps ACU and the 100Mbps ASD WAN switch.

- E. The RIM and power supply enclosures shall have tamper switch and flushlock keyed to match all other security system cabinets.
- F. Enclosure shall have a custom termination drawing/point list affixed to the inside panel front that shows connection details of each input point. The documentation shall be specific to each cabinet.
- G. Quantity and locations of all RIMs shall be as specified in the Contract Documents or as required for a complete and operable system.

### 2.05 REMOTE RELAY MODULE (RRM)

- A. Lenel #LNL-1200.
- B. Each RRM shall support a total of 16 outputs using industry standard dry contact output relays with LED indicators.
- C. Each RRM shall be powered by the on-board UPS of the ACU.
- D. RRM enclosure shall have tamper switch and flushlock keyed to match all other security system cabinets.
- E. Enclosure shall have a custom termination drawing/point list affixed to the inside panel front that shows connection details of each output point. The documentation shall be specific to each cabinet.
- F. Quantity and locations of all RRMs shall be as specified in the Contract Documents or as required for a complete and operable system.

### 2.06 CARD READERS

- A. Bosch # ARD-SER40-RO
- B. 13.56 MHz proximity card reader.
- C. 2 unsupervised dedicated inputs.
- D. 16 Form-C outputs.

## 2.07 SECURITY SYSTEM WIRE AND CABLE

- A. Multi-Drop RS-485 Communications Cable: Belden #82842 or approved equal plenum-rated, 2pair, 24 AWG, stranded tinned copper conductors, individually twisted pairs, 100% braided overall shield, drain wire, 300-Volt insulation, rated 90° C, with an overall plenum jacket.
- B. Multi-Drop Power Cable: West Penn #25224 or approved equal plenum-rated, 1-pair, 18 AWG, stranded tinned copper conductors, unshielded twisted pair, 300-Volt insulation, rated 90° C, with an overall plenum jacket.
- C. Door Contact/Alarm Input Cable: West Penn #25222 or approved equal 1-pair, 20 AWG, twisted, unshielded, stranded tinned copper conductors, 300-Volt FEP insulation, rated 90° C, with an overall plenum jacket.
- D. Motion/Glassbreak Sensor Input Cable: West Penn #25244 or approved equal 4-conductor, 18 AWG, stranded tinned copper conductors, 300-Volt FEP insulation, rated 90° C, with an overall plenum jacket.
- E. Relay Output Cable: West Penn #25225 or approved equal 1-pair, 16 AWG, twisted, unshielded, stranded tinned copper conductors, 300-Volt FEP insulation, rated 90° C, with overall plenum jacket.
- F. Interconnect Cable: Plenum-rated, 18 AWG, twisted, shielded or unshielded (as required or recommended by manufacturer), stranded tinned copper conductors, 300-Volt FEP insulation, rated 90° C, and plenum jacket. Pair count as required to provide connections for all specified points between DDC and security system.

## 2.08 ACCESS CONTROL SYSTEM LABELING

- A. Nameplates: Laminated 1/8-inch thick, three-layer plastic with engraved white letters on black background. Letter size shall be 1/4-inch high letters for identifying individual panel or equipment, 1/8-inch high letters for remaining lines with 1/8 inch spacing between lines. Attach to equipment using threaded screws or pop-rivets.
- B. Labels: Adhesive tape labels, with 3/16 inch Bold Black letters on clear background made using Dymo RhinoPro label printer or approved equal.
- C. Wire Markers: Self-adhesive machine-printed label with unique wire number that is shown on security system shop drawings.

### PART 3 EXECUTION

### 3.01 EXAMINATION

A. Prior to beginning equipment installation, examine areas to receive access control equipment. Verify that all conditions are acceptable.

### 3.02 INSTALLATION

- A. General:
  - 1. Install all equipment in accordance with the manufacturer's instructions and drawings. Coordinate locations of all sensors and magnetic contacts to provide optimum performance in the associated area.
  - 2. Keep up to date "As-built" record drawings at each job site detailing the layout and field modifications to the Shop Drawings. Update the Shop Drawing electronic copy with the field red-lined changes.
  - 3. Unless otherwise noted on the Drawings, all RIMs, RRMs, ACUs, and other control equipment panels shall be mounted where they are accessible for maintenance and testing. Panels shall not be mounted above accessible ceilings. The maximum mounting height to the top of the enclosure shall be +8'-0" AFF or 6" below the ceiling, whichever is lower.
  - 4. Pathway Separation Clearances:
    - a. Provide 3" minimum clearance from bottom of security system pathway to ceiling tile and T-bar ceiling and 12 inches clear space above cable trays for access.
    - b. Do not route security system cables adjacent and parallel to unshielded and ungrounded power cabling.
  - 5. Do not route raceways over or adjacent to boilers.
- B. Environmental Conditions:
  - 1. Components mounted in locations exposed to weather shall be housed in corrosion resistant enclosures with appropriate environmental protection. Component performance shall not degrade because of improper housing design. Components in enclosures shall meet manufacturer's performance requirements when exposed to the ambient conditions beyond manufacturer's limits. If required, Contractor shall provide heaters in enclosures.
- C. All work shall conform to the National Electrical Contractor's Association "Standard of Installation".
- D. Door Contacts: Secure the magnet side of recessed door contacts in the door, using metal mounting brackets as required. Magnet shall not be mounted on a wood spacer block to make it flush with the top of the door.

# 3.03 SYSTEM WIRING

A. No wiring other than that directly associated with Security Access Control System shall be permitted in Security Access Control System conduits and pathways.
- B. Cables to be installed in raceway, cable tray, continuous cable support system or J-hooks the entire length of each cable. In all locations where devices are installed in inaccessible ceilings or concealed in walls (i.e. door contacts, motion sensors), utilize signal cable in raceway from the device to the area above the accessible grid ceiling.
- C. Unless otherwise noted in the Contract Documents, install a dedicated cable to each individual field device.
- D. Install 1-foot cable service loop for all security system cable at the last J-hook nearest the raceway down to the device, or as near as possible to the device when J-hooks are not installed.
- E. Wiring splices are to be avoided to the extent possible, and if needed they must be made only in junction boxes and shall be crimp connected. Wire nut-type connections are not acceptable.

## 3.04 SYSTEM LABELING

- A. Install nameplates and labels parallel to equipment lines.
- B. Secure nameplate with pop rivets or brass machine screws tapped and threaded to cabinet. Machine screws shall not protrude more than 1/16 inch on back side.
  - 1. Provide nameplate for each control panel with the following information:
    - a. Line 1: Unique control panel name as shown on the shop drawings.
    - b. Line 2: System description (Access Controls).
    - c. Line 3: Panelboard and circuit number from which the control panel is fed (if applicable).
- C. Provide label on each security field device, denoting device address. Affix label to device faceplate for ceiling-mounted devices or wall-mounted devices above 8'-0" AFF. Affix label inside backbox for exterior devices.
- D. Install wire marker for each cable at cabinets, pull boxes, junction boxes, and each load connection. Wire ID number to match at each end.

## 3.05 FIELD QUALITY CONTROL AND TESTING

- A. Perform a 100% Device Test on each device point and circuit for proper operation. Confirm operation by observation via a Contractor's laptop computer.
  - 1. Test each set of magnetic contacts for proper operation and contact closure.
  - 2. Test each card reader for proper operation.

#### 3.06 SYSTEM DEMONSTRATION

- A. Demonstrate to the SCF Project Manager the system can Arm and Disarm.
- B. Demonstrate all doors are operable.
- C. Demonstrate proper operation of the reports. Generate sample Historical Reports using Ownerprovided printers.
- D. Confirm access controls operation under simulated utility power outage.
- E. Demonstrate use of the graphical maps and their function connected at building LAN/WAN via a Contractor's laptop.
- F. Demonstrate archiving of the System Event Transaction Log File.
- G. Demonstrate properly restricted operator privileges by logging in as an Operator and demonstrating operation.

## END OF SECTION 28 1000

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## SECTION 28 2300 VIDEO SURVEILLANCE SYSTEM

## PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Video Storage Appliance.
- B. Client Workstation Computer.
- C. Video Cameras.
- D. Network Switch.
- E. Video Cable.
- F. UTP Components.
- G. Video Intercom System.

## 1.02 RELATED SECTIONS

- A. The Work under this section is subject to requirements of the Contract Documents including the General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements and Section 26 0500 – Common Work Results for Electrical.
- B. Section 26 0533 Raceway and Boxes for Electrical Systems.
- C. Section 26 0553 Identification for Electrical Systems.
- D. Section 27 1000 Structured Cabling.

#### 1.03 REFERENCE CODES AND STANDARDS

- A. The publications listed below form a part of the specification to the extent referenced. The publications are referred to in the text by basic designation only, latest edition. The reference codes and standards are minimum requirements:
  - 1. ANSI/NFPA 70 National Electrical Code, latest adopted edition.
  - 2. BICSI Telecommunications Distributions Methods Manual
  - 3. ANSI/TIA 568-B.1 Commercial Building Telecommunications Cable Standard, Part 1: General Cabling System Requirements (including Addendums).
  - 4. ANSI/TIA 568-B.2 Commercial Building Telecommunications Cable Standard, Part 2: Balanced Twisted-Pair Cabling Components (including Addendums).
  - 5. ANSI/TIA 569-A Commercial Building Standard for Telecommunications Pathways and Spaces
  - 6. ANSI/TIA 606 Administration Standards for the Telecommunications Infrastructure of Commercial Buildings

#### 1.04 SYSTEM DESCRIPTION

- A. Provide a new video surveillance system for the facility, which will include interior and exterior color cameras, video system server and client workstation computer, color monitors, cable, and UTP signal transmission components. All new cameras shall be connected to the IP video servers/recorder and shall use the VMS software to provide video communications between points of surveillance and the workstation.
- B. All new equipment and assemblies shall be Underwriters Laboratories approved if applicable.
- C. Remote Access: The system shall have provision for secure remote access via a VPN. This shall enable either the Owner or the Security Systems Integrator to access the system remotely for troubleshooting or maintenance. The VPN settings will be provided by the Owner.

D. Video Archive: The system shall have sufficient hard drive space to provide thirty (30) days of archived video for all cameras, based on all cameras being set to their highest resolution, with a recording rate of 15 frames per second (fps), set to record on motion, assuming 30% motion.

## 1.05 QUALIFICATIONS

- A. The Security Systems Integrator shall have a minimum of three years documented experience assembling and installing these types of systems.
  - 1. Where the system installer is a branch office or other division of a larger organization, the qualifications of the branch office or other division shall meet the requirements of the Contract Documents.
  - 2. Contractor shall have local technician(s) who have attended training and hold relevant certificates from the manufacturer of the specified system.
  - 3. Maintenance Service and Support: The Security Systems Integrator shall be able to provide initial contact on warranty service and/or service contract requests from their principal location within eight (8) hours of notification. During the warranty period, the Contractor may choose to attempt troubleshooting of the system by telephone, with the facility maintenance staff. If the problem cannot be resolved within 24 hours, the Security Systems Integrator shall travel to the facility on the next business day to repair the system.
- B. Technical Support: All new systems and components shall be provided with the availability of a toll free 24-hour technical support phone number from the manufacturer. The phone number shall allow for immediate technical assistance for either the dealer/installer or the end user at no charge.
- C. IP Video System Manufacturers: Companies specializing in the specified systems with a minimum of three years documented experience.
- D. IP Video System Suppliers: Companies specializing in supplying the products specified in this Division with minimum three years documented experience, and authorized by product manufacturers.
- E. All systems and components shall be provided with an explicit manufacturer warranty.

#### 1.06 SUBMITTALS

- A. Product Data: Submit data for each component specified, showing electrical characteristics and connection requirements. <u>Note</u>: due to constantly evolving technology and the length of the project construction, the specified equipment may be obsolete by the time the submittals are prepared or the equipment is ordered. If that is the case, provide the newest model that provides similar/better characteristics than the specified equipment.
- B. Electronic AutoCAD® drawings of the facility are available upon request for preparation of the shop drawings.
- C. Provide contract-size shop drawings that include the following information:
  - 1. One-line diagrams for the IP Video system that show the signal relationships of all new devices within the system.
  - 2. Floor plan drawings showing the locations of all cameras, along with camera name, camera type and mounting (i.e. wall or ceiling), lens selection, conduit routing, and telecom closet/rack assignment.
  - 3. Floor plan drawings shall show entire cable pathway (i.e. conduit, cable tray, or J-hooks) that are used for the IP Video system. Show sizes of all conduit sleeves along the pathway.
  - 4. Indicate electrical characteristics and connection requirements, including line voltage and low voltage wiring where required.
  - 5. Provide bandwidth and storage calculations for the selected cameras and storage appliance.

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- 6. Drawings shall be done in a scale that allows the smallest text on the drawing to be legible when the drawing is reduced to 11" x 17".
- D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
- E. Camera Names: All camera names that are displayed on the IP Video monitors and programmed into the VMS system shall be approved by the Owner prior to programming.

## 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site, store and protect under provisions of Division 01.
- B. Store products in clean, dry area; maintain temperature to NEMA ICS 1.

## 1.08 ENVIRONMENTAL REQUIREMENTS

A. Maintain area free of dirt and dust during and after installation of products. Protect other surfaces against damage and discoloration caused by work of this section.

## 1.09 COORDINATION

- A. The necessity to coordinate this work with the Owner is emphasized. The Contractor shall be responsible for any omissions, delays and additional cost due to lack of coordination or approval from the same.
- B. Coordinate all work with lighting, power, ventilation, sprinklers and other systems in the areas of work to avoid interferences.
- C. IP Addresses: The Contractor shall submit a written request to the Owner for the quantity of IP addresses that will be required for the IP Video system. The Owner will furnish a list of addresses within ten (10) business days.

## 1.10 QUALITY ASSURANCE

- A. Provide complete testing of the IP Video system in accordance with this Section.
- B. After installation, and before termination, all wiring shall be checked and tested to ensure there are no grounds, opens, or shorts on any conductors or shields. The Contractor shall maintain a complete log of all such quality assurance tests and make them available for inspection by the Owner at any time during the construction phase. At the completion of the installation all test results shall become part of the maintenance documentation.
- C. Inspection:
  - 1. The Contractor shall carry out the inspection requirements of the Contract and shall provide the Owner with documentation to the effect that off-site work is being properly fabricated, and in accordance with the contract documents.
  - 2. The Contractor shall notify the Owner sufficiently in advance of the time when quality control tests are to be performed so that the Owner or their designee may witness such tests, if desired. The presence or absence of the Owner from these tests shall not relieve the Contractor from completing the tests in accordance with the contract documents. Contractors QA documentation and practices shall be subject to Engineer or Owner inspection at any time. The field-certified installer must be present during final testing and calibration.

## 1.11 CLOSEOUT SUBMITTALS

- A. Project Record Drawings:
  - 1. Accurately indicate actual locations of all cameras, power supplies, etc.
  - 2. Show the actual installed cable pathway route, including type and size of pathway.
  - 3. Include a reduced set (11" x 17") set of the IP Video system project record drawings in the operation and maintenance manual.
- B. Operation and Maintenance Manuals:

- 1. Document ratings of system and of each major component.
- 2. Identify operating limits, which may result in hazardous or unsafe conditions, or in equipment damage.
- 3. Include routine preventive maintenance schedule.
- 4. List special tools, maintenance materials, and replacement parts.
- 5. Include repair instructions for procedures to check, repair, and test equipment during typical malfunctions.
- 6. Include copies of manufacturer product warranties for all equipment.

## 1.12 SYSTEM DEMONSTRATION AND ACCEPTANCE

- A. Provide systems demonstration under provisions of Division 01 and this Section.
- B. At the time of the Substantial Completion Inspection, the Contractor and Security System Integrator shall be on-site to demonstrate the operation of the IP Video system to the Owner's Representatives and Engineer. All IP Video system components shall be installed and fully operational at the time of the system demonstration.
- C. The Engineer shall review the demonstration with the Owner's Representatives and provide the Contractor with a list of modifications and/or adjustments deemed appropriate for the proper operation of the system. The Contractor shall make all modifications prior to final completion and at no additional cost to the Owner.
- D. System demonstration shall be conducted as directed by the Owner and Engineer but generally described as follows:
  - 1. Call up each camera on the client workstation computer using the VMS software.
- E. After all changes have been made to the system, the Contractor shall provide the Owner's authorized personnel with operation and maintenance training for the IP Video system, as specified in this section.

#### 1.13 IP VIDEO SYSTEM TRAINING

A. Provide (4) hours training for maintenance and operation of the new cameras and servers/storage appliance.

#### 1.14 EXTRA MATERIALS

A. No extra materials are required.

#### 1.15 WARRANTY AND MAINTENANCE CONTRACT

- A. Warrant all materials and equipment to be new and free from defects in material and workmanship for a period of one year under provisions of Division 01.
- B. Thirty days prior to the expiration of the warranty period, the Security Systems Integrator shall contact the Owner's Representative to determine if any adjustments or reprogramming are necessary to maintain proper operation of the security system. If any adjustments or reprogramming are necessary, they shall be done at no cost to the Owner.
- C. At the end of the warranty period, the Owner shall have the option of entering into a maintenance contract with the Security Systems Integrator.

#### PART 2 PRODUCTS

## 2.01 PRODUCT SPECIFICATIONS

- A. Throughout this specification, specific manufacturers and manufacturer's catalog numbers are cited. Unless otherwise noted, these citations are for the purpose of establishing quality and performance criteria and are not intended to be proprietary.
- B. Where no manufacturer is specified, provide products of manufacturers in compliance with requirements. Any item of equipment or material not specifically addressed on the drawings or

in this document and required to provide a complete installation shall be provided in a level of quality consistent with other specified items.

- C. The Contractor shall provide the latest product model and software version available from each manufacturer at the time of installation. No "beta version" or "test software" products will be accepted. All proposed and provided equipment and products shall be from the specified and approved manufacturers only, unless previously approved by the Engineer or Owner.
- D. All products and materials are to be new and free of defects, damage and corrosion. All materials shall be in compliance to all applicable codes and designed specifically for the function intended.
- E. Quantity and location of all devices and equipment shall be as specified in Contract Documents or as required for a complete and operable system.

## 2.02 VIDEO MANAGEMENT SYSTEM SOFTWARE

A. Milestone "X-Protect Expert" or equal, latest published version. Coordinate with SCF for integrating into their campus wide existing systems.

## 2.03 IP VIDEO SYSTEM COMPUTERS

- A. Video Server/Storage Appliance: Dell "PowerEdge R730" or approved equal. Provide a minimum of 48TB useable storage after RAID 5.
- B. Client Workstation Computer: Where indicated on the Drawings, new Client Workstation Computer shall be a Dell "XPS Tower" or approved equal computer that is approved by the system manufacturer and is compatible with the installed system. Specifications for the workstation shall meet or exceed minimum requirements for the submitted VMS.
  - 1. Monitors: 24" Widescreen, 1080p. Exact type and connection requirements shall be determined by video system provider.

## 2.04 MANUFACTURERS – FIXED IP VIDEO CAMERAS

- A. Avigilon.
- B. Substitutions: Under provisions of Division 01.
- C. Type 'A' –Indoor Day/Night 2 Megapixel IP Mini-Dome (Corridors, Entries): Avigilon #2.0C-H5A-DO1 or approved equal.
- D. Type 'B' Outdoor Day/Night 2 Megapixel IP Mini-Dome (Building Entries): Avigilon #2.0C-H5A-DO1 or approved equal.
- E. Type 'C' Outdoor Day/Night 5 Megapixel IP Mini-Dome (Building Site): Avigilon #5.0C-H5A-DO2 or approved equal.
- F. Type 'D' Indoor/Outdoor Day/Night (4) 3 Megapixel Multi-Sensor IP Mini-Dome (Rooms): Avigilon #12C-H5A-3MH or approved equal.
- G. Type 'E' Indoor/Outdoor Day/Night Dual Head (2) 5 Mega Pixxel Camera IP (Corridors or Exterior ): Avigilon #10.0-H5DH-DO1-IR or approved equal.
- H. Type 'F' Indoor Day/Night 8 or 12 Megapixel IP Mini-Dome (As required in large rooms): Avigilon #X.0-H5A-FE-DO1-IR or approved equal.
- I. Type 'G' Outdoor Day/Night 5 Megapixel IP Bullet Camera (as shown): Avigilon #5.0C-H6SL-BO1-IR or approved equal.
- J. Type 'P' Outdoor 8 Megapixel Pan-Tilt-Zoom: Avigilon #8.0C-H5A-IRPTZ-DP36-WP or approved equal.

## 2.05 GENERAL HARDWARE AND MOUNTS

- A. Anchoring:
  - 1. Anchoring shall be rated for the load and mounting surface.
  - 2. All anchoring sets shall be installed per manufacturers' instructions and be appropriate for the surface to which they are mounted.

- 3. All manufacturers' torque specifications shall be adhered to as applicable and be appropriate for the surface to which the anchoring sets are mounted.
- 4. Mounts shall be rated for the weight, external weight (i.e., snow or rain), twist, and wind loading of the equipment used.
- 5. All hardware shall be installed so that it cannot be removed without the use of hand tools.
- 6. All exterior exposed mounting hardware including arms, poles, adapters conduit and boxes shall be painted to match the architecture of the building.

## 2.06 PoE NETWORK SWITCH

A. PoE Switch: Cisco #1000 series or equal, 24-port, PoE+ available on all ports.

## 2.07 UTP CABLE

- A. Camera Power/Data Field Cable: Per Specification Section 27 1000, with green jacket.
- B. IP Video Cross-Connect Patch Cables: Per Specification Section 27 1000, with green jacket.

## 2.08 UTP COMPONENTS

- A. UTP Patch Panel: Per Specification Section 27 1000.
- B. UTP Feed-Through Cable Management Panel: Per Specification Section 27 1000.
- C. UTP Jacks: Per Specification Section 27 1000.

## 2.09 IP VIDEO RACK

A. Per Specification Section 27 1000.

## 2.10 VIDEO INTERCOM SYSTEM

- A. Where indicated on the drawings, provide video intercom field station. 2N "IP Force" or approved equal. Connect to patch panels provided under Specification Section 271000.
- B. Where indicated on the drawings, provide video intercom master station. 2N "IP Touch" or approved equal. Connect to patch panels provided under Specification Section 271000.

