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SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Project information.
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3. Phased construction.
4. Work under separate contracts.
5. Access to site.
6. Coordination with owner.
7. Owner occupancy.
8. Work restrictions.
9. Temporary facilities and controls
10. Specification and drawing conventions.

1.2 PROJECT INFORMATION

A. Project Identification: Mercersburg Academy Health Center Renovation.

1. Project Location: Mercersburg Academy, 300 East Seminary Street, Mercersburg, Pennsylvania.

B. Owner: Mercersburg Academy.

1. Project Owner's Representative: Dan Izer, Project Engineer, 300 East Seminary Street, Mercersburg, Pennsylvania.

C. Architect: KD3 Design Studio, 426 South Third Street, Lemoyne, PA 17043.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of the Project is defined by the Contract Documents and consists of the following:
1. The Work consists of
a. A renovation of approximately 6,800 gsf of existing on campus, health center facility. The building has been vacated by the Owner. Renovation scopes consist of but are not limited to: site work, landscaping, architectural demolition and removal, masonry in fills, glazing, doors, painting, as well as mechanical, electrical, plumbing and fire protection.
1) Anticipated Construction Start: November 2017
2) Estimated Substantial Completion: June 2018

B. Type of Contract.

1. Project will be constructed using the AIA 101-2007 Agreement.

1.4 WORK UNDER SEPARATE CONTRACTS

A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under separate contracts.

B. Preceding Work: Owner will award separate contract(s) for the following construction operations at Project site. Those operations are scheduled to be substantially complete before work under this Contract begins.

1. Hazardous Material Abatement: To be determined.

C. Concurrent Work: Owner will award and will assign to the Contractor separate contract(s) for the following construction operations at Project site. Those operations will be conducted simultaneously with work under this Contract.

1. Data/Telecomm/AV Cabling: To be determined for installing and pulling data/telecommunications cabling.

2. Security and Access Control: To be determined, for providing 'fob' reader and electronic remote monitored access control.

1.5 ACCESS TO SITE

A. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

B. Use of Site: Limit use of Project site to work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Limits: Confine construction operations to areas scheduled for work and to areas assigned by the Owner.
2. Limits: Unless shown otherwise, limit site disturbance, including earthwork and clearing of vegetation, to 40 feet (12.2 m) beyond building perimeter; 10 feet (3 m) beyond surface walkways, patios, surface parking, and utilities less than 12 inches (300 mm) in diameter; 15 feet (4.5 m) beyond primary roadway curbs and main utility branch trenches; and 25 feet (7.6 m) beyond constructed areas with permeable surfaces (such as landscaping and grading) that require additional staging areas in order to limit compaction in the constructed area.
3. Driveways, Walkways and Entrances: Keep campus drives and public roads clear of construction vehicles and parking. Parking limited to building site as defined by the Limit of Disturbance on the documents but not to include adjacent drives or streets.

    a. Schedule deliveries to minimize use of driveways and pathways by construction operations.
    b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

C. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weather tight condition throughout construction period. Repair damage caused

by construction operations.

1.6 COORDINATION WITH OWNER

A. Project Meetings: Owner, Architect and Contractor shall have one project coordination meeting every other week throughout the duration of construction activity. Items for discussion include but not limited to: project progression, project issues, submittals, project walk-thru, etc.

1.7 OWNER OCCUPANCY

A. Partial Owner Occupancy: Owner will not occupy the premises during entire construction period. Cooperate with Owner during construction operations to minimize conflicts with ongoing use of adjacent facilities and residences. Perform the Work so as not to interfere with Owner's operations. Maintain existing exits unless otherwise indicated.

1. Maintain access to existing walkways. Do not close or obstruct campus walkways, without written permission from Owner and authorities having jurisdiction.
2. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.

B. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.

1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied prior to Owner acceptance of the completed Work.
2. Obtain a Certificate of Occupancy from authorities having jurisdiction before limited Owner occupancy.
3. Before limited Owner occupancy, mechanical and electrical systems shall be fully operational, cleaned, and required tests and inspections shall be successfully completed.
4. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of Work.
5. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of Work.

1.8 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets and other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Limit work in the existing building to normal business working hours of 7:00 a.m. to 6:00 p.m., Monday through Friday, except as otherwise indicated.

C. Work Restrictions: Comply with Mercersburg Academy visitor and outside vendor

requirements.

1. Mercersburg Academy Visitor and Vendor Requirements:
   a. All personnel working on campus must be approved by Mercersburg Academy Human Resources Department prior to work. A 24-hour notice must be provided prior to being approved to be onsite.

   b. Prior to approval, all personnel must obtain:
      1) FBI Background Clearance
      2) PDE-6004 Arrest/Conviction Report Disclosure Form

D. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:

1. Notify Owner not less than 48-hours in advance of proposed utility interruptions.
2. Obtain Owner's written permission before proceeding with utility interruptions.

E. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.

1. Notify Owner not less than 48-hours in advance of proposed disruptive operations.
2. Obtain Owner's written permission before proceeding with disruptive operations.

F. Controlled Substances: Use of tobacco products, alcohol and other controlled substances on the Mercersburg Academy campus is not permitted.

1.9 TEMPORARY FACILITIES AND CONTROLS

A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, testing agencies, and authorities having jurisdiction.

B. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use. Contractor shall provide metering at temporary connection and reimburse Owner for all use at rate paid by Owner to utility.. Provide connections and extensions of services as required for construction operations.

C. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use. Contractor shall provide metering at temporary connection and reimburse Owner for all use at rate paid by Owner to utility. Provide connections and extensions of services as required for construction operations.

1.10 SPECIFICATION AND DRAWINGS

A. Division 1 General Requirements: Requirements of Sections in Division 1 apply to the Work of all Sections in the Specifications.

B. Drawing Coordination: Requirements for materials and products identified on the Drawings are described in detail in the Specifications.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Chain-Link Fencing: Minimum 2-inch (50-mm), 0.148-inch- (3.8-mm-) thick, galvanized steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized steel pipe posts; minimum 2-3/8-inch- (60-mm-) OD line posts and 2-7/8-inch- (73-mm-) OD corner and pull posts, with 1-5/8-inch- (42-mm-) OD top rails.

B. Portable Chain-Link Fencing: Minimum 2-inch (50-mm), 0.148-inch- (3.8-mm-) thick, galvanized steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized steel pipe posts; minimum 2-3/8-inch- (60-mm-) OD line posts and 2-7/8-inch- (73-mm-) OD corner and pull posts, with 1-5/8-inch- (42-mm-) OD top and bottom rails. Provide concrete bases for supporting posts.

2.2 TEMPORARY FACILITIES

A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, and construction personnel office activities and to accommodate project meetings specified in other Division 1 Sections. Keep office clean and orderly.

C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

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

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

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

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

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

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

E. Electric Power Service: Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.

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

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

2. Provide superintendent with cellular telephone for use when away from field office.

G. Project Signs: Unauthorized signs are not permitted.

1. Identification Signs: Provide Project identification signs as approved by Owner and Architect.
2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.

a. Provide temporary, directional signs for construction personnel and visitors.

3. Maintain and touchup signs so they are legible at all times.

H. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.

I. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.

1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.

2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to Owner.

3. Lock at the end of each day by Contractor.

END OF SECTION

SECTION 024100
DEMOLITION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Selective demolition of built site elements.
   2. Selective demolition of building elements for alteration purposes.
   3. Abandonment and removal of existing utilities and utility structures.

B. Related Sections:
   1. Section 015000 - Temporary Facilities and Controls: Site fences, security, and protective barriers.
   2. Section 017000 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain.
   3. Section 017419 - Construction Waste Management and Disposal: Limitations on disposal of removed materials; requirements for recycling.

1.02 REFERENCE STANDARDS

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

PART 2 PRODUCTS -- NOT USED

PART 3 EXECUTION

3.01 SCOPE

A. Remove other items indicated, for salvage, relocation, and recycling.

3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Comply with other requirements specified in Section 017000.

B. 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.

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

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D. Do not begin removal until specified measures have been taken to protect vegetation to remain.

E. Protect existing structures and other elements that are not to be removed.
   1. Provide bracing and shoring.
   2. Prevent movement or settlement of adjacent structures.
   3. Stop work immediately if adjacent structures appear to be in danger.

F. Minimize production of dust due to demolition operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

G. 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.

H. Perform demolition in a manner that maximizes salvage and recycling of materials.
   1. Comply with requirements of Section 017419 - Construction Waste Management.

3.03 EXISTING UTILITIES

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

B. Protect existing utilities to remain from damage.

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

D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.

E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.

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

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

H. Prepare building demolition areas by disconnecting and capping utilities outside the demolition zone; identify and mark utilities to be subsequently reconnected, in same manner as other utilities to remain.

3.04 SELECTIVE DEMOLITION FOR ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
   1. Verify that construction and utility arrangements are as shown.
   2. Report discrepancies to Architect before disturbing existing installation.
   3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.

B. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.

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C. Remove existing work as indicated and as required to accomplish new work.
   1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction specified.
   2. Remove items indicated on drawings.

D. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove existing systems and equipment as indicated.
   1. Verify that abandoned services serve only abandoned facilities before removal.
   2. Remove abandoned pipe, ducts, conduits, and equipment; 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.

3.05 DEBRIS AND WASTE REMOVAL

A. Remove from site all materials not to be reused on site; comply with requirements of Section 017419 - Construction Waste Management.

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

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SECTION 033000
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Concrete formwork.
   2. Concrete reinforcement.
   3. Concrete curing.

1.02 REFERENCE STANDARDS

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

B. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; 1991 (Reapproved 2009).

C. ACI 301 - Specifications for Structural Concrete; 2010 (Errata 2012).

D. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000.

E. ACI 305R - Hot Weather Concreting; 2010.

F. ACI 306R - Cold Weather Concreting; 2010.

G. ACI 308R - Guide to Curing Concrete; 2001 (Reapproved 2008).

H. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2011.

I. ACI 347R - Guide to Formwork for Concrete; 2014.

J. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement; 2015.

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

L. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2015a.

M. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2015.

N. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2012.

O. ASTM C150/C150M - Standard Specification for Portland Cement; 2015.

P. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2014.

1.03 SUBMITTALS

A. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.

B. Mix Design: Submit proposed concrete mix design.
   1. Indicate proposed mix design complies with requirements of ACI 301, Section 4 - Concrete Mixtures.

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2. Indicate proposed mix design complies with requirements of ACI 318, Chapter 5 - Concrete Quality, Mixing and Placing.

C. Manufacturer's Installation Instructions: For concrete accessories, indicate installation procedures and interface required with adjacent construction.

1.04 QUALITY ASSURANCE

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

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

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

PART 2 PRODUCTS

2.01 FORMWORK

A. Formwork Design and Construction: Comply with guidelines of ACI 347R to provide formwork that will produce concrete complying with tolerances of ACI 117.

B. Form Materials: Contractor's choice of standard products with sufficient strength to withstand hydrostatic head without distortion in excess of permitted tolerances.
   1. Form Coating: Release agent that will not adversely affect concrete or interfere with application of coatings.
   2. Form Ties: Cone snap type that will leave no metal within 1-1/2 inches of concrete surface.

2.02 REINFORCEMENT

A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi).
   1. Type: Deformed billet-steel bars.
   2. Finish: Unfinished, unless otherwise indicated.

B. Steel Welded Wire Reinforcement (WWR): ASTM A185, Grade 60.

C. Reinforcement Accessories:
   1. Tie Wire: Annealed, minimum 16 gage, 0.0508 inch.

2.03 CONCRETE MATERIALS

A. Cement: ASTM C150/C150M, Type I - Normal Portland type.
   1. Acquire all cement for entire project from same source.

B. Fine and Coarse Aggregates: ASTM C 33.
   1. Acquire all aggregates for entire project from same source.

C. Water: Clean and not detrimental to concrete.

2.04 CONCRETE MIX DESIGN

A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.

B. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.
   1. For trial mixtures method, employ independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.

C. Normal Weight Concrete:

1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: strength as specified on drawings.
2. Water-Cement Ratio: Maximum 50 percent by weight.
3. Total Air Content: Percentage as specified on drawings, determined in accordance with ASTM C173/C173M.
4. Maximum Slump: As specified on drawings.
5. Maximum Aggregate Size: 1 inch.

2.05 MIXING

A. Transit Mixers: Comply with ASTM C94/C94M.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 PREPARATION

A. Formwork: Comply with requirements of ACI 301. Design and fabricate forms to support all applied loads until concrete is cured, and for easy removal without damage to concrete.

B. Verify that forms are clean and free of rust before applying release agent.

C. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.

D. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning and applying bonding agent in according to bonding agent manufacturer's instructions.

E. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.

3.03 INSTALLING REINFORCEMENT AND OTHER EMBEDDED ITEMS

A. Comply with requirements of ACI 301. Clean reinforcement of loose rust and mill scale, and accurately position, support, and secure in place to achieve not less than minimum concrete coverage required for protection.

B. Install welded wire reinforcement in maximum possible lengths, and offset end laps in both directions. Splice laps with tie wire.

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

3.04 PLACING CONCRETE

A. Place concrete in accordance with ACI 304R.

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

C. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.

D. Place concrete continuously without construction (cold) joints wherever possible; where construction joints are necessary, before next placement prepare joint surface by removing laitance and exposing the sand and sound surface mortar, by sandblasting or high-pressure water jetting.

3.05 CONCRETE FINISHING

A. Repair surface defects, including tie holes, immediately after removing formwork.

B. Unexposed Form Finish: Rub down or chip off fins or other raised areas 1/4 inch or more in height.

C. Exposed Form Finish: Rub down or chip off and smooth fins or other raised areas 1/4 inch or more in height. Provide finish as follows:

3.06 CURING AND PROTECTION

A. Comply with requirements of ACI 308R. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

3.07 FIELD QUALITY CONTROL

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

B. Submit proposed mix design of each class of concrete to Architect and inspection and testing firm for review a minimum of 7 days prior to commencement of concrete operations.

C. Tests of concrete and concrete materials shall be performed to ensure conformance with specified requirements.

D. Compressive Strength Tests: ASTM C39/C39M. For each test, mold and cure four concrete test cylinders. Obtain test samples for every 100 cubic yards or less of each class of concrete placed. Break one cylinder at 7 days, two cylinders at 28 days, and retain one spare.

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

F. Perform one slump test for each set of test cylinders taken, following procedures of ASTM C143/C143M.

3.08 DEFECTIVE CONCRETE

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

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

C. Repair or replacement of defective concrete will be determined by the Architect. The cost of additional testing shall be borne by Contractor when defective concrete is identified.

D. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect for each individual area.

END OF SECTION

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SECTION 040511
MORTAR AND MASONRY GROUT

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Mortar for masonry.
   2. Grout for masonry.

B. Related Sections:
   1. Section 042000 - Unit Masonry: Installation of mortar and grout.

1.02 REFERENCE STANDARDS

A. ACI 530/ASCE 5/TMS 402 - Building Code Requirements for Masonry Structures and Related Commentaries; American Concrete Institute International; 2008.

B. ACI 530.1/ASCE 6/TMS 602 - Specification for Masonry Structures; American Concrete Institute International; 2008.

C. ASTM C33 - Standard Specification for Concrete Aggregates.

D. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2006 (Reapproved 2011).

E. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2014a.

F. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2011.

G. ASTM C476 - Standard Specification for Grout for Masonry; 2010.

H. ASTM C1019 - Standard Test Method for Sampling and Testing Grout; 2013.

1.03 SUBMITTALS

A. Product Data: Include mortar design mix conforming to Property specification of ASTM C270. Also include required environmental conditions and admixture limitations.

B. Reports: Submit reports on grout indicating conformance of component grout materials to requirements of ASTM C476 and test and evaluation reports to requirements of ASTM C1019.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Manufacturer's Installation Instructions: Submit packaged dry mortar manufacturer's installation instructions.

1.04 QUALITY ASSURANCE

A. Comply with provisions of ACI 530/530.1, except where exceeded by requirements of the contract documents.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Maintain packaged materials clean, dry, and protected against dampness, freezing, and foreign matter.

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1.06 FIELD CONDITIONS

A. Cold and Hot Weather Requirements: Comply with requirements of ACI 530/530.1.

PART 2 PRODUCTS

2.01 MATERIALS

A. Masonry Cement: ASTM C91, Type N.
   1. Acceptable product: Lehigh Cement, Riverton, or Approved Equal.

B. Portland Cement: ASTM C 150, Type I - Normal; standard gray color.

C. Hydrated Lime: ASTM C207, Type S.

D. Grout Coarse Aggregate: ASTM C 404, up to 3/8-inch diameter.

E. Grout Fine Aggregate: ASTM C404, fine aggregate.

F. Water: Clean and potable.

2.02 MORTAR MIXES

A. Use masonry cement mortars or portland/lime mortars at the Contractor's option.

B. Mortar for Unit Masonry: ASTM C270, Property Specification.
   1. Exterior, loadbearing and non-loadbearing masonry: Type S.
   2. Interior, loadbearing and non-loadbearing masonry: Type N.
   3. Pointing mortar: Type O .

2.03 MORTAR MIXING

A. Thoroughly mix mortar ingredientsusing mechanical batch mixer, in accordance with ASTM C270 and in quantities needed for immediate use.

B. Maintain sand uniformly damp immediately before the mixing process.

C. Colored Mortar: Proportion selected pigments and other ingredients to match Architect's sample, without exceeding manufacturer's recommended pigment-to-cement ratio; mix in accordance with manufacturer's instructions, uniform in coloration.

D. Add admixtures in accordance with manufacturer's instructions. Provide uniformity of mix and coloration.

E. Do not use anti-freeze compounds to lower the freezing point of mortar.

F. If water is lost by evaporation, re-temper only within two hours of mixing.

G. Use mortar within two hours after mixing at temperatures of 90 degrees F, or two-and-one-half hours at temperatures under 40 degrees F.

2.04 GROUT MIXES

A. Masonry Walls (Vertical Application): 3000 psi strength at 28 days; 8-10 inches slump; provide premixed type in accordance with ASTM C 94/C 94M. Water-reducing admixtures not permitted.
   1. Fine grout for spaces with smallest horizontal dimension of 2 inches or less.
   2. Coarse grout for spaces with smallest horizontal dimension greater than 2 inches.

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2.05 GROUT MIXING

A. Thoroughly mix grout ingredients in quantities needed for immediate use in accordance with ASTM C476 for fine and coarse grout.

B. Do not use anti-freeze compounds to lower the freezing point of grout.

PART 3 EXECUTION

3.01 APPLICATION

A. Use masonry cement mortars or portland/lime mortars at the Contractor's option.

3.02 INSTALLATION

A. Install mortar and grout to requirements of section(s) in which masonry is specified.

B. Work grout into masonry cores and cavities to eliminate voids.

C. Do not install grout in lifts greater than 12 inches without consolidating grout by mechanical vibration during placement and reconsolidate after initial water loss has occurred and before plasticity is lost.

D. Do not displace reinforcement while placing grout.

E. Remove excess mortar from grout spaces.

END OF SECTION

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SECTION 042000
UNIT MASONRY

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Concrete Block (CMU).
   2. Reinforcement and Anchorage.
   3. Accessories.

B. Related Sections:
   1. Section 040511 - Mortar and Masonry Grout.
   2. Section 079200 - Joint Sealants: Sealing control and expansion joints.

1.02 REFERENCE STANDARDS

A. ACI 530/ASCE 5/TMS 402 - Building Code Requirements for Masonry Structures and Related Commentaries; American Concrete Institute International; 2008.

B. ACI 530.1/ASCE 6/TMS 602 - Specification for Masonry Structures; American Concrete Institute International; 2008.

C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

D. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement; 2015.

E. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2009a (Reapproved 2014).

F. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2015.

G. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units; 2014.

H. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units; 2011.

I. ASTM C140/C140M - Standard Test Methods of Sampling and Testing Concrete Masonry Units and Related Units; 2014.

J. ASTM C150/C150M - Standard Specification for Portland Cement; 2015.

K. ASTM C744 - Standard Specification for Prefaced Concrete and Calcium Silicate Masonry Units; 2014.

L. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry; 2012.

M. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete; 2010.

1.03 SUBMITTALS

A. Product Data: Provide data for masonry units, fabricated wire reinforcement, and reinforcing steel.

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B. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls.

C. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

1.04 QUALITY ASSURANCE

A. Comply with provisions of ACI 530/530.1/ERTA, except where exceeded by requirements of the contract documents.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS

A. Acceptable Manufacturers:
   1. Beavertown Block Co, Inc.
   2. Nitterhouse Masonry Products, LLC.
   3. York Building Products.
   4. Or Approved Equal.

B. Concrete Block: Comply with referenced standards and as follows:
   1. Size: Standard units with nominal face dimensions of 16 by 8 inches and nominal depths as indicated on the drawings for specific locations.
   2. Special Shapes: Provide non-standard blocks configured for corners and lintels.
   3. Load-Bearing Units: ASTM C90, normal weight.
      a. Hollow block.
      b. Exposed Faces: Manufacturer's standard color and texture where indicated.
   4. Non-Loadbearing Units: ASTM C129.
      a. Hollow block.
      b. Normal weight.
   5. Fire Rated CMU: Where fire walls are indicated, use the appropriate aggregates in the manufacturing of the CMU to provide the required fire rating for the wall thickness indicated.

2.02 CONCRETE LINTELS

A. Concrete Lintels: ASTM C1623, matching CMUs in color, texture, and density classification; and with reinforcing bars as indicated.

2.03 MORTAR AND GROUT MATERIALS

A. Mortar and Grout: As specified in Section 040511.

2.04 REINFORCEMENT AND ANCHORAGE

A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi), deformed billet bars; galvanized.

B. Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.

C. Single Wythe Joint Reinforcement: Truss or ladder type; ASTM A1064/A1064M steel wire, mill galvanized to ASTM A641/A641M, Class 3; 0.1483 inch side rods with 0.1483 inch cross rods; width as required to provide not more than 1 inch and not less than 1/2 inch of mortar coverage on each exposure.

D. Multiple Wythe Joint Reinforcement: Truss type; fabricated with moisture drip; ASTM A1064/A1064M steel wire, hot dip galvanized after fabrication to ASTM A153/153M, Class B; 0.1483 inch side rods with 0.1483 inch cross rods; width as required to provide not more than 1 inch and not less than 1/2 inch of mortar coverage on each exposure.

2.05 ACCESSORIES

A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints.
   1. Manufacturers:
      a. Blok-Lok Limited: www.blok-lok.com.
      b. Hohmann & Barnard, Inc: www.h-b.com.
      c. WIRE-BOND: www.wirebond.com.
      d. Or Approved Equal.

B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and hold reinforcing bars in center of cells.

C. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

PART 3 EXECUTION

3.01 EXAMINATION

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

B. Verify that related items provided under other sections are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 PREPARATION

A. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.03 COLD AND HOT WEATHER REQUIREMENTS

A. Comply with requirements of ACI 530 and ACI530.1.

3.04 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Concrete Masonry Units and Architectural Concrete Masonry Units:
   1. Bond: Running.

2. Coursing: One unit and one mortar joint to equal 8 inches.
3. Mortar Joints: Concave.

3.05 PLACING AND BONDING

A. Lay hollow masonry units with face shell bedding on head and bed joints.

B. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.

C. Remove excess mortar and mortar smears as work progresses.

D. Remove excess mortar with water repellent admixture promptly. Do not use acids, sandblasting or high pressure cleaning methods.

E. Interlock intersections and external corners.

F. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

G. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

3.06 REINFORCEMENT AND ANCHORAGE - GENERAL

A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches on center.

B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.

C. Place continuous joint reinforcement in first and second joint below top of walls.

D. Lap joint reinforcement ends minimum 6 inches.

E. Provide continuity at corners and intersections by using prefabricated L-shaped and T-shaped units.

3.07 REINFORCEMENT AND ANCHORAGE - SINGLE WYTHE MASONRY

A. Install horizontal joint reinforcement 16 inches on center.

B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.

C. Place continuous joint reinforcement in first and second joint below top of walls.

D. Lap joint reinforcement ends minimum 6 inches.

3.08 REINFORCEMENT AND ANCHORAGES - MULTIPLE WYTHE UNIT MASONRY

A. Install horizontal joint reinforcement 16 inches on center.

B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.

C. Place continuous joint reinforcement in first and second joint below top of walls.

D. Lap joint reinforcement ends minimum 6 inches.

3.09 LINTELS

A. Install precast concrete lintels over openings.

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3.10 GROUTED AND REINFORCED COMPONENTS

A. Lap splices minimum 48 bar diameters. Comply with placing reinforcement requirements of ACI 530.1.

B. Support and secure reinforcing bars from displacement using reinforcing bar positioners. Maintain position within 1/2 inch of dimensioned position.

C. Place and consolidate grout fill without displacing reinforcing. Do not grout until entire height of masonry has attained enough strength to resist grout pressure.

D. Comply with grouting requirements of ACI 530.1 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
   1. Limit height of vertical grout pours to not more than 60 inches.

3.11 CONTROL AND EXPANSION JOINTS

A. Do not continue horizontal joint reinforcement through control or expansion joints.

B. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.

C. Form expansion joint as detailed on drawings.

3.12 BUILT-IN WORK

A. As work progresses, install built-in metal door frames and other items to be built into the work and furnished under other sections.

B. Install built-in items plumb, level, and true to line.

C. Bed anchors of metal door frames in adjacent mortar joints.

3.13 TOLERANCES

A. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.

B. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.

C. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.

D. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.

E. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch.

F. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

3.14 CUTTING AND FITTING

A. Cut and fit for pipes and conduit. Coordinate with other sections of work to provide correct size, shape, and location.

B. Cut exposed masonry by an approved saw cut method. Do not use chipped or broken masonry units in exposed masonry work.

3.15 CLEANING

A. Remove excess mortar and mortar droppings.

B. Replace defective mortar. Match adjacent work.

C. Clean soiled surfaces with cleaning solution.

3.16 PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION

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SECTION 044200
EXTERIOR STONE CLADDING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Cut stone to match existing veneer at exterior walls.
   2. Metal anchors and supports.
   3. Sealing exterior joints.

1.02 REFERENCE STANDARDS

A. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; 2015b.

B. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

C. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2014a.

D. ASTM C568/C568M - Standard Specification for Limestone Dimension Stone; 2010.

E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014.

F. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants; 2008 (Reapproved 2012).

G. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants; 2002 (Reapproved 2013).

H. ILI (HB) - Indiana Limestone Handbook; 2007, 22nd Edition.

1.03 SUBMITTALS

A. Samples: Submit two stone samples 12 by 12 inch in size, illustrating color range and texture, markings, surface finish.

B. Installation Instructions: Submit stone fabricator's installation instructions and field erection or setting drawings; indicate panel identifying marks and locations on setting drawings.

1.04 QUALITY ASSURANCE

A. Perform work in accordance with ILI Indiana Limestone Handbook.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store stone panels vertically on edge, resting weight on panel edge.

B. Protect stone from discoloration.

1.06 FIELD CONDITIONS

A. During temporary storage on site, at the end of working day, and during rainy weather, cover stone work exposed to weather with non-staining waterproof coverings, securely anchored.

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PART 2 PRODUCTS

2.01 STONE

A. Stone: Stone to match existing building stone.

2.02 MORTAR

A. Mortar: ASTM C270, Type N, Proportion specification, using Portland cement of white color.

2.03 ANCHORS AND ACCESSORIES

A. Anchors and Other Components in Contact with Stone: Stainless steel, ASTM A666, Type 304.
   1. Sizes and configurations: As required for vertical and horizontal support of stone and applicable loads.
   2. Wire ties are not permitted.

B. Support Components not in Contact with Stone: Stainless steel, ASTM A240/A240M, Type 304.

C. Setting Buttons and Shims: Lead type.

D. Joint Sealant: ASTM C920 silicone sealant with movement capability of at least plus/minus 25 percent and non-staining to stone when tested in accordance with ASTM C1248.

E. Joint Backer Rod: ASTM C1330 open cell polyurethane of size 40 to 50 percent larger in diameter than joint width.

F. Cleaning Solution: Type that will not harm stone, joint materials, or adjacent surfaces.

2.04 STONE FABRICATION

A. Thickness to aproximately match existing stone.

B. Fabricate units for uniform coloration between adjacent units and over the full area of the installation.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that support work and site conditions are ready to receive work of this section.

B. Verify that items built-in under other sections are properly located and sized.

3.02 PREPARATION

A. Clean stone prior to erection. Do not use wire brushes or implements that will mark or damage exposed surfaces.

3.03 INSTALLATION

A. Erect stone in accordance with stone supplier's instructions and erection drawings.

B. Set stone with a joint width(s) to match existing joint width(s).

C. Install anchors and place setting buttons to support stone and to establish joint dimensions.

D. Joints in Exterior Work: Seal joints with joint sealant over backer rod, following sealant manufacturer's instructions; tool sealant surface to concave profile.

3.04 TOLERANCES

A. Positioning of Elements: Maximum 1/4 inch from true position.

B. Maximum Variation from Plane of Wall: 1/4 inch in 10 feet; 1/2 inch in 50 feet.

C. Maximum Variation Between Face Plane of Adjacent Panels: 1/16 inch.

D. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in any two stories.