## PART 3 EXECUTION

#### 3.01 GENERAL INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide boxes for mounting devices, cable pulling, and splicing cables under provisions of Section 26 0533.
- C. Cabling installation shall be compliant with Specification Section 27 1000.
- D. Program video intercom stations for communication.

#### 3.02 INTERFACE WITH OTHER WORK

- A. Coordinate all camera locations with Owner's Representative prior to rough-in and avoid conflicts with equipment and objects that may obstruct the field of view or, in the case of light fixtures, may affect the camera performance and quality of the video image.
- B. Coordinate all camera, outlet box, J-hook, and conduit locations to avoid conflicts with mechanical piping and ductwork, structural members, and other materials above the accessible ceilings and along the entire cable pathway.
- C. Any camera that is located so that camera performance or field of view is adversely affected shall be relocated by the Contractor at no additional cost to the Owner.
- D. Configure video intercom for release of associated door(s).

## 3.03 LABELING

A. Furnish and install labels and documentation to identify all cables, jacks, and connections in accordance with ANSI/TIA standards, as shown on the Drawings, and under the provisions of

Section 26 0553 and this Section. As a minimum, each IP Video jack in each outlet box shall have a unique identifier that matches the identifier at the opposite end and matches the naming scheme on the camera schedule. Identifiers shall be installed on the cable at both ends.

B. Label all IP Video junction boxes. For junction boxes above ceilings, mark the box cover with "IP Video" using permanent black marker. For junction boxes in finished areas, mark the inside of the cover.

## 3.04 CABLE ACCEPTANCE TESTING

A. Per Specification Section 27 1000.

## 3.05 ADJUSTING, PROGRAMMING, AND CONFIGURATION

- A. Fixed Cameras: The Contractor shall coordinate with the Owner to obtain the desired field of view for each new camera. This includes, but is not limited to, adjusting camera aiming point, white balance, backlight compensation, AGC, iris control, viewing angle, and adjusting vari-focal lenses.
- B. Video Intercom: If compatible, configure video system to display video intercom view while active, and record stream to video server.
- C. VMS Software: The Contractor shall completely configure each video input for camera title, frame rate, resolution, compression, motion detection, alarms, pre/post event recording, macros, and all other features of the software. The software shall be initially configured with the following parameters:
  - 1. Camera Title: Coordinate with Owner for approval of camera title.
  - 2. Resolution: High for all cameras.
  - 3. Record Rate: 15fps upon motion.
  - 4. Record Mode: Motion.
  - 5. Motion Detection: ON.
  - 6. Pre/Post Event Recording: Match existing.

## 3.06 DEMONSTRATION

- A. Provide systems demonstration under provisions of Division 01.
- B. Conduct walking tour of project and briefly describe function, operation, and maintenance of each component.

## END OF SECTION 28 2300

## SECTION 28 4600 FIRE DETECTION AND ALARM

## PART 1 GENERAL

## 1.01 SECTION INCLUDES

A. Contractor designed and installed addressable fire alarm and smoke detection system. This is a performance type specification describing the minimum acceptable fire alarm system. The Contractor shall design and install the fire alarm and smoke detection system in accordance with the requirements of NFPA 72 and ICC/ANSI A117.1. The fire alarm devices on the drawings are shown in suggested locations. The final locations of all devices shall be solely determined by the Contractor and shall be in accordance with NFPA 72 and ICC/ANSI A117.1.

## 1.02 RELATED SECTIONS

- A. Division 08 Door Hardware: Door Closers.
- B. Division 21 Sprinkler System.
- C. Division 25 Mechanical: Fire/Smoke Dampers.
- D. Section 26 0519 Low-Voltage Electrical Power Conductors and Cables.
- E. Section 26 0533 Raceway and Boxes for Electrical Systems.
- F. Section 26 0553 Identification for Electrical Systems.

## 1.03 REFERENCES

- A. NFPA 72 National Fire Alarm Code.
- B. NFPA 101 Life Safety Code.
- C. International Mechanical Code (IMC).
- D. Americans with Disabilities Act (ADA) and ADA Guidelines for Buildings and Facilities (ICC/ANSI A117.1).
- E. ANSI S3.41 Audible Emergency Evacuation Signals.
- F. ANSI/ASME A17.1 Safety Code for Elevators and Escalators.

## 1.04 REGULATORY REQUIREMENTS

- A. System: UL and FM listed.
- B. Conform to the requirements of UL 864.
- C. Conform to requirements of NFPA 101.
- D. Conform to requirements of ICC/ANSI A117.1.
- E. Install system in accordance with NFPA 72.
- F. Comply with requirements of ANSI A17.1.

#### **1.05 SYSTEM DESCRIPTION**

- A. Fire Alarm System: Contractor designed and installed, microprocessor controlled manual and automatic fire alarm system with individually addressable initiating devices. The Contractor shall design and install the fire alarm and smoke detection system in accordance with the requirements of these specifications, NFPA 72, NFPA 101, ANSI A17.1, and ICC/ANSI A117.1. The fire alarm devices on the drawings are shown in suggested locations. The Contractor shall modify these device locations as necessary to accommodate actual architectural, structural, or mechanical conditions, at no cost to the Owner.
- B. System Supervision: Provide electrically-supervised class B, addressable fire alarm system with fault tolerant supervised signaling line circuits and notification appliance circuits. Occurrence of single ground or open condition in signaling line circuit or notification appliance circuit places

circuit in TROUBLE mode. Component or power supply failure places system in TROUBLE mode.

- C. Alarm Sequence of Operation: Actuation of manual fire alarm station or automatic initiating device causes system to enter ALARM, which includes the following operations:
  - 1. Sound and display local fire alarm notification appliances with ANSI S3.41 compliant temporal signal and synchronized flash.
  - 2. Transmit alarm signal to activate the digital alarm communicator.
  - 3. Indicate location and address of device in alarm on fire alarm control panel and on remote annunciator panel.
  - 4. Record the time, date and location of the alarm in the fire alarm panels' accessible history database.
  - 5. Transmit signal for closure of all fire/smoke dampers and shutdown of all building supply and return air fans.
  - 6. Coordinate with the kitchen hood extinguishing system installer to determine if the kitchen hood exhaust fan and make-up air fan are required to be shutdown upon activation of the hood extinguishing system. If the hood extinguishing system listing requires the exhaust fan or make-up air fan or both fans to be shut down, transmit a signal to listed control relays to shut down the fans in accordance with the hood extinguishing system's listing.
  - 7. Transmit signal to release all door hold open devices.
  - 8. Transmit non-coded signal to remote station equipment.
  - 9. Transmit signals to building elevator control panel to initiate return to main floor or alternate floor in accordance with Rule 211.3b of ANSI/ASME A17.1.
  - 10. Transmit signal to shut down power to elevator in accordance with Rule 102.2 of ANSI/ASME A17.1. Upon activation of the heat detector used for elevator power shutdown, the system shall delay activation of the power shunt trip. Per section A.6.15.4.4 of NFPA 72, the delay shall be the time that it takes the elevator cab to travel from the top of the hoistway to the lowest recall level.
  - 11. Transmit signal to release exit door electric locks.
- D. Alarm Reset: Key-accessible RESET function resets alarm system out of ALARM if alarm has cleared.
- E. Trouble Sequence of Operation: System trouble, including grounding or open circuit of signaling line or notification appliance circuits, or power or system failure causes system to enter TROUBLE mode, including the following operations:
  - 1. Activate visual and audible trouble alarm by device at the fire alarm panel.
  - 2. Activate visual and audible trouble alarm by device at panel.
  - 3. Manual ACKNOWLEDGE function at control panel silences audible trouble alarm; visual alarm is displayed until initiating trouble is cleared.
  - 4. Record the time, date and location of the trouble condition in the panel's accessible history database.
  - 5. Transmit alarm signal to activate the digital alarm communicator.
- F. Drill Sequence of Operation: Manual DRILL function causes ALARM mode operation to sound and display local fire alarm notification appliances.
- G. Sprinkler System Water Flow Sequence of Operation: Water flow in sprinkler system shall cause the fire alarm control panel to enter the alarm state.
- H. Sprinkler System Valve Tamper Sequence of Operation: Activation of sprinkler valve tamper switch shall cause the fire alarm control panel to display a supervisory trouble indicator.

- I. Lamp Test: Manual LAMP TEST function causes each indicator lamp/LED at the fire alarm control panel to illuminate.
- J. The system shall be 100% field programmable for additions and deletions, and shall be capable of being expanded and field programmed at any time from the fire alarm control panel with a plug-in programmer without returning the devices or operating system to the factory for program change. System software and training shall be provided to the Owner as part of this contract.
- K. The fire alarm control panel shall report and identify the failure of any device connected to the system, a device removed from a signaling line or notification appliance circuit, or a transmitting device component failure while all other line devices on the channel shall continue to function. The control panel shall report failures by specific channel and address number and permanently record the event including time and date on the system database.
- L. Addressable control relays connected to the system shall be continuously monitored for proper state and position of contacts. Incorrect positions shall be automatically corrected by command from the control panel. If control relay fails to respond to the corrective command; the trouble signal shall sound, and the panel shall identify and permanently record the location of the fault. The control panel shall also monitor addressable control relays for proper state (position) after the system has commanded the relay to operate. Failure of the control relay to operate (change state) shall cause the panel to generate a trouble signal, identify and permanently record the location of the fault.

## 1.06 QUALIFICATIONS

- A. The installation of the system shall conform to the State of Alaska requirements and be supervised by a representative with a current State Fire Alarm License.
- B. Manufacturer: Company specializing in addressable smoke detection and fire alarm systems with five years documented experience.
- C. System Supplier: Factory trained to provide the submitted fire alarm system.
- D. Installer: Installation of the system shall be 100% field checked by a factory trained and authorized NICET Level III technician certified in the Fire Alarm System Program. The actual supervising technician must be approved prior to start of work.

## 1.07 SUBMITTALS

- A. Submit product data and shop drawings under the provisions of Division 01.
- B. Submit shop drawings prepared and signed by a NICET Level III technician certified in fire alarm systems under the provisions of Division 01. Shop drawings shall have the following requirements:
  - 1. The Shop Drawings shall be reproduced electronically from a Master Copy supplied in digital format. Electronic copy of the Contract Drawings will be available at no charge to use as base plan for generation of electronic submittal. Shop Drawings shall be printed at Contract Drawing size and scale of floor plans on Shop Drawings shall match Contract Drawings.
  - 2. All text on the drawings shall be legible without magnification when the shop drawings are reduced to 11" x 17".
  - Provide minimum 1/8" scale floor plans with all new fire alarm control and auxiliary panels, field devices, raceway and conductor routing, quantities and connection requirements for every component.
  - 4. Provide point-to-point system wiring diagrams showing interconnection of all devices.
  - 5. Provide a riser diagram showing all devices on each NAC, SLC, and auxiliary circuit connected to the fire alarm control panel. Individual device addresses on riser diagram are not required for initial shop drawing submittal but shall be provided on the as-built drawings.
  - 6. Provide calculations to support battery size selection. Provide voltage drop calculations for each SLC and NAC circuit. Show the voltage drop at the furthest notification appliance from

the control panel. Show all formulas and acceptable limits for all calculations. All calculations shall be shown on the shop drawings.

- C. Submit shop drawings and product data to the State Fire Marshal for review and approval. All shop drawings and product data shall be reviewed and approved by the authority having jurisdiction prior to procurement and installation of materials or devices for the system.
- D. Device Names: All device names that are displayed on the LCD text annunciators in the fire alarm panel shall be approved by the Owner. The Contractor shall request a list of approved room names for the facility <u>prior to</u> programming the fire alarm panel or any field devices.

## 1.08 PROJECT RECORD DRAWINGS

- A. Submit documents under the provisions of Division 01.
- B. Accurately indicate actual locations of notification appliances, initiating devices, fire alarm control panel, annunciators, etc.
- C. Provide Point to Point as-built wiring diagrams of the entire Life Safety System as installed. This shall include all connected devices with actual addresses and locations of all T-taps. All drawings shall be provided in AutoCAD .DWG format. Paper plots of each sheet shall also be provided.

## **1.09 OPERATION AND MAINTENANCE DATA**

- A. Submit operating instructions and maintenance and repair procedures under the provisions of Division 01.
- B. Include manufacturer representative's letter stating the system is operational.
- C. Include an 11" x 17" set of the fire alarm system project record drawings.
- D. Include a completed copy of the NFPA 72 Inspection and Testing Form.

## 1.10 DEMONSTRATION AND TRAINING

- A. The Manufacturer's Representative shall be responsible for an on-site demonstration of the operation of the system and initial staff training.
- B. Under the provisions of Division 01 and Section 26 05 00, provide formal instruction in the operation, maintenance, and troubleshooting of all equipment, provided at the project site with manufacturer's representative with the Owner's personnel.

## 1.11 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site, store and protect, under provisions of Division 01.

## 1.12 EXTRA MATERIALS

- A. Provide spare parts under provisions of Division 01.
- B. Provide two keys of each type.
- C. Provide four addressable smoke detectors.
- D. Provide two 135°F addressable heat detectors.
- E. Provide one fire alarm horn/strobe.
- F. Provide two fire alarm strobe lights.

#### 1.13 WARRANTY

A. The Contractor shall be able to provide initial contact on warranty service and/or service contract requests from their principal location within eight (8) hours of notification. During the warranty period, the Contractor may choose to attempt troubleshooting of the system by telephone, with the facility maintenance staff. If the problem cannot be resolved within 24 hours, the Contractor shall travel to the facility on the next available flight to repair the system.

Southcentral Foundation Benteh Nuutah Valley Primary Care Center Expansion October 24, 2024

## PART 2 PRODUCTS

## 2.01 MANUFACTURERS

- A. Siemens (Basis of design).
- B. Autocall
- C. Edwards Systems Technology (EST).
- D. Gamewell-FCI.
- E. Honeywell.
- F. Johnson Controls.
- G. Notifier.
- H. Simplex.
- I. Substitutions: Under provisions of Division 01.

## 2.02 FIRE ALARM AND SMOKE DETECTION CONTROL PANEL

- A. Control Panel: Microprocessor controlled, addressable panel with modular construction and surface wall-mounted enclosure.
- B. Power Supply: Adequate to serve control panel modules, initiating devices, notification appliances, remote annunciators, door holders, fire/smoke dampers, relays, duct smoke detectors, etc. plus 25 percent spare capacity to allow for future system load growth. Include battery-operated emergency power supply with capacity for operating system in standby mode for 24 hours followed by alarm mode for 5 minutes. Size battery capacity to allow for a 25 percent growth of the system load while complying with the above requirements.
- C. Signaling Line Circuits: Class B, Style 7, signaling line circuit with capacity sufficient for all initiating devices connected to the circuit plus 25 percent spare capacity to allow for future load growth.
- D. Notification Appliance Circuits: Class B, Style Y, notification appliance circuit complying with ANSI S3.41 with capacity sufficient for all notification appliances connected to the circuit plus 25 percent spare capacity to allow for future load growth.
- E. Control Relays: Provide sufficient addressable control relays to provide accessory functions specified and required by the drawings.
- F. Provide TROUBLE ACKNOWLEDGE, DRILL, and ALARM SILENCE switch.

## 2.03 INITIATING DEVICES

- A. Manual Station: Semi-flush mounted, single action addressable manual station. Provide with high impact clear polycarbonate protective cover in gymnasium and multipurpose rooms.
- B. Ceiling Mounted Smoke Detector: Addressable, NFPA 72, photoelectric type with adjustable sensitivity, plug-in base, and visual indication of detector actuation, suitable for mounting on 4-inch outlet box. For devices in VNPCC1 they must be suitable for operation on existing control panel power supply and signaling line circuits.
- C. Duct Mounted Smoke Detector: Addressable, NFPA 72, photoelectric type with auxiliary SPDT relay contact, duct sampling tubes extending the width of duct, and visual indication of detector activation, in duct-mounted housing. Provide with remote visual indicator, test, and reset station. For devices in VNPCC1 they must be suitable for operation on existing control panel power supply and signaling line circuits.
- D. Heat Detector: Addressable combination rate-of-rise and fixed temperature, rated 135° F, and temperature rate of rise of 15° F. Provide fixed temperature devices rated 200° F where indicated. Heat detectors in the elevator machine rooms shall have both a lower temperature rating and a higher sensitivity as compared to the sprinkler head in the room.

## 2.04 INTELLIGENT MODULES

A. A control relay/transponder shall be installed where building services (i.e. fan shutdown, door holder or release, etc.) are to be automatically controlled by the fire alarm system during a fire emergency. The control relay shall be of a type that only consumes power momentarily while transferring from the deenergized to the energized state or back again. The command to change state shall come from the control panel in accordance with the system program. The control relay shall be condition (deenergized or energized) supervised, and its condition shall be confirmed and corrected, if necessary, during each polling cycle. The control relay/transponder shall be capable of operating on the same communication channel with initiating devices/transponders so that it can be located within 3 feet of the building service device it is controlling as required by NFPA 101-Life Safety Code while its integrity is being monitored from the control panel. The address code of the control relay transponder shall be field selectable and changeable in the same manner as for other transponders. The control relay/ transponder type code shall be factory preset and not be field changeable.

#### 2.05 NOTIFICATION APPLIANCES

- A. All appliances shall be U.L. Listed for Fire Protective Service.
- B. All appliances shall be of the same manufacturer as the Fire Alarm Control Panel specified to assure absolute compatibility between the appliances and the control panels, and to assure that the application of the appliances is done in accordance with the single manufacturer's instructions.
- C. Any appliances that do not meet the above requirements, and are submitted for use must show written proof of their compatibility for the purposes intended. Such proof shall be in the form of documentation from all manufacturers that clearly states that their equipment (as submitted) is 100% compatible with each other for the purposes intended.
- D. Fire Alarm Bells: electric vibrating, 10 inch bell with operating mechanism behind dome. Sound Rating: 81dB at 10 feet. Provide weatherproof back box on exterior bells. Contractor shall field verify whether 120V circuit is required for bell and provide if necessary.
- E. Fire Alarm Strobe Lights: NFPA 72 compliant, flush wall or ceiling mounted, self-synchronizing, xenon, fire alarm strobe lamp and flasher with flashrate of one flash per second, complying with the requirements of ICC/ANSI A117.1. Provide red lettered FIRE on clear lens. The strobe shall be field-selectable to provide 15, 30 75, or 110 candela synchronized flash outputs. The settings of all strobes shall be determined by the Contractor during the shop drawing process.
- F. Fire Alarm Horn: ANSI S3.41 and NFPA 72 compliant, flush mounted fire alarm horn with adjustable sound output level. Sound Rating: 87 dBA (reverberant) at 10 feet on the "high" setting and 82 dBA (reverberant) at 10 feet on the "low" setting. Provide minimum sound pressure level of 15 dBA above the average ambient sound level in every occupied space within the building. Provide integral fire alarm strobe light as specified above where indicated on the drawings.
- G. Fire Alarm Chime and Strobe: ANSI S3.41 and NFPA 72 compliant, flush mounted fire alarm chime with adjustable sound output level. Sound Rating: 70 dBA (reverberant) at 10 feet on the maximum volume setting and 64 dBA (reverberant) at 10 feet on the minimum volume setting. Provide minimum sound pressure level of 15 dBA above the average ambient sound level in areas where mini-horns are used. Provide integral fire alarm strobe light as specified above.
- H. Remote Graphic Annunciator: Provide UL Listed, supervised, remote graphic annunciator, including visual indication of fire alarm by area of the building and visual indication of system trouble. Panel shall have the following features:
  - 1. Enclosure: Semi-recessed, wall-mounted, 16-gauge steel enclosure with black textured powder coat finish and concealed stainless steel hinge.
  - 2. Security Door: 16-gauge steel with black textured powder coat finish and 3/16" Lexan window. Door shall be secured with key lock and no other visible fasteners. All switches shall be mounted in door trim.

- 3. Graphic panel: Full-color, black background, UV-coated, electronically printed laminate designed for LEDs. Laminate shall be mounted on 1/8" acrylic backing plate and mounted behind clear front pane to render display and LEDs tamperproof. LED wiring shall be neatly harnessed to designated terminal blocks in annunciator backbox. Graphic panel shall be minimum 22" x 19" or larger, as required to show scaled 1/32" floor plan of building.
- 4. Lamp Test: Keyswitch mounted in the door frame and keyed to match door lock. Activating keyswitch shall cause each indicator lamp/LED on the graphic annunciator to illuminate.
- 5. Panel-mounted LED labeled "Power On" to indicate power is being supplied to the annunciator.
- 6. Panel-mounted LED labeled "Trouble" to indicate system trouble.
- 7. Submit a copy of the graphic map with the product data submittal.
- I. For devices in VNPCC1 notification appliances shall be listed for use on the existing fire alarm control panel power supply.
- J. Digital Alarm Communicator: Provide an electrically supervised, U.L. 864 listed digital alarm communicator to be installed in the fire alarm control cabinet. Communicator shall be capable of transmitting an alarm condition, a trouble condition, a supervisory alarm or a sprinkler system water flow alarm over telephone lines to a central station receiver. Communicator shall be listed for use with the installed system.
- K. Automatic Telephone Dialer: Provide an automatic telephone dialer complete with power supply, battery back-up, built-in line seizure, remote turn-off, EEPROM memory, 4 voice message alarm zones, and the ability to call a minimum of 8 preprogrammed telephone numbers on a signal from the fire alarm system. United Security Products (USP) #AD2000F or approved equal.

## 2.06 AUXILIARY DEVICES

- A. Door Release: Magnetic hold open as specified in Division 08. Provide with integral diodes to reduce buzzing, 120VAC coil voltage. Provide power supply to power all door holders. Provide power connection to 120 V primary source and overcurrent protection.
- B. Vandal-Resistant Pull Station Cover: UL listed polycarbonate pull station cover with integral 100dB horn and internal 9-Volt battery power supply. Covers for both flush-mounted and surfacemounted pull stations shall be provided as required to match the installation (i.e. flush covers for flush pull stations). STI "Stopper II" series or approved equal.
- C. NAC Booster Power Supplies:
  - 1. Existing Power Supplies: New notification appliances may be connected to existing booster power supplies if the unit and batteries have sufficient capacity.
  - 2. Power supply quantity, rating and battery size shall be determined by the Contractor. All locations of new power supplies shall be approved by the Owner prior to shop drawing submittal. Provide one or more dedicated circuits for all new power supplies. Each circuit shall have a handle lock on the breaker.
  - 3. Smoke Detection: Provide a smoke detector to protect each NAC booster power supply in accordance with NFPA 72 requirements. Note that because the quantity and locations of NAC boosters are determined by the Contractor, these smoke detectors are <u>not</u> shown on the Contract Drawings but they shall be provided at no additional cost to the Owner.
- D. Smoke Detector Guard: 16-gauge steel louvered guard with tamperproof fasteners and white baked powder coat enamel finish. Guard shall be specifically UL Listed for use with the installed smoke detector. Guard shall not affect smoke detector sensitivity or reduce detector spacing. Where surface conduits and backboxes are installed, provide an extension ring with conduit knockout. Extension ring shall be UL listed for use with the installed smoke detector and detector guard.

## 2.07 FIRE ALARM WIRE AND CABLE

- A. Fire Alarm System Power Branch Circuits: Building wire as specified in Section 26 0519.
- B. Notification Appliance Circuits: Minimum #12 AWG copper building wire, as specified in Section 26 0519.
- C. Initiating and Signaling Line Circuits: Twisted, shielded or unshielded fire alarm cable as recommended by the fire alarm system manufacturer. Minimum size #16 AWG.

#### 2.08 FIRE ALARM SYSTEM MAP

- A. On wall beside each fire alarm panel and text annunciator, provide a system map under clear 1/8" plexiglass with black metal frame permanently screwed to the wall with 4 screws around the perimeter of the map.
- B. Map to denote locations of all panels, annunciator, and device address and room numbers that correlate with text display on panel to locate system event.
- C. Orientate each map consistent with location the map is installed. Provide call denoting "YOU ARE HERE" at the installation point for each map.
- D. The map shall be color-coded for clarity.
- E. The final layout to be approved prior to final printing.

## PART 3 EXECUTION

## 3.01 INSTALLATION

- A. Install the fire alarm system in accordance with the manufacturer's instructions.
- B. Install manual station with operating handle not less than 42 inches and not more than 48 inches above finished floor. Install audible notification appliances with top of device not less than 90 inches above finished floor, and not less than 6 inches below finished ceiling. Install visual notification appliances such that the entire lens is not less than 80 inches and not greater than 96 inches above finished floor.
- C. Install all smoke detectors a minimum of three feet from any air supply, return, or exhaust diffuser and a minimum of one foot from any light fixture.
- D. Install all fire alarm system wiring in a dedicated fire alarm MC cable or conduit system separate from any other system wiring. Provide minimum 8 inch wire tails at each device box and 50 inch wire tails at the fire alarm control panel.
- E. Make conduit and wiring connections to door release devices, sprinkler water flow switches, sprinkler valve tamper switches, fire/smoke dampers, kitchen hood fire extinguishing system control panels, elevator controllers and other items as shown on the drawings or required by NFPA 72. Note that the sprinkler system is a design build system and not all valve tamper switches and flow switches may be shown on the drawings. The Contractor is responsible to field coordinate all tamper and flow switch locations and connect all switches to the fire alarm system.
- F. In elevator shafts and/or machine rooms, install heat detectors within two feet of each sprinkler head. The temperature rating of the heat detector shall be lower than that of the associated sprinkler head.
- G. Mount outlet box for magnetic door holder to withstand 80 pounds pulling force.
- H. The Contractor is responsible to field coordinate the final location of all initiating devices and notification appliances to comply with the requirements of NFPA 72. Any initiating devices or notification appliances that are not installed in accordance with NFPA 72 shall be relocated to comply with the requirements of NFPA 72 at no cost to the Owner.
- I. Detectors shall not be installed until after the construction cleanup of all trades is complete and final. Protective dust covers shall be installed on all detectors prior to final clean-up. Detectors

that have been installed without dust covers prior to final clean-up shall be replaced at no cost to the Owner.

- J. Field locate remote visual indicators and test/reset stations for duct detectors in an accessible location.
- K. Provide two dedicated telephone lines for connection of the digital alarm communicator.
- L. Coordinate with owner to arrange a 24 hour monitoring service for digital alarm communicator that meets the requirements of NFPA 72 and the Authority Having Jurisdiction.
- M. Program the system to identify each device with the submitted and approved designation in the LCD annunciators on the control panel.

## 3.02 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Division 01.
- B. Test in accordance with NFPA 72 and local fire department requirements. Provide a completed NFPA 72 Inspection and Testing Form for inclusion in the Operation and Maintenance manual at the completion of testing and commissioning the fire alarm system.
- C. Provide all equipment, devices and manpower as necessary to test each and every device in the fire alarm system both for function and supervision. Demonstrate that all devices connected to the system function properly.
- D. The facility will not be accepted as substantially complete until the fire alarm system has been tested and demonstrated to the Owner's authorized representative as 100 percent complete and fully functional, a completed NFPA 72 Inspection and Testing form is submitted.

## 3.03 MANUFACTURER'S FIELD SERVICES

- A. Provide manufacturer's field services under provisions of Division 01.
- B. Include services of a certified technician to supervise installation, adjustments, final connections, programming and system testing.

## 3.04 FIRE ALARM SYSTEM IDENTIFICATION

- A. Wire and Cable: Provide fire alarm unit conductors with color coded insulation, or use color coded tape at each conductor termination and in each junction box as follows:
  - 1. Power Branch Circuit Conductors: Black, red, white.
  - 2. Initiating Device Circuit: Black, red.
  - 3. Detector Power Supply: Violet, brown.
  - 4. Notification Appliance Circuit: Blue (positive), white (negative).
  - 5. Door Release: Gray, gray.
- B. Identify all circuit conductors at all terminal and junction boxes per NEC 760.30. Use the circuit designations (i.e. "NAC 1", "SLC 1", etc.), as indicated on the shop drawings.
- C. Fire Alarm Device Labels:
  - Install machine-printed device address labels on all addressable devices, including smoke/heat detectors, control relays, monitor modules, etc. Unless otherwise noted, in public spaces where devices are mounted below +80" on walls, install label on inside cover of device. At all other locations, install label on exterior cover of device. Device labels shall show the unique device address corresponding to the text annunciator description. For smoke detectors, the label shall be affixed to the base and not to the detector itself.
  - 2. Provide label on each remote test station indicating description and location of device being tested.
  - 3. Provide label on telephone conductors at each end denoting FACP lines for use with the digital alarm communicator transmitter (DACT).

D. The circuit disconnecting means for the fire alarm control panel circuit, remote power booster supply, 120V door holders, or other control equipment circuits shall have a painted red handle and handle lock. The circuit(s) shall be labeled "Fire Alarm Circuit". The circuit assignment and panel location shall be permanently identified on all fire alarm control equipment.

# END OF SECTION 28 4600

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## SECTION 31 11 00 GRUBBING

# PART 1 GENERAL

## 1.01DESCRIPTION

A. This section covers grubbing all areas within the limits of the project

# PART 2 PRODUCTS

## 2.01 NOT APPLICABLE.

## PART 3 EXECUTION

## 3.01 GRUBBING

A. All stumps and roots shall be removed to a depth of 12 inches below the original grade.

## 3.02 DISPOSAL OF MATERIALS

A. The Contractor shall remove all waste materials from the grubbing operations to Contractorfurnished disposal site.

## 3.03 STRIPPING

- A. Remove the overburden from all areas to be excavated. Overburden is defined as all organic materials.
- B. Organic material is defined as all living or dead plant materials, including peat, roots, stumps, and surface debris, and organic silts, commonly referred to as topsoil.

## END OF SECTION 31 11 00

#### SECTION 31 20 00 EARTH MOVING

## PART 1 - GENERAL

#### 1.01DESCRIPTION

A. This section covers the furnishing of materials, labor, equipment, and supervision required to complete the site earthwork construction including roadway, walkway, parking lot, and building excavation, fill, backfill, site grading, and drainage as shown on the contractDrawings.

#### 1.02 TESTING

- A. Where compaction requirements are specified, the maximum soil density shall be determined by one of the laboratory procedures listed below. The particle size distribution of the soil dictates which laboratory procedure should be used.
  - 1. Soils meeting the following gradation requirement and having cohesionless, free-draining characteristics should be tested in accordance with ASTM D 4253 "Maximum Index Density and Unit Weight of Soils Using a Vibratory Table."

| Sieve Size | Percent Passing<br><u>by Weight</u> |
|------------|-------------------------------------|
| 3"         | 100*                                |
| 1-1/2"     | 70-100                              |
| No. 200    | 0-15                                |

2. Soils which do <u>not</u> meet the gradation requirement presented in Item 1 above and which do meet the following gradation requirement should be tested in accordance with ASTM D 1557 "Laboratory Compaction Characteristics of Soil Using Modified Effort [56,000 ft-lb/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>)]."The oversize fraction (retained on the No. 4, three-eighth inch or three-fourth inch sieve, as appropriate) should not be used in performing the D 1557 compaction test. The modified maximum dry unit weight of soils that contain more than five percent oversize should be corrected in accordance with ASTM D 4718, "Correction of Unit Weight and Water Content for Soils Containing Oversize Particles."

| Sieve Size | Percent Passing<br><u>by Weight</u> |
|------------|-------------------------------------|
| 3"         | 100*                                |
| 3/4"       | 70-100                              |

- 3. Soils that do <u>not</u> meet the gradation requirements presented in Items 1 and 2 above should be tested in accordance with one of the methods listed above that have been modified with the concurrence of the project geotechnical engineer.
- B. The in-place soil density shall be determined in accordance with:

| ASTM D 6938 | Standard Test Method for in-place Density and Water Content of |
|-------------|----------------------------------------------------------------|
|             | Soils and Soil-Aggregate byNuclear Methods (Shallow Depth)     |

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- C. In-place density tests shall be taken on each lift of fill or backfill in the parking lots at the rate of one test per 5,000 square feet of compacted work area. Failing test areas shall be recompacted and retested until the compaction requirements are met. The Contractor shall perform a new gradation and hydrometer test for each 5,000 cubic yards of furnished material and each time the furnished material changes from that which was previously approved.
- D. In-place density tests shall be taken on each lift of building fill or backfill at the rate of one test per 3,000 square feet of compacted work area and one test per every 200 linear feet of continuous footing, and one for every other interior and perimeter column footing for these same three buildings. Failing test areas shall be recompacted and retested until the compaction requirements are met. A new gradation and hydrometer test shall be performed for each 3,000 cubic yards of furnished material and each time the furnished material changes from that which was previously approved.
- E. In-place density tests shall be taken on each lift of fill or backfill on driveways and access roads at the rate of one test per 150 linear feet of compacted work area. Failing test areas shall be recompacted and retested until the compaction requirements are met. A new gradation and hydrometer test for each 3,000 cubic yards of furnished material and each time the furnished material changes from that which was previously approved.

## 1.03 SUBMITTALS

A. Contractor shall submit a gradation test in accordance with ASTM D 422 on each type and source of material used in fills and backfills. If material is to be non-frost susceptible (NFS), hydrometer tests shall be performed in accordance with ASTM D 422.

## 1.04 DEFINITIONS

- A. NFS Material: NSF material is sand, gravel, crushed stone, or mixtures thereof, which contains no more than three percent particles finer than 0.02 mm by weight.
- B. Classified Material
  - 1. NFS, unfrozen, inorganic soils meeting the following gradation requirements for the minus three-inch fraction.

| <u>Sieve Size</u> | Percent Passing  |
|-------------------|------------------|
| 3"                | <u>by Weight</u> |
| 3                 | 100*             |

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| 1-1/2"  | 70-100 |
|---------|--------|
| 3/4"    | 30-100 |
| 1/2"    | 25-100 |
| No. 4   | 20-49  |
| No. 40  | 0-25   |
| No. 200 | 0-6    |
| 0.02 mm | 0-3    |

\* The fill may contain up to 10% cobbles.

- 2. Unclassified Material: Inorganic soils free of trash, peat, volcanic ash, debris, or frozen clods, which are capable of being satisfactorily compacted as required by the plans and these specifications.
- 3. Unsuitable Material: Soil materials that do not qualify as "classified" or "unclassified" materials.
- 4. General Excavation: Any excavation of any type of material, including rock and frozen material, within the limits of excavation as shown on the Drawings or called for in the specifications.
- 5. Over-Excavation: Any excavation beyond limits of the contract that has been done without the authorization of the Owner's Representative.
- 6. Subgrade: The surface upon which classified or unclassified material is placed.
- 7. Area Grading: Area grading consists of the excavation and fill work along the perimeter of the site necessary for a smooth transition from the design site grades to the grade(s) of the adjacent properties. This work is also commonly called "site grading" or "overlot grading."
- 8. Work Area: For purposes of determining the number of required in-place density tests, work area is defined as the location where fill is being actively placed at any one time. The work area could be the entire site or a small fraction of the site depending on how the earthwork is performed.

# PART 2 - PRODUCTS

## 2.01 MATERIALS

- A. Pipe
  - Corrugated Polyethylene Pipe (CPEP): All CPEP shall conform to the requirements of AASHTO M-294 and ASTM F 667-84a. Piping shall be ADS N-12 Corrugated Polyethylene Pipe manufactured by Advanced Drainage Systems, Inc., 3300 Riverside Drive, Columbus, Ohio 43221, (614) 457-3051, or approved substitution. Pipe shall have a corrugated outer surface and smooth inner surface.
- B. Pipe Bedding
  - 1. Pipe bedding shall be Municipality of Anchorage standard specification Class C or alternate approved by the Engineer.

## PART 3 – EXECUTION

## 3.01 CONSTRUCTION STAKING

- A. The Contractor shall furnish the following surveys for construction staking:
  - 1. Grade stakes shall be placed to show cuts or fills to finish grade. These may be preserved or referenced by the Contractor to serve for both excavation and subsequent backfill operations.
  - 2. Culverts shall be located with two offset stakes at each end showing location and the cut or fill to the invert.

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## 3.02 EXCAVATION

## A. General

- 1. Excavation consists of the removal and reuse or disposal of all materials encountered to obtain the required subgrade elevations and to remove organics.
- 2. Classified and unclassified excavated materials shall not be removed from the site unless they are surplus to the requirements of the work. The Drawings indicate the extent of the excavation required.
- 3. The Contractor shall conform to the elevations and dimensions shown on the Drawings, within a tolerance of 0.10 feet for roads, parking areas, walkways, and 0.05 for building areas.
- 4. The excavation shall be shaped to drain and shall be maintained in a dry condition, free of puddles or holes where water may accumulate. The Contractor shall plan his operation in a sequence that will provide drainage at all times. Any areas that cannot be so drained shall be kept free of standing water by pumping, if necessary.
- 5. Excavation shall be performed in a manner that will not endanger adjacent structures or improvements.
- 6. If hazardous materials of any kind are encountered in the excavation, Contractor shall immediately notify the Owner's Representative and stop excavation until the Owner has determined how to deal with it.
- B. Roadways, Parking Areas, Walkways
  - 1. Excavation shall be carried to the subgrade elevations required for the placement of classified material per the site and roadway cross sections. Existing peat found below the bottom of classified fill can remain in place under parking lots, roadways, and sidewalks.
- C. Building Areas
  - 1. Excavation consists of the removal and reuse or disposal of all materials encountered to obtain the required subgrade elevations. Subgrade for footings is at the bottom of footings or six inches below the bottom of unsuitable materials as determined from the test boring data, whichever is deeper. Subgrade for floor slabs is bottom of slab or six inches below the bottom of unsuitable materials as determined from the test boring data, whichever is deeper.
- D. Stability of Sides
  - 1. The Contractor shall slope the sides of excavations to the angle required for safety or shore and brace where sloping is not possible either because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in a safe condition until completion of backfilling by scaling, benching, shelving, or bracing. Take precautions to prevent slides or cave-ins when excavations are made in locations adjacent to backfilled excavations and when sides of excavations are subjected to vibrations from vehicular traffic or the operation of machinery or any other source. In all cases the sides of all excavations shall be constructed to satisfy the requirements set forth in the local, state, and federal safety regulations regarding shoring and slope angle.

## 3.03 FILL AND BACKFILL

- A. General
  - 1. Fill and backfill consists of the placement of classified and/or unclassified material in layers to the required elevations.
  - 2. The Contractor shall keep all fills and backfill well shaped, drained, and maintained.
- B. Roads, Parking Areas, Walkways
  - 1. Fills and backfills shall be constructed of classified or unclassified materials as shown on the Drawings.
  - 2. Fills and backfills shall be constructed in lifts of 12-inch maximum thickness, [six-inch maximum thickness if hand-operated compactors are used] and compacted to not less

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than 95 percent of maximum density. The finished surface of fills and backfills shall be smooth with no soft or yielding areas and shall be graded to not more than 0.05 feet above or below the design grade.

- 3. The Contractor shall backfill excavations as promptly as the work permits, but not until completion of the following:
  - a. Owner's acceptance of construction below finish grade such as culverts, subdrains, and other utilities.
  - b. Inspection, testing, approval, and recording locations of underground utilities.
  - c. Removal of shoring and bracing and backfilling of any resulting voids with satisfactory materials.
  - d. Removal of trash and debris.
  - e. Placement of permanent or temporary horizontal bracing on earth retaining walls.
- C. Building Areas
  - 1. Fill and backfill consists of the placement of classified backfill material in layers to the required elevations.
  - 2. The Contractor shall place 4 inches of 2 inch minus compactable material under building slabs to provide a uniform working surface.
  - 3. For backfilling around footings the Contractor shall use classified material. Unless the surface is to be paved, the backfill shall be carried to within 12 inches of final grade around perimeter or other footings exposed to freezing and/or surface water. Complete the backfill with compacted less permeable soil, (sandy silt, silty sand, or silt) to provide a surface seal.
  - 4. Under interior building slabs, fills and backfills shall be constructed of classified material.
  - 5. Fills and backfills shall be constructed in lifts of 12-inch maximum thickness [6 inch maximum thickness if hand-operated compactors are used] and be compacted to not less than 95 percent of maximum density.
  - 6. The finished surface shall be smooth with no soft or yielding areas and shall be graded to not more than 0.05 feet above or below the design finish grade.
- D. Grading Outside Building Lines
  - 1. Areas outside the building lines shall be graded to provide drainage away from the structure and to prevent ponding of water. Slope shall be a minimum of two percent for 10 feet from the building unless shown otherwise on the Drawings.
- E. Grading Surface of Fill Under Building Slabs
  - 1. The Contractor shall grade the surface of fill under building slabs smooth and even, free of voids, compacted as specified and to required elevation. Provide final grades within a tolerance of one-fourth inch when tested with a 10-foot straightedge.
  - 2. During grading, the Contractor shall compact subgrade surfaces to the depth and percentage of maximum density for each area classification.

## 3.04 AREA GRADING

A. Area grading fill shall be constructed of unclassified material. The top six inches shall have a maximum particle size of six inches. The fill material shall be placed in lifts of 12-inch maximum thickness; six-inch maximum thickness if hand-operated compactors are used and shall be compacted to not less than 90 percent of maximum density. Lift thickness up to 24 inches maybe allowed in selected areas with permission of the geotechnical engineer. The finished surface of the fill shall be smooth with no soft or yielding areas and shall be graded to not more than 0.10 feet above or below the design finish grade. In those areas where the grade at the limit of grading is above or below the elevation of the adjoining natural surface, the design finish grade shall be maintained to the limit of grading and the edge of the cut or fill feathered off to make a smooth transition to the adjoining natural surface.

## 3.05 CULVERTS

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- A. Pipe culverts shall be placed in open trenches either in an excavation in the existing ground or a previously placed compacted embankment. The elevation of the existing ground or previously placed and compacted embankment shall be at least as high as the top of the proposed culvert prior to excavating the trench.
- B. The trench shall be excavated as nearly vertical as safety codes allow and only to such width as necessary to place the pipe and to provide for sufficient working room outside the pipe to properly compact the backfill under the lower half of the pipe. The trench excavation shall be so shaped that at least the lower one-tenth of the outside circumference of the pipe will be in contact with the bottom of the trench as excavated for the entire length of the pipe. Where rock, hardpan, boulders, or fragmented material is encountered, the trench shall be excavated six inches below the elevation established for the bottom of the pipe, and this excess depth shall be backfilled with classified backfill.
- C. Corrugated metal pipe shall be so laid that flow is over the lap of the sheets. Field joints shall be made by butting the ends of pipe together and the sections joined with a corrugated band bolted firmly in-place. Longitudinal laps shall be located at the horizontal axis.
- D. All pipes shall be laid true to the designated line, grade, and camber. They shall be fitted and matched so that when laid in the trench they will form a smooth and uniform invert.
- E. The backfilling material in the trench above the pipe bed shall be classified fill and shall be carefully placed and thoroughly rammed, tamped or vibrated around the pipe in layers not exceeding six inches in depth to the elevation of the top of the pipe. The entire length of each layer of backfill shall be thoroughly compacted before the succeeding layer is placed. The remaining backfill shall be placed in lifts of 12-inch maximum thickness (six-inch maximum thickness if hand-operated compactors are used) and compacted to not less than 95 percent maximum density.

END OF SECTION 31 20 00

## **SECTION 32 05 05**

## SELECTIVE DEMOLITION FOR EXTERIOR IMPROVEMENTS

#### GENERAL

## **1.01SECTION INCLUDES:**

A. The Work under this Section consists of performing all operations pertaining to the removal and disposal of sidewalks and concrete aprons designated for removal, including wire mesh or steel reinforcement within the concrete sidewalk and apron, in accordance with the limits shown on the Drawings or as directed by the Engineer.

## 1.02 CONSTRUCTION

A. Sidewalks or concrete aprons to be removed shall be saw cut or broken at a joint. Broken joints shall be finished, as required by the Engineer, to eliminate jagged edges. The Contractor shall dispose of this material at a Contractor-provided disposal site as delineated in MASS Division 10, Section 10.04, Article 4.9 – Disposal Sites. AHJ: Authority (Authorities) Having Jurisdiction.

## 1.03 MEASUREMENT

A. Sidewalk and concrete apron designated for removal will be measured in square yards

## 1.04 BASIS OF PAYMENT

- A. Payment for this Work shall be in accordance with MASS Division 10, Section 10.07 -Measurement and Payment, and shall include full payment for all Work described in this Section.
- B. Payment shall be made under the following unit:

ITEM

Remove Sidewalk

Remove Concrete Apron

Square Yard

UNIT

Square Yard

END OF SECTION 32 05 05

## SECTION 32 10 00 BASES, BALLASTS, AND PAVING

## PART 1 - GENERAL

## 1.01DESCRIPTION

A. The Contractor shall provide all labor, material, equipment, and supervision necessary for the furnishing and placing of the aggregate leveling course and the bituminous concrete pavement as shown on the Drawings.