E. Maximum Variation of Joint Thickness: 1/8 inch in 3 feet.

3.05 CUTTING AND FITTING

A. Obtain approval prior to cutting or fitting any item not so indicated on Drawings.

B. Do not impair appearance or strength of stone work by cutting.

3.06 CLEANING

A. Remove excess joint material upon completion of work.

B. Clean soiled surfaces with cleaning solution.

C. Use non-metallic tools in cleaning operations.

END OF SECTION

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SECTION 055000
METAL FABRICATIONS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Shop fabricated steel items.
   2. Prefabricated ladders.

1.02 REFERENCE STANDARDS

A. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements; 2008.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

C. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions; 2015a.

D. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.

E. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015.

F. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 1999 (Ed. 2004).

G. SSPC-SP 2 - Hand Tool Cleaning; 1982 (Ed. 2004).

H. Federal Specifications, FF-S-325 - Shield, expansion; Nail, Expansion; and Nail, Drive Screw (Devices, Anchoring, Masonry) Group II (Shield, Expansion Bolt Anchor) Type 4 (Wedge Expansion Anchors) Class 1 (One Piece Steel Expander with Cone Taper Integral with Stud).

1.03 SUBMITTALS

A. Product Data: Provide manufacturer's standard product data for prefabricated items.

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.

C. Welders' Certificates: Submit certification for welders employed on the project, verifying AWS qualification within the previous 12 months.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Store steel above the ground surface on platforms, skids, blocking or other supports.

B. Protect steel from exposure to conditions that produce rust.

C. Store beams with webs vertical.

D. Handle steel so no parts are bent, broken or otherwise damaged and avoid damage to other material and work.

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PART 2 PRODUCTS

2.01 MATERIALS - STEEL

A. Steel Sections: As specified on the drawings.

B. Steel Tubing: As specified on the drawings structural tubing.

C. Plates: As specified on the drawings.

D. Fasteners:

1. Steel Expansion Anchors: Conforming to Federal Specification FF-S-325 Group II, Type 4, Class 1, such as Hilti Kwik-Bolt, Philips Red Head Wedge-Anchor and Molly Parabolt, or approved equal.
2. Adhesive Anchors: Composed of an anchor rod assembly and an anchor rod adhesive cartridge.
    a. Anchor Rod Assembly: Chamfered and threaded stud rod of ASTM A325 steel with nut and washer. Stud size as indicated on Drawings.
    b. Adhesive cartridge: Sealed capsule containing premeasured amounts of resin, quartz sand aggregate, and a hardener contained in a separate vial within the capsule. Capsule ingredients activated by the insertion procedure of the anchor rod assembly.
    c. Acceptable Manufacturers:
        1) Hilti Fastening Systems; HVA.
        2) Molly Fastener Group; PARABOND.
        3) Or Approved Equal.

E. Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, plain.

F. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

G. Steel used at exterior locations to be galvanized.

H. Shop and Touch-Up Primer: SSPC-Paint 15, 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.

C. Continuously seal joined members by continuous welds.

D. 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. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

F. Supply 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. Ladders: Steel; in compliance with ANSI A14.3; with mounting brackets and attachments; prime paint finish.
   1. Side Rails: 3/8 x 2 inches members spaced at 30 inches.
   2. Rungs: one inch diameter solid square bar spaced 12 inches on center.
   3. Space rungs 7 inches from wall surface.

2.04 FINISHES - STEEL

A. Prime paint steel items.
   1. Exceptions: Galvanize items to be embedded in concrete and items to be imbedded in masonry.

B. Prepare surfaces to be primed in accordance with SSPC-SP2.

C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

D. Prime Painting: One coat.

E. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements. Provide minimum 1.7 oz/sq ft galvanized coating.

F. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

2.05 FABRICATION TOLERANCES

A. Squareness: 1/8 inch maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch.

C. Maximum Misalignment of Adjacent Members: 1/16 inch.

D. Maximum Bow: 1/8 inch in 48 inches.

E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

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.

C. Field weld components as indicated on drawings.

D. Perform field welding in accordance with AWS D1.1/D1.1M.

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

F. After erection, prime welds, abrasions, and surfaces not shop primed.

G. Expansion Anchor Installation:

1. General: In general, install expansion anchors in strict accordance with manufacturer's instructions and in accordance with the following.
2. Drilling Holes: Use rotary hammer type drill and make drill holes to the required diameter and depth as consistent with anchor manufacturer's instructions for size of anchors being installed.
3. Minimum Embedment: Embed expansion anchors to four and one-half bolt diameters, unless otherwise indicated on Drawings.

H. Adhesive Anchor Installation:
1. General: In general, install adhesive anchors in strict accordance with manufacturer's instructions and in accordance with the following.
2. Drilling Holes: Use rotary hammer type drill and make holes to the required diameter and depth as consistent with anchor manufacturer's instructions for size of anchors being installed.
   a. Prior to setting cartridge and anchor stud clean drilled holes free of loose material by vacuum process, finishing with a blast of compressed air, and cover hole until actual use.
3. Anchor Rod Installation: Following cartridge installations in prepared drill holes, set anchor rod to the required depth. Set anchor rod truly perpendicular (normal) to the base plate of item being anchored.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

SECTION 061000
ROUGH CARPENTRY

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Structural dimension lumber framing.
   2. Non-structural dimension lumber framing.
   3. Rough opening framing for doors, windows, and roof openings.
   4. Sheathing.
   5. Floor Deck.
   6. Miscellaneous framing and sheathing.
   7. Communications and electrical room mounting boards.
   8. Concealed wood blocking, nailers, and supports.
   9. Miscellaneous wood nailers, furring, and grounds.

1.02 REFERENCE STANDARDS

A. AWC (WFCM) - Wood Frame Construction Manual for One- and Two-Family Dwellings; 2015.

B. AFPA WCO1, "Details for Conventional Wood Frame Construction."

C. AFPA (WFCM) - Wood Frame Construction Manual for One- and Two-Family Dwellings; American Forest and Paper Association; 2012.

D. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

F. ASTM C209 - Standard Test Methods for Cellulosic Fiber Insulation Board; 2015.

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

H. PS 1 - Structural Plywood; 2009.

I. PS 2 - Performance Standard for Wood-Based Structural-Use Panels; 2010.

J. PS 20 - American Softwood Lumber Standard; 2010.

K. SPIB (GR) - Grading Rules; 2014.

1.03 SUBMITTALS

A. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.

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.

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PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
   1. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.
   2. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
   3. Lumber of other species or grades is acceptable provided structural and appearance characteristics are equivalent to or better than products specified.

B. Lumber fabricated from old growth timber is not permitted.

C. All composite wood products must be certified as compliant with California 93120 Phase 2. If using a composite wood product that does not comply with California 93120 Phase 2, all exposed edges and sides must be sealed with a low VOC sealant with a VOC content of 250 g/l or less.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

A. Grading Agency: Southern Pine Inspection Bureau, Inc; SPIB (GR).

B. Sizes: Nominal sizes as indicated on drawings, S4S.

C. Moisture Content: S-dry or MC19.

D. Structural Stud Framing: Species and Grade as indicated on structural drawings.

E. Stud Framing (2 by 2 through 2 by 6):
   1. Species: Any allowed under referenced grading rules.
   2. Grade: No. 2.

F. Joist, Rafter, and Small Beam Framing (2 by 6 through 4 by 16):
   1. Species and grade as indicated on structural drawings.

G. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
   1. Lumber: S4S, No. 2 or Standard Grade.
   2. Boards: Standard or No. 3.

2.03 ENGINEERED WOOD PRODUCTS

A. Laminated-Veneer Lumber (LVL), Parallel-Strand Lumber (PSL), and Rim Boards as indicated on structural drawings.

2.04 CONSTRUCTION PANELS

A. Subfloor/Underlayment Combination: Any PS 2 type, rated Single Floor.
   1. Bond Classification: Exposure 1.
   2. Span Rating: 48.
   3. Edges: Square.

B. Floor Deck: Wood structural panel; PS 2, rated Single Floor or Underlayment.

1. Bond Classification: Exterior.
2. Performance Category: 23/32 PERF CAT.
3. Span Rating: 24.
4. Edges: Tongue and groove.
5. Surface Finish: Fully sanded face.
6. Exposure Time: Sheathing will not delaminate or require sanding due to moisture absorption from exposure to weather for up to 200 days.
7. Provide fastening guide on top panel surface with separate markings indicating fastener spacing for 16 inches, 19.2 inches and 24 inches on center, respectively.
8. Warranty: Manufacturer's standard lifetime limited warranty against manufacturing defects and that panels will not delaminate or require sanding due to moisture absorption damage from exposure to weather for up to the stated period.

C. Roof Sheathing: Oriented strand board wood structural panel; PS 2.
1. Grade: Structural 1 Sheathing.
2. Bond Classification: Exposure 1.
3. Performance Category: As specified on the drawings.
4. Span Rating: 48/24.
5. Edges: As specified on the drawings.
6. Exposure Time: Sheathing will not delaminate or require sanding due to moisture absorption from exposure to weather for up to 500 days.
7. Provide fastening guide on top panel surface with separate markings indicating fastener spacing for 16 inches and 24 inches on center, respectively.
8. Warranty: Manufacturer's standard lifetime limited warranty against manufacturing defects and that panels will not delaminate or require sanding due to moisture absorption damage from exposure to weather for up to the stated period.

D. Wall Sheathing: Oriented strand board wood structural panel; PS 2.
1. Grade: Structural 1 Sheathing.
2. Bond Classification: Exposure 1.
3. Performance Category: 1/2 PERF CAT.
4. Span Rating: 32/16.
5. Edges: Square.
6. Exposure Time: Sheathing will not delaminate or require sanding due to moisture absorption from exposure to weather for up to 500 days.
7. Provide fastening guide on top panel surface with separate markings indicating fastener spacing for 16 inches and 24 inches on center, respectively.
8. Warranty: Manufacturer's standard lifetime limited warranty against manufacturing defects and that panels will not delaminate or require sanding due to moisture absorption damage from exposure to weather for up to the stated period.

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

F. Other Applications:

1. Plywood Concealed From View But Located Within Exterior Enclosure: PS 1, C-C Plugged or better, Exterior grade.
2. Other Locations: PS 1, C-D Plugged or better.

2.05 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacturer.
   1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153A.

B. Nails, Brads, and Staples: ASTM F1667.

C. Power-Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1.

E. Lag Bolts: ASME B18.2.1.

F. Bolts: Steel bolts complying with ASTM A307, Grade A; with ASTM A563 hex nuts and where indicated, flat washers.

G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the loads imposed when installed in unit masonry assemblies and equal to four times the load imposed when installed in concrete as determined by testing per ASTM E488 conducted by a qualified independent testing and inspecting agency.
   1. Material: Carbon-steel components, zinc plated to comply with ASTM B633, Class Fe/Zn 5.
   2. Material: Stainless steel with bolts and nuts complying with ASTM F593 and ASTM F594, Alloy Group 1 or 2.

2.06 METAL FRAMING ANCHORS

A. Basis of Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product.

B. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meets or exceeds those of basis-of-design products. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

C. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A653, G60 coating designation.
   1. Use for interior locations unless otherwise indicated.

D. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A 653; structural steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 coating designation; and not less than 0.036 inch thick.
   1. Use for wood-preservative-treated lumber and where indicated.

E. Joist Hangers: U-shaped joist hangers with 2 inch long seat and 1 1/4 inch wide nailing flanges at least 85 percent of joist depth.

1. Thickness: 0.050 inch.

F. I-Joist Hangers: U-shaped joist hangers with 2 inch long seat and 1 1/4 inch wide nailing flanges full depth of joist. Nailing flanges provide lateral support at joist top chord.
   1. Thickness: 0.050 inch.

G. Top Flange Hangers: U-Shaped joist hangers, full depth of joist, formed from metal strap with tabs bent to extend over and be fastened to supporting member.
   1. Strap Width: 1 1/2 inches.
   2. Thickness: 0.050 inch.

H. Bridging: Rigid, V-section, nailless type, 0.050 inch thick, length to suit joist size and specing.

I. Rafter Tie-Downs: Bent strap tie for fastening rafters or roof trusses to wall studs below, 1 1/2 inches wide by 0.050 inch thick. Tie fastens to side of rafter or truss, face of top plates, and side of stud below.

2.07 ACCESSORIES

A. Truss Clip: Provide Simpson Strong-Tie model as specified on the drawings or approved equal.

B. Subfloor Glue: Waterproof, air cure type, cartridge dispensed, APA AFG-01.

C. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick.

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.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Comply with AFPA WCO1.

D. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
   1. NES NER-272 for power driven fasteners.
   2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.

E. Use steel common nails unless otherwise indicated. Make tight connections between members. Install fasteners without splitting wood.

3.03 FRAMING INSTALLATION

A. Set structural members level, plumb, and true to line. Discard pieces with defects that would lower required strength or result in unacceptable appearance of exposed members.

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B. Make provisions for temporary construction loads, and provide temporary bracing sufficient to maintain structure in true alignment and safe condition until completion of erection and installation of permanent bracing.

C. Install structural members full length without splices unless otherwise specifically detailed.

D. Comply with member sizes, spacing, and configurations indicated, and fastener size and spacing indicated, but not less than required by applicable codes and AFPA Wood Frame Construction Manual.

E. Install horizontal spanning members with crown edge up and not less than 1-1/2 inches of bearing at each end.

F. Construct double truss headers at floor and ceiling openings and under wall stud partitions that are parallel to floor joists; use metal joist hangers unless otherwise detailed.

G. Provide bridging at joists in excess of 8 feet span as detailed. Fit solid blocking at ends of members.

H. Frame wall openings with two or more studs at each jamb; support headers on cripple studs.

3.04 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to code authorities may be used in lieu of solid wood blocking.

C. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

D. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

E. Provide the following specific non-structural framing and blocking:
   1. Cabinets and shelf supports.
   2. Wall brackets.
   3. Handrails.
   4. Grab bars.
   5. Towel and bath accessories.

3.05 ROOF-RELATED CARPENTRY

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

B. Provide wood curb at all roof openings except where prefabricated curbs are specified and where specifically indicated otherwise. Form corners by alternating lapping side members.

3.06 INSTALLATION OF CONSTRUCTION PANELS

A. Subflooring/Underlayment Combination: Glue and nail to framing; staples are not permitted.

B. Underlayment: Secure to subflooring with nails.
   1. At locations where resilient flooring will be installed, fill and sand splits, gaps, and rough areas.

C. Roof Sheathing: Secure panels with long dimension perpendicular to framing members, with ends staggered and over firm bearing.
   1. At long edges provide solid edge blocking where joints occur between roof framing members.
   2. Secure panels to framing using threaded fasteners and plates that provide a smooth profile, meeting FM 4470. Nails are NOT permitted.

D. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches on center on all edges and into studs in field of board.
   1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
   2. Install adjacent boards without gaps.

3.07 TOLERANCES

A. Framing Members: 1/4 inch from true position, maximum.

B. Surface Flatness of Floor: 1/8 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

C. Variation from Plane (Other than Floors): 1/4 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

END OF SECTION

SECTION 061753
SHOP-FABRICATED WOOD TRUSSES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Shop fabricated wood trusses for roof framing.
   2. Bridging, bracing, and anchorage.

B. Related Requirements:
   1. Section 061000 - Rough Carpentry: Installation requirements for miscellaneous framing.

1.02 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; 2015.

B. SPIB (GR) - Grading Rules; 2014.

C. TPI 1 - National Design Standard for Metal-Plate-Connected Wood Truss Construction; 2007 and errata.

D. TPI BCSI 1 - Building Component Safety Information Booklet: The Guide to Good Practice for Handling, Installing & Bracing of Metal Plate Connected Wood Trusses; 2011.

E. TPI DSB-89 - Recommended Design Specification for Temporary Bracing of Metal Plate Connected Wood Trusses; 1989.

1.03 SUBMITTALS

A. Product Data: Manufacturer's data sheets on plate connectors, bearing plates, and metal bracing components.

B. Shop Drawings: Show layout plan, truss configurations, sizes, spacing, size and type of plate connectors, cambers, framed openings, bearing and anchor details, and bridging and bracing.
   1. Include identification of engineering software used for design.
   2. Provide shop drawings stamped or sealed by design engineer.

1.04 QUALITY ASSURANCE

A. Designer Qualifications: Perform design by or under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State in which the Project is located.

B. Fabricator Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Handle and erect trusses in accordance with TPI BCSI 1.

B. Store trusses in vertical position resting on bearing ends.

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PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Truss Plate Connectors:
   1. Alpine Engineered Products, Inc: www.alpeng.com.
   2. MiTek Industries, Inc: www.mii.com.
   3. Truswal Systems: www.truswal.com.
   4. Or Approved Equal.

2.02 TRUSSES

A. Wood Trusses: Designed and fabricated in accordance with TPI 1 and TPI DSB-89 to achieve structural requirements indicated.
   1. Species and Grade: Southern Pine, SPIB (GR) Grade _____.
   2. Connectors: Steel plate.
   3. Structural Design: Comply with applicable code for structural loading criteria.
   4. Roof Deflection: 1/360, maximum.

2.03 MATERIALS

A. Lumber:
   1. Moisture Content: Between 7 and 9 percent.
   2. Lumber fabricated from old growth timber is not permitted.

B. Steel Connectors: Hot-dipped galvanized steel sheet, ASTM A653/A653M Structural Steel (SS) Grade 33/230, with G90/Z275 coating; die stamped with integral teeth; thickness as indicated.

C. Truss Bridging: Type, size and spacing recommended by truss manufacturer.

2.04 ACCESSORIES

A. Wood Blocking, Bridging, Plates, and Miscellaneous Framing: Softwood lumber, any species, construction grade, 19 percent maximum and 7 percent minimum moisture content.

B. Fasteners: Electrogalvanized steel, type to suit application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that supports and openings are ready to receive trusses.

3.02 PREPARATION

A. Coordinate placement of bearing items.

3.03 ERECTION

A. Install trusses in accordance with manufacturer's instructions and TPI DSB-89 and TPI BCSI 1.

B. Set members level and plumb, in correct position.

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C. Make provisions for erection loads, and for sufficient temporary bracing to maintain structure plumb, and in true alignment until completion of erection and installation of permanent bracing.

D. Do not field cut or alter structural members without approval of Architect.

E. Install permanent bridging and bracing.

F. Install headers and supports to frame openings required.

G. Frame openings between trusses with lumber in accordance with Section 061000.

H. Coordinate placement of decking with work of this section.

3.04 TOLERANCES

A. Framing Members: 1/2 inch maximum, from true position.

END OF SECTION

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SECTION 064100
ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Specially fabricated cabinet units.
   2. Solid surface countertops.
   3. Cabinet hardware.
   4. Window stools.

1.02 REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.

B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.0; 2016.

C. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.

D. AWI P-200 - Architectural Woodwork Quality Standards Illustrated; Architectural Woodwork Institute; 2005, 8th Ed., Version 2.0.

E. NEMA LD 3 - High-Pressure Decorative Laminates; National Electrical Manufacturers Association; 2005.

1.03 SUBMITTALS

A. Shop Drawings: Indicate materials, component profiles and elevations, assembly methods, joint details, fastening methods, accessory listings, hardware location and schedule of finishes.

B. Product Data: Provide data for hardware accessories.

C. Samples: Provide manufacturer's samples of colors for solid surface countertops.

D. Samples: Submit actual sample items of proposed pulls and hinges, demonstrating hardware design, quality, and finish.

1.04 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.

B. Perform work in accordance with AWI/AWMAC Architectural Woodwork Quality Standards Illustrated Premium quality.

C. Perform cabinet construction in accordance with AWI/AWMAC Architectural Woodwork Quality Standards Illustrated Premium quality.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the site protected from the weather and in an undamaged condition. Exercise care when off-loading lumber and such products subject to damage. In the event of damage make replacements at no increase in Contract Price.

B. Store lumber and wood products in such a manner as to ensure proper ventilation and drainage and to protect against damage and the weather.

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C. Protect units from moisture damage.

1.06 FIELD CONDITIONS

A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

PART 2 PRODUCTS

2.01 CABINETS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

2.02 WOOD-BASED COMPONENTS

A. Wood fabricated from old growth timber is not permitted.

2.03 LUMBER MATERIALS

A. Softwood Lumber: Provide pine species in sizes indicated on drawings.

2.04 PANEL MATERIALS

A. Particleboard: ANSI A208.1; medium density industrial type as specified in AWI/AWMAC Architectural Woodwork Quality Standards Illustrated, composed of wood chips bonded with moisture resistant adhesive under heat and pressure; sanded faces; thickness as required; use for plastic laminate covered locations only.

2.05 LAMINATE MATERIALS

A. Manufacturers:
   1. Formica Corporation: www.formica.com.
   2. Panolam Industries International, IncNevamar: www.nevamar.com.
   3. Wilsonart: www.wilsonart.com.
   4. Or Approved Equal.

B. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications and as follows:
   1. Horizontal Surfaces: HGS, 0.048 inch nominal thickness, through color, colors as scheduled, finish as scheduled.
   2. Vertical Surfaces: VGS, 0.028 inch nominal thickness, through color, colors as scheduled, finish as scheduled.

2.06 COUNTERTOPS AND WINDOW STOOLS

A. Solid Surface Countertops and Window Stools: Homogenous compression molded material composed of acrylic resins or polyester/acrylic resin blend, fire-retardant filler materials, fiber reinforcement, and coloring agents.
   1. Manufacturer: WilsonArt or approved equal; color to be selected during submittal approvals.

2.07 ACCESSORIES

A. Fasteners: Size and type to suit application.

B. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.

C. Concealed Joint Fasteners: Threaded steel.

D. Grommets: Standard rubber grommets for cut-outs, in color to match adjacent surface.

2.08 HARDWARE

A. Adjustable Shelf Supports: Standard side-mounted system using recessed metal shelf standards and coordinated self rests, polished chrome finish, for nominal 1 inch spacing adjustments.

B. Drawer and Door Pulls: "U" shaped wire pull, aluminum with satin finish, 4 inch centers.

C. Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, steel with chrome finish. Provide cabinet lock at Security Desk cabinet only.

D. Drawer Slides:
   1. Type: Extension types as scheduled.
   2. Static Load Capacity: Commercial grade.
   3. Mounting: Side mounted.
   4. Stops: Integral type.
   5. Features: Provide self closing/stay closed type.

E. Hinges: European style concealed self-closing type, steel with polished finish.

2.09 FABRICATION

A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.

B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.

C. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.

D. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs.

E. Provide cutouts for inserts and fixtures and fittings. Verify locations of cutouts from on-site dimensions. Prime paint cut edges.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify location and sizes of utility rough-in associated with work of this section.

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3.02 INSTALLATION

A. Install work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.

B. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.

C. Use fixture attachments in concealed locations for wall mounted components.

D. Use concealed joint fasteners to align and secure adjoining cabinet units and countertops.

E. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.

F. Secure cabinets to floor using appropriate angles and anchorages.

G. Install window stools adhered to adjacent surface. Carefully scribe window stools abutting other components, with maximum gaps of 1/32 inch. Provide sealant between window stools and adjacent materials.

3.03 ADJUSTING

A. Adjust installed work.

B. Adjust moving or operating parts to function smoothly and correctly.

3.04 CLEANING

A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

END OF SECTION

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SECTION 071113
BITUMINOUS DAMPPROOFING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Bituminous dampproofing.
   2. Protection boards.

1.02 REFERENCE STANDARDS

A. ASTM D1187/D1187M - Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal; 1997 (Reapproved 2011).

B. ASTM D1227 - Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing; 2013.

1.03 SUBMITTALS

A. Product Data: Provide properties of primer, bitumen, and mastics.

B. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.04 FIELD CONDITIONS

A. Maintain ambient temperatures above 35 degrees F for 24 hours before and during application until dampproofing has cured.

PART 2 PRODUCTS

2.01 BITUMINOUS DAMPPROOFING

A. Bituminous Dampproofing: Cold-applied water-based emulsion; asphalt with mineral colloid or chemical emulsifying agent; with or without fiber reinforcement; asbestos-free; suitable for application on vertical and horizontal surfaces.
   1. Composition - Vertical Application: ASTM D1227 Type II or ASTM D1187/D1187M Type I.
   2. Composition - Horizontal and Low-Slope Application: ASTM D1227 Type II or III.
   3. VOC Content: Not more than permitted by local, State, and federal regulations.
   4. Applied Thickness: 1/16 inch, minimum, wet film.
   5. Products:
      a. W.R. Meadows, Inc.; Sealmastic Emulsion Type II (brush/spray-grade): www.wrmeadows.com.
      b. Tremco; Tuff-N-Dri H8: www.tremcobarriersolutions.com.
      c. Or Approved Equal.

B. Primers, Mastics, and Related Materials: Type as recommended by dampproofing manufacturer.

2.02 ACCESSORIES

A. Protection Board: 1/8 inch thick provide manufacturer's approved material.

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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. Repoint existing stone wall as needed to provide a surface accpetable to dampproofing manufacturer.

E. Apply mastic to seal penetrations, small cracks, or minor honeycombs in substrate.

3.03 APPLICATION

A. Foundation Walls: Apply two coats of asphalt dampproofing.

B. Perform this work in accordance with manufacturer's instructions.

C. Prime surfaces in accordance with manufacturer's instructions.

D. Apply bitumen by spray application.

E. Apply dampproofing to existing stone wall in accordance with manufacturer's instructions.

F. Seal items watertight with mastic, that project through dampproofing surface.

G. Place protection board directly over dampproofing, butt joints, and adhere to tacky dampproofing.

H. Backfill within 24-48 hours using care to avoid damaging the dampproofing.

END OF SECTION

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SECTION 072100
THERMAL INSULATION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Batt insulation in interior wall and floor/ceiling construction.

1.02 REFERENCE STANDARDS

A. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2012.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

C. ASTM E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace At 750 Degrees C; 2012.

1.03 SUBMITTALS

A. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

B. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

C. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

1.04 FIELD CONDITIONS

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

PART 2 PRODUCTS

2.01 APPLICATIONS

2.02 BATT INSULATION MATERIALS

A. Glass Fiber Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C665; friction fit.
   1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
   2. Smoke Developed Index: 50 or less, when tested in accordance with ASTM E84.
   3. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
   4. Formaldehyde Content: Zero.
   5. Thermal Resistance: As indicated on drawings
   6. Facing: Asphalt treated mesh reinforced Kraft paper, one side.
   7. Manufacturers:
      a. CertainTeed Corporation: www.certainteed.com.
      b. Johns Manville: www.jm.com.
      c. Owens Corning Corporation: www.ocbuildingspec.com.
      d. Or Approved Equal.

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2.03 ACCESSORIES

A. Staples: Steel wire; electroplated or galvanized; type and size to suit 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.

3.02 BATT INSTALLATION

A. Install insulation in accordance with manufacturer's instructions.

B. Install in interior wall and floor/ceiling 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. Install with factory applied vapor retarder membrane facing warm side of building spaces. Lap ends and side flanges of membrane over framing members.

F. Staple or nail facing flanges in place at maximum 6 inches on center.

G. Tape seal butt ends, lapped flanges, and tears or cuts in membrane.

3.03 PROTECTION

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

END OF SECTION

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SECTION 072400
EXTERIOR INSULATION AND FINISH SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Composite wall cladding of rigid insulation and reinforced finish coating ("Class PB").
   2. Drainage and water-resistive barriers behind insulation board.

B. Related Sections:
   1. Section 076200 - SHEET METAL FLASHING AND TRIM: Perimeter flashings.
   2. Section 079200 - Joint Sealants: Sealing joints between EIFS and adjacent construction and penetrations through EIFS.

1.02 REFERENCE STANDARDS

A. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus; 2011.

B. ASTM C150/C150M - Standard Specification for Portland Cement; 2015.

C. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2013.

D. ASTM C297/C297M - Standard Test Method for Flatwise Tensile Strength of Sandwich Constructions; 2015.

E. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2015a.

F. ASTM C1397 - Standard Practice for Application of Class PB Exterior Insulation and Finish Systems (EIFS) and EIFS with Drainage; 2013.

G. ASTM D968 - Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive; 2005 (Reapproved 2010).

H. ASTM D2247 - Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity; 2011.

I. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2012.

J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

K. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2009).

L. ASTM E2273 - Standard Test Method for Determining the Drainage Efficiency of Exterior Insulation and Finish Systems (EIFS) Clad Wall Assemblies; 2003 (reapproved 2011).

M. ASTM G153 - Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials; 2013.

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N. ASTM G155 - Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Nonmetallic Materials; 2013.

O. ICC-ES AC219 - Acceptance Criteria for Exterior Insulation and Finish Systems; 2009.

P. ICC-ES AC235 - Acceptance Criteria for EIFS Clad Drainage Wall Assemblies; 2004 (Editorially revised 2009).

Q. NFPA 259 - Standard Test Method for Potential Heat of Building Materials; 2013.

R. NFPA 268 - Standard Test Method for Determining Ignitibility of Exterior Wall Assemblies Using a Radiant Heat Energy Source; 2012.

S. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components; 2012.

1.03 SUBMITTALS

A. Shop Drawings: Indicate wall joint patterns, joint details, and molding profiles.

B. Product Data: Provide data on system materials, product characteristics, performance criteria, and system limitations.

C. Selection Samples: Submit manufacturer's standard range of samples illustrating available coating colors and textures.

D. Manufacturer's Installation Instructions: Indicate preparation required, installation techniques, and jointing requirements.

1.04 QUALITY ASSURANCE

A. Maintain copy of specified installation standard and manufacturer's installation instructions at project site during installation.

B. EIFS Manufacturer Qualifications: Provide EIFS products other than insulation from the same manufacturer with qualifications as follows:
   1. Manufacturer of EIFS products for not less than 5 years.

C. Insulation Manufacturer Qualifications: Approved by manufacturer of EIFS and approved and labeled under third party quality program as required by applicable building code.

D. Installer Qualifications: Company specializing in the type of work specified and with at least three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to project site in manufacturer's original, unopened containers with labels intact. Inspect materials and notify manufacturer of any discrepancies.

B. Storage: Store materials as directed by manufacturer's written instructions.
   1. Protect adhesives and finish materials from freezing, temperatures below 40 degrees F and temperatures in excess of 90 degrees F.
   2. Protect Portland cement based materials from moisture and humidity. Store under cover off the ground in a dry location.
   3. Protect insulation materials from exposure to sunlight.

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1.06 FIELD CONDITIONS

A. Do not prepare materials or apply EIFS under conditions other than those described in the manufacturer's written instructions.

B. Do not prepare materials or apply EIFS during inclement weather unless areas of installation are protected. Protect installed EIFS areas from inclement weather until dry.

C. Do not install coatings or sealants when ambient temperature is below 40 degrees F.

D. Do not leave installed insulation board exposed to sunlight for extended periods of time.

1.07 WARRANTY

A. Provide manufacturer's standard material warranty, covering a period of not less than 10 years.

B. Provide separate warranty from installer covering labor for repairs or replacement for a period of not less than 10 years.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers:
   1. Basis of Design: Dryvit Systems, Inc; Dryvit Outsulation Plus MD Exterior Insulation and Finish System, Class PB with Moisture Drainage: www.dryvit.com.
   2. Parex USA, Inc.: www.parex.com.
   3. Sto Corp: www.stocorp.com.
   4. Or Approved Equal.

2.02 EXTERIOR INSULATION AND FINISH SYSTEM

A. Exterior Insulation and Finish System: DRAINAGE type; reinforced finish coating on insulation board with drainage grooves adhesive-applied to water-resistive coating over substrate; provide a complete system that has been tested to show compliance with the following characteristics; include all components of specified system and substrate(s) in tested samples.

B. Fire Characteristics:
   1. Flammability: Pass, when tested in accordance with NFPA 285.
   2. Ignitibility: No sustained flaming when tested in accordance with NFPA 268.
   3. Potential Heat of Foam Plastic Insulation Tested Independently of Assembly: No portion of the assembly having potential heat that exceeds that of the insulation sample tested for flammability (above), when tested in accordance with NFPA 259 with results expressed in Btu per square foot.

C. Adhesion of Water-Resistive Coating to Substrate: For each combination of coating and substrate, minimum flatwise tensile bond strength of 15 psi, when tested in accordance with ASTM C297/C297M.

D. Adhesion to Water-Resistive Coating: For each combination of insulation board and substrate, when tested in accordance with ASTM C297/C297M, maximum adhesive failure of 25 percent unless flatwise tensile bond strength exceeds 15 psi in all samples.

E. Water Penetration Resistance: No water penetration beyond the plane of the base coat/insulation board interface after 15 minutes, when tested in accordance with ASTM E331 at 6.24 psf differential pressure with tracer dye in the water spray; include in tested sample at least two vertical joints and one horizontal joint of same type to be used in construction; disassemble sample if necessary to determine extent of water penetration.

F. Drainage Efficiency: Average minimum efficiency of 90 percent, when tested in accordance with ASTM E2273 for 75 minutes.

G. Salt Spray Resistance: No cracking, checking, crazing, erosion, blistering, peeling, delamination, or corrosion of finish coating after 300 hours exposure in accordance with ASTM B117, using at least three samples matching intended assembly, at least 4 by 6 inches in size.

H. Freeze-Thaw Resistance: No cracking, checking, crazing, erosion, blistering, peeling, delamination, or corrosion of finish coating when viewed under 5x magnification after 10 cycles, when tested in accordance with ICC-ES AC219 or ICC-ES AC235.

I. Weathering Resistance: No cracking, checking, crazing, erosion, blistering, peeling, delamination, or corrosion of finish coating when viewed under 5x magnification after 2000 hours of accelerated weathering conducted in accordance with ASTM G153 Cycle 1 or ASTM G155 Cycle 1, 5, or 9.

J. Water Degradation Resistance: No cracking, checking, crazing, erosion, blistering, peeling, delamination, or corrosion of finish coating after 14 days exposure, when tested in accordance with ASTM D2247.

K. Mildew Resistance: No growth supported on finish coating during 28 day exposure period, when tested in accordance with ASTM D3273.

L. Abrasion Resistance Of Finish: No cracking, checking or loss of film integrity when tested in accordance with ASTM D968 with 113.5 gallons of sand.

2.03 MATERIALS

A. Finish Coating Top Coat: Water-based, air curing, acrylic or polymer-based finish with integral color and texture.
   1. Texture: Dryvit Systems, Inc., E-Finish (Lightweight); Sandpebble Fine E.
   2. Color: As selected by Architect from manufacturer's standard range.

B. Base Coat: Acrylic- or polymer-modified, fiber reinforced Portland cement coating.
   1. Portland Cement: ASTM C150/C150M, Type I or II.
   2. Base Coat Thickness: 1/4 inch, minimum.

C. Insulation Board: Extruded polystyrene (XPS) board insulation with natural skin surfaces; ASTM C578, Type V, with the following characteristics:
   1. Board Size: 48 by 96 inch.
   2. Board Size Tolerance: 1/16 inch from square and dimension.
   3. Board Thickness: As indicated on drawings.
   4. Dimensional Stability: 2 percent, maximum.
   5. Board Edges: Square.

6. Thermal Resistance: R-value of 5.0 per 1 inch at 75 degrees F mean temperature using ASTM C177 test method.
7. Compressive Resistance: 100 psi.
8. Board Density: 3.0 lb/cu ft.
9. Water Absorption: 0.3 percent by volume, maximum.
10. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/450, when tested in accordance with ASTM E84.
11. Manufacturers:
    a. DOW "XNERGY" rigid insulation.
    b. Or Approved Equal by manufacturer.

D. Drainage Layer or Spacers: Furnished or approved by EIFS manufacturer; capable of achieving specified drainage rate; not required to be water-resistive, air retarder, or vapor retarder.

E. Air/Water-Resistive Barrier (For use at existing masonry locations): Provide a flexible, polymer-based noncementitous water-resistive coating and air barrier; and an open weave fiberglass mesh tape with pressure sensitive adhesive. (Flash around openings as per Dryvit standard detail OPMD 0.0.13)

F. Water-Resistive Barrier Coating: Fluid-applied air and water barrier membrane; applied to sheathing; furnished or approved by EIFS manufacturer.

G. Flashing Tape: Self-adhering rubberized asphalt tape with polyethylene backing or other material and surface conditioner furnished or approved by EIFS manufacturer.

2.04 ACCESSORY MATERIALS

A. Insulation Adhesive: Type required by EIFS manufacturer for project substrate.

B. Metal Flashings: As specified in Section 076200.

C. Trim: EIFS manufacturer's standard PVC or galvanized steel trim accessories, as required for a complete project and including starter track and drainage accessories.

D. Sealant Materials: Compatible with EIFS materials and as recommended by EIFS manufacturer.

PART 3 EXECUTION

3.01 GENERAL

A. Install in accordance with EIFS manufacturer's instructions and ASTM C1397.

B. Where different requirements appear in either document, comply with the most stringent.

C. Neither of these documents supercedes the provisions of the Contract Documents that define the contractual relationships between the parties or the scope of work.

3.02 EXAMINATION

A. Verify that substrate is sound and free of oil, dirt, other surface contaminants, efflorescence, loose materials, or protrusions that could interfere with EIFS installation and is of a type and construction that is acceptable to EIFS manufacturer. Do not begin work until substrate and adjacent materials are complete and thoroughly dry.

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B. Verify that substrate surface is flat, with no deviation greater than 1/4 in when tested with a 10 ft straightedge.

3.03 INSTALLATION - WATER-RESISTIVE BARRIER

A. Apply barrier coating as recommended by coating manufacturer; prime substrate as required before application.

B. Seal substrate transitions and intersections with other materials to form continuous water-resistive barrier on exterior of sheathing, using method recommended by manufacturer.

C. At door and window rough openings and other wall penetrations, seal water-resistive barrier and flexible flashings to rough opening before installation of metal flashings, sills, or frames, using method recommended by manufacturer.

D. Lap flexible flashing or flashing tape at least 2 inches on each side of joint or transition.

E. Install drainage layer or spacers after flashing tape has been completed.

3.04 INSTALLATION - INSULATION

A. Install in accordance with manufacturer's instructions.

B. Prior to installation of boards, install starter track and other trim level and plumb and securely fastened. Install only in full lengths, to minimize moisture intrusion; cut horizontal trim tight to vertical trim.

C. Install back wrap reinforcing mesh at all openings and terminations that are not to be protected with trim.

D. On wall surfaces, install boards horizontally.

E. Place boards in a method to maximize tight joints. Stagger vertical joints and interlock at corners. Butt edges and ends tight to adjacent board and to protrusions. Achieve a continuous flush insulation surface, with no gaps in excess of 1/16 inch.

F. Fill gaps greater than 1/16 inch with strips or shims cut from the same insulation material.

G. Rasp irregularities off surface of installed insulation board.

H. Mechanical Fastening: Space fasteners as recommended by EIFS manufacturer.

I. Adhesive Attachment: Use method required by manufacturer to achieve drainage efficiency specified; do not close up drainage channels when placing insulation board.

3.05 INSTALLATION - CLASS PB FINISH

A. Base Coat: Apply in thickness as necessary to fully embed reinforcing mesh, wrinkle free, including back-wrap at terminations of EIFS. Install reinforcing fabric as recommended by EIFS manufacturer.
   1. Lap reinforcing mesh edges and ends a minimum of 2-1/2 inches.
   2. Allow base coat to dry a minimum of 24 hours before next coating application.

B. Apply finish coat after base coat has dried not less than 24 hours, embed finish aggregate, and finish to a uniform texture and color.

C. Finish Coat Thickness: As recommended by manufacturer.

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D. Seal control and expansion joints within the field of exterior finish and insulation system, using procedures recommended by sealant and finish system manufacturers.

3.06 CLEANING

A. Clean EIFS surfaces and work areas of foreign materials resulting from EIFS operations.

3.07 PROTECTION

A. Protect completed work from damage and soiling by subsequent work.

END OF SECTION

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SECTION 073113
ASPHALT SHINGLES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Asphalt shingle roofing.
   2. Flexible sheet membranes for eave protection, underlayment, and valley protection.
   3. Associated metal flashings and accessories.

1.02 REFERENCE STANDARDS

A. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 2009.

B. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2013.

C. ASTM D3161/D3161M - Standard Test Method for Wind-Resistance of Steep Slope Roofing Products (Fan-Induced Method); 2016.

D. ASTM D3462/D3462M - Standard Specification for Asphalt Shingles Made From Glass Felt and Surfaced with Mineral Granules; 2010a.

E. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.

F. ICC-ES AC188 - Acceptance Criteria for Roof Underlayments; 2012.

G. Miami (APD) - Approved Products Directory; Miami-Dade County; database at www.miamidade.gov/development/product-control.asp.

H. NRCA (RM) - The NRCA Roofing Manual; 2017.

I. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.03 SUBMITTALS

A. Product Data: Provide data indicating material characteristics and performance criteria.

B. Shop Drawings: For metal flashings, indicate specially configured metal flashings.

C. Samples: Submit two samples of each shingle color indicating color range and finish texture/pattern; for color selection.

D. Manufacturer's Installation Instructions: Indicate installation criteria and procedures.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.04 QUALITY ASSURANCE

A. Products are Required to Comply with Fire Resistance Criteria: UL (DIR) listed and labeled.

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1.05 FIELD CONDITIONS

A. Do not install shingles or eave protection membrane when surface temperatures are below 45 degrees F.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Asphalt Shingles:
   1. GAF; Timberline Natural Shadow: www.gaf.com/sle.
   2. Owens Corning Corp: www.owenscorning.com.
   3. Or Approved Equal.

2.02 ASPHALT SHINGLES

A. Asphalt Shingles: Asphalt-coated glass felt, mineral granule surfaced, complying with ASTM D3462.
   1. Fire Resistance: Class A.
   2. Wind Resistance: Class F, when tested in accordance with ASTM D3161.
   3. Warranted Wind Speed: 110 mph.
   4. Miami-Dade County approved.
   5. Self-sealing type.
   6. Style: Laminated overlay.
   7. Color: To be selected during submittal approval from manufacturer's standard colors.

2.03 SHEET MATERIALS

A. Underlayment: Self-adhering rubber-modified asphalt sheet complying with ASTM D1970/D1970M; 22 mil total thickness; with strippable release film and woven polypropylene sheet top surface.
   1. Minimum Requirements: Comply with requirements of ICC-ES AC188 for non-self-adhesive sheet.
   2. Self Sealability: Passing nail sealability test specified in ASTM D1970/D1970M.
   3. Low Temperature Flexibility: Passing test specified in ASTM D1970/D1970M.
   4. Water Vapor Permeance: 0.067 perm, when tested in accordance with ASTM E96/E96M Procedure A (desiccant method).
   5. Manufacturers:
      a. GAF Stormguard.
      b. Or Approved Equal.

B. Underlayment: Asphalt-saturated organic roofing felt, unperforated, complying with ASTM D226/D226M, Type I ("No.15").

2.04 ACCESSORIES

A. Nails: Standard round wire shingle type, of hot-dipped zinc coated steel, 10 wire gage, 0.1019 inch shank diameter, 3/8 inch head diameter, of sufficient length to penetrate through roof sheathing or 3/4 inch into roof sheathing or decking.

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B. Staples: Standard wire shingle type, of hot dipped zinc coated steel, 16 wire gage, 0.0508 inch diameter, 15/16 inch crown width, of sufficient length to penetrate through roof sheathing or 3/4 inch into roof sheathing or decking.

C. Ridge Vents: Plastic, extruded with vent openings that do not permit direct water or weather entry; flanged to receive shingles.

2.05 METAL FLASHINGS

A. Metal Flashings: Provide sheet metal eave edge, open valley flashing, dormer flashing, and other flashing indicated.
   1. Form flashings to protect roofing materials from physical damage and shed water.
   2. Form sections square and accurate to profile, in maximum possible lengths, free from distortion or defects detrimental to appearance or performance.
   3. Hem exposed edges of flashings minimum 1/4 inch on underside.

B. Aluminum Sheet Metal: Prefinished aluminum, 26 gage, 0.017 inch minimum thickness; PVC coating, color as selected.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions prior to beginning work.

B. Verify that deck is of sufficient thickness to accept fasteners.

C. Verify that roof penetrations and plumbing stacks are in place and flashed to deck surface.

D. Verify roof openings are correctly framed.

E. Verify deck surfaces are dry, free of ridges, warps, or voids.

3.02 PREPARATION

A. Seal roof deck joints wider than 1/16 inch as recommended by shingle manufacturer.

B. At areas where eave protection membrane is to be adhered to substrate, fill knot holes and surface cracks with latex filler.

C. Broom clean deck surfaces before installing underlayment or eave protection.

D. Install eave edge flashings tight with fascia boards. Weather lap joints 2 inches and seal with plastic cement. Secure flange with nails spaced six inches on center.

3.03 INSTALLATION - EAVE PROTECTION MEMBRANE

A. Install eave protection membrane from eave edge to minimum 4 ft up-slope beyond interior face of exterior wall.

B. Install eave protection membrane in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.

3.04 INSTALLATION - UNDERLAYMENT

A. Underlayment At Roof Slopes Greater Than 4:12: Install underlayment perpendicular to slope of roof, with ends and edges weather lapped minimum 4 inches. Stagger end laps of each consecutive layer. Nail in place. Weather lap minimum 4 inches over eave protection.

B. Items projecting through or mounted on roof: Weather lap and seal watertight with plastic cement.

3.05 INSTALLATION - VALLEY PROTECTION

A. Install flexible flashing in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.

B. Weather lap joints minimum 2 inches.

C. Nail in place minimum 18 inches on center, 1 inch from edges.

D. At Exposed Valleys: Install one layer of sheet metal flashing, minimum 24 inches wide, centered over open valley and crimped to guide water. Weather lap joints minimum 2 inch wide band of lap cement along each edge of first, press roll roofing into cement, and nail in place minimum 18 inches on center, 1 inch from edges.

3.06 INSTALLATION - METAL FLASHING AND ACCESSORIES

A. Install flashings in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.

B. Weather lap joints minimum 2 inches and seal weather tight with plastic cement.

C. Secure in place with nails at six inches on center. Conceal fastenings.

D. Items Projecting Through or Mounted on Roofing: Flash and seal weather tight with plastic cement.

3.07 INSTALLATION - SHINGLES

A. Install shingles in accordance with manufacturer's instructions manufacturer's instructions and NRCA (RM) applicable requirements.

1. Fasten individual shingles using 2 nails per shingle, or as required by code, whichever is greater.
2. Fasten strip shingles using 4 nails per strip, or as required by code, whichever is greater.

B. Place shingles in straight coursing pattern with 5 inch weather exposure to produce double thickness over full roof area. Provide double course of shingles at eaves.

C. Project first course of shingles 3/4 inch beyond fascia boards.

D. Extend shingles 1/2 inch beyond face of gable edge fascia boards.

E. Cap hips and ridges with individual shingles, maintaining 5 inch weather exposure. Place to avoid exposed nails.

F. Coordinate installation of roof mounted components or work projecting through roof with weather tight placement of counterflashings.

G. Complete installation to provide weather tight service.

3.08 PROTECTION

A. Do not permit traffic over finished roof surface.

END OF SECTION

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SECTION 074113
METAL ROOF PANELS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Architectural roofing system of preformed aluminum panels. Metal Roof to be an alternate bid item as defined in Summary of Work.
   2. Fastening system.
   3. Factory finishing.
   4. Accessories and miscellaneous components.

1.02 REFERENCE STANDARDS

A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

B. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2014.

C. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 2009.

D. IAS AC472 - Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems; 2012.

1.03 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Storage and handling requirements and recommendations.
   2. Installation methods.
   3. Specimen warranty.

B. Shop Drawings: Include layouts of roof panels, details of edge and penetration conditions, spacing and type of connections, flashings, underlayments, and special conditions.
   1. Show work to be field-fabricated or field-assembled.

C. Selection Samples: For each roofing system specified, submit color chips representing manufacturer's full range of available colors and patterns.

D. Manufacturer Qualification Statement: Provide documentation showing metal roof panel fabricator is accredited under IAS AC472.

E. Warranty: Submit specified manufacturer's warranty and ensure that forms have been completed in Owner's name and are registered with manufacturer.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in the manufacture of roofing systems similar to those required for this project.
   1. Not less than 5 years of documented experience.

B. Installer Qualifications: Company trained and authorized by roofing system manufacturer.

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1.05 DELIVERY, STORAGE, AND HANDLING

A. Provide strippable plastic protection on prefinished roofing panels for removal after installation.

B. Store roofing panels on project site as recommended by manufacturer to minimize damage to panels prior to installation.

1.06 WARRANTY

A. Finish Warranty: Provide manufacturer's special warranty covering failure of factory-applied exterior finish on metal roof panels and agreeing to repair or replace panels that show evidence of finish degradation, including significant fading, chalking, cracking, or peeling within specified warranty period of 30 year period from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Roof Panels:
   1. ATAS International, Inc; Field-Lok 1 1/2": www.atas.com/sle.
   2. Metl-Span, a Division of NCI Group, Inc: www.metlspan.com.
   3. Petersen Aluminum Corporation: www.pac-clad.com/sle.
   4. Or Approved Equal.

2.02 ARCHITECTURAL METAL ROOF PANELS

A. Architectural Metal Roofing: Provide complete engineered system complying with specified requirements and capable of remaining weathertight while withstanding anticipated movement of substrate and thermally induced movement of roofing system.

B. Metal Panels: Factory-formed panels with factory-applied finish.
   1. Aluminum Panels:
      a. Alloy: Aluminum conforming to ASTM B209 (ASTM B209M); temper as required for forming.
      b. Thickness: Minimum 20 gage (0.032 inch).
   2. Profile: Standing seam, with minimum 1.5 inch seam height; concealed fastener system for field seaming with special tool.
   3. Texture: Smooth.
   4. Length: Maximum possible length to minimize lapped joints. Where lapped joints are unavoidable, space laps so that each sheet spans over three or more supports.
   5. Width: Maximum panel coverage of 16 inches.

2.03 ATTACHMENT SYSTEM

A. Concealed System: Provide manufacturer's standard stainless steel or nylon-coated aluminum concealed anchor clips designed for specific roofing system and engineered to meet performance requirements, including anticipated thermal movement.

2.04 PANEL FINISH

A. Fluoropolymer Coating System: Manufacturer's standard multi-coat thermocured coating system, including minimum 70 percent fluoropolymer color topcoat with

minimum total dry film thickness of 0.9 mil; color and gloss as selected from manufacturer's standards.

2.05 ACCESSORIES AND MISCELLANEOUS ITEMS

A. Miscellaneous Sheet Metal Items: Provide flashings, trim, moldings, closure strips, preformed crickets, and caps of the same material, thickness, and finish as used for the roofing panels. Items completely concealed after installation may optionally be made of stainless steel.

B. Rib and Ridge Closures: Provide prefabricated, close-fitting components of steel with corrosion resistant finish or combination steel and closed-cell foam.

C. Sealants:
   1. Exposed Sealant: Elastomeric; silicone, polyurethane, or silyl-terminated polyether/polyurethane.
   2. Concealed Sealant: Non-curing butyl sealant or tape sealant.

D. Underlayment for Wood Substrate: ASTM D226/D226M roofing felt, perforated type; covered by water-resistant rosin-sized building paper.

E. Snow Guards: Provide aluminum Snow Guards powder coated to match roofing. Provide Alpine Snow Guards model ASG33G or Approved Equal.

2.06 FABRICATION

A. Panels: Fabricate panels and accessory items at factory, using manufacturer92s standard processes as required to achieve specified appearance and performance requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation of preformed metal roof panels 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. Broom clean wood sheathing prior to installation of roofing system.

B. Coordinate roofing work with provisions for roof drainage, flashing, trim, penetrations, and other adjoining work to assure that the completed roof will be free of leaks.

C. Remove protective film from surface of roof panels immediately prior to installation. Strip film carefully, to avoid damage to prefinished surfaces.

D. Separate dissimilar metals by applying a bituminous coating, self-adhering rubberized asphalt sheet, or other permanent method approved by roof panel manufacturer.

E. Where metal will be in contact with wood or other absorbent material subject to wetting, seal joints with sealing compound and apply one coat of heavy-bodied bituminous paint.

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3.03 INSTALLATION

A. Overall: Install roofing system in accordance with approved shop drawings and panel manufacturer's instructions and recommendations, as applicable to specific project conditions. Anchor all components of roofing system securely in place while allowing for thermal and structural movement.
   1. Install roofing system with concealed clips and fasteners, except as otherwise recommended by manufacturer for specific circumstances.
   2. Minimize field cutting of panels. Where field cutting is absolutely required, use methods that will not distort panel profiles. Use of torches for field cutting is absolutely prohibited.

B. Accessories: Install all components required for a complete roofing assembly, including flashings, trim, moldings, closure strips, preformed crickets, caps, rib closures, ridge closures, and similar roof accessory items.

C. Install roofing felt and building paper slip sheet on roof deck before installing preformed metal roof panels. Secure by methods acceptable to roof panel manufacturer, minimizing use of metal fasteners. Apply from eaves to ridge in shingle fashion, overlapping horizontal joints a minimum of 2 inches and side and end laps a minimum of 3 inches. Offset seams in building paper and seams in roofing felt.

D. Roof Panels: Install panels in strict accordance with manufacturer92s instructions, minimizing transverse joints except at junction with penetrations.

E. Snow Guards: Install snow guards per manufacturer's standard installation instructions. Provide 2 rows staggered on standing seams around entire perimeter of roof edge.

3.04 CLEANING

A. Clean exposed sheet metal work at completion of installation. Remove grease and oil films, excess joint sealer, handling marks, and debris from installation, leaving the work clean and unmarked, free from dents, creases, waves, scratch marks, or other damage to the finish.

3.05 PROTECTION

A. Touch-up, repair, or replace damaged roof panels or accessories before Date of Substantial Completion.

END OF SECTION

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SECTION 074633
PLASTIC SIDING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Vinyl soffit and trim.

1.02 REFERENCE STANDARDS

A. ASTM D4477 - Standard Specification for Rigid (Unplasticized) Poly(Vinyl Chloride) (PVC) Soffit; 2009.

1.03 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

B. Color Charts: Where colors are not specified, provide samples of manufacturer's entire color line for selection.

1.04 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.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Alside, Inc: www.alside.com.

B. CertainTeed Corporation: www.certainteed.com.

C. Ply Gem Industries, Inc: www.plygem.com.

D. Or Approved Equal.

2.02 MATERIALS

A. General Requirements:
   1. Soffit: Comply with ASTM D4477.

B. Vinyl Soffit:
   1. Profile: Beaded Style, Single 12-Inch Beaded; 12 inches wide, vented; 12 inch exposure.
   2. Thickness: 0.038 inch, minimum.
   3. Length: 12 feet, minimum; where available, provide up to 12 foot by 12 foot panels.
   4. Nailing Hem: Single layer, with 1-1/8 inch long nail holes at maximum 18 inches on center.
   5. Finish: Smooth.
   6. Color: As selected from manufacturer's full range of available colors.

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C. Accessories: Provide coordinating accessories made of same material as required for complete and proper installation whether or not specifically shown on the drawings.
   1. J-Channel Trim: 3/8 inches.

D. Fasteners: Aluminum nails, alloy 5056 or 6110, with minimum tensile strength of 63,000 pounds per square inch; length as required to penetrate framing at least 3/4 inch.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrate conditions before beginning installation; verify dimensions and acceptability of substrate.

B. Do not proceed with installation until unacceptable conditions have been corrected.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 INSTALLATION

A. Install soffit and trim in accordance with manufacturer's printed installation instructions.

B. Clean dirt from surface of installed products, using mild soap and water.

3.03 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

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SECTION 075300
ELASTOMERIC MEMBRANE ROOFING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Elastomeric roofing membrane, adhered conventional application.
   2. Insulation, tapered.
   3. Vapor retarder.
   4. Flashings.

1.02 REFERENCE STANDARDS

A. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2006a (Reapproved 2013).

B. ASTM D624 - Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers; 2000 (Reapproved 2012).

C. ASTM D746 - Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact; 2014.

D. ASTM D4637/D4637M - Standard Specification for EPDM Sheet Used in Single-Ply Roof Membrane; 2013.

E. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.

F. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.03 SUBMITTALS

A. Product Data: Provide data indicating membrane materials, flashing materials, insulation, vapor retarder, and fasteners.

B. Shop Drawings: Indicate joint or termination detail conditions, conditions of interface with other materials, and setting plan for tapered insulation.

C. Manufacturer's Installation Instructions: Indicate membrane seaming precautions and perimeter conditions requiring special attention.

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

1.04 QUALITY ASSURANCE

A. Perform work in accordance with manufacturer's instructions.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in manufacturer's original containers, dry, undamaged, with seals and labels intact.

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B. Store products in weather protected environment, clear of ground and moisture.

C. Protect foam insulation from direct exposure to sunlight.

1.06 PROJECT CONDITIONS

A. Coordinate the work with installation of associated counterflashings installed by other sections as the work of this section proceeds.

1.07 FIELD CONDITIONS

A. Do not apply roofing membrane during unsuitable weather.

B. Do not apply roofing membrane when ambient temperature is below 40 degrees F or above 100 degrees F.

C. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.

D. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.

1.08 WARRANTY

A. Provide the Owner a manufacturer's 15-year total roofing system (roof membrane and insulation) warranty commencing with date of final inspection and certificate of acceptance of roofing system installation by roofing materials manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. EPDM Membrane Materials:
   1. Carlisle Roofing Systems, Inc; Sure-Seal EPDM: www.carlisle-syntec.com.
   2. Firestone Building Products, LLC: www.firestonebpco.com.
   3. GenFlex Roofing Systems, LLC: www.genflex.com.
   4. Or Approved Equal.

2.02 ROOFING - UNBALLASTED APPLICATIONS

A. Elastomeric Membrane Roofing: One ply membrane, fully adhered, over vapor retarder and insulation.

B. Roofing Assembly Requirements:
   1. Roof Covering External Fire Resistance Classification: UL (DIR) certified Class A.

C. Acceptable Insulation Types - Tapered Application: Any of the types specified.
   1. Uniform thickness composite board covered with tapered polyisocyanurate, extruded polystyrene, or perlite board.