## 1.02 TESTING

- A. The maximum soil density of the leveling course shall be determined in accordance with ASTM D 4253, "Maximum Index Density and Unit Weight of Soils Using A Vibratory Table".
- B. The in-place density of the leveling course shall be determined in accordance with:
- C. ASTM D 6938Standard Test Method for in-place Density and Water Content of Soils and Soil-Aggregate by Nuclear Methods (Shallow Depth)
- D. The tests shall be taken at a rate of one test per 5,000 square feet.
- E. The Marshall density, stability, and flow of the asphalt pavement shall be determined in accordance with ASTM D 1559, "Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus." The Marshall series shall be performed at the start of paving and each time the mix is changed.
- F. The asphalt content of the pavement shall be determined in accordance with ASTM D 2172, "Quantitative Extraction of Bitumen from Bituminous Paving Mixtures." The gradation of the extracted aggregate shall be determined in accordance with AASHTO T-30, "Mechanical Analysis of Extracted Aggregate." The fracture count of the coarse aggregate shall be determined in accordance with WAQTC TM-1, "Determination of Percentage of Fractured Particles." The theoretical maximum density shall be determined in accordance with ASTM D 2041, "Theoretical Maximum Specific Gravity and Density of bituminous Paving Mixtures." Maximum density tests shall be performed at the rate of one set of tests per days paving and per each 500 tons of asphalt paving placed.
- G. The thickness and density of the compacted pavement shall be determined in accordance with ASTM D 2726, "Bulk Specific Gravity of Compacted Bituminous Mixtures Using Saturated Surface-Dry Specimens," and ASTM D 3549, "Thickness or Height of Compacted Bituminous Paving Mixture Specimens."

## 1.03 SUBMITTALS

- A. The contractor shall submit aggregate suitability test results showing compliance with the following Specifications for each source of bituminous pavement aggregate. The testing must have been completed within the previous 24 months.
  - Wear <= 45 after 500 revolutions: ASTM C 131, "Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine"
  - Degradation Value >= 30: ATM T-13, "Degradation of Aggregate"
  - Sodium Sulfate Loss, 5 Cycles, (Coarse Aggregate) <= 9: ASTM C 88, "Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate"
  - Sodium Sulfate Loss, 5 Cycles, (Fine Aggregate) <= 15: ASTM C 88, "Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate"
- B. The Contractor shall submit asphalt cement test results showing compliance with Section 2.2 Bituminous Concrete.
- C. The Contractor shall submit aggregate coating and stripping test results performed in accordance with ATM T-14, "Coating and Stripping of Bitumen-Aggregate Mixtures." The quantity of required

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anti-stripping additive to result in more than 70 percent asphalt retention shall be determined and supplied with the asphalt cement. The test must have been performed within the previous 12 months.

D. The Contractor shall submit an asphalt pavement mix design showing compliance with the following Specifications for each mix specified. The mix design must be performed in accordance with the procedure set forth in the "Asphalt Institute Manual Series No. 2, (MS-2)," <u>Mix Design Methods for Asphalt Concrete</u>, most recent edition.

## PART 2 – PRODUCTS

## 2.01 LEVELING COURSE

- A. The leveling course shall conform to DOT&PF Standard Specifications for Highway Construction 2004 Edition, Section 703, Aggregates:
- B. Gradation shall be D-1.
- C. Other leveling course gradations may be acceptable if approved by the Engineer. Recycled asphalt pavement (RAP) may be used for leveling course if approved by the Engineer.

## 2.02 BITUMINOUS CONCRETE

A. The bituminous concrete mix design shall conform to MASS class D.

## **PART 3 - CONSTRUCTION**

## 3.01 CONSTRUCTION STAKING

- A. The Contractor shall provide construction staking (blue tops) for establishing proper grades on the leveling course.
- B. Roadways will be staked along centerline and both edges at 50-foot stations plus breaks in grade. Large area paving will be staked on a 50-foot grid plus breaks in grade.
- C. The Contractor shall place redheads for pavement surface control by reference to the bluetops. Replacement of missing bluetops shall be at the Contractor's expense.
- D. GPS equipped graders and dozers can be used in place of bluetops and redtops.

## 3.02 LEVELING COURSE CONSTRUCTION

- A. The purpose of the leveling course material is to provide a smooth, stabilized surface on which to place the pavement. The leveling course shall be placed to the lines and grades shown on the Drawings and shall consist of the materials specified herein. The thickness of the leveling course shall be 2 inches unless otherwise shown on the drawings.
- B. Preparation shall consist of dressing, shaping, and compacting the underlying material to a minimum density of 95 percent. Surfaces shall be cleaned of all foreign substances and debris. Any ruts or soft yielding spots that may appear in the subbase surface shall be corrected by loosening, removing, and adding approved material, reshaping and recompacting the affected areas to line and grade and to the specified density requirements.
- C. The approved leveling course material shall be deposited and spread in a uniform layer to the required contour and grade and to such loose depth that when compacted to the density required, the layer will be the required depth as shown on the drawings. The material shall be spread uniformly on the prepared surface from moving vehicles or spreading boxes, then leveled to the required contour and graded with blade graders. Portions of the layer that become segregated in spreading shall be removed and replaced with a satisfactory mixture or shall be remixed to the required gradation.

D.

- E. The leveling course shall be rolled until compacted to at least 95 percent of the maximum density. Blading, rolling and tamping shall continue until the surface is smooth. The finished leveling course shall be maintained by the Contractor in the above condition until the pavement is applied.
- F. The surface of the leveling course shall not show any deviation in excess of three-eighth inch when tested with a 10-foot straightedge applied parallel with and at right angles to the centerline of the area to be paved. The surface grade shall not deviate more than ±0.05-foot from the plan grade. Any deviation in excess of this amount shall be corrected by loosening, adding, or removing material and reshaping and compacting to satisfy the requirements.

## 3.03 BITUMINOUS CONCRETE PLANTS AND PAVING EQUIPMENT

- A. All equipment shall be in good working order and free of bituminous concrete buildup.
- B. Mixing plants shall conform to AASHTO M156, "Requirements for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures."
- C. Trucks used for hauling asphalt mixtures shall have tight, clean, smooth metal beds that have been thinly coated with a minimum amount of paraffin oil, lime water solution or other approved manufactured asphalt release agents. Diesel fuel or fuel oil shall not be used as an asphalt release agent.
- D. Pavers shall be self-propelled units provided with a heated vibratory screed. Grade and cross slope shall be controlled using automatic grade and slope control devices. The paver screed control system shall be automatically actuated by the use of an erected string line or a mobile stringline (ski) at least 30 feet in length on the high side of the paver. Grade control shall be used either on both the high and low sides or on the high side and slope control on the low side.
  - 1. The paver shall be equipped with a receiving hopper having sufficient capacity for a uniform spreading operation. The hopper shall be equipped with a distribution system to place the asphalt concrete mixture uniformly in front of the screed.
  - 2. The screed assembly shall produce a finished surface of the required smoothness, thickness and texture without tearing, shoving or displacing the bituminous concrete mixture. Screed extensions used for paving a constant width shall be heated and vibrated. Auger extensions shall be within one and one-half feet of the screed extensions on both sides.
  - 3. The use of a pickup machine to transfer the bituminous concrete mixture from a windrow to the paver hopper will be permitted, provided the pickup machine is capable of collection of the windrowed material without damage to the underlying course. The continued use of the pickup machine will not be allowed if segregation, excessive temperature loss, or any detrimental effects are observed.
- E. The Contractor shall supply a sufficient number and weight of rollers to compact the mixture to the required density while maintaining the pace of the paving operations. Rollers shall be of the static steel wheel, vibratory steel wheel, and pneumatic tire type, self propelled and capable of reversing without backlash. They shall be specifically designed to compact hot bituminous concrete mixtures. The use of equipment that results in crushing of the aggregate will not be permitted.

## 3.04 BITUMINOUS CONCRETE PAVING

- A. Existing surfaces shall be prepared in conformance with the Drawings and Specifications. Existing paved surfaces shall be cleaned of loose material by sweeping with a power broom, supplemented by hand sweeping, if necessary.
  - 1. Contact surfaces of curbing, gutters, manholes, and other structures shall be coated with a thin, uniform coating of tack coat material in conformance with Item G in this section prior to the concrete mixture being placed.
  - 2. Surfaces that have received a prime coat shall be allowed to cure. Surfaces that have received an emulsion tack coat shall be allowed to break prior to placement of the bituminous concrete mixture.

- B. A continuous supply of the asphalt cement shall be supplied to the mixer at a uniform temperature, within 25 degrees Fahrenheit of the Job Mix Design mixing temperature.
- C. The aggregates for the bituminous concrete mixture shall be heated and dried to a temperature compatible with the mix requirements specified. Flames used for drying and heating shall be properly adjusted to avoid damage to the aggregate and to avoid the presence of unburned fuel on the aggregate. Any asphalt concrete mixture in which soot or fuel is present shall be wasted and no payment made.
  - 1. Drying operations shall reduce the aggregate moisture content so that the moisture content of the bituminous concrete mixture, sampled at the pint of acceptance for asphalt cement content, shall be no more than 0.5 percent (by total weight of mix), as determined by ATM T-25, "Determination of Moisture in Hot Asphalt Pavement Mixes."
- D. The aggregate, asphalt cement and additives shall be combined in the mixer in the amounts required by the job mix design.
  - The materials shall be mixed such that a complete and uniform coating of the aggregate is obtained. For batch plants, dry aggregate shall be placed in motion immediately prior to the addition of asphalt cement. Wet mixing time shall be adequate to obtain 98 percent coated particles when tested in accordance with AASHTO T195, "Determining Degree of Particle Coating of Bituminous-Aggregate Mixtures."
- E. The bituminous concrete mixture shall be laid on the leveling course, spread and struck off and compacted to the required compacted thickness. Asphalt pavers shall be used to distribute the asphalt concrete mixture in lanes of such widths as to hold to a practical minimum the number of longitudinal joints required, subject to the requirement of Item G in this section.
  - 1. On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impracticable, the bituminous concrete mixture shall be spread, raked and luted by hand tools. For such areas, the bituminous concrete mixture shall be placed to the compacted thickness.
  - 2. Any asphalt concrete mixture that is contaminated or segregated will be rejected.
- F. Immediately after the bituminous concrete mixture has been spread, struck-off and surface irregularities adjusted, it shall be thoroughly and uniformly compacted by rolling.
  - 1. The bituminous concrete shall be compacted to a density of 93 ± one percent of the theoretical maximum density determined in accordance with ASTM D2041, "Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures."
  - 2. Area not accessible to the rollers shall be graded with rakes and lutes and compacted with mechanical tampers. For depressed areas, a trench roller may be used to achieve the required compaction.
  - 3. Any bituminous concrete mixture that becomes loose and broken, segregated, mixed with dirt, or is in any other way defective, shall be removed and replaced with fresh hot bituminous concrete, which shall be compacted to conform to the surrounding area. Any area showing an excess or deficiency of asphalt cement shall be removed and replaced.
  - 4. Rollers or other vehicles shall not be parked or left standing on pavement that has not cooled sufficiently to prevent indentation by wheels.
- G. Joints shall be constructed to ensure a continuous bond between old and new section of the course. All joints shall present the same texture and smoothness as other sections of the course.
  - 1. When joining old existing pavement and new pavement, the old pavement shall be cut in a neat line.
  - 2. Improperly formed joints resulting in surface irregularities shall be removed full depth, replaced with new material, and thoroughly compacted. Rolling of joints after the material has cooled

- 3. below 160 degrees Fahrenheit shall not be allowed. All pavement removal shall be precut to a neat line.
- 4. A thin tack coat of asphalt cement or asphalt emulsion shall be applied on all cold (less than 160 degrees Fahrenheit) joints and allowed to break prior to placing any fresh bituminous concrete mixture against the joint. This work shall be completed by the Contractor just prior to paving.
- 5. Transverse joints shall be formed by cutting back on the previous run to expose the full depth of the course or by using a removable bulkhead.
- 6. The longitudinal joints in one layer shall offset those in the layer immediately below by at least six inches. The joints shall be at centerline or lane lines.
- H. The surface shall be tested after final rolling at selected locations using a 10-foot straightedge. The variation of the surface from the testing edge of the straightedge between any two contacts with the surface shall not exceed three-sixteenths of one inch.
- I. Any bituminous concrete mixture that becomes contaminated with foreign material or is any way defective as determined by the Owner's Representative shall be removed. Skin patching will not be permitted. Defective materials shall be removed for the full thickness of the course. The pavement shall be cut so that the sides are perpendicular or parallel to the direction of traffic and so that the edges are vertical. Edges shall be coated with a thin tack coat of material in accordance with Item G in this section. Fresh bituminous concrete mixture shall be placed so that the finished surface will conform to the grade and smoothness requirements. The bituminous concrete mixture shall be compacted to the density specified. No payment shall be made for material replacing defective material. All costs associated with the patching of defective areas shall be paid by the Contractor.

END OF SECTION 32 10 00

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## SECTION 32 16 00 CONCRETE SIDEWALKS

## PART 1 - GENERAL

## 1.01DESCRIPTION

A. The work covered by this section consists of furnishing plant, labor, equipment, and material for construction of Portland cement concrete sidewalks, and miscellaneous concrete work as shown on the Drawings and covered by this specification. Applicable portions of this specification shall cover concrete such as post footings, etc.

## 1.02 SUBMITTALS

A. Contractor shall submit a concrete mix design for approval.

## PART 2 - PRODUCTS

## 2.01 CONCRETE MIX

- A. Mix design shall be prepared by a recognized laboratory using aggregates from job stockpiles or standard mix from local ready-mix supplier in accordance with ASTM Specification C94, Alternate No. 2. Submit for approval prior to use. No salts or other additives shall be used unless specifically authorized.
- B. Concrete materials shall conform to the following specifications:
  - 1. Aggregates: ASTM C33.
  - 2. Cement: ASTM C150, Type I or II.
  - 3. Air Entraining Admixture: ASTM C260.
  - 4. Water Reducing Admixture: ASTM C494, Type A.
- C. Specifications for Mix
  - 1. Sidewalks: 4,000 psi compressive strength at 28 days, and a water cement ratio of .45
  - 2. Entrained air content 6 percent, plus or minus 1-1/2 percent.
  - 3. Four-inch slump, maximum.
  - 4. Three-quarter inch maximum aggregate size.

## 2.02 CURING MATERIALS

- A. Curing materials shall be of the following types:
  - 1. Membrane curing compound conforming to ASTM C-309.
- B. JOINT SEALANT
  - 1. Joint sealant for sidewalk expansion joints shall be polyurethanes

## **PART 3 - EXECUTION**

## 3.01 SAMPLING AND TESTING

- A. Sampling and testing shall be done by the testing service for at least one set of three cylinders for each day's pour or every 100 cubic yards within each class, type, and/or source of concrete placed. Slump and air tests shall be performed for each set of cylinders taken.
- B. Types and sizes of cylinders shall conform to ASTM C-31 and tested in accordance with ASTM C-39. Slump tests shall be performed in accordance with ASTM C-143. Air tests shall be performed in accordance with ASTM C-231.

## 3.02 WEATHER LIMITATIONS

A. Except under special conditions, concrete shall be mixed and placed only when the air temperature is at least 40 degrees Fahrenheit. For placing at lower temperatures where permission is obtained from the Owner Project Manager, all materials shall be heated. Means

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shall be provided for maintaining the concrete at a temperature of at least 50 degrees Fahrenheit for 72 hours after placing. Concrete shall be protected from freezing temperatures for the first seven days after placement. The concrete shall be covered with a canopy and heaters (with adequate ventilation) placed under the canopy to heat the air over the concrete or an insulating blanket cover shall be placed over the concrete whenever the air temperature drops below 32 degrees Fahrenheit within the seven-day curing period. Methods proposed for heating materials and protecting the concrete shall be approved by the Owner. Salt, chemicals, and other material shall not be mixed with the concrete to prevent freezing. Placing of concrete shall not be undertaken whenever there is standing water in the forms, the subgrade is soggy due to rain or if rain is indicated.

## 3.03 SUBGRADE AND FORMS

## A. General

- Prior to placement of forms, ensure that subgrade is smooth, compacted, and free of frozen or soft or yielding spots, and that compaction is at least 95 percent of maximum density. Backfilling within the forms will be permitted if the subgrade is brought to the above specification and care is taken to maintain the forms to line, shape, and elevation.
- B. Construction Stakes
  - 1. The Contractor shall set control stakes at breaks in grade and on even grade at intervals not to exceed 50 feet with additional stakes at vertical curves.

## C. Forms

- 1. Forms shall be of wood or steel. Forms shall be thoroughly clean. All forms shall be set to the line and grade and shall be braced to resist deformation or displacement under load. Before placement of concrete, forms shall be lightly oiled with a good grade of lubricating oil. Wooden forms may be watered immediately in advance of the placement of concrete. Concrete shall not be poured until all forms have been inspected and approved.
- 2. Where wood forms are used, concrete shall cure a minimum of two days prior to removal of the forms. Steel forms may be removed after one day. Special care shall be taken to avoid spalling of edges.
- 3. If concrete is to be placed by the extruded method, the Contractor shall demonstrate that the machine is capable of placing a dense, uniformly compacted concrete to exact section, line, and grade.

## 3.04 CONSTRUCTION

- A. Concrete shall be handled from transport vehicle to the place of final deposition in a continuous manner and as rapidly as practicable. Forms shall not be splashed with concrete in advance of pouring. The concrete shall be deposited in the forms as nearly as possible in final position to avoid rehandling in the forms. Where the vertical drop is more than three feet, elephant trunks shall be used.
- B. Immediately after depositing, concrete shall be compacted by thoroughly agitating. Hand puddling or spading shall be used along the edges, corner, and angles of the forms. Where spacers are used in curb and gutter forms at points other than dummy joints, they shall be removed before initial set of the concrete, the concrete thoroughly puddled and mixed, and the void carefully filled with concrete.

# 3.05 FINISHING

- A. Exposed concrete shall be finished in a neat and workmanlike manner and present a uniform appearance when completed. Exposed surfaces shall be free of voids, tool marks, and unsightly irregularities. Particular attention shall be paid to the constructing and finishing of joints and edges.
- B. Unsightly, sloppy or poorly finished surfaces will constitute grounds for rejection of the particular piece of work involved. The surface of sidewalks and sidewalk crossings shall be struck off by means of a straightedge supported on the side forms with sufficient concrete maintained ahead of

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the straightedge at all times to assure a dense, even surface. When the concrete has reached a proper set, the surface shall be finished with a wood float. All exposed or unprotected edges shall be tooled to a radius of not more than one-half inch. Final finish shall be obtained by brooming the surface, including the tooled edge, to a gritty finish after all free moisture has disappeared from the surface. Sprinkling of cement or sand for blotting will not be permitted.

## 3.06 JOINTS

- A. Expansion joints shall be placed along all structures and about all features that project into, through or against the concrete. An expansion joint shall be constructed at the intersection of sidewalks, between sidewalk crossings and sidewalks, and elsewhere as shown on the Drawings. Expansion joint material shall conform to the requirements of ASTM D-994. This material shall extend the full width of the structure and shall be cut to such dimensions that the base of the expansion joint shall extend to the subgrade and the top shall be depressed not less than one- fourth inch nor more than one-half inch below the finished surface of the concrete. The material shall be of one piece in the vertical position in full contact with the existing concrete face against which fresh concrete is to be poured. After the concrete has set, the expansion joints shall be filled flush to the finished concrete surface with joint sealant.
- B. Application temperature of the sealing asphalt shall be between 250 degrees and 350 degrees Fahrenheit. Sealing asphalt shall be applied by pouring from a bucket with a V-shaped spout equipped with a positive shutoff to prevent spilling or dripping of asphalt. Before sealing, the joint shall be cleaned of all dirt, oil, gravel, concrete mortar or other extraneous material. Sealing shall be done in a neat, workmanlike manner. Sloppy work in sealing of expansion joints will not be tolerated.
- C. Transverse contraction joints cut a depth of one inch prior to the final set of the concrete shall be tooled in the sidewalks at intervals approximately equal to the width of the sidewalk.

## 3.07 PATCHING CONCRETE

- A. All concrete surfaces shall be inspected upon removal of forms and if they are found to contain voids, faulty joints, pockets or other areas deviating from the intent of the Drawings and specifications, they shall be classified as defective.
- B. All defective areas shall be removed and replaced or patched at the Contractor's expense. Patching will be allowed only if permission to patch is granted by the Owner. Such permission shall not be construed as an acceptance of the work or as a waiver of the Owner Project Manager to require the complete removal of the work if, in his opinion, the patch did not satisfactorily restore the quality or appearance of the surface to that intended or desired.
- C. Concrete which deviates from the design dimensions or elevations by more than one-half inch shall not be patched or repaired but shall be removed and replaced at the Contractor's expense.
- D. Any concrete which is removed shall be sawcut or removed to an expansion joint so that no ragged or rough edges result.

## 3.08 CURING

A. Curing compounds to be used and applied in strict conformance with the manufacturer's recommendations and ASTM C-309. Approval of the Contractor's use of such curing compounds shall not be construed as relieving him of the responsibility of protecting all concrete surfaces from the effects of adverse weather conditions by supplemental methods.

## END OF SECTION 32 16 00

## **SECTION 32 17 23 PAVEMENT MARKINGS**

## PART 1 - GENERAL

## **1.01DESCRIPTION**

A. This section consists of furnishing all materials and labor and equipment necessary to paint parking lines and traffic control markings as shown on the Drawings.

## 1.02 SUBMITTALS

A. The Contractor shall submit for approval manufacturer's specifications, drawings, and recommendations for all materials incorporated into the project. The submittal shall include manufacturer's published data, engineering data, letter of certification or certified test laboratory report indicating that each material complies with specified standards and other requirements.

## PART 2 - PRODUCTS

## 2.01 MARKING PAINT

A. Use a traffic line marking paint conforming to AASHTO M248, Type F (alkyd resin) or Federal Specification TT-P-19D(1) paint, latex (acrylic emulsion, exterior).

## **PART 3 - EXECUTION**

## 3.01 MARKING

- A. Unless otherwise shown on the Drawings, all lines shall be four inches wide. Color shall be yellow. Spacing and length shall be as shown on the Drawings.
- B. Sweep surface with power broom supplemented by hand brooms to eliminate loose material and dust. Do not begin marking asphalt surfacing until the surface has been inspected and approved. The surface shall be thoroughly dry prior to and during application. Paint with mechanical equipment providing uniform straight edges. Apply evenly at the manufacturer's recommended rates.
- C. Contractor shall lay out the dimensions for painting. Parking lot stalls shall be measured from edge of pavement.

## END OF SECTION 32 17 23

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## SECTION 32 3300 SITE FURNISHINGS

## <<<< UPDATE NOTES

## PART 1 GENERAL

- 1.01 SECTION INCLUDES
  - A. Benches.
  - B. Waste receptacles.
  - C. Bike racks

## 1.02 RELATED REQUIREMENTS

- A. Section 03 3000 Cast-in-Place Concrete: Bollard infill and underground encasement.
- B. Section **05 5000 Metal Fabrications**: Anchors to attach site furnishings to mounting surfaces.

## 1.03 REFERENCE STANDARDS

- A. AAMA 611 Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).
- B. AAMA 2604 Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2017a.
- C. ADA Standards Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- D. ASTM A36/A36M Standard Specification for Carbon Structural Steel; 2014.
- E. ASTM A53/A53M Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2020.
- F. ASTM A500/A500M Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2021.
- G. ASTM A536 Standard Specification for Ductile Iron Castings; 1984, with Editorial Revision (2019).
- H. ASTM A666 Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.
- I. ASTM A999/A999M Standard Specification for General Requirements for Alloy and Stainless Steel Pipe; 2018.
- J. ASTM B221M Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.
- K. ASTM B221 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2020.
- L. ASTM B26/B26M Standard Specification for Aluminum-Alloy Sand Castings; 2018, with Editorial Revision.
- M. ASTM B211/B211M Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire; 2019.

#### 1.04 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's specifications and descriptive literature, installation instructions, and maintenance information.
- C. Shop Drawings: Indicate plans for each unit or group of units, elevations with model number, overall dimensions, construction, and anchorage details.
- D. Samples: Submit one set of manufacturer's available colors for metal furnishings and steel bollards
- E. NSI Installer Qualification: Documentation of Natural Stone Institute Accreditation.

## 1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least thirty years of documented experience.

# 1.06 WARRANTY

- A. See Section 01 7800 Closeout Submittals, for additional warranty requirements.
- B. Provide manufacturer's standard warranty against defects in materials or workmanship from Date of Substantial Completion.

# PART 2 PRODUCTS

# 2.01 MANUFACTURERS

- A. Metal Furnishings:
  - 1. Victor Stanley, Inc: vitorstanley.com
  - 2. Substitutions: Not permitted.
- B. Steel Pipe Bollards:
  - FairWeather Site Furnishings<< ; \_\_\_\_\_; or None N/A>>: www.fairweathersf.com/#sle.
  - 2. Huntco Supply, LLC<< ; \_\_\_\_\_; or None N/A>>: www.huntco.com/#sle.
  - 3.
  - 4. Substitutions: << See Section 01 6000 Product Requirements; or Not permitted>>.
- C. Cast Iron Bollards:
  - Architectural Iron Company, Inc<< ; \_\_\_\_\_; or None N/A>>: www.architecturaliron.com/#sle.
  - BollardsUSA, a division of J. R. Hoe & Sons<< ; \_\_\_\_\_; or None N/A>>: www.bollardsusa.com/#sle.
  - 3. Neenah Foundry, a division of Neenah Enterprises, Inc<< ; \_\_\_\_; or None N/A>>: www.nfco.com/#sle.
  - 4. Stewart Iron Works, LLC<< ; \_\_\_\_; or None N/A>>: www.stewartironworks.com/#sle.
  - 5.
  - 6. Substitutions: << See Section 01 6000 Product Requirements; or Not permitted>>.
  - 7. Mezger Enterprises Ltd<< ; \_\_\_\_; or None N/A>>: www.mezger.com/#sle.
  - 8.
  - 9.
  - 10. Substitutions: << See Section 01 6000 Product Requirements; or Not permitted>>.

# 2.02 METAL FURNISHINGS

- A. Metal Furnishings, General:
  - 1. Cast iron components: Ductile iron castings complying with ASTM A536; cleaned, treated, and powder-coated.
    - a. Color: As selected by Architect from manufacturer's standard or optional colors.
  - 2. Steel components: Plates, bars, and shapes complying with ASTM A36/A36M and tubing complying with ASTM A500/A500M; cleaned, treated, and powder-coated.
    - a. Color: As selected by Architect from manufacturer's standard or optional colors.
  - 3. Aluminum Components: ASTM B211/B211M.
  - 4. Hardware: Stainless steel.

- B. Benches: Metal frame and seat section with back and armrests.
  - 1. Frame: Steel.
  - 2. Seat: Steel bars.
  - 3. Length: 6' or as noted on Drawings.
  - 4. Width: As per manufacturer for specific product.
  - 5. Height: As per manufacturer for specific product.
  - 6. Intermediate support: As shown on Drawings.
  - 7. Intermediate arm rest. No intermediate arm rests, only end armrests as manufactured for specific product.
  - 8. Mounting: As indicated on Drawings.
  - 9. Products:
    - a. Victor Stanley Freesia Bench as indicated on Drawings.
    - b. Victor Stanley Curved Bench as indicated on Drawings.
    - c. Substitutions: Not permitted.
- C. Waste Receptacles: Steel frame with steel bar slats, top with covered ash urn, molded liner. two top openings and hinged side opening for maintenance as manufactured for product indicated on Drawings.
  - 1. Capacity: 36 gallon.
  - 2. Shape: Round as per manufacturer for specific product.
  - 3. Diameter: As per manufacturer for specific product.
  - 4. Length: As per manufacturer for specific product.
  - 5. Width: As per manufacturer for specific product.
  - 6. Height: As per manufacturer for specific product.
  - 7. Wall liners: Galvanized steel panels welded inside waste receptacle frame as integral part of waste receptacle unit.
  - 8. Inserts: Removable plastic containers for waste material.
  - 9. Lids:
    - a. Material: Steel.
    - b. Type: As per manufacturer for specific product.
  - 10. Mounting: Surface mount.
  - 11. Products:
    - a. Victor Stanley, Inc SCD-36 as indicated on Drawings.
    - b. Substitutions: Not permitted.
  - 12. Color: As selected by Architect from manufacturer's standard or optional colors.
- D. Bike racks: Closed tube steel frame for 2 bike capacity.
  - 1. Length: As per manufacturer for specific product.
  - 2. Width: As per manufacturer for specific product.
  - 3. Height: As per manufacturer for specific product.
  - 4. Mounting: Surface mount.
  - 5. Products:
    - a. Victor Stanley, Inc Freesia BFRE-161 with cross bar as indicated on Drawings.
    - b. Substitutions: Not permitted.
    - Color: As selected by Architect from manufacturer's standard or optional colors.

# 6. Color: .

# 3.01 EXAMINATION

- A. Verify proper installation of mounting surfaces, preinstalled anchor bolts, and other mounting devices; and ready to receive site furnishing items.
- B. See Section <u>05 5000</u> for anchors to attach site furnishings to mounting surfaces.
- C. Do not begin installation until unacceptable conditions are corrected.

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# 3.02 INSTALLATION

- A. Install site furnishings in accordance with approved shop drawings, and manufacturer's installation instructions.
- B. See Section 03 3000 for bollard infill and underground encasement.
- C. Provide level mounting surfaces for site furnishing items.

#### END OF SECTION 32 3300

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#### SECTION 32 9219 SEEDING

## <<<< UPDATE NOTES

#### PART 1 GENERAL

#### **1.01 SECTION INCLUDES**

- A. Preparation of subsoil.
- B. Placing topsoil.
- C. Hydroseeding, mulching and fertilizer
- D. Soil pH neutralizer.
- E. Maintenance.

#### 1.02 RELATED REQUIREMENTS

- A. Section <u>31 2200</u> <u>Grading</u>: Preparation of subsoil and placement of topsoil in preparation for the work of this section.
- B. Section <u>31 2323</u> Fill: Topsoil material.

#### 1.03 PRICE AND PAYMENT PROCEDURES

- A. See Section 01 2200 Unit Prices, for additional unit price requirements.
- B. Topsoil:
  - 1. Basis of Measurement: By the cubic yard.
  - 2. Basis of Payment: Includes topsoil, placing topsoil.
- C. Grassed Areas:
  - 1. Basis of Measurement: By the square foot area
  - 2. Basis of Payment: Includes <u>preparation of subsoil</u>, preparation of topsoil, <u>placing topsoil</u>, seeding, watering and maintenance to specified <u>time limit</u>.

#### 1.04 REFERENCE STANDARDS

A. ASTM D7322/D7322M - Standard Test Method for Determination of Erosion Control Product (ECP) Ability to Encourage Seed Germination and Plant Growth Under Bench-Scale Conditions; 2017.

#### 1.05 DEFINITIONS

A. Weeds: Include Dandelion, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Bermuda Grass, Johnson Grass, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

#### 1.06 SUBMITTALS

- A. See Section <u>01 3000</u> Administrative Requirements, for submittal procedures.
- B. Topsoil samples.
- C. Certificate: Certify seed mixture approval by << <u>authority having jurisdiction</u>; or \_\_\_\_\_>>.
- D. Maintenance Data: Include maintenance instructions, cutting method and maximum grass height; << <u>types, application frequency, and recommended coverage of fertilizer</u>; or None - N/A>><< <u>; and \_\_\_\_\_</u>; or None - N/A>>.
- E. Maintenance Contract.

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## 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable. Deliver seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging.
- Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of B. manufacturer.

## MAINTENANCE SERVICE (SEE END OF SECTION)

#### PART 2 PRODUCTS

## 2.01 REGULATORY REQUIREMENTS

- A. Comply with regulatory agencies for << fertilizer and; or None N/A>> herbicide composition.
- Provide certificate of compliance from << authority having jurisdiction: or >> В. indicating approval of seed mixture.

# 2.02 SEED MIXTURE

- A. Seed Mixture:
  - Merion Blue Grass: percent. 1.
  - Kentucky Blue Grass: percent. 2.
  - 3. Creeping Red Fescue Grass: percent.
  - 4. Streambark Wheat: \_\_\_\_\_ percent.
  - Red Top: \_\_\_\_ percent. 5.
  - Norlea Perennial Rye: \_\_\_\_ percent. 6.
  - 7. Clover: \_\_\_\_\_ to \_\_\_\_ percent.

## 2.03 SOIL MATERIALS

- A. Topsoil: Type as specified in Section **31 2200**.
- Topsoil: Type as specified in Section **31 2323**. В.
- Topsoil: Fertile, agricultural soil, typical for locality, capable of sustaining vigorous plant growth, C. taken from drained site; free of subsoil, clay or impurities, plants, weeds and roots; pH value of minimum << 5.4; or >> and maximum << 7.0; or >>.
- D. Topsoil: Excavated from site and free of weeds.

## 2.04 ACCESSORIES

- Mulching Material: Oat or wheat straw, free from weeds, foreign matter detrimental to plant life, A. and dry. Hay or chopped cornstalks are << not; or None - N/A>> acceptable.
- Mulching Material: << Atmospherically refined; Thermally refined; or Refined>> wood B. fiber, nontoxic, free of growth or germination inhibiting ingredients, << dust; or chip>> form.
  - Seed Germination and Vegetation Enhancement: Greater than or equal to << 1. **100**; **200**; **300**; **400**; **500**; **800**; or >> percent when tested in accordance with ASTM D7322/D7322M.
  - 2. Manufacturers:
    - Profile Products<<; Flexterra HP-FGM; ; HP Wood/Wood with Tackifier; ; а ProGanics Biotic Soil Media; ; ProGanics DUAL; ; ; ; or None -N/A>>: www.profileevs.com/#sle.
    - b.
    - C.
    - Substitutions: << See Section 01 6000 Product Requirements; or Not d. permitted>>.
- Fertilizer: Recommended for grass, << slow release nitrogen; biological materials; C. and biostimulant materials>>; of proportion necessary to eliminate deficiencies of topsoil. 1. Manufacturers:

- Profile Products<<; BioPrime; ; \_\_\_\_; or None a. N/A>>: www.profileevs.com/#sle.
- b.
- C.
- Substitutions: << See Section 01 6000 Product Requirements; or Not d. permitted>>.
- Fertilizer: Recommended for grass, with 50 percent of the elements derived from organic D. sources; of proportion necessary to eliminate deficiencies of topsoil, to the following proportions:
  - 1. Nitrogen: \_\_\_\_\_ percent.
  - Phosphoric Acid: \_\_\_\_\_ percent. Soluble Potash: \_\_\_\_\_ percent. 2.
  - 3.
- E. Soil pH Neutralizer: Recommended for planting and re-vegetating areas with << acidic; alkaline; or >> soils, as indicated by analysis.
  - Manufacturers: 1.
    - a. Profile Products<< ; NeutraLime Dry; ; \_\_\_\_; or None -N/A>>: www.profileevs.com/#sle.
    - b.
    - C. Substitutions: << See Section 01 6000 - Product Requirements; or Not d. permitted>>.
- Biostimulant: Recommended to accelerate vegetation establishment. F.
  - 1 Manufacturers:
    - Profile Products<< ; JumpStart; ; \_\_\_\_; or None a. N/A>>: www.profileevs.com/#sle.
    - b.
    - C. Substitutions: << See Section 01 6000 - Product Requirements; or Not d. permitted>>.
- G. Water: Clean, fresh and free of substances or matter that could inhibit vigorous growth of grass.
- H. Erosion Fabric: << Jute; or \_\_\_\_\_>> matting, open weave.
- I. Herbicide:
- J. Stakes: Softwood lumber, chisel pointed.
- K. String: Inorganic fiber.
- L. Edging: << Galvanized steel; Plastic; Wood of \_\_\_\_\_ species; or \_\_\_\_>>.

#### 2.05 **TESTS**

- A. Provide analysis of topsoil fill under provisions of Section 01 4000.
- B. Analyze to ascertain percentage of nitrogen, phosphorus, potash, << ...,; or None -N/A>> soluble salt content, organic matter content, and pH value.
- Submit minimum << 10 oz; or oz>> sample of topsoil proposed. Forward sample to C. approved testing laboratory in sealed containers to prevent contamination.
- Testing is not required if recent tests are available for imported topsoil. Submit these test D. results to the testing laboratory for approval. Indicate, by test results, information necessary to determine suitability.

# PART 3 EXECUTION

## 3.01 EXAMINATION

A. Verify that prepared soil base is ready to receive the work of this Section.

#### 3.02 PREPARATION

- A. Prepare subgrade in accordance with Section 31 2200.
- B. Place topsoil in accordance with Section <u>31 2200</u>.
- C. Install edging at periphery of seeded areas in straight lines to consistent depth.

# 3.03 FERTILIZING

- A. Apply fertilizer << in accordance with manufacturer's instructions; or at a rate of \_\_\_\_\_\_>>.
- B. Apply after smooth raking of topsoil << and prior to roller compaction; or None N/A>>.
- C. Do not apply fertilizer at same time or with same machine as will be used to apply seed.
- D. Mix thoroughly into upper << <u>2 inches</u>; or \_\_\_\_\_ inches>> of topsoil.
- E. Lightly water to aid the dissipation of fertilizer.

## 3.04 SOIL NEUTRALIZER

- A. Apply << in accordance with manufacturer's instructions; or at a rate of \_\_\_\_\_>>.
- B. Apply after smooth raking of topsoil<< and prior to roller compaction; or None N/A>>.
- C. Do not apply soil neutralizer at same time or with same machine used to apply seed.
- D. Mix thoroughly into upper << 2 inches; or \_\_\_\_\_ inches>> of topsoil.
- E. Lightly water to aid dissipation.

## 3.05 SEEDING

- A. Apply seed at a rate of <u>Ibs per 1000 sq ft</u> evenly in two intersecting directions. Rake in lightly.
- B. Do not seed areas in excess of that which can be mulched on same day.
- C. Planting Season:
- D. Do not sow immediately following rain, when ground is too dry, or during windy periods.
- E. Roll seeded area with roller not exceeding << <u>112 lbs;</u> or \_\_\_\_\_ lbs>>.
- F. Immediately following seeding << <u>and compacting</u>; or None N/A>>, apply mulch to a thickness of << <u>1/8 inches</u>; or \_\_\_\_\_ inches>>. Maintain clear of shrubs and trees.
- G. Apply water with a fine spray immediately after each area has been mulched. Saturate to << <u>4</u> <u>inches;</u> or <u>inches>></u> of soil.
- H. Following germination, immediately re-seed areas without germinated seeds that are larger than << <u>4 by 4 inches</u>; 8 by 8 inches; or \_\_\_\_\_ inches>>.

#### 3.06 HYDROSEEDING

- A. Apply seeded slurry with a hydraulic seeder at a rate of \_\_\_\_\_ **Ibs per 1000 sq ft** evenly in two intersecting directions.
- B. Do not hydroseed area in excess of that which can be mulched on same day.
- C. Immediately following seeding, apply mulch to a thickness of << <u>1/8 inches;</u> or \_\_\_\_\_\_ inches>>. Maintain clear of shrubs and trees.
- D. Apply water with a fine spray immediately after each area has been mulched. Saturate to << <u>4</u> <u>inches</u>; or <u>inches</u>>> of soil.

E. Following germination, immediately re-seed areas without germinated seeds that are larger than << <u>4 by 4 inches</u>; 8 by 8 inches; or \_\_\_\_\_ inches>>.

## 3.07 PROTECTION

- B. Cover seeded slopes where grade is << <u>4 inches per foot</u>; or \_\_\_\_\_ inches per foot>> or greater with erosion fabric. Roll fabric onto slopes without stretching or pulling.
- C. Lay fabric smoothly on surface, bury top end of each section in <u>6 inch</u> deep excavated topsoil trench. Provide <u>12 inch</u> overlap of adjacent rolls. Backfill trench and rake smooth, level with adjacent soil.
- D. Secure outside edges and overlaps at <u>36 inch</u> intervals with stakes.
- E. Lightly dress slopes with topsoil to ensure close contact between fabric and soil.
- F. At sides of ditches, lay fabric laps in direction of water flow. Lap ends and edges minimum <u>6</u> <u>inches</u>.

# 3.08 MAINTENANCE

- A. See Section <u>32 0190</u> << <u>Operation and Maintenance of Planting;</u>
  or \_\_\_\_\_\_ >> for post-occupancy maintenance.
- B. Provide maintenance at no extra cost to Owner; Owner<< will; or will not>> pay for water.
- C. See Section <u>01 7000</u> Execution Requirements, for additional requirements relating to maintenance service.
- D. Provide a separate maintenance contract for specified maintenance service.
- E. Provide maintenance of seeded areas for << <u>three</u>; or \_\_\_\_>> months from Date of Substantial Completion.
- F. Maintain seeded areas immediately after placement << <u>until grass is well established and</u> <u>exhibits a vigorous growing condition</u>; for two cuttings; or for \_\_\_\_ cuttings>>.
- G. Mow grass at regular intervals to maintain at a maximum height of << <u>2-1/2 inches</u>; or \_\_\_\_\_\_ inches>>. Do not cut more than 1/3 of grass blade at any one mowing.
- H. Neatly trim edges and hand clip where necessary.
- I. Immediately remove clippings after mowing and trimming.
- J. Water to prevent grass and soil from drying out.
- K. Roll surface to remove minor depressions or irregularities.
- L. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions. Remedy damage resulting from improper use of herbicides.
- M. Immediately reseed areas that show bare spots.
- N. Protect seeded areas with warning signs during maintenance period.

## END OF SECTION 32 9219

# ALL TEXT DRAFT

#### SECTION 32 9300 PLANTS

## <<<< UPDATE NOTES

## PART 1 GENERAL

# 1.01 SECTION INCLUDES

- A. Preparation of << <u>subsoil</u>; and topsoil>>.
- B. Topsoil bedding.
- C. New << trees; plants; ground cover; and \_\_\_\_>>
- D. Relocated << trees; plants; ground cover; and \_\_\_\_
- E. << <u>Mulch;</u> and <u>Fertilizer</u>>>.
- F. Maintenance.
- G. Tree Pruning.
- H. Hidden access panels.

## 1.02 RELATED REQUIREMENTS

A. Section 32 0190 - Operation and Maintenance of Planting: Post-occupancy maintenance.

>>

B. Section 32 9119 - Landscape Grading: Topsoil placement and finish grading.

# 1.03 PRICE AND PAYMENT PROCEDURES

- A. Allowances:
  - 1. See Section <u>01 2100 Allowances</u>, for << <u>cash</u>; testing; and quantity>> allowances affecting this section.
  - 2. Allowance includes << <u>purchase and delivery of trees, plants, and ground cover.</u> <u>Installation is included in this section and is part of the Contract Sum;</u> or purchase, delivery, and installation of trees, plants, and ground cover>>.
- B. Unit Prices:
  - 1. See Section 01 2200 Unit Prices, for additional unit price requirements.
  - 2. Topsoil: By the cubic << yard; or \_\_\_\_\_>>. Includes topsoil, placing topsoil.
  - Plants: By the unit. Includes << <u>preparation of subsoil</u>,; preparation of topsoil,; or None - N/A>><< <u>placing topsoil</u>,; or None - N/A>> planting, watering and maintenance to specified time period.

## 1.04 DEFINITIONS

- A. Weeds: Include Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.
- B. Weeds: Any plant life not specified << or scheduled; or None N/A>>.
- C. Plants: Living trees, plants, and ground cover specified in this Section << <u>, and described in</u> <u>ANSI Z60.1</u>; or None N/A>>.

## 1.05 REFERENCE STANDARDS

- A. AASHTO HB Standard Specifications for Highway Bridges; 2005, with Errata.
- B. ANSI/AHIA Z60.1 American National Standard for Nursery Stock; 2014.
- C. ANSI A300 Part 1 American National Standard for Tree Care Operations Tree, Shrub, and Other Woody Plant Management Standard Practices (Pruning); 2017.

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# 1.06 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements, for submittal procedures.
- B. Certificate: Certify fertilizer<< <u>and herbicide</u>; or None N/A>> mixture approval by << <u>authority having jurisdiction</u>; or \_\_\_\_\_>>.
- C. Certificate: Submit certificate for plants free of disease or hazardous insects; << <u>certified by</u> <u>federal department of agriculture</u>; certified by state department of agriculture; as described in ASTM Z60.1; or \_\_\_\_>>; free of disease or hazardous insects.
- D. Maintenance Data: Include cutting and trimming method << <u>; types, application frequency,</u> <u>and recommended coverage of fertilizer</u>; or None - N/A>><< <u>; and</u> <u>; or None -</u> N/A>>.
- E. Submit list of plant life sources.
- F. Maintenance Contract.