2.03 ROOFING MEMBRANE AND ASSOCIATED MATERIALS

A. Membrane: Ethylene-propylene-diene-terpolymer (EPDM); externally reinforced with fabric; complying with minimum properties of ASTM D4637/D4637M.
   1. Thickness: 0.060 inch (60 mil).
   2. Sheet Width: 54 inch, minimum; factory-fabricate into largest sheets possible.
   3. Color: black.

4. Tensile Strength: 1200 psi, measured in accordance with ASTM D412.
5. Ultimate Elongation: 350 percent, measured in accordance with ASTM D412.
6. Tear Strength: 175 lbf/in, measured in accordance with ASTM D 624.
7. Water Vapor Permeability: 2.0 perm inch, measured in accordance with ASTM E96/E96M.
8. Brittleness Temperature: -75 degrees F, measured in accordance with ASTM D 746.

B. Seaming Materials: As recommended by membrane manufacturer.

C. Vapor Retarder: Reinforced Kraft paper laminate, complying with requirements of fire rating classification; compatible with roofing and insulation materials.
1. Fire-retardant adhesive.

D. Flexible Flashing Material: EPDM sheet; conforming to the following:
1. Thickness: 0.06 mil.
2. Maximum Perm Rate: 2.0 perm-mils.
3. Tensile Strength: 1305 psi.
4. Elasticity: 50 percent with full recovery without set.
5. Color: Black.
6. Product: Sure-Seal Uncured EPDM Elastoform Flashing manufactured by Carlisle Syn Tec Systems, Division of Carlisle Corporation.

2.04 INSULATION

A. Molded Polystyrene Board Insulation: Expanded polystyrene board (provide 1/2 inch thick fiberboard laminated to insulation board when using fully adhered roof system), with the following characteristics:
1. Board Size: 48 by 96 inch.
2. Board Thickness: 1-1/2 inches.
3. Tapered Board: Slope as indicated; minimum thickness 1/2 inch; fabricate of fewest layers possible.
4. Board Edges: Square.
5. Manufacturers:
a. Carlisle Syn Tec Systems, Division of Carlisle Corporation; Sure-Seal.
b. Schuller International, Inc..
c. AFM Corporation.
d. Or Approved Equal.

2.05 ACCESSORIES

A. Insulation Joint Tape: Glass fiber reinforced type as recommended by insulation manufacturer, compatible with roofing materials; 6 inches wide; self adhering.

B. Insulation Fasteners: Appropriate for purpose intended.
1. Length as required for thickness of insulation material and penetration of deck substrate, with metal washers.

C. Membrane Adhesive: As recommended by membrane manufacturer.

D. Thinners and Cleaners: As recommended by adhesive manufacturer, compatible with membrane.

E. Insulation Adhesive: As recommended by insulation manufacturer.

F. Sealants: As recommended by membrane manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and site conditions are ready to receive work.

B. Verify deck is supported and secure.

C. Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof system.

D. Verify deck surfaces are dry and free of snow or ice.

3.02 WOOD DECK PREPARATION

A. Verify flatness and tightness of joints of wood decking. Fill knot holes with latex filler.

3.03 VAPOR RETARDER AND INSULATION - UNDER MEMBRANE

A. Apply vapor retarder to deck surface with adhesive in accordance with manufacturer's instructions.

1. Extend vapor retarder to deck edge.
2. Install flexible flashing from vapor retarder to air seal material of wall construction, lap and seal to provide continuity of the air barrier plane.

B. Ensure vapor retarder is clean and dry, continuous, and ready for application of insulation.

C. Attachment of Insulation: Mechanically fasten insulation to deck in accordance with roofing manufacturer's instructions and Factory Mutual requirements.

D. Lay subsequent layers of insulation with joints staggered minimum 6 inch from joints of preceding layer.

E. Place tapered insulation to the required slope pattern in accordance with manufacturer's instructions.

F. Lay boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.

G. Tape joints of insulation in accordance with roofing and insulation manufacturers' instructions.

H. Do not apply more insulation than can be covered with membrane in same day.

3.04 MEMBRANE APPLICATION

A. Roll out membrane, free from wrinkles or tears. Place sheet into place without stretching.

B. Shingle joints on sloped substrate in direction of drainage.

C. Fully Adhered Application: Apply adhesive to substrate at rate of ____ gal/square. Fully embed membrane in adhesive except in areas directly over or within 3 inches of expansion joints. Fully adhere one roll before proceeding to adjacent rolls.

D. Overlap edges and ends and seal seams by contact adhesive, minimum 3 inches. Seal permanently waterproof. Apply uniform bead of sealant to joint edge.

E. Around roof penetrations, seal flanges and flashings with flexible flashing.

3.05 CLEANING

A. Remove bituminous markings from finished surfaces.

B. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and conform to their documented instructions.

C. Repair or replace defaced or damaged finishes caused by work of this section.

3.06 PROTECTION

A. Protect installed roofing and flashings from construction operations.

B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.

END OF SECTION

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SECTION 076200
SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Fabricated sheet metal items, including flashings, counterflashings, gutters, and downspouts.
   2. Sealants for joints within sheet metal fabrications.
   3. Precast concrete splash pads.

B. Related Sections:
   1. Section 079200 - Joint Sealants: Sealing non-lap joints between sheet metal fabrications and adjacent construction.

1.02 REFERENCE STANDARDS

A. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels; 2013.

B. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

C. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2014.

D. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2012).

E. CDA A4050 - Copper in Architecture - Handbook; current edition.

F. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.03 SUBMITTALS

A. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

B. Color Samples: Submit manufacturer's standard color charts for final color selection.

1.04 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.

1.05 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.

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PART 2 PRODUCTS

2.01 SHEET MATERIALS

A. Pre-Finished Aluminum: ASTM B209 (ASTM B209M); 0.040 inch thick; plain finish shop pre-coated with fluoropolymer coating.
   1. Fluoropolymer Coating: High Performance Organic Finish, AAMA 2604; multiple coat, thermally cured fluoropolymer finish system.
   2. Color: As selected by Architect from manufacturer's standard colors.

2.02 ACCESSORIES

A. Fasteners: Galvanized steel, with soft neoprene washers.

B. Primer: Zinc chromate type.

C. Sealant: Silicone Sealant as specified in Section 079200.

D. Plastic Cement: ASTM D4586, Type I.

2.03 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

B. Form pieces in longest possible lengths.

C. Hem exposed edges on underside 1/2 inch; miter and seam corners.

D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

E. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.

F. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.

2.04 GUTTER AND DOWNSPOUT FABRICATION

A. Gutters: SMACNA (ASMM), Rectangular profile.

B. Downspouts: Rectangular profile.

C. Gutters and Downspouts: Sizes indicated.

D. Accessories: Profiled to suit gutters and downspouts.
   1. Anchorage Devices: In accordance with SMACNA (ASMM) requirements.

E. Splash Pads: Precast concrete type, of size and profiles indicated; minimum 3000 psi at 28 days, with minimum 5 percent air entrainment.

F. Seal metal joints.

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.

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3.02 INSTALLATION

A. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted..

B. Apply plastic cement compound between metal flashings and felt flashings.

C. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.

D. Seal metal joints watertight.

E. Secure downspouts in place using fasteners.

F. Slope gutters 1/4 inch per 10 feet, minimum.

G. Set splash pads under downspouts.

END OF SECTION

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SECTION 078400
FIRESTOPPING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Firestopping systems.
   2. Firestopping of all joints and penetrations in fire resistance rated and smoke resistant assemblies, whether indicated on drawings or not, and other openings indicated.

1.02 REFERENCE STANDARDS

A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2015.

B. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops; 2013a.

C. ITS (DIR) - Directory of Listed Products; current edition.

D. FM (AG) - FM Approval Guide; current edition.

E. FA (AG) - FM Approval Guide; Factory Mutual Research Corporation; current edition.

F. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition.

G. UL (FRD) - Fire Resistance Directory; current edition.

1.03 SUBMITTALS

A. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.

B. Product Data: Provide data on product characteristics, performance ratings, and limitations.

C. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.04 QUALITY ASSURANCE

A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.
   1. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.
   2. Valid evaluation report published by ICC Evaluation Service, Inc. (ICC-ES) at www.icc-es.org will be considered as constituting an acceptable test report.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

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C. Installer Qualifications: Company specializing in performing the work of this section and:
   1. With minimum 3 years documented experience installing work of this type.

1.05 FIELD CONDITIONS

A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation. Maintain minimum temperature before, during, and for 3 days after installation of materials.

PART 2 PRODUCTS

2.01 FIRESTOPPING - GENERAL REQUIREMENTS

A. Manufacturers:
   1. 3M Fire Protection Products: www.3m.com/firestop.
   2. Hilti, Inc: www.us.hilti.com/#sle.
   3. Specified Technologies, Inc.: www.stifirestop.com.
   4. Or Approved Equal.

B. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Type required for tested assembly design.

C. Sealants and Primers: Provide products having lower volatile organic compound (VOC) content than indicated in South Coast Air Quality Management District (SCAQMD); Rule 1168.

2.02 FIRESTOPPING SYSTEMS

A. Firestopping: Any material meeting requirements.
   1. Fire Ratings: Use any system that is listed by FM (AG), ITS (DIR), or UL (FRD) and tested in accordance with ASTM E814 or ASTM E119 with F Rating equal to fire rating of penetrated assembly and minimum T Rating Equal to F Rating and in compliance with other specified requirements.

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 matter that could adversely affect bond of firestopping material.

B. Remove incompatible materials that could adversely affect bond.

C. Install backing materials to arrest liquid material leakage.

3.03 INSTALLATION

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

B. Install labeling required by code.

3.04 CLEANING

A. Clean adjacent surfaces of firestopping materials.

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3.05 PROTECTION

A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

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SECTION 079200
JOINT SEALANTS

PART 1 GENERAL

1.01 SUMMARY

A. Sections Includes:
   1. Nonsag gunnable joint sealants.
   2. Self-leveling pourable joint sealants.
   3. Joint backings and accessories.

1.02 REFERENCE STANDARDS

A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer; 2006 (Reapproved 2011).

B. ASTM C834 - Standard Specification for Latex Sealants; 2014.

C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014.

D. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2013.

E. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition.

1.03 SUBMITTALS

A. 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.
   5. Substrates for which use of primer is required.
   6. Installation instructions, including precautions, limitations, and recommended backing materials and tools.
   7. Sample product warranty.
   8. Certification by manufacturer indicating that product complies with specification requirements.

B. 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.

C. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

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B. Installer Qualifications: Company specializing in performing the work of this section and with at least three years of documented experience.

1.05 WARRANTY

A. Correct defective work within a five year period after Date of Substantial Completion.

B. 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 JOINT SEALANTS - GENERAL

A. Sealants and Primers: Provide products having lower volatile organic compound (VOC) content than indicated in SCAQMD 1168.

2.02 NONSAG JOINT SEALANTS

A. Non-Staining Silicone Sealant: ASTM C920, Grade NS, Class 50, Uses NT, G, O, M and A; single component, neutral curing, non-sagging, non-staining, non-bleeding.
   1. Movement Capability: Plus and minus 50 percent, minimum.
   2. Hardness Range: 15 to 35, Shore A, when tested in accordance with ASTM C661.
   3. Color: To be selected by Architect from manufacturer's standard range.
   4. Cure Type: Single-component, neutral moisture curing.
   5. Service Temperature Range: Minus 65 to 180 degrees F.
   6. VOC Content: VOC content maximum of 45 g/l.
   7. Applications: Use for all exterior structure joints as indicated on the Drawings and such joints not indicated, to render the structure leak free from wind, water, dust and weather.
   8. Manufacturers:
      a. Pecora Corporation; 860: www.pecora.com.
      b. Bostik Inc; Product Chem-Calk 1200; www.bostik-us.com.
      c. Or Approved Equal.

B. Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use.
   1. Color: To be selected by Architect from manufacturer's standard range.
   2. Movement Capability: 7.5 percent.
   3. Shore A Hardness: 15 to 40.
   4. VOC Content: VOC content maximum 35 g/l.
   5. Applications: Use for all interior vertical and horizontal joints.
   6. Manufacturers:
      a. Pecora Corporation: www.pecora.com.
      b. Sherwin-Williams Company; 850A Acrylic Latex Caulk: www.sherwin-williams.com.
      c. Dap, Inc; Dap Alex Plus Acrylic Latex Caulk plus Silicone.
      d. Or Approved Equal.

2.03 INSULATING FOAM SEALANT

A. Polyurethane Foam Sealant: Provide one component polyurethane foam sealant that conforms to ASTM E2112 and AAMA 812-04.

B. VOC Content: VOC content maximum of 165 g/l.

C. Applications: Use to fill voids between materials around perimeter at all exterior door and window locations.

D. Provide Greenguard Certified product.

E. Products:
   1. Dow Chemical Company; Product Great Stuff Pro Window & Door Insulating Foam Sealant; www.dowbuildingsolutions.com.
   2. Fomo Products, Inc; Product Hand-Foam Window and Door Foam Sealant; www.fomo.com.
   3. Or Approved Equal.

2.04 SELF-LEVELING SEALANTS

A. Self-Leveling Polyurethane Sealant for Continuous Water Immersion: Polyurethane; ASTM C920, Grade P, Uses M and A; multicomponent; explicitly approved by manufacturer for traffic exposure and continuous water immersion.
   1. Movement Capability: Plus and minus 50 percent, minimum.
   2. Hardness Range: 25 to 35, Shore A, when tested in accordance with ASTM C661.
   3. Color: To be selected by Architect from manufacturer's standard range.
   4. Service Temperature Range: Minus 40 to 180 degrees F.
   5. VOC Content: VOC content maximum of 45 g/l.
   6. Applications: Use for exterior trafficked and non-trafficked horizontal working joints and interior trafficked horizontal working joints.
   7. Manufacturers:
      a. Bostik Inc; Product Bostik 555 SL: www.bostik-us.com.
      b. Pecora Corporation: Product NR-200: www.pecora.com.
      c. BASF Construction Chemicals-Building Systems: Product Sonolastic SL2; www.chemrex.com.
      d. Or Approved Equal.

2.05 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.

B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.

C. Joint Cleaner: Non-corrosive and non-staining type, type recommended by sealant manufacturer; compatible with joint forming materials.

D. Primers: Type recommended by sealant manufacturer to suit application; non-staining. VOC Content maximum of 50 g/l.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joints are ready to receive work.

B. Verify that backing materials are compatible with sealants.

C. Verify that backer rods are of the correct size.

3.02 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

3.03 INSTALLATION

A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Perform installation in accordance with ASTM C1193.

C. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.

D. Install bond breaker backing tape where backer rod cannot be used.

E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.

F. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.

G. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

END OF SECTION

SECTION 081210
CARVED WOOD DOORS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Carved interior MDF doors.
   2. Hollow metal interior door frames.

B. Related Sections:
   1. Section 087100 - Door Hardware: Door hardware.
   2. Section 099000 - Paints and Coatings: Field finish painting for doors.

1.02 SUBMITTALS

A. Product Data: Provide manufacturer's standard details and installation instructions.

B. Shop Drawings: Indicate layout and profiles.

C. Certificate: Certify that doors and frames meet or exceed specified requirements.

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

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

1.04 WARRANTY

A. Provide five year manufacturer warranty for defects in materials and workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. eccodoors Stile and Rail MDF Doors: www.eccodoors.com.

B. Masonite International Corporation: www.masonite.com.

C. Or Approved Equal.

2.02 CARVED INTERIOR MDF DOORS

A. Provide doors carved from medium density fiberboard (MDF) with a minimum 75% recycled content. Doors to be buffed to a smooth finish. Doors to stile and rail construction with doweled joints. Provide solid perimeter blocking. Provide doors with no added urea formaldehyde.

B. All composite wood products must be certified as compliant with California 93120 Phase 2. If using a composite wood product that does not comply with California 93120 Phase 2, all exposed edges and sides must be sealed with low VOC sealants with a VOC content of 250 g/l or less.

C. Door Designs: Provide Ecco Door style indicated below or approved equal. Provide all doors with standard profile type "A" and panel type "A" unless indicated otherwise.
   1. 2 Panel Door: G2000.

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2. Full Panel Glass Door: G1000.
3. Flush Door.

D. Hollow Metal Door Frames:
1. Header and Jamb Members: Form door frames of ASTM A366 commercial quality cold rolled steel.
a. Fire Rated Standard Frames: 20 gauge.
2. Hinge Reinforcement: 14 gauge hot dipped galvanized (G60) steel to ASTM A653.
3. Strikes and Deadbolt Covers and Dust Box: 18 gauge commercial quality cold rolled steel to ASTM A366.
4. Silencers: Provide felt silencers, 3 per strike jamb.
5. Manufacturer: Rediframe Door Frames or approved equal.

E. Fire Doors: Provide fire doors where indicated on the Contract Drawings. Provide rating as indicated. Fire doors to be constructed with intumescent cores.

F. Doors to be factory machined for hinges and cylinder locks. Coordinate with hardware supplier for templates for machining doors.

G. Doors and frames to be factory primed per manufacturer's standard priming.

H. Doors and frames to be field finish painted, see Section 099000 - Paints and Coatings.

2.03 ACCESSORIES

A. Hardware: As specified in Section 087100.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Set doors and frames plumb, level, and true-to-line, without warping or racking doors, and with specified clearances.

C. Field finish paint doors and frames including all edges per requirements of Section 099000.

3.02 ADJUSTING

A. Adjust doors to operate easily, free from warp, twist, or distortion.

B. Adjust Hardware for smooth and quiet operation.

3.03 PROTECTION

A. Protect installed doors and frames from subsequent construction operations.

END OF SECTION

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SECTION 081423
CLAD WOOD DOORS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Clad wood doors with integral frames.

B. Related Sections:
   1. Section 087100 - Door Hardware.

1.02 REFERENCE STANDARDS

A. ASTM C1036 - Standard Specification for Flat Glass; 2011.

B. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.

C. ASTM E2112 - Standard Practice for Installation of Exterior Windows, Doors and Skylights; 2007.

1.03 SUBMITTALS

A. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.

B. 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.

C. Performance Validation: Submit certified label or test report on products as indicated under performance requirements to validate product compliance.

D. Manufacturer's Installation Instructions: Indicate special installation instructions.

E. 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 the products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Package, deliver and store doors in accordance with specified quality standard.

B. Accept doors on site in manufacturer's packaging. Inspect for damage.

C. Protect doors with resilient packaging. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges with tinted sealer if stored more than one week. Break seal on site to permit ventilation.

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1.06 WARRANTY

A. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Exterior Aluminum Cladding with Interior Face Veneer Wood Doors:
   1. Andersen Windows, Inc; Commercial Entry Doors: www.andersenwindows.com/sle.
   2. Pella Corp: www.pella.com.
   3. Weather Shield Manufacturing, Inc: www.weathershield.com.
   4. Or Approved Equal.

2.02 COMPONENTS

A. Exterior Clad Wood Doors: Water repellent treated.
   1. Thickness: 1-3/4 inches, unless otherwise indicated.
   2. Exterior Door Cladding: Aluminum sheet as indicated.
   3. Exterior Frame Cladding: Extruded aluminum as indicated.
   4. Interior Wood Facing, Opaque: Wood veneer for field finish as scheduled.

B. Configuration: As indicated on drawings.
   1. Door Style: As indicated on drawings.

C. Integral Wood Frame Depth: 4-9/16 inch, minimum.

D. Glazing: Double glazed, clear, high performance Low-E coated, manufacturer's standard gas filled, fully tempered, with glass thicknesses as recommended by manufacturer for specified wind conditions.
   1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality - Q3 (architectural).
   2. Fully Tempered Glass: ASTM C1048, Kind FT - Fully Tempered.
   3. Outboard Lite: Clear glass.
   4. Inboard Lite: Clear glass.
   5. High Performance Low-E Coating: Magnetron sputtering vapor deposition (MSVD) titanium dioxide (TiO2) coating, applied to No. 2 surface.
   6. Air Space: 3/4 inch.

E. Glazing Stops: Wood, of same species as door facing, butted corners; prepared for countersink style tamper proof screws.
   1. Apply silicone glazing sealant to exterior glazing stops as recommended by manufacturer.
   2. Apply water repellent treatment to wood glazing stops.

F. Door Stops: Clear preservative treated wood, finished to match frame.

G. Door Sill: Extruded 6063-T5 aluminum, 1/2 inch low profile threshold with compressible bulb weatherstripping and attached to frame jambs.
   1. Color: Mill finish.

H. Hinges: Heavy duty ball bearing type, 4-1/2 inch, with non-removable pin and set screw.
   1. Finish: Satin stainless steel.

I. Door Hardware: As specified in Section 087100.

2.03 DOOR INTERIOR WOOD FACINGS

A. Veneer Facing for Opaque Finish: Medium density overlay (MDO).

B. Door Edging: Any option allowed by quality standard for grade.

C. Wood Finish: Factory applied primer and opaque finish.
   1. Color: Color as selected by Architect from manufacturer's standard colors.

D. Facing Adhesive: Type I - waterproof.

2.04 DOOR EXTERIOR CLADDING

A. Aluminum Cladding: 6063-T5 aluminum cladding on exterior side, 0.045 inch minimum thickness, factory fabricated, factory glazed; complete with integral sloped sill/threshold, flashings, and anchorage devices.

B. Exterior Aluminum Finish: Class II color anodized.
   1. Color: Color as selected by Architect from manufacturer's standard colors.

C. Exterior Wood Frame Aluminum Cover: Extruded 6063-T5 aluminum, color to match door aluminum cladding.

D. Aluminum Members: Factory finished; solid corner construction; thermally broken.

E. Drainage: Provide drainage to exterior for moisture entering joints and glazing spaces and for condensation occurring within frame construction.

F. Glass Stops: Same material and color as frame, sloped for wash.

2.05 FABRICATION

A. Fabricate doors in accordance with door quality standard specified.

B. At exterior doors, provide aluminum flashing at the top and bottom rail and the sill of glazed openings for full thickness and width of door.
   1. Provide manufacturers standard nailing fin at jambs and head of integral door frame.

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.
   1. Exception: Doors to be field finished.

F. Cut and configure exterior door edge to receive recessed weatherstripping devices.

G. Provide edge clearances in accordance with the quality standard specified.

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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.

B. Install exterior doors in accordance with ASTM E2112.

C. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.

D. Use machine tools to cut or drill for hardware.

E. Coordinate installation of doors with installation of integral frames and hardware.

F. Coordinate installation of glazing.

3.03 TOLERANCES

A. Conform to specified quality standard for fit and clearance tolerances.

B. Conform to 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 CLEANING

A. Remove protective material from factory finished surfaces.

B. Clean units using cleaning material and methods in accordance with door manufacturer's written recommendations.

C. Remove excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer.

3.06 PROTECTION

A. Protect installed work from damage due to subsequent construction activity on the site.

END OF SECTION

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SECTION 085200
WOOD WINDOWS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Factory fabricated wood windows.
   2. Glazing.
   3. Operating hardware.
   4. Insect screens.

B. Related Sections:
   1. Section 079200 - Joint Sealants: Sealing joints between frames and adjacent construction.
   2. Section 099000 - Painting and Coating: site finishing wood surfaces.
   3. Section 099123 - Interior Painting: Site finishing wood surfaces.

1.02 REFERENCE STANDARDS

A. AAMA/WDMA/CSA 101/I.S.2/A440 - North American Fenestration Standard/Specification for windows, doors, and skylights; 2011.

1.03 SUBMITTALS

A. Product Data: Show component dimensions, anchorage and fasteners, glass, and internal drainage details.

B. Shop Drawings: Indicate opening dimensions, framed opening tolerances, and installation requirements.

C. Performance Validation: Submit certified label or test report on products as indicated under performance requirements to validate product compliance.

D. Manufacturer's Certificate: Certify that products furnished meet or exceed specified requirements.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with not less than three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect factory finished surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond when exposed to sunlight or weather.

1.06 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F.

B. Maintain this minimum temperature during and after installation of sealants.

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1.07 WARRANTY

A. Provide five year manufacturer warranty for insulated glass units from seal failure, interpane dusting or misting, and replacement of same.

B. Warranty: Include coverage for the following:
   1. Degradation of color finish.
   2. Delamination or separation of finish cladding from window member.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Clad Wood Windows:
   1. Andersen Windows, Inc; 400 Series Tilt-Wash Double Hung and Transom Full Frame Windows: www.andersenwindows.com/sle. Provide Energy Star windows.
   2. Pella Corp: www.pella.com.
   3. Or Approved Equal.

2.02 WOOD WINDOWS

A. Wood Windows: Wood frame and sash, factory fabricated and assembled.
   1. Exterior Finish: Plastic clad.
   2. Interior Finish: Unfinished, for opaque finish.
   3. Color: As selected by Architect from manufacturer's standard range.

B. Windows: Wood frame and sash, factory fabricated and assembled, complying with NWWDA I.S.2.
   1. Configuration: As indicated on drawings.
   2. Window Product Types: FW - Fixed window and H (VS) - Hung window (Vertical sliding window), in accordance with AAMA/WDMA/CSA 101/I.S.2/A440.
   3. Factory glazed; dry glazing method.
   4. Wood Species: Clear pine, preservative treated using treatment type suitable for required finish.
   5. Frame and Sash Members: Mortise and tenon joints. Glue and steel pin joints to hairline fit, weather tight.
   6. Vinyl Cladding: Extruded PVC, low sheen surface, factory fit to profile of wood members.
   7. Clearances and Shim Spacing: Minimum required for installation and dynamic movement of perimeter seal.
   8. Fasteners: Concealed from view.
   9. Internal Drainage of Glazing Spaces to Exterior: Weep holes.
   10. Insect Screen: Locate on inside of windows.
   11. Operable Units: Double weatherstripped.

2.03 COMPONENTS

A. Glazing: Double glazed, clear, Low-E coated, manufacturer's standard fill, with glass thicknesses as recommended by manufacturer for specified wind conditions.

B. Frames: 2 7/16 inch wide by 5 13/16 inch deep profile; flush extruded PVC glass stops to match cladding of screw fastened type, sloped for wash.

C. Sills: one inch nominal thickness, plastic clad wood; sloped for positive wash; fit under sash to project 1/2 inch beyond wall face; one piece full width of opening.

D. Insect Screens: Extruded aluminum frame with mitered and reinforced corners; screen mesh taut and secure to frame; secured to window with adjustable hardware allowing screen removal without use of tools.
   1. Hardware: Spring loaded steel pins; four per screen unit.
   2. Screen Mesh: Vinyl-coated fiberglass, window manufacturer's standard mesh.
   3. Frame Finish: Baked enamel, color to match window interior color.

E. Operable Sash Weatherstripping: Wool pile; permanently resilient, profiled to effect weather seal.

F. Fasteners: Stainless steel.

G. Sealant and Backing Materials: As specified in Section 079200 of types as indicated.

H. Accessories: Provide related flashings, and anchorage and attachment devices.

I. Sealant for Setting Sills, Stools, Aprons, and Sill Flashing: Non-curing butyl type.

2.04 MATERIALS

2.05 ACCESSORIES

A. Double Hung Sash: Metal and nylon spiral friction slide cylinder, each sash, each jamb.

B. Sash lock: Lever handle with cam lock.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify wall openings and adjoining air and vapor seal materials are ready to receive work of this section.

3.02 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. Set sill members and sill flashing in continuous bead of sealant.

E. 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.

F. Finish interior surfaces with opaque material as specififed in Section 099000.

3.03 TOLERANCES

A. Maximum Variation from Level or Plumb: 1/16 inch per 3 ft non-cumulative or 1/8 inch per 10 ft, whichever is less.

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3.04 ADJUSTING

A. Adjust hardware for smooth operation and secure weathertight closure.

3.05 CLEANING

A. Remove protective material from factory finished 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 manufacturer.

END OF SECTION

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SECTION 085659
SERVICE AND TELLER WINDOW UNITS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Service and teller window units.

1.02 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2012.

B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

C. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]; 2013.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordinate work with adjacent materials specified in other sections and as indicated on drawings and approved shop drawings.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's product data for specified products indicating materials, operation, glazing, finishes, and installation instructions.

B. Shop Drawings: Indicate configuration, sizes, rough-in, mounting, anchors and fasteners, and installation clearances.

C. Manufacturer Qualification Statement.

D. Warranty: 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 at least ten years documented experience, and with ability to provide test reports showing that their standard manufactured products meet the specified requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver units in manufacturer's original packaging and unopened containers with identification labels intact.

B. Store units in area protected from exposure to weather and vandalism.

1.07 WARRANTY

A. Provide manufacturer's warranty agreeing to repair or replace units and their components that fail in materials or workmanship within two years from Date of Substantial Completion.

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PART 2 PRODUCTS

2.01 SERVICE AND TELLER WINDOW UNITS

A. Pass-Through Window:
   1. Location: Interior.
   2. Window: Double horizontal sliding, center-parting.
      a. Operation: Manual, self-closing.
      b. Mounting: Projected from the wall surface.
      c. Size: As indicated on drawings.
      d. Material: Aluminum.
      e. Finish: Natural anodized.
   3. Glazing: Single (monolithic), clear.
   4. Products:
      a. C.R. Laurence Co., Inc.; "Daisy" Model D1041.
      b. Or Approved Equal.