## 1.07 QUALITY ASSURANCE

- A. Nursery Qualifications: Company specializing in growing and cultivating the plants with << <u>three</u>; or \_\_\_\_\_>> years << <u>documented</u>; or None N/A>> experience.
- B. Installer Qualifications: Company specializing in installing and planting the plants << <u>with</u> <u>years experience</u>; with <u>years documented experience</u>; or approved by nursery>>.
- C. Tree Pruner Qualifications: Company specializing in pruning trees with proof of Arborist Certification.
- D. Tree Pruning: Comply with ANSI A300 Part 1.
- E. Maintenance Services: Performed by << installer; or \_\_\_\_\_>>.
- F. Non-native, Invasive Plant Species: Do not introduce, grow, or cultivate plant species that are non-native to the ecosystem of the project site, and whose introduction causes or is likely to cause economic or environmental harm or harm to human health.
  - 1. Comply with laws regulating non-native and invasive plant species in the State in which the Project is located.

## 1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.
- B. Protect and maintain plant life until planted.
- C. Deliver plant life materials immediately prior to placement. Keep plants moist.

## 1.09 FIELD CONDITIONS

- A. Do not install plant life when ambient temperatures may drop below << <u>35 degrees F</u>; or <u>degrees F</u>>> or rise above << <u>90 degrees F</u>; or <u>degrees F</u>>>.
- B. Do not install plant life when wind velocity exceeds << <u>30 mph;</u> or \_\_\_\_ mph>>.

## 1.10 WARRANTY

- A. See Section 01 7800 Closeout Submittals, for additional warranty requirements.
- B. Provide << <u>one;</u> or \_\_\_\_> year warranty.
- C. Warranty: Include coverage for one continuous growing season; replace dead or unhealthy plants.
- D. Replacements: Plants of same size and species as specified, planted in the next growing season, with a new warranty commencing on date of replacement.

# 1.11 MAINTENANCE (SEE END OF SECTION)

- A. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.
- Provide a separate maintenance contract for specified maintenance service. В.
- Provide a separate maintenance contract for the service and maintenance of work specified in C. this section for << <u>years;</u> or <u>months>></u> from Date of Substantial Completion.

## PART 2 PRODUCTS

## 2.01 MANUFACTURERS

- A. Hidden Access Panels:
  - WunderCovers: www.wundercovers.com/#sle. 1.
  - 2.
  - 3.
  - Substitutions: << See Section 01 6000 Product Requirements; or Not permitted>>. 4.

## 2.02 REGULATORY REQUIREMENTS

- A. Comply with regulatory agencies for << <u>fertilizer and</u>; or None N/A>> herbicide composition.
- R Provide certificate of compliance from << authority having jurisdiction; or \_ indicating approval of plants, fertilizer << and herbicide; or None - N/A>> mixture.
- Plant Materials: << Certified by federal department of agriculture; Certified by state C. department of agriculture; Described by ASTM Z60.1; or \_\_\_\_\_ >>; free of disease or hazardous insects.

## 2.03 PLANTS

Plants: Species and size identified in plant schedule, grown in climatic conditions similar to Α. those in locality of the work.

#### 2.04 SOIL MATERIALS

- A. Topsoil: Type \_\_\_\_; see Section 32 9119.
- Topsoil: << Excavated from site; or Imported>>. В.
- C. Topsoil: Fertile, agricultural soil, typical for locality, capable of sustaining vigorous plant growth, taken from drained site; free of subsoil, clay or impurities, plants, weeds and roots; minimum pH value of << <u>5.4;</u> or \_\_\_\_>> and maximum << <u>7.0;</u> or \_\_\_\_>>.

#### 2.05 SOIL AMENDMENT MATERIALS

- Fertilizer: Containing fifty percent of the elements derived from organic sources; of proportion Α necessary to eliminate any deficiencies of topsoil. << as indicated in analysis.; or to the following proportions:>>
  - 1.
  - Nitrogen: \_\_\_\_\_ percent. Phosphoric Acid: \_\_\_\_\_ percent. 2.
  - percent. Soluble Potash: 3.
- Peat Moss: Shredded, loose, sphagnum moss; free of lumps, roots, inorganic material or acidic Β. materials; minimum of << 85; or \_\_\_\_> percent organic material measured by oven dry weight, pH range of << 4 to 5; or \_\_\_\_\_ >>; moisture content of << 30; or \_\_\_\_> percent.
- Bone Meal: << Raw, finely ground, commercial grade, minimum of 3 percent nitrogen C. and 20 percent phosphorous; or >>.
- Lime: << Ground limestone, dolomite type, minimum 95 percent carbonates; D. >>. or \_\_\_\_
- Water: Clean, fresh, and free of substances or matter that could inhibit vigorous growth of E. plants.
- F. Herbicide:

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G. Pesticide: \_\_\_\_\_

#### 2.06 MULCH MATERIALS

- A. Mulching Material: \_\_\_\_\_\_ species wood << <u>shavings</u>; ground bark; or cellulose fiber dust>>, free of growth or germination inhibiting ingredients.
- B. Mulching Material: Oat or wheat straw, free from weeds, foreign matter detrimental to plant life, and dry. Hay or chopped cornstalks are << <u>not</u>; or None N/A>> acceptable.

## 2.07 HIDDEN ACCESS PANELS

- A. Infill tray with perimeter drainage grate.
  - 1. Material: << Steel; Stainless steel; or \_\_\_\_>>.
  - Size: << <u>12 by 12 inches (300 x 300 mm)</u>; 24 by 24 inches (600 by 300 mm); 30 by 30 inches (750 by 750 mm); or \_\_\_\_ by \_\_\_\_ inches ( \_\_\_\_ by \_\_\_\_ mm) >>.
  - 3. Loading: << Pedestrian; H 10; H 15; H 20; or >> according to AASHTO HB.

>>.

#### 2.08 ACCESSORIES

- A. Wrapping Materials: << <u>Burlap;</u> or \_\_\_\_\_
- B. Stakes: << <u>Softwood lumber, pointed end</u>; Mild steel angle, galvanized, pointed end; or \_\_\_\_\_>>.
- C. Cable, Wire, Eye Bolts << <u>and Turnbuckles</u>; or None N/A>>: Non-corrosive, of sufficient strength to withstand wind pressure and resulting movement of plant life.
- D. Plant Protectors: Rubber sleeves over cable to protect plant stems, trunks, and branches.
- E. Plant Pot: \_\_\_\_\_.
- F. Grates: << <u>Cast iron</u>; Cast steel; or \_\_\_\_>>, << <u>galvanized</u>; or \_\_\_\_>> finish, with \_\_\_\_\_ grillage design, <u>inch</u><< <u>diameter</u>; or square>>, sized to resist << <u>pedestrian</u>; or vehicular>> loads. << <u>Provide</u> \_\_\_\_\_ <u>manufactured by</u> \_\_\_\_\_; or None N/A>>
- G. Decorative Cover: << <u>Fir bark chips</u>; Crushed gravel; Smooth gravel; or \_\_\_\_>>, <u>inch</u> minimum and \_\_\_inch maximum size.
- H. Membrane: << <u>20 mil;</u> or <u>mil>></u> thick, << <u>clear polyethylene;</u> black polyethylene; water permeable polyolefin fabric; or <u>sector</u> >>.
- I. Wrapping: << <u>Waterproof fabric;</u> or \_\_\_\_\_>>.
- J. Tree Protectors: << Metal; or Plastic>> with galvanized rings.
- K. Tree Grate: << <u>2 inches (51 mm)</u>; 1-1/2 inches (38 mm); or \_\_\_\_\_>> thick, height equal to slab thickness<< <u>None N/A</u>; or , ADA compliant>>.
  - 1. Material: << Ductile iron; Aluminum; Recycled plastic; or \_\_\_\_>>.
  - 2. Shape: << <u>Square;</u> Round; or \_\_\_\_>>.
  - 3. << <u>Length/Width:</u>; or Diameter: >><< 3 feet (0.9 m); <u>4 feet (1.2 m)</u>; 5 feet (1.5 m); or \_\_\_\_\_>>.
  - 4. Style: << Grid; Circular; Decorative; or \_\_\_\_>>.
  - 5. Color: << <u>Black;</u> Bronze; or \_\_\_\_>>.
  - 6. Manufacturers:
    - a. EJ<< ; \_\_\_\_; or None N/A>>: www.ejco.com/#sle.
    - b. \_\_\_\_\_
    - C. \_\_\_\_\_
    - d. Substitutions: << <u>See Section 01 6000 Product Requirements</u>; or Not permitted>>.
- L. Landscape Glass: Colored glass chips; 100 percent recycled material, tumbled to remove sharp edges.

- Size: << <u>1/4 inch to 1/2 inch;</u> 1/2 inch to 1 inch; 1 inch to 2 inches; or \_\_\_\_ inch to \_\_\_\_ inch>> diameter.
- 2. Color: \_\_\_\_
- Color: To be selected by Architect from manufacturer's << <u>standard</u>; full; or custom>> range.
- 4. Products:
  - a. American Specialty Glass<< ; \_\_\_\_; or None N/A>>: www.americanspecialtyglass.com/#sle.
  - b. \_\_\_\_\_
  - С.
  - d. Substitutions: << <u>See Section 01 6000 Product Requirements;</u> or Not permitted>>.

## 2.09 << <u>TOP SOIL MIX;</u> OR PLANT SOIL MIX>>

A. A uniform mixture of << <u>1</u>; or \_\_\_\_>> part << <u>peat</u>; or \_\_\_\_>> and << <u>3</u>; or \_\_\_\_>> parts topsoil by volume.

# 2.10 SOURCE QUALITY CONTROL

- A. Provide analysis of topsoil; comply with requirements of Section <u>01 4000</u>.
- B. Provide << testing; and analysis>> of << imported; or existing>> topsoil.
- C. Analyze to ascertain percentage of nitrogen, phosphorus, potash, soluble salt and organic matter; pH value and \_\_\_\_\_.
- D. Submit minimum << <u>10 oz</u>; or \_\_\_\_ oz>> sample of topsoil proposed. Forward sample to testing laboratory in sealed containers to prevent contamination.
- E. Testing is not required if recent tests are available for imported topsoil. Submit these test results to the testing laboratory for approval. Indicate, by test results, information necessary to determine suitability.

# PART 3 EXECUTION

## 3.01 EXAMINATION

- A. Verify that prepared subsoil << and planters; or None N/A>> are ready to receive work.
- B. Saturate soil with water to test drainage.
- C. Verify that required underground utilities are available, in proper location, and ready for use.

## 3.02 PREPARATION OF SUBSOIL

- A. Prepare subsoil to eliminate uneven areas. Maintain profiles and contours. Make changes in grade gradual. Blend slopes into level areas.
- B. Remove foreign materials, weeds and undesirable plants and their roots. Remove contaminated subsoil.
- C. Scarify subsoil to a depth of << <u>3 inches</u>; or \_\_\_\_\_ inches>> where plants are to be placed. Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has compacted subsoil.
- D. Dig pits and beds << <u>6 inches</u>; or \_\_\_\_\_ inches>> larger than plant root system.

## 3.03 PLACING TOPSOIL

- A. Spread topsoil to a minimum depth of << <u>4 inches</u>; <u>6 inches</u>; or <u>inches</u> >> over area to be planted. Rake smooth.
- B. Place topsoil during dry weather and on dry unfrozen subgrade.
- C. Remove vegetable matter and foreign non-organic material from topsoil while spreading.
- D. Grade topsoil to eliminate rough, low or soft areas, and to ensure positive drainage.

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E. Install topsoil into pits and beds intended for plant root balls, to a minimum thickness of << <u>6</u> <u>inches</u>; or \_\_\_\_\_ inches>>.

# 3.04 FERTILIZING

- A. Apply fertilizer << in accordance with manufacturer's instructions; or at a rate of \_\_\_\_\_\_>>.
- B. Apply after initial raking of topsoil.
- C. Mix thoroughly into upper << <u>2 inches</u>; or \_\_\_\_\_ inches>> of topsoil.
- D. Lightly water to aid the dissipation of fertilizer.

# 3.05 PLANTING

- A. Place plants << for best appearance; or as indicated>>.
- B. Place plants << <u>for best appearance</u>; or as indicated>> for review and final orientation by Architect.
- C. Set plants vertical.
- D. Remove non-biodegradable root containers.
- E. Set plants in pits or beds, partly filled with prepared plant mix, at a minimum depth << <u>of 6</u> <u>inches</u>; or as indicated on drawings>> under each plant. << <u>Remove</u>; or Loosen>> burlap, ropes, and wires, from the root ball.
- F. Place bare root plant materials so roots lie in a natural position. Backfill soil mixture in << <u>6</u> <u>inch</u>; or \_\_\_\_\_ inch>> layers. Maintain plant life in vertical position.
- G. Saturate soil with water when the pit or bed is half full of topsoil and again when full.

# 3.06 PLANT RELOCATION AND RE-PLANTING

- A. Relocate plants as << indicated; or directed>> by Architect.
- B. Replant plants in pits or beds, partly filled with prepared topsoil mixture, at a minimum depth << <u>of 6 inches</u>; or as indicated on drawings>> under each plant. << <u>Remove</u>; or Loosen>> burlap, ropes, and wires, from the root ball.
- C. Place bare root plant materials so roots lie in a natural position. Backfill soil mixture in << <u>6</u> <u>inch</u>; or \_\_\_\_\_ inch>> layers. Maintain plant materials in vertical position.
- D. Saturate soil with water when the pit or bed is half full of topsoil and again when full.

# 3.07 INSTALLATION OF HIDDEN ACCESS PANELS

- A. Mount panel frame on << <u>mortar</u>; gravel; or \_\_\_\_>> bed at indicated elevation, plumb and level.
- B. Infill panel cover with paver units following layout pattern without disruptions.
- C. Place panel cover in panel frame securely.

# 3.08 INSTALLATION OF ACCESSORIES

- A. Place << <u>decorative cover and membrane</u>; stone; or \_\_\_\_\_>>, << <u>where indicated on</u> <u>drawings</u>; or at base of plant to a nominal diameter of \_\_\_\_ inches>>.
- B. Place grates at base of << trees; or \_\_\_\_>> where indicated on drawings.
- C. Wrap deciduous shade and flowering tree trunks and place tree protectors.

## 3.09 PLANT SUPPORT

- A. Brace plants vertically with plant protector wrapped guy wires and stakes to the following:
  - 1. Tree Caliper: <u>1 inch;</u> Tree Support Method: 1 stake with one tie
  - 2. Tree Caliper: <u>1 to 2 inches</u>; Tree Support Method: 2 stakes with two ties
  - Tree Caliper: <u>2 to 4 inches</u>; Tree Support Method: 3 guy wires << <u>with eye bolts and</u> <u>turn buckles</u>; or None - N/A>>

> Tree Caliper: Over <u>4 inches</u>; Tree Support Method: 4 guy wires << <u>with eye bolts and</u> <u>turn buckles</u>; or None - N/A>>

## 3.10 TREE PRUNING

- A. Prune trees as recommended in ANSI A300 Part 1.
- B. Prune newly planted trees as required to remove dead, broken, and split branches.

## 3.11 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 01 4000.
- B. Plants will be rejected if a ball of earth surrounding roots has been disturbed or damaged prior to or during planting.

# 3.12 MAINTENANCE

- A. See Section <u>32 0190 Operation and Maintenance of Planting</u> for post-occupancy maintenance.
- B. Provide maintenance at no extra cost to Owner; Owner<< will; or will not>> pay for water.
- C. See Section <u>01 7000 Execution and Closeout Requirements</u>, for additional requirements relating to maintenance service.
- D. Provide a separate maintenance contract for specified maintenance service.
- E. Maintain plant life for << three; or \_\_\_\_>> months after Date of Substantial Completion.
- F. Maintain plant life immediately after placement << <u>and until plants are well established and</u> <u>exhibit a vigorous growing condition</u>; or None - N/A>>. Continue maintenance until termination of warranty period.
- G. Irrigate sufficiently to saturate root system and prevent soil from drying out.
- H. Cultivate and weed plant beds and tree pits.
- I. Remove dead or broken branches and treat pruned areas or other wounds.
- J. Neatly trim plants where necessary.
- K. Immediately remove clippings after trimming.
- L. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions.
- M. Control insect damage and disease. Apply pesticides in accordance with manufacturers instructions.
- N. Remedy damage from use of herbicides and pesticides.
- O. Replace mulch when deteriorated.
- P. Maintain wrappings, guys, << <u>turnbuckles</u>; or None N/A>> and stakes. << <u>Adjust</u> <u>turnbuckles to keep guy wires tight</u>; or None - N/A>> Repair or replace accessories when required.
- 3.13 SCHEDULE PLANT LIST
  - Α.

END OF SECTION 32 9300

## SECTION 33 10 00 WATER UTILITIES

#### PART 1 - GENERAL

#### 1.01DESCRIPTION

A. This section covers all labor, equipment, material, and supervision to complete the water utility system and appurtenances in accordance with the Drawings. Building plumbing (to five feet  $\pm$  outside the building) is not covered by this Division.

#### 1.02 SUBMITTALS

A. The Contractor shall submit for approval manufacturer's specifications, drawings, and recommendations for all materials incorporated into the project. The submittal shall include manufacturer's published data, engineering data, letter of certification or certified test laboratory report indicating that each material complies with specified standards and other requirements.

# 1.03 DEFINITIONS

A. See Section 31 20 00, EARTH MOVING

#### 1.04 TESTING

- A. The in-place soil density shall be determined in accordance with Section 31 20 00, EARTH MOVING.
- B. A gradation test, in accordance with ASTM D 422, shall be performed on each type of material used in fills and backfills. If material is to be NFS, hydrometer tests shall be performed in accordance with ASTM D 422.
- C. Compaction tests shall be taken on the pipe bedding and every other lift of trench backfill at the average rate of one test per 150 linear feet of trench. Failing tests shall be retested at no additional cost.
- D. The water lines shall be tested in accordance with City of Wasilla standards.

## PART 2 - PRODUCTS

## 2.01 POLYVINYL CHLORIDE (PVC) PIPE

- A. Four inch (4") through twelve inch (12") Polyvinyl Chloride Pipe is to conform to the requirements of AWWA C900, have a dimensional ratio (DR) of 18.
- B. Fourteen inch (14") through sixteen inch (16") Polyvinyl Chloride Pipe must conform to the requirements of AWWA C905, have a DR of 18. PVC pipe larger than sixteen inches (16") in diameter requires approval from the Utility Company's Engineering Director for use.
- C. All PVC pipe is to be blue in color. PVC water main and service piping must be installed with an over insertion prevention device equal to EBAA Iron Mega Stop or the Cert-Lok bi-directionally restraint system.

#### 2.02 VALVES AND VALVE BOXES

- A. Gate valves shall be iron body, fully bronze-mounted, double disc, parallel seat valves as manufactured by Mueller Company or approved equal and in accordance with AWWA Specification C-500-93 or C509-01. All valves shall have non-rising stem, an O-ring seal, a twoinch square operating nut, and open counterclockwise. Valves shall have mechanical joint ends.
- B. Valve boxes shall be cast iron of sliding adjustable height type with round bottom hood sections to fit over the top of the valve. The top section shall be recessed to receive a closed fitting "eared" lid with the word "water" cast into it. Casting shall be smooth with five sixteenths of one-inch minimum thickness and a minimum of five inches internal diameter and 10 feet long. Valve box sections shall be dipped in coal-tar pitch. Dust pans shall be installed in all valve boxes including hydrant valves.

| KPB PN: 22047.01         | 22 10 000 |                 |
|--------------------------|-----------|-----------------|
| Design Development Phase | 33 10 000 | WATER UTILITIES |

#### 2.03 FIRE HYDRANTS

- A. Fire hydrants shall be American Darling, Mueller "Improved" Hydrants, Mueller "Centurion" Hydrants or approved equal and shall conform to AWWA Specification C-502-94, "Dry Barrel Fire Hydrants." All connections shall be mechanical joint.
- B. All "single pumper" hydrants shall have two, two and one-half inch hose connections and one four and one-half inch pumper connection with 5" storz insert. All hose threads shall be National Standard threads. Standard fire hydrants shall be furnished with a 10-foot stem with extensions added as required to leave the flange two to six inches above finish grade. The working parts of all fire hydrants shall be bronze or non-corrodible metal.
- C. Painting and coating shall be in accordance with the cited AWWA Specifications for dry barrel fire hydrants Section 4, Article 4.2 (Paint). Color of paint shall be "Red."
- D. The adjustment of hydrant barrel and valve box to the required finish grade will be at the expense of the Contractor.
- E. All hydrants shall have drain outlets at the base of the barrel. Plugs shall be removed prior to installation.
- F. Fire hydrant to operate counterclockwise to open.
- G. Steamer pipes shall be provided on barrel and leg of hydrants.

#### 2.04 INSULATION BOARD

A. The insulation board shall be "Styrofoam HI-35" extruded polystyrene insulation as manufactured by the Dow Chemical Company, "Certiform" as manufactured by Minnesota Diversified Products, Inc., 1901 13<sup>th</sup> Street, N.E., New Brighton, Minnesota, 55112 or approved equal that shall conform to the following requirements:

| z por minimum |
|---------------|
|               |
| 35 minimum    |
| 0.25 maximum  |
|               |
| 0.23 maximum  |
|               |

## 2.05 BURIED WARNING AND IDENTIFICATION TAPE

A. All water lines installed shall have a plastic marker tape 6-inch wide by 0.004 inches. The plastic marker tape shall include a metallic wire for detection purposes. Tape shall be blue with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification tape to read, "caution buried water line below" or similar wording. The plastic marker tape shall be placed 2-foot above pipe.

#### 2.06 PIPE BEDDING

A. See Section 31 20 00 EARTH MOVING.

## 2.07 CONTINUITY STRAPS

A. Continuity straps shall be standard number 2 AWG copper wire with HMWPE insulation suitable for burial.

#### 2.08 SOLDER

A. Only lead-free pipe, flux, and solder will be used as required by A.A.C. 80.500.

## **PART 3 - EXECUTION**

3.01 CONSTRUCTION STAKING

- A. The Contractor shall furnish the following surveys for construction staking:
  - 1. Two offset hubs with guard stakes shall be placed to mark the offset and cut to invert of each tee, bend, valve, hydrant, vertical grade change, and service connection on the waterline. On longer lines, additional stakes shall be provided to mark line and grade at two hundred-foot intervals.

## 3.02 LINE AND GRADE

- A. Horizontal distances are from center to center of fittings or appurtenances unless otherwise noted. Elevations are to pipe invert.
- B. The Contractor shall provide a competent surveyor to maintain line and grade during all pipelaying operations with a transit and engineer's level at no additional cost to the Owner. Accurate survey notes shall be kept in accordance with accepted survey practice. A copy of these notes shall be given to the Owner's Representative as part of the record drawing submittal.
- C. The pipe shall be so laid in the trench that after the line is completed the interior surface thereof conforms accurately to the grades and alignment given on the plans. A maximum 0.2-foot deviation from design elevation and alignment will be allowed. The pipe shall be straight to the eye unless otherwise called for on the plans.
- D. All adjustments to line and grade shall be done by scraping away or filling the earth under the body of the pipe and not by blocking or wedging up.
- E. Any time pipe has to be deflected around curves where no fittings are used, the line and grade shall be staked at intervals of each length of pipe.

# 3.03 EXCAVATION

- A. General
  - 1. Contractor shall accomplish all excavation required by the contract Drawings through whatever substances encountered to a depth of approximately two inches below invert of pipe. All excavation shall be accomplished in accordance with the State of Alaska safety code and other applicable safety requirements.
  - 2. Unauthorized excavation below the required grade line shall be backfilled with approved material and mechanically compacted to 95 percent of maximum density at the expense of the Contractor.
  - 3. In areas where large boulders, bedrock or other unyielding material is encountered at the pipe bed elevation, the trench shall be undercut six inches and backfilled to the proper grade line with unclassified material. The Contractor shall separate unsuitable material from classified and unclassified material during excavation to preclude subsequent undesirable mixing. The method of separation could include, but may not be limited to, placing the materials on opposite sides of the trench.
- B. Water Removal
  - 1. During excavation and pipe installation, the Contractor shall remove by pumping or other approved means all water above the bottom of trench.
- C. Limits on Open Trenches
  - 1. The maximum length of open trench shall be 500 feet. No more than 500 feet of trench may remain open over night.

# 3.04 INSTALLATION

A. Pipe

- 1. All pipe shall be laid in compliance with AWWA C-600-99 with a minimum of 10 feet of cover and shall not be less than 10 feet below finished grade of road centerline. True line and grade shall be kept. Backfill under and around the pipe shall be fully tamped so that no voids exist that will allow bridging or settlement of the pipe.
- 2. All faulty workmanship and all materials found to be defective before or after installation shall be replaced, repaired, or corrected to meet the specification requirements without additional expense to the Owner.

- 3. Cutting of pipe shall be done in a workmanlike manner as recommended by the manufacturer and approved by the Owner.
- 4. Open ends of pipe and appurtenances shall be protected with an approved plug at all times to prevent earth or other substances from entering the pipe.
- B. Joints
  - 1. All joints shall be approved standard mechanical joint or a heat (butt) fusion connection. All jointing shall be accomplished in accordance with the manufacturer's recommendations.
- C. Pipe Deflection
  - 1. When it is necessary to deflect pipe from a straight line in either the vertical or horizontal plane or where long radius curves are permitted, the amount of deflection shall not exceed the maximum recommended by the pipe manufacturer.
- D. Thrust Restraint
  - 1. Thrust restraint on ductile iron pipe shall be provided through the use of mega lug pipe joints installed at all tees, crosses, and bends or combination of bends 11-1/4 degrees or greater in deflection.
- E. Flushing
  - 1. Before the pressure or leakage tests are performed and before the system is sterilized, all newly laid mains shall be thoroughly flushed to remove all foreign materials. The use of fire hydrants for this initial flushing will not be permitted. Flushing times shall be at the discretion of the Owner and utility.
  - 2. In the event repeated flushing is necessary to approve and certify the system, such flushing shall be done at the expense of the Contractor.
  - 3. A representative of the Owner and Contractor shall be present for all flushing and testing.
- F. Connect to Existing Waterline
  - 1. Connections to the existing waterlines shall be coordinated with the Owning Utility before any shutdown of existing water facilities.
- G. Valves
  - 1. Valves and valve boxes shall be installed where shown on the Drawings. Valves shall have the interiors cleaned of all foreign matter before installation. The valve shall be inspected in the open and closed position to insure that all parts are in working condition.
  - 2. Stuffing boxes shall be tightened prior to installation. The base of the hood section shall rest on compacted fill and should be approximately two inches above the flanged joint of the valve dome.
  - 3. The valve box assembly shall be plumb and accurately centered over the valve-operating nut. The top section shall be so set as to permit vertical adjustment above or below finished grade. On gravel streets, the top of the valve box shall be set three inches below the surface and on paved streets one-quarter inch below finished grade. Earth fill shall be carefully compacted around each valve box. Burlap or rubber shall be wrapped around the base of the valve box. Dust pans shall be installed in all valve boxes. An alignment pole shall be used on each valve to insure the bottom and 10-foot sections are straight.
- H. Fire Hydrants
  - 1. Fire hydrant assemblies shall be installed where shown on the Drawings. Hydrant barrels shall be installed plumb. The hydrant barrel shall be wrapped full height with two layers of four-mil polyethylene, securely fastened to the barrel.
  - 2. The Contractor shall install hydrants with the flange a minimum of two inches and a maximum of six inches above finished grade. Backfill along the hydrant lead shall be in accordance with the section covering pipe backfill and compaction.
  - 3. If shown on the Drawings, install guard posts in accordance with the details.

#### 3.05 INSULATION OF PIPE

- A. When shown on the Drawings, Contractor shall install insulation above the pipe. This insulation is referred to as "insulation board."
- B. "Insulation board" shall be installed one foot above the top of the pipe. The receiving surface shall consist of sand or granulated material and shall be graded smooth to provide uniform bearing for the entire bottom surface of the insulation board. The insulation board shall be placed and secured in such a manner to prevent movement during backfilling using an overlapping joint or sealed joint.
- C. Construction equipment shall not be operated directly on the insulation. The first lift of material placed over the insulation board shall be a minimum of one-foot and it shall be carefully placed and spread over the insulation so as not to damage or disturb the board. Compaction of the first layer over the insulation shall be performed by equipment that will exert a contact stress of 90 psi or less. Subsequent layers may be compacted with conventional equipment.

# 3.06 BACKFILL

## A. General

- 1. After the lines have been inspected and tested, the trenches shall be backfilled. Backfill may be accomplished prior to testing at the Contractor's risk.
- 2. Unsuitable or surplus excavated materials shall be removed from the area. Contractor shall furnish additional backfill materials, if required, from off-site sources.
- B. Backfill Outside Roads, Parking, and Walks
  - Backfill to one-foot above top of pipe shall be original unclassified material, if available, otherwise the Contractor shall bring in unclassified material from other sources. Material shall be two inches maximum size and free from frozen clods. The Contractor shall carefully place and thoroughly compact backfill around and above pipe to minimum 90 percent density. The remainder of the backfill shall be compacted to 90 percent density and be original material provided it is free of all extraneous material such as organic soils, trees, brush, trash and boulders. Additional backfill, if required, may be unclassified material.
  - 2. Restore surface to its original elevation or in areas of new grading to the new design grade.
- C. Backfill Under Roads, Parking, and Walks
- D. Backfill to one-foot above top of pipe shall be with original unclassified material, if available, otherwise the Contractor shall bring in unclassified material from other sources. Material shall be two inches maximum size and free from frozen clods. The Contractor shall carefully place and thoroughly compact backfill around and above the pipe to minimum 90 percent density. Remaining backfill up to subgrade elevation shall be of unclassified material compacted to not less than 95 percent density. The remaining backfill shall be classified material as specified for subbase.

## 3.07 TESTING

- A. General
  - 1. After open bore flushing and prior to installing water service connections, all newly laid water main and appurtenances shall be subjected to pressure and leakage tests as specified herein. Said testing shall be done at the expense of the Contractor. This work shall be considered incidental to the installation of the water utility system and shall not be paid for separately.
  - 2. The Owner's Representative and Contractor shall be present for all testing.
- B. Pressure Test
  - 1. Before applying the specified test pressure, all air shall be expelled from the pipe. If permanent air vents are not located at all high points, the Contractor shall install corporation cocks at such points so that air can be expelled as the line is filled with water. The newly laid piping, or any valved section thereof, shall be subjected to a hydrostatic pressure test of 150 psi. After the required test pressure has been reached, the pumping will be terminated. If the

- 2. pressure (150 psi) remains constant for 30 minutes without the aid of a pump, the waterline will not be subjected to any further hydrostatic test. If the pressure does not remain constant for 30 minutes, a leakage test will follow. All valves within the section of line being tested will be closed and reopened after the required pressure (150 psi) has been obtained and prior to the 30 minute constant pressure test.
- 3. Services to buildings, which serve as fire lines or sprinkler lines, shall be tested same as above with 200 psi for two hours.
- C. Leakage Test
  - 1. The duration of each leakage test shall be at least two hours and during the test, the main shall be subjected to a constant pressure of 150 psi for two hours. Leakage for any newly laid pipe or any valved section thereof is defined as the quantity of water that is necessary to maintain the specified leakage test pressure after the pipe had been filled with water and the air is expelled.
  - 2. The allowable leakage per 100 feet of main at 150 psi is as follows:

| ipe Diameter | Gallons         |
|--------------|-----------------|
| (Inches)     | <u>per Hour</u> |
| 6            | .06             |
|              |                 |
| 8            | .08             |
| 10           | .10             |
| 12           | .12             |

3. Cracked or defective pipe, gaskets, mechanical joints, fittings, valves, or hydrants discovered as a consequence of the hydrostatic tests shall be removed and replaced with sound material at the Contractor's expense. The test shall then be repeated until the results are satisfactory.

# 3.08 CONTINUITY TEST

A. The Contractor shall perform electrical conductivity tests on all ductile iron mains in the presence of a representative of the Engineer. Continuity testing shall also be performed on all water service connections and extensions greater than two inches (2") in diameter.

The Contractor shall maintain a circuit of six hundred (600) amperes DC current for a period of fifteen (15) minutes. Input current shall not exceed ten percent (10%) of the return circuit. All equipment necessary to maintain the circuit shall be supplied by the Contractor.

All continuity tests will be through wires connected to the main and brought to the surface. The use of water service thaw wires, fire hydrants and valves as substitutes for wires will not be accepted. All wires brought to the surface to complete the continuity test shall be removed to a depth of two feet (2') below finished street grade upon completion of tests.

## 3.09 DISINFECTION

## A. General

- 1. After pressure, leakage, and continuity tests and before being placed into service, all newly laid water mains shall be thoroughly disinfected by the Contractor.
- B. Disinfection Method
  - 1. ANSI/AWWA Standard C651 provides three methods of chlorine disinfection of water mains. Contractor shall use one of these methods and comply with the complete Standard C651 procedure associated with the chosen method including final flushing and testing.
  - 2. Contractor shall not flush or discharge highly chlorinated water directly to the environment where the chlorine will have damaging effects on fish, animals, plants, or physical installations. ANSI/AWWA Standard C651 provides information on neutralizing the chlorine residual in water.
  - 3. Contractor shall verify satisfactory bacterial results by performing the bacterial tests according to ANSI/AWWA Standard C651. If the initial disinfection fails to produce satisfactory results, then the re-disinfection procedures described in Standard C651 shall be performed.

4.

5. Following satisfactory bacterial testing, all test coppers and air vent coppers shall be disconnected and removed. Test valves permanently attached to the water main shall be closed and test holes permanently plugged where necessary.

# 3.10 EXISTING UTILITIES

A. Contractor is responsible for the protection of all existing underground, surface, and overhead utilities, and for the protection of adjacent structures. Plan locations of existing underground facilities are to be considered approximate only and shall be verified with the owning utility by the Contractor. The methods used to protect existing utilities, appurtenances, structures, etc. shall be subject to the approval of the Owning Agency.

# 3.11 AS-BUILTS

- A. Contractor shall provide staking notes and a redlined drawing showing as-built information on the following:
  - 1. Horizontal location and elevation at least every 200 feet along the pipe and of all tees, bends, changes in grade, and end of the dead-end runs.
  - 2. Horizontal location for all valves, hydrants, bleeders, change in pipe size or class. In addition to stationing, location of valves shall also be shown by three swing ties from each valve to appropriate prominent features. Swing ties shall not exceed 100 feet in length without the written consent of the Owner's Representative.
  - 3. Horizontal and vertical location of any other utilities intercepted in the trench.
  - 4. Type and depth of bedding used, if any.
  - 5. Accurate detail and location of any unique tie-ins, special combination of fittings, etc.

## END OF SECTION 33 10 00

#### SECTION 33 30 00 SANITARY SEWERAGE UTILITIES

#### PART 1 - GENERAL

#### 1.01DESCRIPTION

A. This section covers the furnishing of all material, labor, and equipment necessary to completely install the sanitary sewer utility system and appurtenances in accordance with the Drawings. Building plumbing (upstream from the building cleanout) is not covered by this division.

#### 1.02 APPLICABLE STANDARDS

A. The latest revision of the following standards of the American Society for Testing and Materials (ASTM), the American Association for State Highway and Transportation Officials (AASHTO), the American Standards Association (ASA), and the American Water Works Association (AWWA) are hereby made a part of these specifications.

| ASTM C-478 – AASHTO-199 | Specification for Pre-cast Reinforced Concrete      |
|-------------------------|-----------------------------------------------------|
| AWWA C-151/A21.51-96    | Ductile Iron Pipe                                   |
| AWWA C-104/A21.04-95    | Cement Mortar for Ductile Iron Pipe                 |
| AWWA C-110/A21.10-98    | Ductile Iron Fittings                               |
| AWWA C-111/A21.11-00    | Rubber Gasket Fittings for D.I. Pipe                |
| ASTM D-3034             | Specifications for PVC Sewer Pipe                   |
|                         | and Fittings                                        |
| ASTM C-76               | Specification for Reinforced Concrete               |
| ASTM C-14               | Specification for Non-Reinforced Concrete Pipe      |
| ASTM C-443              | Joints for Concrete Pipe                            |
| ASTM A-48 and ASTM 438  | Strength Requirements for Manhole Frames and Covers |

#### 1.03 DEFINITIONS

A. See Section 31 20 00, EARTH MOVING.

#### 1.04 COMPACTION TESTING

- A. Where compaction density is specified, the maximum density shall be determined in accordance with Section 31 20 00 EARTH MOVING.
- B. The in-place soil density shall be determined in accordance with Section 31 20 00 EARTH MOVING.
- C. A gradation test, in accordance with Section 31 20 00, EARTH MOVING.
- D. The sewer line shall be tested in accordance with Anchorage Water and Wastewater Utility (AWWU) requirements.

#### 1.05 SUBMITTALS

A. See Section 33 10 00, WATER UTILITIES.

## PART 2 - PRODUCTS

#### 2.01 DUCTILE IRON (GRAVITY)

- A. Ductile iron pipe shall conform to ANSI/AWWA Specification C-151/A21.51-96 with cement mortar lining conforming to ANSI/AWWA C-104/A21.4-95. Class 50 pipe shall be used, unless otherwise indicated in the specification or Drawings. Fittings shall be ductile or cast iron and all bell conforming to ANSI/AWWA Specification C-110/A21.10-98 except that so-called "shortbody" fittings, otherwise meeting said ANSI/AWWA Specification may be used.
- B. Rubber gasket joints shall conform to ANSI/AWWA Specification C-111/A21.11-00.

#### 2.02 HIGH DENSITY POLYETHYLENE PIPE (FORCE MAIN)

- A. Pipe and Pipe Fittings: Piping shall be high-density polyethylene (HDPE) plastic. Pipe and pipe fittings, including special fittings, shall comply with the following requirements and specifications contained in this Subsection.
- B. High Density Polyethylene (HDPE) Pipe and Fittings
  - 1. High Density Polyethylene (HDPE) Plastic Pipe shall possess the following characteristics unless otherwise specified, shown, or approved by the Engineer.
    - a. Shall have a cell classification of 345464C per ASTM D 3350.
    - b. Nominal pipe dimensions as given on the drawings shall have actual diameter dimensions in accordance with ASTM F 714.
    - c. Shall have a maximum standard dimension ratio (SDR) of 11.0 and a minimum pressure rating of 160 psi.
    - d. All HDPE pipe used on the project shall have the same trade name. Additionally, the manufacturer shall certify that all HDPE pipe materials are compatible.
  - 2. Fittings and Specials for Polyethylene Pipe: Fittings and specials shall have the same trade name or be manufactured by the same manufacturer as the HDPE pipe being supplied. The manufacturer shall certify that the fitting material is compatible with the pipe material.
  - 3. Heat Fusion Joints shall comply with ASTM D 2657.
  - 4. Transition Fittings shall be a manufacturer's recommended fitting for the pipe materials and sizes being used.

#### 2.03 MISCELLANEOUS CONCRETE

A. All concrete used in the construction of sanitary sewer systems with the exception of pre-cast manholes, manhole risers, cones, and RCP pipe shall have a minimum strength of 3,000 psi with four to seven percent entrained air and slump of two to four inches.

#### 2.04 MORTAR

A. Cement for mortar used in the construction of sanitary sewer systems shall conform with ASTM Specification Designation C-150, Type II; sand shall conform with AASHTO Specification Designation M-45. The mortar shall be composed of one part cement and three parts sand. The addition of lime is not permitted. The joints shall be made so as to produce a smooth, regular watertight surface. Only enough water shall be added to provide plasticity in placing the mortar.

#### 2.05 MANHOLES

- A. Materials used in the construction of manholes shall conform to the requirements of ASTM Specification Designation C-478 and Standard Details. Cones shall be eccentric unless otherwise approved.
- B. Reinforced concrete pipe of the required inside diameter may be used for manhole riser sections as an alternative. This pipe shall conform to ASTM Specification Designation C-76 with a minimum thickness of five (5) inches.
- C. Each pre-cast concrete barrel section, pre-cast concrete eccentric cone section, concrete adjusting ring and manhole cover-frame shall be set and sealed by use of plastic gasket joint sealer as manufactured by K.T. Snyder Company, Inc., Ram-Nek Gasket Division, 9601 West Tidwell Street, Houston, Texas 77041 or approved equal.
- D. The tensile strength of the gray cast iron frames and covers shall be 30,000 psi minimum as per ASTM A438-64 and the requirement for transverse breaking load shall be 2,000 pounds as per ASTM A438-62. Contact surfaces between frames and covers shall be machined to provide a uniform contact surface.

## 2.06 SANITARY SEWER CLEANOUTS

A. Material used in the construction of sanitary sewer cleanouts shall conform to AWWA Specification C-151/A21.51-96 for Class 50 ductile iron pipe and AWWA Specification C- 110/A21.10-98 for ductile iron and gray iron fittings

#### 2.07 INSULATION BOARD

A. See Section 31 20 00, EARTH MOVING.

#### 2.08 POLYETHYLENE PIPE ENCASEMENT

A. The outside of all ductile iron sewer pipe and fittings shall be covered with one layer of eight-milthick polyethylene encasement "baggies" conforming to ANSI Standard A-21.5.

# 2.09 BURIED WARNING AND IDENTIFICATION TAPE

A. All sewer lines installed shall have a plastic marker tape 6-inch wide by 0.004 inches. The plastic marker tape shall include a metallic wire for detection purposes. Tape shall be green with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification tape to read, "caution buried sewer line below" or similar wording. The plastic marker tape shall be placed 2-foot above pipe.

#### 2.10 PIPE BEDDING

A. See Section 31 20 00 EARTH MOVING.

#### 2.11 SEPTIC TANK

- A. Per City of Wasilla Standards. Drawings and specifications.
- B. 6,000 gallon capacity.

#### 2.12 LIFT STATION

A. Per City of Wasilla Standards. Drawings and specifications.

## **PART 3 - EXECUTION**

#### 3.01 CONSTRUCTION STAKING

- A. The Contractor shall furnish surveys for construction staking:
  - 1. Two offset hubs with guard stakes will be placed to mark the offset and cut to the invert of each manhole, cleanout, junction, and service connection on the sewer line. On longer lines, additional stakes will be provided to mark line and grade at two hundred foot intervals.

## 3.02 LINE AND GRADE

- A. General
  - 1. Horizontal pipe distances are measured from inside face of manhole unless otherwise noted. Slopes are calculated based on horizontal distances from inside face of manhole to inside face of manhole. Elevations are to pipe invert.
- B. Field Checks
  - 1. Prior to utilizing information such as bench marks, etc. it shall be the Contractor's responsibility to verify bench mark elevations by checking between at least two bench marks.
  - 2. Alignment and grade shall be continuously checked by competent surveyor using transit and surveyor's level during progress of work.
  - 3. The Contractor shall provide a competent surveyor to maintain line and grade during all pipe laying operations with a transit and engineer's level at no additional cost to the Owner. Accurate survey notes shall be kept in accordance with accepted survey practice.

- C. Tolerances
  - 1. Pipe tolerance shall be within 0.03 feet of design elevation with no level or reverse grade sections of pipe. Horizontal alignment to appear straight to the eye and laid so that a full circle of light is seen when sighting through the pipe.

## 3.03 EXCAVATION

- A. See Section 33 10 00, WATER UTILITIES.
- B. Water Removal
  - 1. See Section 33 10 00 WATER UTILITIES.