2.02 COMPONENTS

A. Windows: Factory-fabricated, finished, and glazed, with extruded aluminum frame and glazing stops; complete with hardware and anchors.
   1. Provide window units that are re-glazable from the secure side without dismantling the non-secure side of framing.
   2. Rigidly fit and secure joints and corners with internal reinforcement. Make joints and connections flush, hairline, and weatherproof. Fully weld corners.
   3. Apply factory finish to all exposed surfaces.
   4. Horizontal Sliding Windows: Top-hung operable sash; hook bolt locking device with thumb-turn release.
   5. Self-Closing Operation: Manual open and self-closing with auto-locking handles and magnetic hold-open device.

2.03 MATERIALS

A. Aluminum Extrusions: Minimum 1/8 inch thick frame and sash material complying with ASTM B221 and ASTM B221M.
   1. Finish: Class I natural anodized.

B. Monolithic Glass: Fully tempered float glass; minimum 1/4 inch thickness.

C. Sealant for Setting Sills and Sill Flashing: Non-curing butyl type.

2.04 FINISHES

A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that window openings are ready for installation of windows.

B. Verify that correct embedded anchors are in place and in proper location; repair or replace anchors as required to achieve satisfactory installation.

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C. Notify Architect if conditions are not suitable for installation of units; do not proceed until conditions are satisfactory.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install units in correct orientation (inside/outside or secure/non-secure).

C. Anchor units securely in manner so as to achieve performance specified.

D. Set sill members and sill flashing in continuous bead of sealant.

3.03 ADJUSTING

A. Adjust operating components for smooth operation while also maintaining a secure, weather-tight enclosure and a tight fit at the contact points; lubricate operating hardware.

3.04 CLEANING

A. Remove protective material from factory finished surfaces.

B. Clean exposed surfaces promptly after installation without damaging finishes.

C. Remove and replace defective work.

D. Provide temporary protection to ensure that security windows are without damage upon Date of Substantial Completion.

3.05 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain operable units.
   1. Instructor: Manufacturer's training personnel.
   2. Location: At project site.
   3. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

END OF SECTION

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SECTION 087100
DOOR HARDWARE

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Hardware for wood and hollow steel doors.
   2. Hardware for fire-rated doors.
   3. Electrically operated and controlled hardware.
   4. Thresholds.
   5. Weatherstripping, seals and door gaskets.

B. Related Sections:
   1. Section 081210 - Carved Wood Doors.
   2. Section 081423 - Clad Wood Doors.

1.02 REFERENCE STANDARDS

A. 36 CFR 1191 – Americans with Disabilities Act Accessibility Guidelines for
   1. Buildings and Facilities; Final Rule; current edition; (ADA Standards for Accessible
   2. Design).

B. ANSI/ICC A117.1 – American National Standard for Accessible and Usable
   1. Buildings and Facilities; International Code Council; 2009.

C. BHMA A156.1 – American National Standard for Butts and Hinges; Builders
   1. Hardware Manufacturers Association, Inc.; 2006 (ANSI/BHMA A156.1).

D. BHMA A156.2 – American National Standard for Bored and Preassembled Locks &
   1. Latches; Builders Hardware Manufacturers Association; 2011 (ANSI/BHMA
   2. A156.2).

E. BHMA A156.3 – American National Standard for Exit Devices; Builders Hardware
   1. Manufacturers Association; 2008 (ANSI/BHMA A156.3).

F. BHMA A156.4 – American National Standard for Door Controls – Closers; Builders
   1. Hardware Manufacturers Association, Inc.; 2008 (ANSI/BHMA A156.4).

G. BHMA A156.6 – American National Standard for Architectural Door Trim; Builders
   1. Hardware Manufacturers Association; 2010 (ANSI/BHMA A156.6).

H. BHMA A156.7 – American National Standard for Template Hinge Dimensions;
   1. Builders Hardware Manufacturers Association; 2003 (ANSI/BHMA A156.7).

I. BHMA A156.18 – American National Standard for Materials and Finishes; Builders
   1. Hardware Manufacturers Association, Inc.; 2006 (ANSI/BHMA A156.18).

J. BHMA A156.21 – American National Standard for Thresholds; Builders Hardware
   1. Manufacturers Association; 2009 (ANSI/BHMA A156.21).

K. BHMA A156.22 – American National Standard for Door Gasketing and Edge Seal
   1. Systems, Builders Hardware Manufacturers Association; 2012 (ANSI/BHMA
   2. A156.22).

L. BHMA A156.115 – Hardware Preparation in Steel Doors and Steel Frames; 2006.

M. BHMA A156.115W – Hardware Preparation in Wood Doors with Wood or Steel
   1. Frames; 2006.

N. DHI (LOCS) – Recommended Locations for Architectural Hardware for Standard
   1. Steel Doors and Frames; Door and Hardware Institute; 2004.

O. DHI WDHS.3 – Recommended Locations for Architectural Hardware for Flush
   1. Wood Doors; Door and Hardware Institute; 1993; also in WDHS-1/WDHS-5 Series, 1996.

P. NFPA 80 – Standard for Fire Doors and Other Opening Protectives; 2013.

Q. NFPA 101 – Code for Safety to Life from Fire in Buildings and Structures; National Fire Protection Association; 2012.

R. UL (BMD) – Building Materials Directory; Underwriters Laboratories Inc.; current edition.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the manufacture, fabrication, and installation of products onto which door hardware will be installed.

B. Furnish templates for door and frame preparation to manufacturers and fabricators of products requiring internal reinforcement for door hardware.

C. Convey Owner's keying requirements to manufacturers.

D. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

1.04 SUBMITTALS

A. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project.

B. Shop Drawings:
   1. Indicate locations and mounting heights of each type of hardware, schedules, catalog cuts, electrical characteristics and connection requirements.
   2. Submit manufacturer's parts lists and templates.

C. Hardware Schedule: Detailed listing of each item of hardware to be installed on each door. Use door numbering scheme as included in the Contract Documents. Identify electrically operated items and include power requirements.

D. Keying Schedule: Submit for approval of Owner.

E. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

F. Project Record Documents: Record actual locations of concealed equipment, services, and conduit.

G. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

H. Keys: Deliver with identifying tags to Owner by security shipment direct from hardware supplier.

I. Warranty: Submit manufacturer's 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 the following requirements:
   1. NFPA 101.
   2. NFPA 80.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

C. Hardware Supplier Qualifications: Company specializing in supplying commercial door hardware with three years of documented experience.

1.06 REGULATORY REQUIREMENTS

A. Conform to applicable code for requirements applicable to fire rated doors and frames.

B. All Hardware on Fire-Rated Doors: Listed and classified by UL as suitable for the purpose specified and indicated.

C. Products Requiring Electrical Connection: Listed and classified by UL as suitable for the purpose specified and indicated.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Package hardware items individually; label and identify each package with door opening code to match hardware schedule.

B. Deliver, store, and handle packaged hardware to prevent damage to finishes, and deterioration in the product from the elements.

1.08 COORDINATION

A. Coordinate the work with other directly affected sections involving manufacture or fabrication of internal reinforcement for door hardware.

B. Furnish templates for door and frame preparation.

C. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

D. Coordinate Owner's keying requirements during the course of the Work.

1.09 MAINTENANCE PRODUCTS

A. Provide special wrenches and tools applicable to each different or special hardware component.

B. Provide maintenance tools and accessories supplied by hardware component manufacturer.

PART 2 PRODUCTS

2.01 DOOR HARDWARE – GENERAL

A. Provide all hardware specified or required to make doors fully functional, compliant with applicable codes, and secure to the extent indicated.

B. Provide all items of a single type of the same model by the same manufacturer.

C. Provide products that comply with the following:
   1. Applicable provisions of federal, state, and local codes.
   2. ADA Standards for Accessible Design
   3. ANSI/ICC A117.1, American National Standard for Accessible and Usable Buildings and Facilities.
   4. Applicable provisions of NFPA 101, Life Safety Code.
   5. Fire-Rated Doors: NFPA 80.
   6. All Hardware on Fire-Rated Doors: Listed and classified by UL as suitable for the purpose specified and indicated.
   7. Hardware for Smoke and Draft Control Doors: Provide hardware that enables door assembly to comply with air leakage requirements of the applicable code.
   8. Products Requiring Electrical Connection: Listed and classified by UL as suitable for the purpose specified and indicated.

D. Function: Lock and latch function numbers and descriptions of manufactures series as listed in hardware schedule.

E. Electrically Operated and/or Controlled Hardware: Provide all power supplies, power transfer hinges, relays, and interfaces required for proper operation; provide wiring between hardware and control components and to building power connection.

F. Finishes: Identified in schedule.

2.02 LOCKS AND LATCHES

A. Locks: Provide a lock for every door, unless specifically indicated as not requiring locking.
   1. Hardware Sets indicate locking functions required for each door.
   2. Trim: Provide lever handle or pull trim on outside of all locks unless specifically stated to have no outside trim.
   3. Lock Cylinders: Provide key access on outside of all locks unless specifically stated to have no locking or no outside trim.

B. Electrically Operated Locks: Fail secure unless otherwise indicated.

C. Lock Cylinders: Manufacturer's standard tumbler type, six-pin standard core.
   1. Provide cams and/or tailpieces as required for locking devices required.

D. Latches: Provide a latch for every door that is not required to lock, unless specifically indicated "push/pull" or "not required to latch".

2.03 GENERAL REQUIREMENTS FOR DOOR HARDWARE PRODUCTS

A. Provide products that comply with the following:
   1. Applicable provisions of Federal, State, and local codes.

2. ANSI/ICC A117.1, American National Standard for Accessible and Usable Buildings and Facilities.
3. Applicable provisions of NFPA 101, Life Safety Code.
4. Fire-Rated Doors: NFPA 80.
5. All Hardware on Fire-Rated Doors: Listed and classified by UL as suitable for the purpose specified and indicated.
6. Products Requiring Electrical Connection: Listed and classified by UL as suitable for the purpose specified and indicated.

B. Finishes: Identified in schedule at end of the section.

2.04 KEYING

A. A. Door Locks: Grand master keyed to Owner's existing keying system.
1. Include construction keying.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that doors and frames are ready to receive work; labeled, fire-rated doors and frames are present and properly installed, and dimensions are as instructed by the manufacturer.

B. Verify that electric power is available to power operated devices and of the correct characteristics.

3.02 INSTALLATION

A. Install hardware in accordance with manufacturer's instructions and applicable codes.

B. Use templates provided by hardware item manufacturer.

C. Do not install surface mounted items until finishes applied to substrate are complete.

D. Install hardware on fire-rated doors and frames in accordance with code and NFPA 80.

E. Mounting heights for hardware from finished floor to center line of hardware item:
1. For steel doors and frames: Comply with DHI "Recommended Locations for Architectural Hardware for Steel Doors and Frames."
2. For wood doors: Comply with DHI "Recommended Locations for Architectural Hardware for Wood Flush Doors."

3.03 ADJUSTING

A. Adjust hardware for smooth operation.

B. Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.

3.04 CLEANING

A. Clean adjacent surfaces soiled by hardware installation. Clean finished hardware per manufacturer's instructions after final adjustments has been made. Replace items that cannot be cleaned to manufacturer's level of finish quality at no additional cost.

3.05 PROTECTION

A. Do not permit adjacent work to damage hardware or finish.

3.06 SCHEDULE

A. Set No. 1
   1. 3 Hinges: Stanley FBB191 4" x 4" x NRP x US26D
   2. 1 Latchset: Sargent 1115 x LJ x US26D
   3. 1 Wall Stop: Ives WS402CCV (where applicable)
   4. 2 Hinge Pin Door Stops: Ives 70 (where applicable)

B. Set No. 2
   1. 3 Hinges: Stanley FBB191 4" x 4" x NRP x US26D
   2. 1 Lockset: Sargent 1105 x LJ x US26D
   3. 1 Wall Stop: Ives WS402CCV (where applicable)
   4. 2 Hinge Pin Door Stops: Ives 70 (where applicable)

C. Set No. 3
   1. 3 Hinges: Stanley FBB191 4" x 4" x NRP x US26D
   2. 1 Lockset: Sargent 1105 x LJ x US26D
   3. 1 Wall Stop: Ives WS402CCV (where applicable)
   4. 2 Hinge Pin Door Stops: Ives 70 (where applicable)

D. Set No. 4
   1. 3 Hinges: Stanley FBB191 4" x 4" x NRP x US26D
   2. 1 Lockset: Sargent 1105 x LJ x US26D
   3. 1 Wall Stop: Ives WS402CCV (where applicable)
   4. 2 Hinge Pin Door Stops: Ives 70 (where applicable)

E. Set No. 5
   1. 3 Hinges: Stanley FBB191 4" x 4" x NRP x US26D
   2. 1 Latchset: Sargent 1115 x LJ x US26D
   3. 1 Closer: Falcon SC80A x 689
   4. 1 Threshold: National Guard Products 896S
   5. 1 Weatherseals: National Guard Products 700SA (head and jambs)
   6. 1 Door Sweep: National Guard Products 200 NA

F. Set No. 6
   1. 3 Hinges: Stanley FBB191 4" x 4" x NRP x US26D
   2. 1 Latchset: Sargent 1115 x LJ x US26D
   3. 1 Electromagnetic Lock: Schlage M400 Series (Lock to be coordinated with Owner's existing card swipe system)
   4. 1 Card Reader: Match Owner's existing card readers system and device
   5. 1 Closer: Falcon SC80A x 689
   6. 1 Threshold: National Guard Products 896S
   7. 1 Weatherseals: National Guard Products 700SA (head and jambs)
   8. 1 Door Sweep: National Guard Products 200 NA

G. Set No. 7
   1. 3 Hinges: Stanley FBB191 4" x 4" x NRP x US26D
   2. 1 Panic Device: Falcon F-25-R-NL-510L-Sutro x US26D
   3. 1 Closer: Falcon SC80A x 689

4. 1 Threshold: National Guard Products 896S
5. 1 Weatherseals: National Guard Products 700SA (head and jambs)
6. 1 Door Sweep: National Guard Products 200 NA

END OF SECTION

SECTION 088000
GLAZING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Glass.
   2. Glazing compounds and accessories.

1.02 REFERENCE STANDARDS

A. ASTM C1036 - Standard Specification for Flat Glass; 2011.

B. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.

C. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2013.

D. GANA (GM) - GANA Glazing Manual; 2009.

E. GANA (SM) - GANA Sealant Manual; 2008.

1.03 SUBMITTALS

A. Product Data on Glass Types: Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.

B. Product Data on Glazing Compounds: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors.

C. Certificates: Certify that products meet or exceed specified requirements.

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with GANA Glazing Manual and GANA Sealant Manual for glazing installation methods.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

1.05 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than 50 degrees F.

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

PART 2 PRODUCTS

2.01 GLAZING UNITS

A. Single Safety Glazing: Non-fire-rated.
   1. Application: Provide this type of glazing in the following locations:
      a. Glazed sidelights to doors, except in fire-rated walls and partitions.
      b. Other locations required by applicable federal, state, and local codes and regulations.
      c. Other locations indicated on the drawings.
   2. Type: Fully tempered float glass as specified.

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3. Tint: Clear.
4. Thickness: 1/4 inch.
5. Glazing Method: Interior wet/dry method, tape and sealant.

2.02 GLASS MATERIALS

A. Float Glass Manufacturers:
   1. Guardian Industries Corp: www.sunguardglass.com.
   2. Pilkington North America Inc: www.pilkington.com/na.
   3. PPG Industries, Inc: www.ppgideascapes.com.
   4. Or Approved Equal.

B. Float Glass: Provide float glass based glazing unless noted otherwise.
   1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality-Q3.
   2. Heat-Strengthened and Fully Tempered Types: ASTM C1048, Kind HS and Kind FT.

2.03 GLAZING COMPOUNDS

A. Manufacturers:
   1. Bostik Inc: www.bostik-us.com.
   2. Pecora Corporation: www.pecora.com.
   3. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com.
   4. Or Approved Equal.

B. Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; non-bleeding, non-staining; ASTM C920, Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; color as selected.

2.04 GLAZING ACCESSORIES

A. Setting Blocks: Neoprene, 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot of glazing or minimum 4 inch x width of glazing rabbet space minus 1/16 inch x height to suit glazing method and pane weight and area.

B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Minimum 3 inch long x one half the height of the glazing stop x thickness to suit application, self adhesive on one face.

C. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; hardness range of 5 to 30 cured Shore A durometer; coiled on release paper; black color.
   1. Width: As required for application.
   2. Thickness: As required for application.
   3. Spacer Rod Diameter: As required for application.
   4. Manufacturers:
      a. Pecora Corporation: www.pecora.com.

b. Tremco Global Sealants: www.tremcosealants.com.
c. Or Approved Equal.

D. Glazing Gaskets: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; black color.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that openings for glazing are correctly sized and within tolerance.

B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and ready to receive glazing.

3.02 PREPARATION

A. Clean contact surfaces with solvent and wipe dry.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant.

D. Install sealants in accordance with ASTM C1193 and GANA Sealant Manual.

E. Install sealants in accordance with manufacturer's instructions.

3.03 INSTALLATION - INTERIOR WET/DRY METHOD (TAPE AND SEALANT)

A. Cut glazing tape to length and install against permanent stops, projecting 1/16 inch above sight line.

B. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.

C. Rest glazing on setting blocks and push against tape to ensure full contact at perimeter of pane or unit.

D. Install removable stops, spacer shims inserted between glazing and applied stops at 24 inch intervals, 1/4 inch below sight line.

E. Fill gaps between pane and applied stop with silicone type sealant to depth equal to bite on glazing, to uniform and level line.

F. Trim protruding tape edge.

3.04 CLEANING

A. Remove glazing materials from finish surfaces.

B. Remove labels after Work is complete.

C. Clean glass and adjacent surfaces.

3.05 PROTECTION

A. After installation, mark pane with an 'X' by using removable plastic tape or paste.

END OF SECTION

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SECTION 092116
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Acoustic insulation.
   2. Gypsum wallboard.
   3. Joint treatment and accessories.

B. Related Requirements:
   1. Section 061000 - Rough Carpentry: Building framing.

1.02 REFERENCE STANDARDS

A. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2015.

B. ASTM C514 - Standard Specification for Nails for the Application of Gypsum Board; 2004 (Reapproved 2014).

C. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2012.

D. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2013.

E. 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; 2014.

F. ASTM C1047 - Standard Specification for Accessories For Gypsum Wallboard and Gypsum Veneer Base; 2014a.

G. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2014.

H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

I. GA-216 - Application and Finishing of Gypsum Board; 2013.

J. UL (FRD) - Fire Resistance Directory; current edition.

1.03 SUBMITTALS

A. Shop Drawings: Indicate special details associated with fireproofing.

B. Product Data: Provide data on gypsum board, accessories, and joint finishing system.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing gypsum board installation and finishing, with minimum 5 years of experience.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.

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1. See PART 3 for finishing requirements.

2.02 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:
   1. Georgia-Pacific Gypsum: www.gpgypsum.com.
   2. National Gypsum Company: www.nationalgypsum.com.
   3. USG Corporation: www.usg.com.
   4. Or Approved Equal.

B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
   1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
   2. At Assemblies Indicated with Fire-Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
   3. Thickness:
      a. Vertical Surfaces: 5/8 inch or as indicated as required in the UL assembly.
      b. Ceilings: 1/2 inch.
      c. Multi-Layer Assemblies: Thicknesses as indicated on drawings.

2.03 ACCESSORIES

A. Acoustic Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced. Thickness: 3 5/8 inch.

B. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.

C. Finishing Accessories: ASTM C1047, galvanized steel or rolled zinc, unless noted otherwise.
   1. Types: As detailed or required for finished appearance.
   2. Special Shapes: In addition to conventional corner bead and control joints, provide U-bead at exposed panel edges.

D. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
   1. Tape: 2 inch wide, coated glass fiber tape for joints and corners, except as otherwise indicated.
   2. Ready-mixed vinyl-based joint compound.

E. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inch in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion resistant.

F. Nails for Attachment to Wood Members: ASTM C514.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

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3.02 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. Acoustic Sealant: Install in accordance with manufacturer's instructions.

3.03 BOARD INSTALLATION

A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Single-Layer Non-Rated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.

C. Fire-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

D. Installation on Metal Framing: Use screws for attachment of gypsum board.

E. Installation on Wood Framing: For rated assemblies, comply with requirements of listing authority. For non-rated assemblies, install as follows:
   1. Single-Layer Applications: Screw attachment.

3.04 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.05 JOINT TREATMENT

A. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
   1. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
   2. Level 1: Fire rated wall areas above finished ceilings, whether or not accessible in the completed construction.

B. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
   1. Feather coats of joint compound so that camber is maximum 1/32 inch.
   2. Taping, filling, and sanding is not required at surfaces behind fixed cabinetry.

3.06 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION

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SECTION 092216
NON-STRUCTURAL METAL FRAMING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Metal partition, ceiling, and soffit framing.
   2. Framing accessories.

1.02 REFERENCE STANDARDS

A. ASTM C635 - Standard Specification for Metal Suspension Systems.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

C. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2014.

D. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2015.

E. 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; 2014.

F. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).

1.03 SUBMITTALS

A. Product Data: Provide data describing framing member materials and finish, product criteria, load charts, and limitations.

B. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

C. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Framing, Connectors, and Accessories:
   1. Clarkwestern Dietrich Building Systems LLC: www.clarkdeitrich.com.
   2. Marino: www.marinoware.com.
   3. Or Approved Equal.

2.02 FRAMING MATERIALS

A. Fire Rated Assemblies: Comply with applicable code and as follows:

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B. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf.
   1. Studs: C shaped with flat or formed webs with knurled faces.
   2. Runners: U shaped, sized to match studs.
   3. Ceiling Channels: C shaped.
   4. Furring: Hat-shaped sections, minimum depth of 7/8 inch.

C. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.

D. Partition Head to Structure Connections: Provide track fastened to structure with legs of sufficient length to accommodate deflection, for friction fit of studs cut short and braced with continuous bridging on both sides.

E. Tracks and Runners: Same material and thickness as studs, bent leg retainer notched to receive studs with provision for crimp locking to stud.

F. Furring and Bracing Members: Of same material as studs; thickness to suit purpose; complying with applicable requirements of ASTM C754.

G. Fasteners: ASTM C1002 self-piercing tapping screws.

H. Anchorage Devices: Powder actuated.

I. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic.

2.03 FABRICATION

A. Fabricate assemblies of framed sections to sizes and profiles required.

B. Fit, reinforce, and brace framing members to suit design requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that rough-in utilities are in proper location.

3.02 INSTALLATION OF STUD FRAMING

A. Comply with requirements of ASTM C754.

B. Extend partition framing to structure in all locations.

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 16 inches on center.

E. Fit runners under and above openings; secure intermediate studs to same spacing as wall studs.

F. Install studs vertically at spacing indicated on drawings.

G. Align stud web openings horizontally.

H. Secure studs to tracks using crimping method. Do not weld.

I. Fabricate corners using a minimum of three studs.

J. Double stud at wall openings, door and window jambs, not more than 2 inches from each side of openings.

K. Coordinate erection of studs with requirements of door frames; install supports and attachments.

L. Coordinate installation of bucks, anchors, and blocking with electrical, mechanical, and other work to be placed within or behind stud framing.

M. Blocking: Use wood blocking secured to studs. Provide blocking for support of plumbing fixtures, toilet partitions, wall cabinets, toilet accessories, hardware, and opening frames.

N. Furring: Install at spacing and locations shown on drawings. Lap splices a minimum of 6 inches.

3.03 CEILING AND SOFFIT FRAMING

A. Comply with requirements of ASTM C754.

B. Install framing after work above ceiling or soffit is complete. Coordinate the location of hangers with other work.

C. Install framing independent of walls, columns, and above-ceiling work.

D. Securely anchor hangers to structural members or embed in structural slab. Space hangers as required to limit deflection to criteria indicated.

3.04 TOLERANCES

A. Maximum Variation From True Position: 1/8 inch in 10 feet.

B. Maximum Variation From Plumb: 1/8 inch in 10 feet.

END OF SECTION

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SECTION 095100
ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Suspended metal grid ceiling system.
   2. Acoustical units.

1.02 REFERENCE STANDARDS

A. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2013a.

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; 2014.

D. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2014.

E. CHPS (HPPD) - High Performance Products Database; Current Edition at www.chps.net/.

1.03 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.

1.04 SUBMITTALS

A. Shop Drawings: Indicate grid layout and related dimensioning and junctions with other ceiling finishes.

B. Product Data: Provide data on suspension system components and acoustical units.

C. Manufacturer's Installation Instructions: Indicate special procedures.

1.05 QUALITY ASSURANCE

A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.06 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

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PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acoustic Tiles/Panels:
   1. Armstrong World Industries, Inc: www.armstrong.com.
   2. CertainTeed Corporation: www.certainteed.com.
   3. USG: www.usg.com.
   4. Or Approved Equal.

B. Suspension Systems:
   1. Same as for acoustical units.

2.02 ACOUSTICAL UNITS

A. Acoustical Units - General: ASTM E1264, Class A.

B. Acoustical Panels: Wet-formed mineral fiber, ASTM E1264 Type III, with the following characteristics:
   1. VOC Content: Certified as Low Emission by one of the following :
      a. GreenGuard Children and Schools; www.greenguard.org.
      b. Product listing in the CHPS High Performance Products Database; www.chps.net.
   2. Size: 24 by 24 inches.
   3. Thickness: 7/8 inches.
   4. Recycled Content: Minimum 50 percent.
   5. Light Reflectance: 0.85 percent, determined in accordance with ASTM E1264.
   6. NRC Range: 0.75 to 0.80, determined in accordance with ASTM E1264.
   7. Articulation Class: 170, determined in accordance with ASTM E1264.
   8. Ceiling Attenuation Class (CAC): 35, determined in accordance with ASTM E1264.
   9. Panel Edge: Square.
   10. Surface Color: White.
   11. Suspension System: Exposed grid.
   12. Products:
      a. Cirrus High NRC, Model #563 by Armstrong World Industries, Inc.

2.03 SUSPENSION SYSTEM(S)

A. Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter moldings, and hold down clips as required.

B. Exposed Suspension System: Formed steelgalvanized steel, commercial quality cold rolled; heavy-duty.
   1. Profile: Tee; 15/16 inch wide face.
   2. Finish: White painted.
   3. Products:
      a. Prelude XL 15/16" Exposed Tee Grid by Armstrong World Industries, Inc.

2.04 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

B. Perimeter Moldings: Same material and finish as grid.
   1. At Exposed Grid: Provide L-shaped molding for mounting at same elevation as face of grid.

C. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

3.02 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.

B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

C. Locate system on room axis according to reflected plan.

D. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.

E. 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.

F. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

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 6 inches of each corner, or support components independently.

I. Do not eccentrically load system or induce rotation of runners.

J. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
   1. Use longest practical lengths.
   2. Overlap and rivet corners.

3.03 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Fit border trim neatly against abutting surfaces.

D. Install units after above-ceiling work is complete.

E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

F. Cutting Acoustical Units:
   1. Cut to fit irregular grid and perimeter edge trim.
   2. Make field cut edges of same profile as factory edges.

G. Where round obstructions occur, provide preformed closures to match perimeter molding.

H. Install hold-down clips on panels within 20 ft of an exterior door.

3.04 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION

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SECTION 096500
RESILIENT FLOORING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Vinyl tile flooring.
   2. Safety flooring.
   3. Resilient base.
   4. Installation accessories.

1.02 REFERENCE STANDARDS

A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2014c.

B. ASTM F1861 - Standard Specification for Resilient Wall Base; 2008 (Reapproved 2012).

C. BAAQMD 8-51 - Bay Area Air Quality Management District Regulation 8, Rule 51, Adhesive and Sealant Products; www.baaqmd.gov; 2002.

D. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings; Resilient Floor Covering Institute; October 2011.

E. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition; www.aqmd.gov.

1.03 SUBMITTALS

A. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

B. Shop Drawings: Indicate seaming plans and floor patterns.

C. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.

D. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the site in manufacturer's original, unopened containers with labels indicating brand names, colors and patterns and quality designations legible and intact. Handle flooring products with extreme care when ambient temperatures are below 55 degrees F.

1.05 FIELD CONDITIONS

A. Maintain temperature in storage area between 55 degrees F and 90 degrees F.

B. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

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PART 2 PRODUCTS

2.01 SHEET FLOORING

A. Safety Flooring: Slip resistant safety flooring with the following characteristics:
   1. Basis of Design: Altro Aquarius or approved equal; www.altro.com; local contact: Marilyn Saenz - Stanley Stephens Company, Inc, cell phone 215-932-2291..
   2. Minimum Requirements: Comply with ASTM F1303.
   3. Size: 2.0 mm thick, 2 m by 20 m roll size.
   4. Reaction to Fire: ASTM E648, Class 1.
   5. Slip resistance: ASTM D2047 - .88/D, 1.03/W. TRRL Pendulum Test greater than 50. Ramp Test R11.
   6. Floor Score Certified.
   7. Seams: Heat welded.
   8. Color: As selected from manufacturer's full line of colors during submittal approval.

2.02 TILE FLOORING

A. Vinyl Tile: Provide commercial vinyl tile flooring with the following characteristics:
   1. Basis of Design: Altro Dolce Tile or approved equal; local contact: Marilyn Saenz - Stanley Stephens Company, Inc, cell phone 215-932-2291.
   2. Overall Thickness: 3.0 mm.
   3. Wearlayer Thickness: 3.0 mm, homogeneous construction.
   4. Tile Size: 18 inches by 18 inches.
   5. VOC Emissions: Low VOC; passes CA 01350 .
   6. Static Coefficient of Friction - ASTM C1028: Greater than 0.60.
   7. Critical Radiant Flux - ASTM E648-06: Class 1.
   8. Smoke Density - ASTM E662: Less than 450.
   9. Warranty: 10 year limited commercial warranty.
   10. Color: Selected from manufacturer's full range of colors.

2.03 RESILIENT BASE

A. Resilient Base: ASTM F1861, Type TP, rubber, thermoplastic; Style B, Cove, and as follows:
   1. Height: 4 inch.
   2. Thickness: 0.125 inch thick.
   3. Finish: Satin.
   4. Length: Roll.
   5. Color: Color as selected from manufacturer's standards.
   6. Accessories: Premolded external corners.

2.04 ACCESSORIES

A. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.
   1. Provide only products having lower volatile organic compound (VOC) content than required by the more stringent of the South Coast Air Quality Management

District Rule No.1168 and the Bay Area Air Quality Management District Regulation 8, Rule 51.

B. Moldings, Transition and Edge Strips: Same material as flooring.

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. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive resilient flooring.

C. 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 resilient base.

D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Remove existing resilient flooring and flooring adhesives; follow the recommendations of RFCI (RWP).

B. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

C. Remove sub-floor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface.

D. Prohibit traffic until filler is fully cured.

E. Clean substrate.

F. Apply primer as required to prevent "bleed-through" or interference with adhesion by substances that cannot be removed.

3.03 INSTALLATION - GENERAL

A. Starting installation constitutes acceptance of sub-floor conditions.

B. Install in accordance with manufacturer's written instructions.

C. Spread only enough adhesive to permit installation of materials before initial set.

D. Fit joints and butt seams tightly.

E. Set flooring in place, press with heavy roller to attain full adhesion.

F. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.

G. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.

H. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

3.04 INSTALLATION - SHEET FLOORING

A. Install in accordance with manufacturer's instructions.

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B. Spread only enough adhesive to permit installation of materials before initial set.

C. Set flooring in place, press with heavy roller to attain full adhesion.

D. Lay flooring with joints and seams parallel to longer room dimensions, to produce minimum number of seams. Lay out seams to avoid widths less than 1/3 of roll width; match patterns at seams.

E. Seams are prohibited in bathrooms and toilet rooms.

F. Double cut sheet at seams.

G. Lay flooring with tightly butted seams, without any seam sealer unless otherwise indicated.

H. Finish seams in sheet vinyl Safety Flooring by heat welding.

I. Where floor finishes are different on opposite sides of door, terminate flooring under centerline of door.

J. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

3.05 INSTALLATION - TILE FLOORING

A. Install in accordance with manufacturer's instructions.

B. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.

C. Spread only enough adhesive to permit installation of materials before initial set.

D. Set flooring in place, press with heavy roller to attain full adhesion.

E. Lay flooring with joints and seams parallel.

F. Where floor finishes are different on opposite sides of door, terminate flooring under centerline of door.

G. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

3.06 INSTALLATION - RESILIENT BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.

B. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.

C. Install base on solid backing. Bond tightly to wall and floor surfaces.

D. Scribe and fit to door frames and other interruptions.

3.07 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean in accordance with manufacturer's written instructions.

3.08 PROTECTION

A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION

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SECTION 096813
TILE CARPETING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Carpet tile, loose laid with connector system.
   2. Entrance carpet tile, fully adhered.

B. Related Sections:
   1. Section 096500 - Resilient Flooring: Resilient base.

1.02 REFERENCE STANDARDS

A. CRI (CIS) - Carpet Installation Standard; Carpet and Rug Institute; 2011.

B. CRI (GLA) - Green Label Testing Program - Approved Adhesive Products; Carpet and Rug Institute; Current Edition.

1.03 SUBMITTALS

A. Product Data: Provide data on adhesive showing material meets specification requirements.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

C. Submit data documenting VOC content of carpet tile adhesive; copy of current CRI Approved Products Listing is acceptable.

D. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

E. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Extra Carpet Tiles: Quantity equal to 5 percent of total installed of each color and pattern installed.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in installing carpet tile with minimum three years documented experience and approved by carpet tile manufacturer.

1.05 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. Tile Carpeting:
   1. Basis of Design: Interface. Inc; www.interfaceinc.com.
   2. Other Acceptable Manufacturers:

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a. Lees Carpets: www.leescarpets.com.
b. Mannington Carpet.
c. Shaw Inustries, Inc.
d. Or Approved Equal.

2.02 MATERIALS

A. Carpet Tile: To be used for all areas except entry, as shown on Contract Drawings.
1. Basis of Design: InterfaceFlor; Primary Stitch, color to be selected.
2. Tile Size: 19.69 inch x 19.69 inch.
3. Yarn System: Post-Consumer Content Type 6,6 Nylon.
4. Dye Method: 100% solution dyed.
5. Soil/Stain Protection: Protekt.
6. Preservative Protection: Intersept.
7. Yarn Weight: 14 oz/yd squared.
8. Pile Thickness: 0.069 in.
9. Pile Density: 7,304.
10. Indoor Air Quality: Meets CRI Green Label Plus.

B. Carpet Tile: To be used for Entry as shown on Contract Drawings.
1. Basis of Design: Interface; Step Repeat Collection; Product SR799, color to be selected.
2. Tile Size: 19.69 inch x 19.69 inch.
3. Yarn System: 100% Recycled Content Type 6 Nylon; Scrubber Yarn.
4. Dye Method: 100% solution dyed.
5. Soil/Stain Protection: Protekt.
6. Preservative Protection: Intersept.
7. Pile Thickness: 0.14 in.
8. Stitches: 10/ inch
9. Pile Density: 6,686.
10. Indoor Air Quality: Meets CRI Green Label Plus.

2.03 RESILIENT BASE

A. Resilient Base: As specified in Section 096500 Resilient Flooring.

2.04 ACCESSORIES

A. Connector System: Provide Interface Tac Tile system or approved equal.

B. Adhesives: Acceptable to carpet tile manufacturer, compatible with materials being adhered; maximum VOC of 50 g/L; CRI Green Label certified.

C. Contact Adhesive: Compatible with carpet material, releasable type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that sub-floor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.

B. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to sub-floor surfaces.

C. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Prepare floor substrates as recommended by flooring manufacturers.

B. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler.

C. Vacuum clean substrate.

3.03 INSTALLATION

A. Starting installation constitutes acceptance of sub-floor conditions.

B. Install carpet tile in accordance with manufacturer's instructions.

C. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.

D. Locate change of color or pattern between rooms under door centerline.

E. Install all carpet tile using connector system except as specified below.

F. Trim carpet tile neatly at walls and around interruptions.

G. 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.

END OF SECTION

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SECTION 097734
FIBERGLASS REINFORCED WALL PANELS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. FRP Wainscot Panels.

1.02 REFERENCE STANDARDS

A. ASTM D5319 - Standard Specification for Glass-Fiber reinforced Polyester Wall and Ceiling Panels.

1.03 SUBMITTALS

A. Product Data: Provide manufacturer's product data for panels, trim and adhesive showing compliance with specification requirements.

B. Samples: Submit manufacturer's standard color pattern selection samples representing manufacturer's full range of available colors.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials factory packaged on strong pallets.

B. Store panels and trim lying flat, under cover and protected from the elements. Allow panels to acclimate to room temperature for 48 hours prior to installation.

1.05 FIELD CONDITIONS

A. Environmental Limitations: Buildings are to be fully enclosed prior to installation with sufficient heat (70 degrees) and ventilation consistent with good working conditions for finish work.

B. During installation and for not less than 48 hours before, maintain an ambient temperature and relative humidity within limits required by type of adhesive used and recommendation of adhesive manufacturer.
   1. Provide ventilation to disperse fumes during application of adhesive as recommended by the adhesive manufacturer.

1.06 WARRANTY

A. Provide one year guarantee against defects in material and workmanship.

PART 2 PRODUCTS

2.01 FRP PANELS AND TRIM

A. Fiberglass reinforced thermosetting polyester resin panel sheets complying with ASTM D5319.
   1. Coating: Multi-layer print, primer, and finish coats or applied over-layer.
   2. Dimensions:
      a. Thickness: 3/32 inch.
      b. Height: Provide 6'-0" high wainscot in rooms indicated on finish schedule.
   3. Properties: Resistant to rot, corrosion, staining, denting, peeling, and splintering.

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4. In all rooms except Janitor Closet provide Marlite Symmetrix FRP Subway Tile C100-G23 White or approved equal. In Janitor Closet provide Marlite Standard FRP, color selected from manufacturer's full range of standard colors, or approved equal.
5. Trim: Provide PVC trim in color to match color of panels. Provide top edge, divider and corner trim.

2.02 ACCESSORIES

A. Adhesive: Construction adhesive reccommended by the manufacturer and complying with ASTM C557.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine backup surfaces to determine that corners are plumb and straight, surfaces are smooth, uniform, clean and free from foreign matter, screws countersunk, joints and cracks filled flush and smooth with the adjoining surface.

3.02 PREPARATION

A. Repair wall defects prior to installation. Level walls to panel manufacturer's requirements. Remove protrusions and fill indentations.

3.03 INSTALLATION

A. Install in accordance with manufacturer's recommended procedures and installation sequence.

B. Install adhesive over gypsum board in accordance with adhesive manufacturer's recommended procedures and installation instructions.

C. Apply trim in accordance with manufacturer's recommended procedures and installation instructions.

3.04 CLEANING

A. Clean panels and trim after installation is complete with damp cloth and mild soap solution per manufacturer's cleaning instructions.

END OF SECTION

SECTION 099000
PAINTING AND COATING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Surface preparation.
   2. Field application of paints and other coatings.
   3. Scope: Finish all interior and exterior surfaces exposed to view, unless fully factory-finished
   4. Do Not Paint or Finish the Following Items:
      a. Items fully factory-finished unless specifically so indicated; materials and products having factory-applied primers are not considered factory finished.
      b. Items indicated to receive other finishes.
      c. Items indicated to remain unfinished.
      d. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
      e. Floors, unless specifically so indicated.
      f. Exterior insulation and finish system (EIFS).
      g. Glass.
      h. Concealed pipes, ducts, and conduits.

1.02 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-Base Materials; 2007.

C. GreenSeal GS-11 - Paints and Coatings; 2013.

D. SSPC (PM1) - Good Painting Practice: SSPC Painting Manual, Vol. 1; Society for Protective Coatings; Fourth Edition.

1.03 SUBMITTALS

A. Schedule: Submit paint schedule in same format as the paint schedule herein, and indicate which if the selected manufacturer's products are intended for use. Do not perform painting or coating without Architect's approval of the submitted paint schedule.

B. Product Data: Provide complete list of all products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
   2. MPI product number (e.g. MPI #47).
   3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
   4. Manufacturer's installation instructions.

C. Certification: By manufacturer that all paints and coatings comply with VOC limits specified.

D. Manufacturer's Instructions: Indicate special surface preparation procedures.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Extra Paint and Coatings: 1 gallon of each color; store where directed.
   2. Label each container with color in addition to the manufacturer's label.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum three years documented experience.

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 45 degrees F and a maximum of 90 degrees F, 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 temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

D. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.

E. Minimum Application Temperature for Varnish Finishes: 65 degrees F for interior or exterior, unless required otherwise by manufacturer's instructions.

F. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide all paint and coating products used in any individual system from the same manufacturer; no exceptions except for specialty coating.

B. Paints:
   1. Base Manufacturer: Sherwin-Williams Company: www.sherwin-williams.com.

2. Glidden Professional, a product of PPG Architectural Coatings: www.gliddenprofessional.com.
3. Benjamin Moore & Co: www.benjaminmoore.com.
4. PPG Paints: www.ppgpaints.com.
5. Or approved equal.

C. Primer Sealers: Same manufacturer as top coats.

D. Block Fillers: Same manufacturer as top coats.

2.02 PAINTS AND COATINGS - GENERAL

A. Paints and Coatings: Ready mixed, unless intended to be a field-catalyzed coating.
1. Provide paints and coatings of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
3. Supply each coating material in quantity required to complete entire project's work from a single production run.
4. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.

B. Volatile Organic Compound (VOC) Content:
1. Interior Paints: All interior paints to have a 0 grams/liter emitted VOC for all coating types. All interior paints must meet or exceed the chemical component limits of Green Seal's Standard GS-11 requirements.
2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

C. Colors: To be selected from manufacturer's full range of available colors.
1. Selection to be made by Architect after award of contract.
2. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling they are mounted on/under.

2.03 PAINT SYSTEMS - EXTERIOR

A. Paint WE-OP-3L - Wood, Opaque, Latex, 3 Coat:
1. One coat of latex primer sealer.
2. Flat: Two coats of latex enamel: Duration Exterio Latex Coating.

B. Paint CE-OP-3L - Masonry/Concrete, Opaque, Latex, 3 Coat:
1. One coat of block filler.
2. Flat: Two coats of latex enamel; Duration Exterior Latex Coating.

2.04 PAINT SYSTEMS - INTERIOR

A. Paint WI-OP-2L - Wood, Opaque, Latex, 2 Coat:
1. One coat of latex primer sealer.

2. Eggshell: One coat of latex enamel; ProMar 200 Zero VOC Interior Latex, Eg-Shel, B20-2600 Series.

B. Paint WI-TR-VS - Wood, Transparent, Varnish, Stain:
   1. One coat of stain; Minwax Wood Finish 250 VOC Compliant Stain.
   2. Satin: Two coats of varnish; Minwax Water Based Helmsman 275 VOC compliant.

C. Paint MI-OP-2L - Ferrous Metals, Primed, Latex, 2 Coat:
   1. Touch-up with latex primer.
   2. Semi-gloss: One coat of latex enamel; ProMar 200 Zero VOC Interior Latex Semi-Gloss, B31-2600 Series.
   3. Eggshell: One coat of Latex Enamel; ProMar 200 Zero VOC Interior Latex Eg-Shel, B20-2600 Series.

D. Paint GI-OP-2L - Gypsum Board/Plaster, Latex, 2 Coat:
   1. One coat of latex primer sealer. ProMar 200 Zero VOC Wall Primer.
   2. Eggshell: One coat of latex enamel; ProMar 200 Zero VOC Interior Latex Eg-Shel, B20-2600 Series.
   3. Flat: One coat of latex enamel; ProMar 200 Zero VOC Interior Latex Flat, B30-2600 Series.

2.05 ACCESSORY MATERIALS

A. Accessory Materials: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required to achieve the finishes specified whether specifically indicated or not; commercial quality.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. 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 are below the following maximums:
   1. Gypsum Wallboard: 12 percent.
   2. Plaster and Stucco: 12 percent.
   3. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
   4. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
   5. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to coating application.

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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 coatings that exhibit surface defects.

D. Remove 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. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

G. Concrete and Unit Masonry Surfaces to be Painted: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.

H. Gypsum Board Surfaces to be Painted: Fill minor defects with filler compound. Spot prime defects after repair.

I. Plaster Surfaces to be Painted: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

J. Uncorroded Uncoated Steel and Iron Surfaces to be Painted: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand or power tool wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint entire surface; spot prime after repairs.

K. Shop-Primed Steel Surfaces to be Finish Painted: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.

L. Interior Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.

M. Interior Existing Wood Floors: Sand existing wood floors to remove existing finish and stain. Patch wood floor with similar materials as needed.

N. Interior 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.

O. Exterior Wood Surfaces to Receive Opaque Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior calking compound after prime coat has been applied. Back prime concealed surfaces before installation.

3.03 APPLICATION

A. Exterior Wood to Receive Opaque Finish: If final painting must be delayed more than 2 weeks after installation of woodwork, apply primer within 2 weeks and final coating within 4 weeks.

B. Apply products in accordance with manufacturer's instructions.

C. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.

D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

E. Apply each coat to uniform appearance.

F. Sand wood and metal surfaces lightly between coats to achieve required finish.

G. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

H. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

I. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.05 PROTECTION

A. Protect finished coatings until completion of project.

B. Touch-up damaged coatings after Substantial Completion.

3.06 SCHEDULE - PAINT SYSTEMS

A. Masonry: Finish all surfaces exposed to view.
   1. Exterior: CE-OP-3A, flat.

B. Gypsum Board: Finish all surfaces exposed to view.
   1. Interior Ceilings and Bulkheads: GI-OP-2L, flat.
   2. Interior Walls: GI-OP-2L, egg-shell.

C. Plaster: Finish all surfaces exposed to view.
   1. Interior Walls: GI-OP-2L, egg-shell.

D. Wood: Finish all surfaces exposed to view.
   1. Exterior trim and frames: WE-OP-3A.
   2. Interior trim (Windows): WI-OP-2L, egg-shell.
   3. Interior Wood (MDF) Doors: WI-OP-2L, egg-shell.

E. Wood Flooring (Existing): WI-TR-VS, satin.

F. Steel Frames: Finish all surfaces exposed to view; MI-OP-2L, egg-shell.

G. Shop-Primed Metal Items: Finish all surfaces exposed to view.

1. Finish the following items:
    a. Exposed surfaces of steel ladder .
2. Interior: MI-OP-2L, semi-gloss.

3.07 WASTE MANAGEMENT

A. Do not use kerosene or any such organic solvents to thin or clean up water based paints.

B. Do not dispose of paints or solvents by pouring on the ground. Place in designated containers for proper disposal.

C. Where paint recycling is available, collect all waste by paint type and provide for delivery to recycling or collection facility.

END OF SECTION

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SECTION 101441
PLASTIC SIGNS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Molded Plastic Signs.

1.02 REFERENCES

A. United States of America, Department of Justice, Americans With Disabilities Act.

B. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 1998.

1.03 SUBMITTALS

A. Shop Drawings: Indicate sign styles, lettering font, foreground and background colors, locations, overall dimensions of each sign.

B. Samples: Submit two sample signs, 8 x 8 inch in size illustrating type, style, letter font, and colors specified; method of attachment.

C. Manufacturer's Installation Instructions: Include installation template and attachment devices.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

B. REGULATORY REQUIREMENTS
   1. Conform to federal and state codes and ANSI/CABO A117.1 for requirements for the physically handicapped.

1.05 DELIVERY, STORAGE, AND PROTECTION

A. Package signs, labeled in name groups.

B. Store adhesive attachment tape at ambient room temperatures.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Do not install signs when ambient temperature is lower than recommended by manufacturer.

B. Maintain this minimum temperature during and after installation of signs.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Plastic Signs:
   1. Best Sign Systems, Inc; Product Graphic Blast MP: www.bestsigns.com.
   2. Mohawk Sign Systems, Inc: www.mohawksign.com.
   3. ASI Sign Systems, Inc .
   4. Seton Identification Products.
   5. Or Approved Equal.

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2.02 MOLDED PLASTIC SIGNS

A. Molded Plastic Signs: Melamine Plastic signs molded for one piece construction.
   1. Signs shall have the following characteristics:
      a. Tactile characters/symbols shall be raised 1/32 inch from sign plate face for ADA compliance.
      b. Text shall be accompanied by Grade 2 braille where indicated on the schedule below.
      c. All letters, numbers and/or symbols shall contrast with their background. Characters and background shall have a matte finish. Colors to be selected from manufacturers full range of colors during submittal approval.
      d. Size: See schedule below and contract drawings for sizes of all signs.
      e. Font: Font to be selected from manufacturer's full range of fonts during submittal approval.

2.03 ACCESSORIES

A. 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 signs after surfaces are finished, in locations scheduled.

C. Position signs as indicated in the schedule.

3.03 SCHEDULES

A. Restroom Signs: Provide a sign at each public restroom. Signs to be 8 inches high by 6 inches wide with radiused corners. Signs at rooms 103, 113, and 120 to indicate UNISEX with graphic symbol and ADA symbol on each sign. Signs at rooms 128 and 133 to indicate Men's or Women's (Owner to verify names) with graphic symbol and ADA symbol on each sign. Provide braille under room name. Final locations for signs to be determined during construction with Architect. Sign to be mounted so bottom of sign is 50 inches above finished floor.

END OF SECTION

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SECTION 102601
WALL AND CORNER GUARDS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Corner guards.

1.02 SUBMITTALS

A. Product Data: Indicate physical dimensions and features.

B. Samples: Submit two sections of corner guard, 12 inch long, illustrating component design, configuration, color and finish.

C. Manufacturer's Instructions: Indicate special procedures, perimeter conditions requiring special attention.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wall and Corner Guards:
   1. Babcock-Davis: www.babcockdavis.com.
   2. Construction Specialties, Inc: www.c-sgroup.com.
   3. Inpro: www.inprocorp.com.
   4. Or Approved Equal.

2.02 COMPONENTS

A. Corner Guards - Surface Mounted: High impact vinyl with extruded aluminum full height retainer .
   1. Performance: Resist lateral impact force of 100 lbs at any point without damage or permanent set.
   2. Size: 1-1/2 inches.
   3. Corner: Square.
   4. Color: As selected from manufacturer's standard colors.
   5. Length: One piece.
   6. Preformed end caps.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that wall surfaces are acceptable to receive corner guards. Notify Architect in writing if wall surfaces are not acceptable. Do not begin installation until unacceptable conditions have been corrected.

3.02 INSTALLATION

A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to wall.

B. Corner guards to start on top of base and extend 48 inches above base.

C. Provide corner guards at all external corners.

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3.03 TOLERANCES

A. Maximum Variation From Required Height: 1/4 inch.

B. Maximum Variation From Level or Plane For Visible Length: 1/4 inch.

END OF SECTION

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SECTION 102810
TOILET ACCESSORIES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Toilet Room Accessories.

1.02 REFERENCES

A. ATBCB ADAAG - Americans with Disabilities Act Accessibility Guidelines; US Architectural and Transportation Barriers Compliance Board; 2004.

B. ASTM A 240/A 240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; 2005.

C. ASTM A 554 - Standard Specification for Welded Stainless Steel Mechanical Tubing; 2003.

D. ASTM C 1036 - Standard Specification for Flat Glass; 2001.

E. ASTM F 446 - Standard Consumer Safety Specification for Grab Bars and Accessories Installed in the Bathing Area; 1985 (Reapproved 2004).

1.03 SUBMITTALS

A. Product Data: Manufacturer's product data for products specified, indicating selected options and accessories.

B. Quality Assurance Submittals:
   1. Manufacturer's printed installation instructions for each specified product.

C. Closeout Submittals: Warranty documents, issued and executed by manufacturer of products of this section, and countersigned by Contractor.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum five (5) years of documented experience producing products of the types specified in this section.

B. Regulatory Requirements: Conform to ADA and Commonwealth of Pennsylvania requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Factory-apply strippable protective vinyl coating to sight-exposed surfaces after finishing of products; ship products in manufacturer's standard protective packaging.

B. Storage and Protection: Store products in manufacturer's protective packaging until installation.

1.06 WARRANTY

A. Manufacturer's standard warranty against defects in product workmanship and materials.

B. Manufacturer's 15-year warranty against silver spoilage of mirrors.

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PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer: ASI-American Specialties, Inc; 441 Saw Mill River Road, Yonkers NY 10701-9986; Telephone (914) 476-9000, FAX (914) 476-0688.

B. Other Acceptable Manufacturers:
   1. Bobrick Washroom Equipment, Inc.
   2. Bradley Corporation.
   3. Or Approved Equal.

2.02 MATERIALS

A. Stainless Steel Sheet: ASTM A 240/A 240M, Type 304, 18-8 alloy.

2.03 TOILET ACCESSORIES

A. Soap Dispenser TA-5:
   1. Sight-exposed components: Stainless steel, minimum 0.0313 inch thickness.
   2. Internal components: Non-corroding chrome-plated brass, stainless steel, and ABS plastic.

B. Paper Towel Dispenser TA-3: Model 0215 and 0210 as indicated on the drawings.

C. Toilet Tissue Dispenser TA-1: American Specialties, Inc; Model 0030.
   1. Surface mounted toilet tissue dispenser that holds two standard rolls or two 5 1/4" rolls.
   2. Unit cabinet, door and mounting plate shall be fabricated of alloy 18-8 stainless steel, type 304, 18 gauge with a #4 satin finish.
   3. Door shall be on heavy duty stainless steel pivot hinges and shall be held closed by a tumbler lock with key.
   4. Dispensing mechanism shall be fabricated of high impact chemical and flame retardant ABS.

D. Utility Shelf TA-6: Model 0690-0618.

E. Robe Hook TA-8: Model 7340.

F. Shower Curtain Rod TA-10: American Specialties, Inc; Model 1214.
   1. Heavy duty shower curtain rod with flanges shall be fabricated of alloy 18-8 stainless steel, type 304.
   2. Tubing shall be 20 gauge, 1 inch outside diameter with a satin finish.
   3. Length as required, see contract drawings.
   4. Flanges shall be fabricated of 20 gauge stainless steel with a satin finish. Flanges shall have three countersunk holes to accept screws.

G. Towel Bar TA-7: American Specialties, Inc; Model 0755-SS18.
   1. Towel Bar: One inch diameter fabricate of type 304 stainless steel alloy 18-8. Bar to be 20 gauge tubing with welded closed and finished ground ends.
   2. Post: Heavy duty solid cast brass with satin finish.
   3. Wall Brackets: 18 gauge with embossed ribs for added strength.

H. Shower Curtain TA-10: Model 1200-SHO, with Model 1200-V hooks.

I. Mop Holder TA-9: Model 0796-3.

2.04 MIRRORS

A. Mirror TA-4: American Specialties, Inc; Model 0620.
   1. Frame: Channel.
   2. Mirror: Plate glass.
   3. Size: As indicated on drawings.
   4. Finish: No.4 satin stainless steel.

B. Channel Mirror Frames: Fabricated from 0.0375 inch stainless steel, formed to 1/2 by 1/2 by 1/2 inch channel; finished to match sheet finish; concealed mounting brackets with tamper-proof fasteners.

2.05 GRAB BARS

A. Grab Bars - Basic Requirements: Fabricated to comply with ASTM F 446 and to withstand a 900 pound force, from ASTM A 554 stainless steel tubing, 0.050 inch, Type 304, 18-8 alloy; formed 1-1/2 inch radius return to wall at each end; each end heliarc-welded to minimum 11 gage stainless steel circular flange; welds finished to match tube finish.

B. Grab Bars: American Specialties, Inc; Series 3700.
   1. Peened finish.
   2. Sizes and configurations: As indicated on drawings.

C. Grab Bar Concealed Mounting Flanges: Stainless steel, 3 inch diameter by 1/2 inch deep, with 0.0897 inch steel tenon plate for concealed attachment, using three set screws.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verification of Conditions:
   1. Reinforcement and anchoring devices are correct type and are located in accordance with manufacturer's requirements.

B. Installer's Examination:
   1. Have installer of this section examine conditions under which construction activities of this section are to be performed, then submit written notification if such conditions are unacceptable.
   2. Transmit two copies of installer's report to Architect within 24 hours of receipt.
   3. Beginning construction activities of this section before unacceptable conditions have been corrected is prohibited.
   4. Beginning construction activities of this section indicates installer's acceptance of conditions.

3.02 INSTALLATION

A. Install toilet accessories plumb and level in accordance with manufacturer's printed installation instructions.

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B. Locate toilet accessories at heights specified by Americans with Disabilities Act (ADA) and Commonwealth of Pennsylvania requirements.

3.03 CLEANING

A. Remove manufacturer's protective vinyl coating from sight-exposed surfaces 24 hours before final inspection.

B. Clean surfaces in accordance with manufacturer's recommendations.

3.04 PROTECTION OF INSTALLED PRODUCTS

A. Protect products from damage caused by subsequent construction activities.

B. Field repair of damaged product finishes is prohibited; replace products having damaged finishes caused by subsequent construction activities.

END OF SECTION

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SECTION 104400
FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Fire extinguishers.
   2. Fire extinguisher cabinets.
   3. Accessories.

1.02 REFERENCE STANDARDS

A. NFPA 10 - Standard for Portable Fire Extinguishers; 2013.

B. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.03 PERFORMANCE REQUIREMENTS

A. Conform to NFPA 10.

B. Provide extinguishers classified and labeled by Underwriters Laboratories Inc. for the purpose specified and indicated.

1.04 SUBMITTALS

A. Shop Drawings: Indicate locations of cabinets and cabinet physical dimensions.

B. Product Data: Provide extinguisher operational features.

C. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.05 FIELD CONDITIONS

A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Extinguisher Cabinets and Accessories:
   1. JL Industries, Inc; Ambassador Model 1017: www.jlindustries.com.
   2. Larsen's Manufacturing Co: www.larsensmfg.com.
   3. Potter-Roemer: www.potterroemer.com.
   4. Or Approved Equal.

2.02 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.

B. Dry Chemical Type Fire Extinguishers: steel tank, with pressure gage.

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1. Class A:B:C.
2. Size 10.
3. Finish: Baked enamel, red color.