#### 3.04 PIPE HANDLING

- A. All pipe shall be laid in a six-inch deep bed of classified material with no stones larger than two inches unless the existing trench bottom is suitable for bedding. All force main pipe shall have 10 foot of cover. All bedding material shall extend up to the spring line of pipe. Bedding material shall be compacted to 95 percent maximum density.
- B. Each pipe shall be laid true to line and grade and in such a manner as to form a close concentric joint with the adjoining pipe. The alignment of the installed pipe shall appear straight to the naked eye. Each section of pipe shall be handled carefully and placed accurately.
- C. At all times when work is not in progress, open ends of pipe and fittings shall be securely and satisfactorily closed so that no undesirable substances will enter the pipe or fittings.
- D. Where a project outfalls into an existing sanitary sewer, construction of the physical connection to the existing line shall be delayed until all upstream underground construction including exfiltration testing is complete and accepted unless special permission is granted by the Owning Utility. Care shall be exercised during construction, flushing, and testing operations of this connecting link to assure that water is not diverted into any portion of a sanitary sewer line in service or a sanitary sewer line which is not a portion of the construction project for which the Contractor is responsible.
- E. Freezing Conditions
  - 1. No pipe shall be laid when the bottom of the ditch or the sides to one foot above the pipe is frozen. No backfill containing frozen material shall be placed within three feet of the pipe nor shall the trench be left open during freezing weather so that the temperature of the material near the pipe goes below freezing.
- F. The polyethylene casing shall be installed using the following methods:
  - 1. Cut polyethylene tube to a length approximately two feet longer than the length of the pipe section. Slip the tube around the pipe, centering it to provide a one-foot overlap on each adjacent pipe section, and bunch it accordion-fashion lengthwise until it clears the pipe.
  - 2. Lower the pipe into the trench and make up the pipe joint with the preceding section of pipe. A shallow bell hole must be made at the joints to facilitate installation of the polyethylene tube.
  - 3. After assembling the pipe joint and testing the bonded joint, make the overlap of the polyethylene tube. Pull the bunched polyethylene from the preceding length of pipe, slip it over the end of the new length of pipe, and secure in place. Then slip the end of the polyethylene from the new pipe section over the end of the first wrap until it overlaps the joint at the end of the preceding length of pipe. Secure the overlap in place. Take up the slack width to make a snug but not tight fit along the barrel of the pipe securing the fold at quarter points.
  - 4. Repair any rips, punctures or other damage to the polyethylene with adhesive tape or with a short length of polyethylene tube cut open, wrapped around the pipe, and secured in place. Proceed with installation of the next section of pipe in the same manner.

#### 3.05 TEST OF WORKMANSHIP

#### A. General

- 1. All sanitary sewer facilities constructed shall be subjected to a leakage or infiltration test and proven tight within the tolerances specified herein. All labor, equipment, and supervision required for this work shall be furnished by the Contractor at his expense and shall be considered incidental to the work and will not be paid for separately.
- 2. In those areas where, in the opinion of the Owner's Representative, the water table is high enough to subject the pipe to a satisfactory infiltration test, an exfiltration test will not be required. In checking leakage, there will be no allowance made for external hydrostatic head.
- 3. Where, in the opinion of the Owner's Representative, the water table is not high enough to provide a satisfactory infiltration test, an exfiltration test will be required.
- B. Exfiltration Test (Using Air)
  - 1. The Contractor shall furnish all facilities and personnel for conducting the test under the observation of the Owner's Representative. The equipment and personnel shall be subject to the approval of the Owner's Representative.
  - 2. The Contractor may desire to make an air test prior to backfilling for his own purposes. However, the acceptance air test shall be made after backfilling has been completed and compacted.
  - 3. Immediately following the pipe cleaning, the pipe installation shall be tested with low-pressure air. Air shall be slowly supplied to the plugged pipe installation until the internal air pressure reached 4.0 pounds per square inch greater than the average back pressure of any groundwater that may submerge the pipe. At least two minutes shall be allowed for temperature stabilization before proceeding further.
  - 4. The pipeline shall be considered acceptable when tested at an average of 4.0 pounds per square inch greater than the average back pressure of any groundwater that may submerge the pipe, if the total rate of air loss from any section tested in its entirety between manholes or between manholes and cleanout structures does not exceed 2.0 cubic feet per minute, or the following table may be utilized as a guideline for a satisfactory test by air for pipe sizes shown:

| Pipe Diameter | Allowable Pressure Drop<br>in 10 Minutes |  |
|---------------|------------------------------------------|--|
| 8"            | 2.7 psi                                  |  |

- 5. Pressure gauges shall be in increments of not more than 1/2 pound increments for accurate tests.
- 6. If the pipe installation fails to meet test requirements, the Contractor shall determine at his own expense the source or sources of leakage, and he shall repair (if the extent and type of repairs proposed by the Contractor appear reasonable to the Owner's Representative) or replace all defective materials or workmanship. The completed pipe installation shall meet the requirements of this test or the alternative water exfiltration test before being considered acceptable.
- 7. SAFETY braces shall be required to hold plugs in place and to prevent the sudden release of the compressed air. Due to the large forces that could be exerted by an escaping plug during the testing of the pipe, no workman shall be allowed in the manholes in which plugs have been placed while tests are being conducted. Also the Contractor's testing equipment shall be arranged in such a manner that a pressure relief device will prohibit the pressure in the pipeline from exceeding 10 psi.

## 3.06 MANHOLE CONSTRUCTION

- A. The manhole rings and covers shall be brought to the grades shown on the Drawings. Manhole rings shall be set in a full bed of mortar and made secure.
- B. All portions of pre-cast manholes must be approved prior to installation in the sanitary sewer systems. The pre-cast manhole manufacturer shall provide timely notice (at least two working days in advance) to allow time for the Owner's Representative to arrange for necessary tests.

This approval does not relieve the Contractor of the responsibility for protection of manholes against damage during handling and installation.

- C. Manholes shall be installed at the locations shown on the Drawings such that primary leads enter radially at the invert elevations specified. The base section shall be set plumb on a level subgrade compacted to 95 percent maximum density.
- D. Where indicated on the Drawings, a stub shall be provided for future connections to the manhole. The stub shall be sized and positioned as indicated. The end of the stub shall be stopped with a wooden plug, concrete biscuit or other adequate methods to prevent water, earth or other substances from entering the pipe.
- E. In the case of poured-in-place manhole construction, if the Contractor elects to accomplish the manhole construction utilizing more than one continuous concrete pour, a keyed construction joint shall be used. These manholes shall have poured-in-place bases.
- F. The invert channels shall be smooth and semicircular in shape conforming to the inside of the connecting sewer section. Changes in directions of the flow shall be made by forming a smooth radius sized to allow adequate access of a TV camera and/or maintenance equipment into the served sewer pipe. Changes in size and grades of the channels shall be made gradually and evenly. The invert channels may be formed directly in the concrete of the manhole base or may be formed and poured in place or may be constructed by laying a full section of sewer pipe through the manhole and breaking out the top half after the surrounding concrete has hardened. The floor of the manhole outside the channels shall be smooth and shall slope towards the channels at a grade of one-inch per foot.

#### 3.07 EXISTING UTILITIES

- A. The Contractor is responsible for the protection of all existing underground, surface or overhead utilities, and for the protection of adjacent structures. Plan locations of existing underground facilities are to be considered approximate only and shall be verified with the owning utility by the Contractor. The methods used to protect existing utilities, appurtenances, structures, etc. shall be subject to the approval of the Owning Agency.
- B. Contractor shall verify location of and elevations to existing sewers that new lines tie into prior to construction.
- C. New sewer lines must not cross existing water lines with less than 18 inches clearance. Contractor shall verify existing water line elevations and notify the Engineer immediately of any conflicts prior to laying the new lines.

#### 3.08 BACKFILL

A. See Section 33 10 00 WATER UTILITIES.

## 3.09 INSULATION OF PIPE

A. See Section 33 10 00 WATER UTILITIES.

#### 3.10 AS-BUILTS

A. See Section 33 10 00 WATER UTILITIES.

## 3.11 EXISTING SEWAGE FLOWS

A. The Contractor shall be responsible for handling of existing sewage flows where project work requires modifications, reconstruction, connections, etc. to existing sewer systems. Methods shall include by-passes, enclosures, seals, pumping, and other temporary facilities to safely handle existing sewage flows. Southcentral Foundation Benteh Nuutah Valley Primary Care Center Expansion September 20, 2024 (for cost estimate)

# 3.12 CLEANUP

#### A. General

- 1. During the time that the work is in progress, the Contractor shall make every effort to maintain the premises in a neat and orderly condition. All refuse, broken pipe, excess fill material, cribbing, etc. shall be removed as soon as practicable.
- 2. The pipe laying shall not progress ahead of backfilling of ditches more than 400 feet.
- B. Sanitary Sewers
  - 1. The Contractor shall flush and clean all sanitary sewers. All sand, debris mortar, and foreign material shall be removed from the sanitary sewers and manholes.

## END OF SECTION 33 30 00

#### SECTION 33 30 00 SANITARY SEWERAGE UTILITIES

#### PART 1 - GENERAL

#### 1.01DESCRIPTION

A. This section covers the furnishing of all material, labor, and equipment necessary to completely install the sanitary sewer utility system and appurtenances in accordance with the Drawings. Building plumbing (upstream from the building cleanout) is not covered by this division.

#### 1.02 APPLICABLE STANDARDS

A. The latest revision of the following standards of the American Society for Testing and Materials (ASTM), the American Association for State Highway and Transportation Officials (AASHTO), the American Standards Association (ASA), and the American Water Works Association (AWWA) are hereby made a part of these specifications.

| ASTM C-478 – AASHTO-199 | Specification for Pre-cast Reinforced Concrete      |
|-------------------------|-----------------------------------------------------|
| AWWA C-151/A21.51-96    | Ductile Iron Pipe                                   |
| AWWA C-104/A21.04-95    | Cement Mortar for Ductile Iron Pipe                 |
| AWWA C-110/A21.10-98    | Ductile Iron Fittings                               |
| AWWA C-111/A21.11-00    | Rubber Gasket Fittings for D.I. Pipe                |
| ASTM D-3034             | Specifications for PVC Sewer Pipe                   |
|                         | and Fittings                                        |
| ASTM C-76               | Specification for Reinforced Concrete               |
| ASTM C-14               | Specification for Non-Reinforced Concrete Pipe      |
| ASTM C-443              | Joints for Concrete Pipe                            |
| ASTM A-48 and ASTM 438  | Strength Requirements for Manhole Frames and Covers |

#### 1.03 DEFINITIONS

A. See Section 31 20 00, EARTH MOVING.

#### 1.04 COMPACTION TESTING

- A. Where compaction density is specified, the maximum density shall be determined in accordance with Section 31 20 00 EARTH MOVING.
- B. The in-place soil density shall be determined in accordance with Section 31 20 00 EARTH MOVING.
- C. A gradation test, in accordance with Section 31 20 00, EARTH MOVING.
- D. The sewer line shall be tested in accordance with Anchorage Water and Wastewater Utility (AWWU) requirements.

#### 1.05 SUBMITTALS

A. See Section 33 10 00, WATER UTILITIES.

## PART 2 - PRODUCTS

#### 2.01 DUCTILE IRON (GRAVITY)

- A. Ductile iron pipe shall conform to ANSI/AWWA Specification C-151/A21.51-96 with cement mortar lining conforming to ANSI/AWWA C-104/A21.4-95. Class 50 pipe shall be used, unless otherwise indicated in the specification or Drawings. Fittings shall be ductile or cast iron and all bell conforming to ANSI/AWWA Specification C-110/A21.10-98 except that so-called "shortbody" fittings, otherwise meeting said ANSI/AWWA Specification may be used.
- B. Rubber gasket joints shall conform to ANSI/AWWA Specification C-111/A21.11-00.

#### 2.02 HIGH DENSITY POLYETHYLENE PIPE (FORCE MAIN)

- A. Pipe and Pipe Fittings: Piping shall be high-density polyethylene (HDPE) plastic. Pipe and pipe fittings, including special fittings, shall comply with the following requirements and specifications contained in this Subsection.
- B. High Density Polyethylene (HDPE) Pipe and Fittings
  - 1. High Density Polyethylene (HDPE) Plastic Pipe shall possess the following characteristics unless otherwise specified, shown, or approved by the Engineer.
    - a. Shall have a cell classification of 345464C per ASTM D 3350.
    - b. Nominal pipe dimensions as given on the drawings shall have actual diameter dimensions in accordance with ASTM F 714.
    - c. Shall have a maximum standard dimension ratio (SDR) of 11.0 and a minimum pressure rating of 160 psi.
    - d. All HDPE pipe used on the project shall have the same trade name. Additionally, the manufacturer shall certify that all HDPE pipe materials are compatible.
  - 2. Fittings and Specials for Polyethylene Pipe: Fittings and specials shall have the same trade name or be manufactured by the same manufacturer as the HDPE pipe being supplied. The manufacturer shall certify that the fitting material is compatible with the pipe material.
  - 3. Heat Fusion Joints shall comply with ASTM D 2657.
  - 4. Transition Fittings shall be a manufacturer's recommended fitting for the pipe materials and sizes being used.

#### 2.03 MISCELLANEOUS CONCRETE

A. All concrete used in the construction of sanitary sewer systems with the exception of pre-cast manholes, manhole risers, cones, and RCP pipe shall have a minimum strength of 3,000 psi with four to seven percent entrained air and slump of two to four inches.

#### 2.04 MORTAR

A. Cement for mortar used in the construction of sanitary sewer systems shall conform with ASTM Specification Designation C-150, Type II; sand shall conform with AASHTO Specification Designation M-45. The mortar shall be composed of one part cement and three parts sand. The addition of lime is not permitted. The joints shall be made so as to produce a smooth, regular watertight surface. Only enough water shall be added to provide plasticity in placing the mortar.

#### 2.05 MANHOLES

- A. Materials used in the construction of manholes shall conform to the requirements of ASTM Specification Designation C-478 and Standard Details. Cones shall be eccentric unless otherwise approved.
- B. Reinforced concrete pipe of the required inside diameter may be used for manhole riser sections as an alternative. This pipe shall conform to ASTM Specification Designation C-76 with a minimum thickness of five (5) inches.
- C. Each pre-cast concrete barrel section, pre-cast concrete eccentric cone section, concrete adjusting ring and manhole cover-frame shall be set and sealed by use of plastic gasket joint sealer as manufactured by K.T. Snyder Company, Inc., Ram-Nek Gasket Division, 9601 West Tidwell Street, Houston, Texas 77041 or approved equal.
- D. The tensile strength of the gray cast iron frames and covers shall be 30,000 psi minimum as per ASTM A438-64 and the requirement for transverse breaking load shall be 2,000 pounds as per ASTM A438-62. Contact surfaces between frames and covers shall be machined to provide a uniform contact surface.

## 2.06 SANITARY SEWER CLEANOUTS

A. Material used in the construction of sanitary sewer cleanouts shall conform to AWWA Specification C-151/A21.51-96 for Class 50 ductile iron pipe and AWWA Specification C- 110/A21.10-98 for ductile iron and gray iron fittings

#### 2.07 INSULATION BOARD

A. See Section 31 20 00, EARTH MOVING.

#### 2.08 POLYETHYLENE PIPE ENCASEMENT

A. The outside of all ductile iron sewer pipe and fittings shall be covered with one layer of eight-milthick polyethylene encasement "baggies" conforming to ANSI Standard A-21.5.

# 2.09 BURIED WARNING AND IDENTIFICATION TAPE

A. All sewer lines installed shall have a plastic marker tape 6-inch wide by 0.004 inches. The plastic marker tape shall include a metallic wire for detection purposes. Tape shall be green with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification tape to read, "caution buried sewer line below" or similar wording. The plastic marker tape shall be placed 2-foot above pipe.

#### 2.10 PIPE BEDDING

A. See Section 31 20 00 EARTH MOVING.

#### 2.11 SEPTIC TANK

- A. Per City of Wasilla Standards. Drawings and specifications.
- B. 6,000 gallon capacity.

#### 2.12 LIFT STATION

A. Per City of Wasilla Standards. Drawings and specifications.

## **PART 3 - EXECUTION**

#### 3.01 CONSTRUCTION STAKING

- A. The Contractor shall furnish surveys for construction staking:
  - 1. Two offset hubs with guard stakes will be placed to mark the offset and cut to the invert of each manhole, cleanout, junction, and service connection on the sewer line. On longer lines, additional stakes will be provided to mark line and grade at two hundred foot intervals.

## 3.02 LINE AND GRADE

- A. General
  - 1. Horizontal pipe distances are measured from inside face of manhole unless otherwise noted. Slopes are calculated based on horizontal distances from inside face of manhole to inside face of manhole. Elevations are to pipe invert.
- B. Field Checks
  - 1. Prior to utilizing information such as bench marks, etc. it shall be the Contractor's responsibility to verify bench mark elevations by checking between at least two bench marks.
  - 2. Alignment and grade shall be continuously checked by competent surveyor using transit and surveyor's level during progress of work.
  - 3. The Contractor shall provide a competent surveyor to maintain line and grade during all pipe laying operations with a transit and engineer's level at no additional cost to the Owner. Accurate survey notes shall be kept in accordance with accepted survey practice.

- C. Tolerances
  - 1. Pipe tolerance shall be within 0.03 feet of design elevation with no level or reverse grade sections of pipe. Horizontal alignment to appear straight to the eye and laid so that a full circle of light is seen when sighting through the pipe.

## 3.03 EXCAVATION

- A. See Section 33 10 00, WATER UTILITIES.
- B. Water Removal
  - 1. See Section 33 10 00 WATER UTILITIES.

#### 3.04 PIPE HANDLING

- A. All pipe shall be laid in a six-inch deep bed of classified material with no stones larger than two inches unless the existing trench bottom is suitable for bedding. All force main pipe shall have 10 foot of cover. All bedding material shall extend up to the spring line of pipe. Bedding material shall be compacted to 95 percent maximum density.
- B. Each pipe shall be laid true to line and grade and in such a manner as to form a close concentric joint with the adjoining pipe. The alignment of the installed pipe shall appear straight to the naked eye. Each section of pipe shall be handled carefully and placed accurately.
- C. At all times when work is not in progress, open ends of pipe and fittings shall be securely and satisfactorily closed so that no undesirable substances will enter the pipe or fittings.
- D. Where a project outfalls into an existing sanitary sewer, construction of the physical connection to the existing line shall be delayed until all upstream underground construction including exfiltration testing is complete and accepted unless special permission is granted by the Owning Utility. Care shall be exercised during construction, flushing, and testing operations of this connecting link to assure that water is not diverted into any portion of a sanitary sewer line in service or a sanitary sewer line which is not a portion of the construction project for which the Contractor is responsible.
- E. Freezing Conditions
  - 1. No pipe shall be laid when the bottom of the ditch or the sides to one foot above the pipe is frozen. No backfill containing frozen material shall be placed within three feet of the pipe nor shall the trench be left open during freezing weather so that the temperature of the material near the pipe goes below freezing.
- F. The polyethylene casing shall be installed using the following methods:
  - 1. Cut polyethylene tube to a length approximately two feet longer than the length of the pipe section. Slip the tube around the pipe, centering it to provide a one-foot overlap on each adjacent pipe section, and bunch it accordion-fashion lengthwise until it clears the pipe.
  - 2. Lower the pipe into the trench and make up the pipe joint with the preceding section of pipe. A shallow bell hole must be made at the joints to facilitate installation of the polyethylene tube.
  - 3. After assembling the pipe joint and testing the bonded joint, make the overlap of the polyethylene tube. Pull the bunched polyethylene from the preceding length of pipe, slip it over the end of the new length of pipe, and secure in place. Then slip the end of the polyethylene from the new pipe section over the end of the first wrap until it overlaps the joint at the end of the preceding length of pipe. Secure the overlap in place. Take up the slack width to make a snug but not tight fit along the barrel of the pipe securing the fold at quarter points.
  - 4. Repair any rips, punctures or other damage to the polyethylene with adhesive tape or with a short length of polyethylene tube cut open, wrapped around the pipe, and secured in place. Proceed with installation of the next section of pipe in the same manner.

#### 3.05 TEST OF WORKMANSHIP

#### A. General

- 1. All sanitary sewer facilities constructed shall be subjected to a leakage or infiltration test and proven tight within the tolerances specified herein. All labor, equipment, and supervision required for this work shall be furnished by the Contractor at his expense and shall be considered incidental to the work and will not be paid for separately.
- 2. In those areas where, in the opinion of the Owner's Representative, the water table is high enough to subject the pipe to a satisfactory infiltration test, an exfiltration test will not be required. In checking leakage, there will be no allowance made for external hydrostatic head.
- 3. Where, in the opinion of the Owner's Representative, the water table is not high enough to provide a satisfactory infiltration test, an exfiltration test will be required.
- B. Exfiltration Test (Using Air)
  - 1. The Contractor shall furnish all facilities and personnel for conducting the test under the observation of the Owner's Representative. The equipment and personnel shall be subject to the approval of the Owner's Representative.
  - 2. The Contractor may desire to make an air test prior to backfilling for his own purposes. However, the acceptance air test shall be made after backfilling has been completed and compacted.
  - 3. Immediately following the pipe cleaning, the pipe installation shall be tested with low-pressure air. Air shall be slowly supplied to the plugged pipe installation until the internal air pressure reached 4.0 pounds per square inch greater than the average back pressure of any groundwater that may submerge the pipe. At least two minutes shall be allowed for temperature stabilization before proceeding further.
  - 4. The pipeline shall be considered acceptable when tested at an average of 4.0 pounds per square inch greater than the average back pressure of any groundwater that may submerge the pipe, if the total rate of air loss from any section tested in its entirety between manholes or between manholes and cleanout structures does not exceed 2.0 cubic feet per minute, or the following table may be utilized as a guideline for a satisfactory test by air for pipe sizes shown:

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|---------------|------------------------------------------|--|
| 8"            | 2.7 psi                                  |  |

- 5. Pressure gauges shall be in increments of not more than 1/2 pound increments for accurate tests.
- 6. If the pipe installation fails to meet test requirements, the Contractor shall determine at his own expense the source or sources of leakage, and he shall repair (if the extent and type of repairs proposed by the Contractor appear reasonable to the Owner's Representative) or replace all defective materials or workmanship. The completed pipe installation shall meet the requirements of this test or the alternative water exfiltration test before being considered acceptable.
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This approval does not relieve the Contractor of the responsibility for protection of manholes against damage during handling and installation.

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- C. New sewer lines must not cross existing water lines with less than 18 inches clearance. Contractor shall verify existing water line elevations and notify the Engineer immediately of any conflicts prior to laying the new lines.

#### 3.08 BACKFILL

A. See Section 33 10 00 WATER UTILITIES.

## 3.09 INSULATION OF PIPE

A. See Section 33 10 00 WATER UTILITIES.

#### 3.10 AS-BUILTS

A. See Section 33 10 00 WATER UTILITIES.

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# 3.12 CLEANUP

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  - 1. The Contractor shall flush and clean all sanitary sewers. All sand, debris mortar, and foreign material shall be removed from the sanitary sewers and manholes.

## END OF SECTION 33 30 00