2.03 FIRE EXTINGUISHER CABINETS

A. Metal: Formed primed steel sheet; 0.036 inch thick base metal.

B. Cabinet Configuration: Semi-recessed type.
   1. Size to accommodate accessories.
   2. Trim: Flat rolled edge, with 3 inch wide face.
   3. Provide cabinet enclosure with right angle inside corners and seams, and with formed perimeter trim and door stiles.

C. Door: 0.036 inch metal thickness, reinforced for flatness and rigidity with nylon catch. Hinge doors for 180 degree opening with two butt hinge.

D. Door Glazing: Acrylic plastic, clear, 1/8 inch thick, flat shape and set in resilient channel glazing gasket.

E. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.

F. Weld, fill, and grind components smooth.

G. Finish of Cabinet Exterior Trim and Door: Baked enamel, color as selected.

H. Finish of Cabinet Interior: White colored enamel.

2.04 ACCESSORIES

A. Extinguisher Brackets: Formed steel, chrome-plated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install cabinets plumb and level in wall openings, 32 inches from finished floor to inside bottom of cabinet.

C. Secure rigidly in place.

D. Place extinguishers in cabinets.

E. Provide fire extinguishers and cabinets as shown on contract drawings.

END OF SECTION

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SECTION 200000

GENERAL MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for work under Division 20.

B. Coordinate the work of this Section with the requirements of the Project.

1.2 DEFINITIONS

A. Following are definitions of terms and expressions used in the Mechanical Sections in addition to definitions found in the Contract Conditions:

1. "Piping" includes pipe, fittings, valves, hangers, and other accessories that comprise a system.
2. "Ductwork" includes ducts, fittings, housings, dampers, hangers, and other accessories, which comprise a system.
3. “Refurbish” shall include but not be limited to: inspecting/repairing unit cabinet, such as repairing, seals/latches, curbs, etc., cleaning coils, replacing belts, lubricating bearings, changing filters, inspecting and cleaning gas fired heat exchanger, cleaning/repairing condensate drain and secondary drain pan, check and adjust refrigeration charge on each unit, leak test and repair any refrigeration leaks, etc. to bring the piece of equipment being refurbished into the manufacturers original operating specifications/tolerances and provide warranty of operability for 60 days after the systems have been turned over to the Owner.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements

1. Work shall conform to the requirements of the codes, laws and ordinances of the Montgomery Township, Franklin County, Pennsylvania, National Fire Protection Association, American Society of Mechanical Engineers and other authorities having jurisdiction.
2. Comply with applicable codes, laws, standard practices.
3. Comply with the standards of good practice as outlined in the ASHRAE Guide, the Sheet Metal and Air Conditioning Contractor's Association's "Duct Manual", and the Apprentice Training Manual of the Steam Fitters Union.
4. The requirements of the authorities having jurisdiction shall take precedence over the Drawings and Specifications and changes required by the authorities shall be made after review by the Architect.

1.4 SUBMITTALS

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A. Shop drawings are required for the following:

1. Plumbing
   a. Drains
   b. Water Heaters
   c. Plumbing Fixtures
   d. Circulating Pumps
   e. Sump Pumps
   f. Booster Pumps
2. Fire Protection
   a. Sprinkler Piping
   b. Equipment
   c. Hydraulic Calculations
3. Heating and Air Conditioning
   a. Air Devices
   b. Insulation
   c. Boilers
   d. Expansion Tanks
   e. Exhaust Fans
   f. Heating and Air Conditioning Equipment
   g. Pumps
   h. Mechanical/Electrical Coordination
   i. Flue Vents
   j. Temperature Controls
   k. Testing, Adjustment and Balancing Reports and Qualifications
4. Field Instructor's Name and Credentials.
5. Maintenance Policy

B. Review of shop drawings does not relieve the Contractor of responsibility for complying with the contract documents.

1.5 PROTECTION

A. Protect material and equipment from damage.

B. Post notices prohibiting the use of water closets.

C. Provide plastic protection inserts, specifically manufactured for the bathtubs and shower stalls.

D. Cap or plug openings in equipment, piping and ductwork with proper caps and plugs.

E. Building materials should be stored in a weather-tight, clean area prior to unpacking for installation.

F. Accumulation of water during construction should be avoided and any porous construction materials such as insulation should be protected from moisture.

1.6 VARIANCES

A. Where conflicts exist within the contract documents, request clarification prior to

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Delete Field Instructor's Name and Credentials on Gant Jobs

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Delete Maintenance Policy Gant Jobs

the submission of a bid. If clarification is not requested, provide the work representing the higher cost and quality.

1.7 WARRANTY

A. During the warranty period, make the proper adjustments of systems, equipment and devices installed and perform work necessary to ensure the efficient and proper operation of the systems, equipment and devices.

B. Certain items of equipment shall be warranted for a longer time than the general warranty period. Provide for service or replacement required in connection with the warranty of these items.

C. The warranty period shall not begin until the project has reached substantial completion. Any warranty limits from the manufacturer related to delivery of equipment or unit startup shall be between the contractor and the manufacturer only and shall not impact the warranty between the owner and the contractor.

PART 2 - PRODUCTS

2.1 PRODUCTS TO BE USED

A. Items are specified by designations such as trade name, manufacturer's name, catalog number and indicate the capacity and quality of the products or materials to be used on this project.

B. Only products indicated on Contract Documents by name and model number have been coordinated with other trades. Coordinate items of other manufacturer with other trades.

2.2 MATERIALS AND WORKMANSHIP

A. Items shown and not specifically called for, or items specified and not specifically indicated or detailed on the Drawings, or items neither specified nor shown, but which are reasonably incidental to and commonly required to make a complete job, shall be provided.

2.3 FOUNDATIONS AND EQUIPMENT SUPPORTS

A. Provide foundations, supports, curbs and bases for equipment, as indicated or necessary for satisfactory installation and operation of equipment. Furnish and set anchor bolts.

B. Concrete pads shall be 4 inches thick minimum, thicker if necessary to accommodate a particular piece of equipment. Edges shall be beveled with outer edge extending 3 inches beyond equipment. Provide concrete pads for floor-mounted equipment. Exterior pads shall be reinforced and shall have edges turned down to below the frost line. Exterior pads shall extend eight inches beyond edges of equipment and shall be sloped for drainage.

C. Floor mounted stands, supports, rods or legs, where required, shall be constructed of structural steel shapes (angles, channels) of Kindorf or Unistrut or steel pipe and fittings securely braced and fastened to flanges bolted to the floor. Minimum rod size shall be 3/8-inch diameter. Paint steel **with rust inhibiting paint.**

2.4 ROOF SUPPORTS AND CURBS

A. Provide equipment supports and curbs for the equipment and piping installed on or through the roof. Roof curbs shall be approved for use by the National Roofing Contractors National Association and shall be a minimum of 14 inches high. Curbs shall be sloping roof type suitable for pitch of the roof and shall set the equipment level. Curbs shall be double wall insulated type.

Comment [LR3]: Page: 4
Edit height as necessary to suit the job requirements. Pay close attention to equipment (such as grease fans) specifications which often include custom curbs.

B. Provide wood blocking to raise the level of the bottom of the curb to be level with the top of the roof insulation.

C. Pipe curb assemblies, except for plumbing vent pipes shall be constructed of 18 gauge galvanized steel with base plate, raised cant, wood nailer strip and galvanized steel counter flashing. Top shall be provided with acrylic clad ABS plastic cover and graduated neoprene boots secured to cover and pipes by stainless steel band clamps. Pipe curbs shall be Pate Company PCA-5 or equivalent of Thy Curb.

D. Equipment supports shall be constructed of 18 gauge galvanized steel with base plate, raised cant, insulation, wood nailer strip and galvanized steel counter flashing. Equipment supports shall be Pate Company ES-5b or equivalent of Thy Curb.

E. Roof mounted stands, supports, rods or legs, where required, shall be constructed of structural steel shapes (angles, channels) of Kindorf or Unistrut or steel pipe and fittings securely braced and fastened to flanges bolted to the associated equipment support. Minimum rod size shall be 3/8-inch diameter. Paint members which have been cut or have been damaged with touch up rust inhibiting paint.

2.5 HANGERS AND PIPE SUPPORTS

A. Provide pipe hangers and supports to maintain required slope and alignment for equipment and piping. Pipe hangers shall be as manufactured by Carpenter & Patterson, Fee & Mason, Modern Hanger or Grinnell.

B. Pipes may not be supported from other pipes. Trapeze hangers may be used for parallel runs of pipe with same slope.

C. Provide sway bracing at sufficient intervals to prevent lateral motion of horizontal or vertical piping and ductwork as required by the jurisdiction to meet the appropriate regional requirements.

D. For pipe and tubing, both horizontal and vertical, and regardless of the spacing of other supports, provide supports at or near changes in direction. Hangers shall

be spaced at not over 6 feet apart for ½ inch pipe, not over 8 feet apart for 3/4 and 1-inch pipe and not over 10 feet for larger sizes.

E. For wood joist construction, hanger rods shall be supported from wood joists with hangers bolted through or attached with lag screws to the joists.

F. For steel bar joist construction, hanger rods shall be supported from the top chord of the joists or from panel points of the lower chord of the joists. Where piping runs parallel to joists or where hangers are required at other than joist locations, provide steel angles welded to joists to support hangers so that weight is supported from the top chord of the joists.

G. For new concrete plank construction with a 2 inch thick or thicker concrete topping, hanger rods shall extend through concrete plank and shall be bolted through a 4 X 4 steel plate sitting on top of the plank.

H. For existing concrete plank construction or where the concrete topping is less than 2 inches thick, hangers shall be bolted into planks using toggle bolts. Where these toggle bolts are used, hanger rods shall carry no more than 200 pounds per hanger. The hanger spacing shall be reduced as required to meet this requirement.

I. Hangers for pipe shall be similar to Carpenter & Paterson "Clevis" figure 100. Hangers for insulated lines with vapor barrier and carrying fluids with temperatures below 70 degrees shall be large enough to permit continuous insulation. Hangers on vapor barrier insulated piping shall be provided with rigid protector saddles with rigid core of insulation to thickness of adjacent insulation. Saddles shall be 16 gauge galvanized steel and shall cover one half of the circumference of the pipe covering. Saddle shall be secured to insulation with adhesive.

J. Pipes upon or within close distance of walls shall be carried by wall brackets, Carpenter & Paterson, Fig. 221, 139, or 227 as approved.

K. Support vertical lines at floor level with extension pipe clamps. Support lowest level of riser with pipe hanger as specified above on horizontal pipe as close to riser as possible.

L. Special supports required shall be provided to suit the conditions.

M. Expansion bolts or wood plugs will not be permitted in slag block walls. Equipment hung on such walls shall be supported by through bolts or approved anchor bolts set into masonry as the wall is laid up.

2.6 OPENINGS, CHASES, LINTELS AND SLEEVES

A. Determine the location and size of chases, lintels and openings necessary for the proper installation of the work and provide them during the erection of the work in which such chases and openings occur.

B. Provide sleeves through walls and floors for pipes. Sleeves through walls shall

Comment [Choose4]: Page: 5
Select the appropriate hanger methods for this project

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Select the appropriate hanger methods for this project

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Select the appropriate hanger methods for this project

be of sufficient size to permit the insulation, where specified, to continue through the sleeve. Sleeves through walls shall be flush with the walls.

C. In case cutting of building construction is necessary, including cutting of structural members, such cutting shall be done and repaired to match original condition of the work.

D. Where non-combustible pipes pass through sleeves or around ductwork through openings in fire rated wall, floor-ceiling and ceiling-roof assemblies, seal openings with a Underwriters Laboratories classified firestop method. Firestop method shall be a one part, intumescent (expands with heat), latex elastomer capable of expanding a minimum of three times. Firestop materials shall be UL listed when tested in accordance with ASTM E814 for a two hour fire (F) and temperature (T) rating.

E. If combustible piping materials are used, a UL listed firestop method shall be provided where the combustible materials penetrate fire rated wall, floor-ceiling and ceiling-roof assemblies. Firestop method shall be classified by UL as a through-penetration firestop device when tested in accordance with ASTM E814 for a two hour fire (F) and temperature (T) rating. Plastic piping materials, including, but not limited to PVC, CPVC and ABS, are combustible. Firestop method shall be similar to Nelson Firestop Products.

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Delete this paragraph where combustible piping (ie: plastic, PVC, CPVC) is not being used.

F. Escutcheon plates shall be used to conceal sleeve opening on exposed uninsulated piping. Floor plates shall be split chrome plated cast brass similar to Ritter No. 36A.

2.7 VIBRATION ISOLATION

A. Provide vibration isolators manufactured by a firm specializing in this type of work for equipment and piping that is capable of transmitting noise and vibration to the building structures.

B. Isolators shall be designed to suit vibration frequency to be absorbed. Provide isolator units of area distribution to obtain proper resiliency under machinery load and impact. Where unequal distribution of weight occurs, design isolators for uniform deflection under imposed load.

C. Examine the contract drawings for sizes, horsepowers, rotational speeds, equipment location, length of span between columns and beams and construction type to determine the isolator selection type and deflection required for each piece of mechanical equipment. Conform to the requirements of the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) Handbook, "HVAC Applications", Chapter 48, "Sound and Vibration Control"

D. Isolators of the same type shall be the product of the same manufacturer, Mason, Vibration Eliminator or Korfund.

E. Mountings shall be of the types indicated below:

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1. Type A: Double deflection neoprene mountings shall have a minimum static deflection of 0.50". Metal surfaces shall be neoprene covered to avoid corrosion and have friction pads both top and bottom so they need not be bolted to the floor. Bolt holes shall be provided for those areas where bolting is required. On equipment such as small vent sets and close coupled pumps, steel rails shall be used above the mountings to compensate for the overhang. Mountings shall be type ND or rails type DNR as manufactured by Mason Industries, Inc. Color code to indicate durometer.
2. Type B: Spring type isolation shall be free standing and laterally stable without any housing and complete with ¼" neoprene acoustical friction pads between the baseplate and the support. Mountings shall have leveling bolts that must be rigidly bolted to the equipment. Spring diameters shall be no less than 0.8 of compressed height of the spring at rated load. Springs shall have a minim additional travel to solid equal to 50% of the rated deflection. Submittals shall include spring diameters, deflections, compressed spring height and solid spring height. Mountings shall be type SLF manufactured by Mason Industries, Inc.
3. Type C: Equipment with operating weight different from the installed weight and equipment exposed to the wind such as cooling towers shall be mounted on spring mountings as described in Type B, but a housing shall be used that included vertical limit stops to prevent spring extension when weight is removed. The housing shall serve as blocking during erection and cooling tower mounts shall be located between the supporting steel and roof or the grillage and dunnage as shown on the drawings. The installed and operating heights shall be the same. A minimum clearance of ½" shall be maintained around restraining bolts and between the housing and the spring so as not to interfere with the spring action. Limit stops shall be out of contact furring normal operations. Mounting used out of the doors shall be hot dipped galvanized. Mountings shall be SLR as manufactured by Mason Industries, Inc.
4. Type D: Neoprene crossribbed or waffle pattern, 5/16 inches thick. Provide ¼ inch hot dipped galvanized steel bearing plates. Permanently identify durometer. Mason Industries, Inc. Type W.

F. Hangers shall be of the types indicated below:

1. Type E: Vibration hangers shall contain a steel spring and 0.3" deflection neoprene element in series. The neoprene element shall be molded with a rod isolation bushing that passes through the hanger box. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing thru a 30-degree arc before contacting the hole and short- circuiting the spring. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Submittals shall include a scale drawing of the hanger showing the 30-degree capability. Hanger shall be type 30N as manufactured by Mason Industries, Inc.
2. Type F: Vibration hangers shall be described in Type E, but they shall be pre-compressed to the rated deflection to keep the piping or equipment at a fixed elevation during installation. The hangers shall be designed with a

release mechanism to free the spring after the installation is complete and the hanger is subjected to its full load. Deflection shall be clearly indicated by means of scale. Submittals shall include a scale drawing of the hanger showing the 30-degree capability. Hangers shall be type PC3ON as manufactured by Mason Industries, Inc.

3. Type G: Vibration hanger shall contain a steel spring located in a neoprene cup manufactured with a grommet to prevent short circuiting of the hanger rod. The cup shall contain a steel washer designed to properly distribute the load on the neoprene and prevent its extrusion. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing thru a 30-degree arc before contacting the hole and short circuiting the spring. Springs shall have minimum additional travel to solid equal to 50% of the rated deflection. Hangers shall be provided to attach the housing to the flat iron duct straps. Submittals shall include a scale drawing of the hanger showing the 30-degree capability. Hangers shall be type W30 as manufactured by Mason Industries, Inc.

G. Horizontal thrust restraints shall be of the types indicated below:

1. Type X: Air handling equipment shall be protected against excessive displacement, which might result from high air thrusts in relation to the equipment weight. The horizontal thrust restraint shall consist of a spring element in series with a neoprene pad as specified for the mountings or hangers. The spring element shall be contained within a steel frame and designed so it can be present for thrust at the factory and adjusted in the field to allow for maximum of ¼" movement at start and stop. The assembly shall be furnished with one rod and angle brackets for attachment to both the equipment and ductwork or the equipment and structure. Horizontal restraints shall be attached at the centerline of thrust and symmetrically on either side of the unit. Horizontal thrust restraints shall be WB as manufactured by Mason Industries, Inc.

H. Bases shall be of the types indicated below:

1. Type H: Provide integral structural steel bases. Bases shall be rectangular in shape for equipment other than centrifugal refrigeration machines and pump bases which may be 'T' or "L' shaped. Pump bases for split case pumps shall include supports for suction and discharge base ells. Perimeter members shall be beams with a minimum depth equal to 1/10th of the longest dimension of the base. Beam depth need not exceed 14" provided the deflection and misalignment is kept within acceptable limits as determined by the manufacturer. Height saving brackets shall be employed in mounting locations to provide a base clearance of one inch. Bases shall be type WFSL as manufactured by Mason Industries, Inc.

2. Type J: Provide rectangular structural beam or channel concrete forms for floating foundations. Bases for split case pumps shall be large enough to provide support for suction and discharge base ells. The base depth need not exceed 12' unless specifically recommended by the base manufacturer for mass rigidity. In general, bases shall be a minimum of

1/12th of the longest dimension of the base, but not less than 6". Forms shall include minimum reinforcement consisting of half-inch bars or angles welded in place on 6" centers running both ways in a layer 1-1/2" above the bottom, or additional steel as is required by the structural conditions. Forms shall be furnished with steel members to hold anchor-bolt sleeves when the anchor bolts fall in concrete locations. Height saving brackets shall be employed in mounting locations to maintain a 1" clearance. Bases shall be type KSL as manufactured by Mason Industries, Inc.

I. Roof bases shall be of the types indicated below:

1. Type Y: Curb mounted rooftop air handling equipment shall be mounted on vibration isolation bases that fit over the roof curb under the isolated equipment. The extruded aluminum top member shall overlap the bottom member to provide water runoff independent of the sea;. The aluminum members shall house cadmium plated springs having a 1" minimum deflection with 50% additional travel to solid. Spring diameters shall be no less than 0.8 of the spring height at rated load. Wind resistance shall be provided by means of resilient snubbers in the corners with a means of resilient snubbers in the corners with a minimum clearance of ¼" so as not to interfere with the spring action in high winds. The weather seal consist of continuous closed cell sponge materials both above and below the base and a waterproof flexible duct-like EPDM connection joining the outside perimeter of the aluminum members. Foam or other contact seals are unacceptable at the spring cavity closure. Caulking shall be kept to a minimum. Submittals shall include spring deflection, spring diameters, compressed spring height and solid spring height as well as seal and wind resistance details. Curb mounted bases shall be Type CMAB as manufactured by Mason Industries, Inc. Where vibration isolation bases are provided for insulated roof curbs, provide insulation of the same R-value for the isolation base as is present for the roof curb.

J. Pipe anchors shall be of types indicated below:

1. Type N: Provide an all directional acoustical pipe anchor, consisting of a telescopic arrangement of two sizes of steel tubing separated by a minimum 1 inch thickness of heavy duty neoprene and duct or neoprene isolation materials. Vertical restraints shall be provided by similar material arranged to prevent vertical travel in either direction. Allowable loads on the isolation material and shall not exceed 500 psi and the design shall be balanced for equal resistance in any direction. Deflection shall be a minimum of 1". All directional anchors shall be type ADA as manufactured by Mason Industries, Inc.

K. Pipe connectors shall be of types indicated below:

1. Type K: Flexible wire reinforced butyl or neoprene hose with integral elastomer and duct flanges and iron back-up rings, control cables with isolating bushings and washers and flange brackets to limit expansion. Length: 6 times diameter up to 36" maximum 150 psi working pressure at 250 degrees F, suction service working pressure 200 psi at 100 degrees

F. Mason Industries, Inc. Type MTBF.

2. Type L: Flexible bellows type bronze hose with bronze braid, sweat connections. Length: 8 times diameter, 10” minimum. Suitable for freon refrigerant service. Compressor discharge servicing working pressure 200 psi at 100 degrees F. Mason Industries, Inc. Type BSS.

L. The first three pipe hangers in the main lines near isolated mechanical equipment shall be supported with hangers as described in Type F. Horizontal runs in other locations in mechanical rooms and equipment rooms shall be isolated by hangers as described in Type E. Floor supported piping shall rest on isolators as describes in Type C. Heat exchangers shall be considered part of the piping run. Type F hangers or the first three type C mounts as noted above will have the same static deflection as specified for the mounting under the connected equipment. If piping is connected to equipment located in basements and hangs from ceiling under occupied spaces, the first three hangers shall have 1” deflection for pipe sizes up to and including 3”, 2” deflection for pipe sizes up to and including 6”, and 3” deflection thereafter. Other hangers are mounts shall have a minimum steel spring deflection of 1”. Hangers shall be located as close to the overhead supports as practical.

M. Piping risers shall be suspended from or supported by Type F Hangers or Type C mountings and the piping anchored or guided with Type N anchors. Steel spring deflections shall be minimum of 1” except in those expansion locations where additional deflection is required to limit deflection or load changes to plus minus 25% of the initial stress.

N. Duct discharge runs for a distance of 50’ from the connected equipment shall be isolated from the building structure by means of Type G hangers or Type C floor supports. Spring deflections shall be a minimum of 1”.

O. Provide vibration isolation as required above and as indicted in the following schedule:

EQUIPMENT	LOCATION	ISOLATIION TYPE	DEFL. (IN)
Centrifugal Chillers		C	2.0”
Air Cooled Chillers	[Provide isolation rails on roof mounted chillers.]	H, C	2.0”
Cooling Towers	[Cooling towers on tall buildings need to be checked for structural wind loading.]	H, C	3.5”
Cooling Tower Filtration System		C, J, K (Remove J & K if unit is provided with base)	2.0”
Boilers		C	1.0”
Heat Exchangers		C	1.0”
Base Mounted Pumps	[EDIT Inertia Bases and Spring Isolators are not required for slab	C, J, K B (Slab on Grade)	2.0”

	on grade.]		
Inline Pumps		E, K. X	1.0”
VRV/VRF Outdoor Units		C	1.0”
Roof Mounted Condensing/Heat Pump Units (Residential)		C	1.0”
Rooftop Air Handling Units		Y	2.0”
Indoor Air Handling Units (Commercial)		B – Floor Mounted E – Suspended	1.0”
Indoor Water Source Heat Pumps (Commercial)		C – Floor Mounted E – Suspended	1.0”
Fan Coil (Residential)		A – Floor Mounted E - Suspended	0.5” 1.0”
Inline Centrifugal Fans		E, X	1.0”
Wall Mounted Propeller Fans		D	0.25”
Utility Set Fans		C	1.0”
Air Compressors		C, J, L	2.0”

2.8 ELECTRICAL WORK

A. Motors and heating elements for equipment specified under the mechanical Sections of the Specifications shall be provided with the equipment.

B. Starters, disconnect switches, and work pertaining to equipment power connections are specified under Division 26 unless specified with the equipment of this Division of the Specifications. Electrical devices provided under this Division shall meet requirements for similar equipment specified under Division 26.

C. Interlock wiring, and the provision of pilot devices such as push buttons, thermostats, flow switches and similar items and their related wiring associated with the Automatic Control System, shall be provided in accordance with the applicable requirements of Division 26. For ease of servicing, permanently identify both ends of conductors with W. H. Brady Co. self-sticking Perma-Code wire markers. Mark control diagrams accordingly.

D. Coordinate control device voltages.

E. Unless specifically noted otherwise, motors ½ HP and over shall be wound for XXX volts, 3 phase, 60 hertz current, and those under ½ HP for 120 volts, single

Comment [verify9]: Page: 11
Verify Voltage 120, 208 or 480, (usually not 120V)

Comment [verify10]: Page: 11
Verify Phase

phase, 60 hertz current. Motors shall be equipped with grease packed ball bearings. Motors shall be rated for continuous duty at 100 percent of rated capacity with an ambient temperature of 40 degrees C.

F. Design motors in accordance with NEMA standards and affix to each a nameplate accurately listing pertinent data. Motors shall have sufficient capacity to start and operate the machine they drive without exceeding the motor nameplate rating at the speed specified or at speeds or loads, which may be obtained, by the drive actually furnished. The motor HP or KW ratings are those estimated to be required by the driven equipment when operating at specified duties and efficiencies and are used to determine electrical feeder sizes. If the actual horsepower or KW required for the equipment to be furnished is greater than the indicated horsepower or KW, it shall be provided. Changes required in starter, feeder, branch circuit or other electrical items shall be made. Provide a shop drawing showing the mechanical/electrical coordination between trades. The shop drawing shall list all mechanical equipment with power demand, associated branch circuit feeder designation, conduit and wire size, breaker size and fused safety switch.

G. Unless otherwise indicated, polyphase motors shall be Class B, general purpose, squirrel cage, single speed, open induction type, stamped with NEMA Class B letter designation.

H. Single phase motors except as noted shall be open, capacitor start type. Motors 1/6 horsepower and under shall be permanent split capacitor type with built-in reset thermal overload protection, unless specifically noted otherwise. Motors 1/12 horsepower and smaller that start with no load may be shaded pole with built-in reset thermal overload protection.

I. Two speed motors shall be two winding, variable torque type with 100 percent and 50 percent speeds.

Comment [LR11]: Page: 12
Delete this paragraph when not applicable.

J. Mechanical equipment with a factory wired control panel shall be wired in accordance with the National Electrical Code. Additionally, components within the panel shall bear the UL label.

K. Motors 5 horsepower and over shall be provided with power factor correction devices to provide a power factor of 0.90 at design load.

L. Equipment shall be UL listed as a system or be tested by an independent electrical testing agency acceptable to the Architect to comply with requirements of the Authority having jurisdiction.

M. Do not install equipment, ductwork or piping in the dedicated spaces above switchgear, panels and transformers as identified in the National Electrical Code.

2.9 FLASHING

A. Sanitary vent pipes passing through the roof shall be provided with conical neoprene boots for any pitch roof with base extending minimum of eight inches from vertical portion of boot. Provide clamp for securing boot to pipe.

B. Flashing assemblies specified above shall be set in place as part of the work under this Division of this Specification, but will be finally installed as specified in another Division of this Specification.

C. Base flashing of roof drains, ducts, fans and other equipment, if required, is specified in Division 7 of this Specification. Cap flashings shall be provided to make a water tight seal.

Comment [LR12]: Page: 13
Verify Division Number with Architect.

2.10 IDENTIFICATION

A. Equipment shall be identified with engraved plastic laminate or anodized aluminum nameplates with pressure sensitive backing. Plates shall also be provided with drilled holes and fastened to equipment with moly-rivets. Letters shall be at least 3/8 inch high and larger in proportion to the size of the piece of equipment. Identification shall be the same as noted on schedules on the Drawings. Labels shall be provided for the following equipment.

1. Air Handling Units
2. Pumps
3. Heat Exchangers

(LIST EQUIPMENT REQUIRING LABELS.)

Comment [Edit List13]: Page: 13
List equipment requiring labels.

B. On valves, except immediately adjacent to equipment, provide 1 inch diameter brass tag with embossed and painted black numbers to identify the valve. Tag numbers shall be coordinated between trades. Tags shall be attached to valve wheels with a brass link. Tags shall be manufactured by Brady, Seton Nameplate, or Wilmington Plastics.

C. Prepare a list showing the number and location of valves and a schematic piping diagram showing the location of numbered valves. The list and diagram shall be cross indexed so that the location and purpose of valves is identified. List and diagram shall be stored in a clear plastic envelope mounted on a wall where directed by the Architect.

Comment [Edit List14]: Page: 13
Edit to suit the project

PART 3 - EXECUTION

3.1 EXISTING CONDITIONS

A. Visit the site and become familiar with existing conditions. (DELETE THIS PARAGRAPH ON PUBLIC CONTRACT PROJECTS. COORDINATE WITH ARCHITECT TO ADD THIS REQUIREMENT IN THE “INSTRUCTIONS TO BIDDERS”) Modifications to work required to allow for existing conditions shall be provided. Submit proposed modifications to the Architect for approval prior to installation.

B. Relocate existing hangers and supports where necessary to install new work. Maximum spacing requirements shall apply for relocated supports.

Comment [delete15]: Page: 13
Delete when not applicable

C. Coordinate interruptions in service of existing systems with the Owner. Provide temporary connections to maintain operation of existing systems.

D. The construction will be phased. Maintain service for required systems during phases of construction.

Comment [delete16]: Page: 14
Delete when not applicable.

3.2 MANNER OF INSTALLATION

A. Piping and ductwork shall be installed to preserve access to valves, dampers and equipment. Valves, dampers and equipment which require frequent service, adjustment or control and which cannot be located in a readily accessible and safe place, shall be provided with extension devices and remote operators, as necessary and as accepted for use by the Architect.

B. Piping and ductwork shall be run to follow the lines of the building and to allow the maximum headroom consistent with proper pitch. Piping subject to thermal expansion shall be arranged to permit movement without damage to the piping, ductwork and equipment.

C. The Drawings are generally indicative of the work to be installed, but they do not show all offsets, fittings and similar details required, which shall be provided to meet the job conditions. In areas where work is installed in close proximity to work of other trades or within trades covered by this Division of the Specifications, prepare larger scale drawings consisting of plans and sections to show how work is to be installed in relation to work of other trades.

D. Equipment and systems shall be installed in accordance with the requirements and recommendations of the associated manufacturer.

3.3 EXCAVATION AND BACKFILL

A. Provide excavation and backfill necessary to install underground piping and other work included in this Division of the Specifications. Establish lines and grades required for the proper location of the work.

B. After the piping has been placed, the trenches shall be backfilled to the lines of present grades or finished grade as required. No backfill shall be placed, however, until water has been removed from the trenches and joints have been set and also after the tests have been made on piping as required.

3.4 RECORD DRAWINGS

Comment [LR17]: Page: 14
Consult with Owner/Architect regarding the handling of record drawings and whether or not Division 1 contains a provision for same.

A. Keep at the site two (2) sets of black and white prints for the express purpose of showing changes from the contract Drawings made during construction. Mark up the prints with red pencil during construction and deliver the prints, before final inspection, to the Architect as a final set of "Record Drawings". Refer to Division 1 for additional requirements.

3.5 TESTING

A. Before concealing piping and before insulating piping, test piping per the requirements listed below or as required by the authority having jurisdiction, whichever is more stringent, and prove tight.

B. Replace and retest to Architect's satisfaction pipe or fittings broken or damaged under test.

C. Before testing piping systems, remove or otherwise protect from damage, control devices, air vents, plumbing fixtures and other parts which are not designed to stand pressures used in testing piping.

D. New [and existing] sanitary and storm drain piping shall be tested by a standing water test so that the highest point of the system has no less than a 10 foot head of water. Fixtures shall be removed from system and piping capped or plugged. No drop in water level shall be allowed. Test systems for a period of four (4) hours.

Comment [edit18]: Page: 15
Verify New and existing Sanitary piping

E. New [and existing] domestic water system[s] and new [and existing] hydronic systems shall be tested hydrostatically, pumping the system to [150 psi] test pressure and holding the system at the test pressure for two hours without additional pumping. The fire protection system shall be similarly tested at [175 psi] test pressure. While under pressure, visually inspect joints, welds or other connections to determine leakage. If leaks are detected, repair leak and retest.

(VERIFY THE REQUIRED TEST PRESSURES)

Comment [edit19]: Page: 15
Verify New and existing Domestic water

F. New [and existing] gas piping shall be air pressure tested at 50 psi test pressure for two hours without a drop in pressure during the test period.

3.6 CLEANING OF SYSTEMS

A. After satisfactory completion of pressure tests and before permanently connecting fixtures, equipment, strainers and other accessory items, clean systems. Remove burrs, cuttings and waste. Blow and flush piping until interiors are free of foreign matter. Take precautions to minimize scale build up. Contractor will be responsible for having a clean and scale free system at the time of substantial completion.

B. Provide a bid alternate price to perform a chemical flush in lieu of the mechanical flush indicated above. The chemical flush process shall consist of the following:

1. Inspect the equipment to be cleaned and photograph to document the intial condition.
2. Ensure system is tight and free from leaks prior to addition of chemical treatment solutions.
3. Drain volume of water from the system that the chemical treatment will displace.
4. Add nonvolatile oxygen scavenger (ChemTreat BL-1240 or equal) and circulate in the system for 1 hour to ensure mix.
5. Add sequestering/dispersing agent for iron oxides (ChemTreat CL-3858 or equal)
6. Test pH, iron, and conductivity, dissolved oxygen, oxygen scavenger
   a. If pH climbs over 7.5, add acidic sequestering/dispersing agent (ChemTreat CL-416 or equal) to keep pH between 6.5-7.5.
   b. Take frequent samples for laboratory analysis.
   c. Save samples in vials to show initial and subsequent water

quality.

d. If water viscosity increases significantly, drain the system.

e. Track iron levels in the system. As iron levels and pH plateau, cleaning is complete.

f. The cleaning process shall take no less than 72 hours and the system operating temperature cannot exceed 130 deg F during the cleaning process.

7. At the conclusion of cleaning, flush the system to bring both conductivity and iron values to the same level as the system's make up water. Iron value should be less than 2 mg/L.

8. Inspect equipment that was cleaned and photograph to document final condition.

9. Drain the system and initiate normal treatment program including sterilization and corrosion inhibitors.

C. Clean strainers and dirt pockets as often as required to guarantee no system stoppage by end of warranty period.

D. The heating water piping system including boiler shall be cleaned by filling the system with water with pumps in operation and boiler water set at 180 degrees F or higher with valves open and adding a sufficient quantity of tri-sodium phosphate to provide a solution of 3 pounds of tri-sodium phosphate per 100 gallons of water. Strainer baskets shall be maintained during this period to prevent clogging. At the end of the 48 hour cleaning period, the system shall be drained and flushed and then refilled for operation. The system shall again be brought up to operating temperature for 48 hours and the system shall be vented with the pumps running. At this time, temporary strainer baskets shall be removed, cleaned and reinstalled. Strainers shall be of sufficient fine mesh to protect the close tolerance of the pump, approximately 16 mesh. After one operating season, the temporary strainer baskets shall be removed and new baskets installed in the strainers.

E. Dust shall be removed from ductwork before Substantial Completion. Filter media shall be new at Substantial Completion.

F. If systems become stopped with refuse, remove the obstruction and replace and repair work disturbed.

G. Clean plumbing fixtures using non-scratching cleaners. Polish chromium plated work. Stilson type wrenches shall not be used on chrome plated work.

H. Dust in the construction area shall be suppressed with wetting agents or sweeping compounds. Dust shall be cleaned regularly.

I. Remove rust and clean surfaces to be insulated or painted.

J. Leave systems in clean condition and running order.

3.7 STERILIZATION

A. The domestic water piping systems shall be sterilized with a chlorine water

solution so that the piping system contains water with a chlorine concentration of 100 ppm at the end of a three hour retention period. Systems shall be flushed before sterilization. After the chlorine water solution has remained in the piping system for the specified period and at the specified concentration, the system shall be drained, flushed with clear water until the chlorine concentration is less than 1.0 ppm. Obtain representative samples of the systems water for analysis by a recognized bacteriological laboratory. If samples are not acceptable, the process shall be repeated until the samples are acceptable.

B. The domestic water piping system may be sterilized by other methods approved by local plumbing codes or the Health Department.

C. As a condition of acceptance of the system, furnish a certificate under seal to certify that the system has been sterilized to meet the requirements of the Health Department and that the system is satisfactory for human consumption.

D. Chemicals and materials used for sterilization of the systems shall meet the requirements of the authority having jurisdiction

3.8 PAINTING

A. Remove rust, scale, grease, and dirt from equipment and material and leave ready for finish painting. Equipment specified with factory baked enamel finish shall be touched up as required to provide a surface visually free of scratches, nicks and blemishes.

B. Paint uninsulated ferrous piping, hangers and miscellaneous iron work in concealed spaces with one coat of Rust-O-Leum dampproof red primer.

C. Where metal duct is visible through a register or grille, paint the interior of the duct with flat black paint.

3.9 OPERATING AND MAINTENANCE MANUAL

A. Submit operating and maintenance instructions. The manual shall include the following:

1. A brief description of systems and their various components.
2. Full, definite and explicit instructions for starting, stopping, controlling and changing over systems from one season to another.
3. List of manufacturer's representatives with address and telephone numbers.
4. Manufacturer's printed operating and maintenance instructions, parts lists, illustrations and diagrams for pieces of equipment.
5. A complete schedule of periodic servicing and lubrication requirements for equipment.
6. One copy of each shop drawing and Contractor's drawings.
7. One copy of other items of equipment where not required as a shop drawing submittal.
8. One copy of each wiring diagram.
9. Motor manufacturer's certificate for motors exposed to the weather.

10. The field test data specified in Section 15600 under Balancing and Adjusting.
11. Sterilization certificate for domestic water systems.

3.10 FIELD INSTRUCTION

A. Upon completion of work, furnish services of a competent representative to instruct Owner's representative in the proper operation and maintenance of elements of the mechanical systems. Submit instructor's name and credentials to the Architect for approval.

B. Spend not less than [40] hours in such formal instruction to prepare Owner to operate and maintain the systems.

(ENTER THE REQUIRED HOURS OF INSTRUCTION.)

C. At least [20] hours of the specified [40] hours of instruction shall occur after thirty days operation by Owner's representative and may be divided into periods of [4] hours at different seasons of the year.

(ENTER THE REQUIRED HOURS OF INSTRUCTION.)

3.11 PERFORMANCE TEST

A. Should the performance or capacity of the systems, equipment or devices furnished be questioned by written notice from the Architect after installation, provide necessary test equipment and complete a satisfactory test of the items in question. The test shall be run when and as directed by the Architect and in the presence of his representative. Should the items furnished not pass such a test, they shall be removed and replaced by systems, equipment or devices satisfactory to the Architect.

3.12 MAINTENANCE POLICY

A. Provide labor, materials and equipment to maintain systems installed under this Contract for a period of one year. Maintenance shall be provided on a 24 hour emergency basis. This maintenance policy is in addition to the specified warranty requirements. Policy shall provide parts and labor.

B. Maintenance policy shall include, but not be limited to, replacement of filters at required intervals, lubrication, repair, clogged lines and all other maintenance routines.

C. Submit a specimen of the maintenance policy for review and acceptance by the Architect.

(DELETE THIS ARTICLE FOR MOST PROJECTS. CHECK WITH ARCHITECT)

END OF SECTION

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SECTION 211313

WET PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. The requirements of Section 200000 apply to work performed under this Section.

B. Section includes fire protection sprinkler systems.

C. Based upon the calculations shown in Information Available to Bidders, a fire pump [is] [is not] required with the indicated allowance for piping losses. Verify these calculations. If calculations show a fire pump is required, the cost of the pump related work (including, but not limited to, power supply, emergency power, fire alarm system, construction of the pump room and concrete pads) shall be provided as a negotiated change. However, the cost of the large piping and low pressure heads to avoid a pump or larger pump shall be included in this contract.

1.2 QUALITY ASSURANCE

A. Regulatory requirements of the fire protection system shall be in compliance with the rules and regulations of the Fire Department and the State Fire Marshal (or his legislated authoritative representative) and in accordance with the following:

1. Building Code
2. NFPA 101 - Life Safety Code
3. NFPA Standards
    a. NFPA 13
    b. NFPA 20

B. Fire alarm system and associated wiring are specified under Division 26. Coordinate changes to the fire alarm system due to changes in the sprinkler system layout from that shown on the Contract Documents.

1.3 SUBMITTALS

A. A sprinkler system working drawing as required by NFPA and local jurisdiction shall be submitted to the Architect for review after governmental and regulatory agency approvals have been obtained. The submittal shall include manufacturer’s data sheets and hydraulic calculations. Approval agencies shall include the local fire department and the State Fire Marshal's office. No installation of the system shall be made until approval is obtained. System shown on the Contract Drawings is schematic and is intended for use as a guide.

1.4 INFORMATION AVAILABLE TO BIDDERS

A. This Article and the following flow test data and water supply calculations are made available for the bidder's convenience and are not part of the Contract Documents and do not relieve the bidders from performing their own investigation to determine the accuracy of the information.

1. Flow Test Data
    a. Test Date: 04/15/2016
    b. Test Conducted By: David Gettle, Kohl Bros. Inc.
    c. Test Hydrant Location: Mercersburg Field House

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d. Static Pressure: 150 PSI
e. Residual Pressure: 55 PSI
f. Flow Rate: 1050

2. Water Supply Calculations
   a. Design for density of 0.15 GPM per remote 1,500 square feet. Allowing 50% for overage, design flow becomes 0.15 x 1500 x 1.5 = 337 GPM plus 250 GPM for overage and hose stream allowance Making design flow rate 587 GPM.
   b. Available Pressure at Design Demand of 587 GPM:90 PSI

PART 2 - PRODUCTS

2.1 VALVES

A. Valves on fire protection system shall be Factory Mutual stamped or UL listed.

B. Main backflow prevention device serving the fire protection main shall be a double check detector valve assembly and shall comply with ASSE Standard 1048. The assembly shall consist of a main line valve body composed of two independently acting approved clapper style check modules with replaceable seats and disc rubbers. Accessing for servicing of both check modules is through independent top entry covers. The assembly shall be fitted with approved UL/FM resilient seated shutoff valves and contain four properly located resilient seated test cocks as specified by AWWA Standard C510. The auxiliary bypass line contains a 5/8" x 3/4" water meter that complies with ANSI/AWWA Standard C700 coupled with an approved check assembly. The bypass line shall detect leaks or unauthorized water usage of the water system while protecting against possible backpressure and backsiphonage conditions. Flow and pressure loss performance parameters shall meet the requirements of AWWA Standard C510. Double check detector valve assembly shall be Febco Model LF856 or Watts.

C. Valves at base of risers and sprinkler system service shall be Stockham G634 or similar of Acme, Fairbanks, Walworth or Jenkins, 175 pound iron body, solid wedge disc with rising stem O.S. & Y. Provide a valve tamper switch for each valve. Tamper switch shall be Edwards type OSYS-U, Simplex or Pyron.

D. Fire department valves in stair towers shall be Croker Corporation B0165, type 2 angle pattern male and female, 2-1/2 inch size, rough chrome plated with polished trim. Valves shall have a device to limit the discharge pressure to 100 psi. Hose end threads shall match those of the local fire department. Provide hose connections at each floor for each standpipe.

E. Siamese connections shall be Croker Corporation, 6430 series, with dual clappers, lettered "Automatic Sprinklers". Prior to ordering Siamese connections, confirm type of finish with both Owner and Architect. Basis of design is polished chrome, if approved by Owner/Architect polished brass may be substituted. Hose threads shall be compatible with local fire department requirements. Provide U.L approved check valve behind each siamese connection with standard No. 148 automatic ball drip. Extend drip through the wall to discharge on grade.

2.2 SPRINKLER SYSTEM EQUIPMENT

A. Ceiling sprinkler heads shall be white pendant heads with white two piece escutcheons for installation on a suspended ceiling system. Ceiling heads shall

have full 360 degree spray pattern provided with fusible links or with thermal glass bulb for ordinary temperature rating. Sprinkler and other major devices shall be as manufactured by Reliable or Viking, Automatic Sprinkler.

B. Sidewall sprinkler heads shall be white with white two piece escutcheons, horizontal type with a special deflector to distribute the water in a uniform pattern. Sidewall heads shall have a fusible link or with thermal glass bulb or with thermal glass bulb with an ordinary temperature rating.

C. Exposed piping upright sprinkler heads shall be natural bronze finish for exposed piping installation. Heads shall have full 360 degree spray pattern provided with fusible links for ordinary temperature rating.

D. Alarm check valve shall be provided at service entrance and shall have alarm connection to the fire alarm system. Wiring from the alarm connection to the fire alarm system is specified in Division 26.

E. Flow switches shall be Simplex, Pyrotronics, Johnson or Honeywell pneumatically damped switch with 15 second delay, actuated by a flow rate of 10 gpm or greater. Alarm shall actuate an electric switch. Wiring from the switch to the fire alarm system is specified under Division 26

PART 3 - EXECUTION

3.1 PIPING

A. Piping within the building shall be per NFPA 13.

3.2 SPRINKLER SYSTEM

A. Sprinkler shall be a complete automatic wet pipe system complete with piping, sprinkler heads, valves, accessories, hangers, etc. System shall be generally classified for the code application hazard.

B. Layout of sprinkler heads and piping shall be coordinated with the Architectural, Structural, Mechanical and Electrical Drawings and field conditions. Provide offsets, sleeves, etc., required for the installation.

C. Extend piping for fire protection use from the water service where it enters the building.

D. System shall be hydraulically designed. Computer readout sheets shall be submitted as required for approval and permit purposes.

E. Have a flow test performed in accordance with the procedures established in NFPA 20. Results of this flow test shall be included with the computer calculations.

END OF SECTION

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SECTION 211316

DRY PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. The requirements of Section 200000 apply to work performed under this Section.

B. Section includes fire protection sprinkler systems.

C. Based upon the calculations shown in Information Available to Bidders, a fire pump [is] [is not] required with the indicated allowance for piping losses. Verify these calculations. If calculations show a fire pump is required, the cost of the pump related work (including, but not limited to, power supply, emergency power, fire alarm system, construction of the pump room and concrete pads) shall be provided as a negotiated change. However, the cost of the large piping and low pressure heads to avoid a pump or larger pump shall be included in this contract.

1.2 QUALITY ASSURANCE

A. Regulatory requirements of the fire protection system shall be in compliance with the rules and regulations of the Fire Department and the State Fire Marshal (or his legislated authoritative representative) and in accordance with the following:

1. Building Code
2. NFPA 101 - Life Safety Code
3. NFPA Standards
    a. NFPA 13
    b. NFPA 20

B. Fire alarm system and associated wiring are specified under Division 26. Coordinate changes to the fire alarm system due to changes in the sprinkler system layout from that shown on the Contract Documents.

1.3 SUBMITTALS

A. A sprinkler system working drawing as required by NFPA and local jurisdiction shall be submitted to the Architect for review after governmental and regulatory agency approvals have been obtained. The submittal shall include manufacturer’s data sheets and hydraulic calculations. Approval agencies shall include the local fire department and the State Fire Marshal's office. No installation of the system shall be made until approval is obtained. System shown on the Contract Drawings is schematic and is intended for use as a guide.

1.4 INFORMATION AVAILABLE TO BIDDERS

A. This Article and the following flow test data and water supply calculations are made available for the bidder's convenience and are not part of the Contract Documents and do not relieve the bidders from performing their own investigation to determine the accuracy of the information.

1. Flow Test Data
    a. Test Date: 04/15/2016
    b. Test Conducted By: David Gettle, Kohl Bros. Inc.
    c. Test Hydrant Location: Mercersburg Field House

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d. Static Pressure: 150 PSI
e. Residual Pressure: 55 PSI
f. Flow Rate: 1050

2. Water Supply Calculations
   a. Design for density of 0.15 GPM per remote 1,500 square feet. Allowing 50% for overage, design flow becomes 0.15 x 1500 x 1.5 = 337 GPM plus 250 GPM for overage and hose stream allowance Making design flow rate 587 GPM.
   b. Available Pressure at Design Demand of 587 GPM:90 PSI

PART 2 - PRODUCTS

2.1 VALVES

A. Valves on fire protection system shall be Factory Mutual stamped or UL listed.

B. Valves at base of risers and sprinkler system service shall be Stockham G634 or similar of Acme, Fairbanks, Walworth or Jenkins, 175 pound iron body, solid wedge disc with rising stem O.S. & Y. Provide a valve tamper switch for each valve. Tamper switch shall be Edwards type OSYS-U, Simplex or Pyron.

2.2 SPRINKLER SYSTEM EQUIPMENT

A. Dry pipe system shall be provided with dry system valve, air compressor, air pressure regulator, air-water differential valve and other accessories, piping and controls for a complete system. Air compressor shall be single stage, air cooled electric motor driven, with check valve and moisture removal system. Motor shall be not less than 1/2 horsepower and shall be suitable for 240 volt, single phase operation.

B. Dry pendent heads shall be white recessed type with white two piece escutcheons and shall have a full 360 degree spray pattern provided with fusible links for ordinary temperature rating. Sprinkler and other major devices shall be as manufactured by Reliable, Grinnell, Viking, Automatic Sprinkler or Hodgman.

C. Dry sidewall sprinkler heads shall be white with white two piece escutcheons, horizontal type with a special deflector to distribute the water in a uniform pattern. Sidewall heads shall have a fusible link or with thermal glass bulb or with thermal glass bulb with an ordinary temperature rating. Sprinkler and other major devices shall be as manufactured by Reliable, Grinnell, Viking, Automatic Sprinkler or Hodgman.

D. Exposed piping upright dry sprinkler heads shall be natural bronze finish for exposed piping installation. Heads shall have full 360 degree spray pattern provided with fusible links for ordinary temperature rating.

E. Alarm check valve shall be provided at service entrance and shall have alarm connection to the fire alarm system. Wiring from the alarm connection to the fire alarm system is specified in Division 26.

F. Flow switches shall be Simplex, Pyrotronics, Johnson or Honeywell pneumatically damped switch with 15 second delay, actuated by a flow rate of 10 gpm or greater. Alarm shall actuate an electric switch. Wiring from the switch to the fire alarm system is specified under Division 26

Comment [Check1]: Page: 2 Note: This is an NFPA requirement when backflow preventer is required. It is frequently overlooked but currently enforced by Baltimore County.

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PART 3 - EXECUTION

3.1 PIPING

A. Piping within the building shall be per NFPA 13 except that plastic pipe shall not be used.

3.2 SPRINKLER SYSTEM

A. Sprinkler shall be a partial automatic dry pipe system complete with piping, sprinkler heads, valves, accessories, hangers, etc. System shall be generally classified for the code application hazard.

B. Layout of sprinkler heads and piping shall be coordinated with the Architectural, Structural, Mechanical and Electrical Drawings and field conditions. Provide offsets, sleeves, etc., required for the installation.

C. Extend piping for fire protection use from the water service where it enters the building.

D. System shall be hydraulically designed. Computer readout sheets shall be submitted as required for approval and permit purposes.

E. Have a flow test performed in accordance with the procedures established in NFPA 20. Results of this flow test shall be included with the computer calculations.

END OF SECTION

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SECTION 221116

DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 NOTE

A. The requirements of Section 200000 apply to work performed under this Section.

1.2 SCOPE

A. The work under this Section of the Specification shall include the furnishing of labor, materials and equipment for the installation of complete plumbing systems, including interior domestic hot and cold water piping, plumbing fixtures and appliances to provide continuous and satisfactory service.

1.3 CONNECTIONS TO EQUIPMENT

A. Provide labor and materials to connect equipment furnished under this Section of the Specification.

B. Provide labor and materials to connect equipment furnished under other Sections of the Specification and requiring plumbing connections as if the equipment was furnished under this Section of the Specification. Provide traps, water stop valves, etc., for equipment requiring such connections to provide functioning systems.

PART 2 - PRODUCTS

2.1 SHOCK ABSORBERS

A. Provide shock absorbers in the water piping in horizontal runs to quick closing valves at the end of runs and where shown on drawing and elsewhere as required to prevent noise or injury to the piping system resulting from water hammer.

B. Shock absorbers shall be J. R. Smith Hydrotrol or Zurn Z-1700 Shocktrol. Unit shall consist of stainless steel casing and air charged bellows. Shock absorbers shall be sized as recommended in the Plumbing Drainage Institute Standard WH-201.

2.2 WALL HYDRANTS AND HOSE BIBBS

A. Provide wall hydrants and hose bibbs as herein specified and indicated on the Drawings.

B. The exterior wall hydrants shall be frostproof hydrants Zurn 1310 with integral backflow preventor, J. R. Smith or Josam. The hydrant face shall be polished nickel bronze. The unit shall have bronze working parts and neoprene washers. Provide a loose key which will operate the hydrants.

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C. Hose bibbs shall be Zurn Z1341, American Standard or Crane. The hose bibbs shall be rough chrome finish, loose key handle compression faucets with hose end and male IPS shoulder inlet fitted with Z1399-VB vacuum breaker backflow preventer.

2.3 VALVES

A. Provide valves as indicated on Drawings, as specified below and as required. Valves, where possible, shall be of one manufacturer, Stockham, Nibco or Jenkins, Jomar whose figure numbers are used below.

B. Valves 2 inches and smaller, which will be operated frequently, or will be used for throttling services, shall be ball or globe valves. Stop valves shall be ball valves.

C. Valves in the domestic hot water, cold water and hot water recirculating system shall be:

	FOR STEEL PIPE		
Description	Nibco	Jenkins	Stockham
Gate-4" and larger IBBT, OS & Y, flanged	F-617-0	651A	G-623
Gate-3” and smaller BBT, rising threaded stem	T-111	47	B-100
Globe–4” and larger IBBT OS&Y, flanged	F-718-B	613	G-512
Globe-3” and smaller BBT, threaded	T-211-Y		B-13-T
Check Valves 4” and larger IBBT, swing, flanged	F-918-B	624	G-931
Check Valves 3” and smaller BBT, swing, threaded	T-413-Y	92A	B-319

	For Copper Tube		
Description	Nibco	Jenkins	Stockham
Gate-2-1/2” and smaller, bronze rising stem, solder end.	S-111	1242	B-108
Globe–2-1/2” and smaller, bronze solder end	S-211-Y		B-14-T
Check Valves 2-1/2”and smaller, bronze, swing solder end	S-413-Y	1222	B-309

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D. Non-lubricated plug valves, DeZurik 425 may be used for balancing and shut off valves in hot water circulating lines. Adjustable stop and tapping on the downstream side for pressure gauge connections shall be provided with balancing services. This valve may also be used in lieu of gate and globe valves where shown.

E. Ball valves may be used for shut off and balancing PURPOSES. Ball valves shall be NIBCO figure S-580-M, Jomar T-100 or Apollo. Provide memory stop on balancing valves.

F. Butterfly valves may be used for shut off or balancing purposes in lieu of gate or globe valves on piping 2-1/2 inches and larger. Valves shall be 200 pound and have EPDM liner, aluminum bronze disc and lever lock operator. NIBCO LD-2000-3, Jenkins 23ZE, Centerline, or DeZurik. On piping 8 inches and larger provide gear operator NIBCO LB-2000-5.

G. Non-slam check valves shall be installed on discharge of pumps, in vertical piping and elsewhere as shown and shall be 125 pound wafer style iron body, bronze fitted with renewable seat and disc and spring actuator, Miller 162, NIBCO W910, Hager or Smolensky.

H. In the cold water makeup line to the heating system, install a Watts series 900, Toro or Hersey, reduced pressure backflow preventor. Unit shall be furnished with strainer and double gate valves. Pipe overflow to floor drain.

PART 3 - EXECUTION

3.1 WATER PIPING

A. Water service underground outside the building shall be cement lined ductile iron ASA 21.6 or ASA 21.8 made up with Tyton joints. Provide proper bedding for piping and concrete buttresses at all fittings according to AWWA standards.

B. Water piping inside the building shall be type "L" hard drawn copper water tube, ASTM B88 with solder type wrought copper fittings, ANSI A40.3. Brass solder joint valves shall be used with copper tubing. Solder shall be 95-5 tin antimony type. Protect piping from materials which may cause corrosion of copper.

C. Exposed piping at fixtures shall be IPS red brass, chromium plated.

D. Mains, branches and connections of the hot and cold water distribution piping systems shall be provided with valves placed at the points shown on drawings or directed by the Architect for proper isolation and control of the system. Equipment or appliances shall be separately valved so that service can be shut off and the piece of equipment or appliance removed without disturbing the piping system. Valves shall be located so as to be accessible to the operator. Separate valves for equipment and appliances are in addition to faucets supplied herein or in other Sections.

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E. Provide for expansion of piping subject to temperature changes. This shall be accomplished by swings, bends or loops.

3.2 INSULATION

A. After the systems have been installed and tested, insulation as specified below shall be applied. Materials shall be UL, Inc., approved and shall be applied as recommended by the manufacturer's written instructions. Materials used shall be the products of Owens Corning, PPG, Manville, Knauff Corporation, Certainteed, Armstrong, Eagle Picher, Insul Coustic or Benjamin Foster and shall be equal to those products that meet the Specifications below.

B. Insulate new cold water piping, hot water piping, tempered water piping, hot water circulating piping except chrome plated piping exposed at plumbing fixtures. Insulation shall be heavy density long strand fiberglass, sectional insulation with all service vapor barrier jacket and double side adhesive self-sealing lap, Johns Manville Micro-Lok system or equal of Owens Corning. Insulation shall comply with ASTM E84 with a flame spread rating of 25 or less and smoke developed rating of 50 or less. Insulation thickness shall be in accordance with the Energy Code but shall not be less than 1 inch. Fittings, valve bodies, etc., shall be covered with Zeston type precut vinyl insulation jackets with pre-shaped fiberglass insert.

C. Insulate hot water generator with 2 inch thickness of calcium silicate insulation board held in place with wire bands. Finish with a ½ inch thick coat of Eagle Pitcher One Cote Cement with a layer of glass cloth embedded in cement and finished with a lagging adhesive.

D. On exposed insulated piping in finished areas within seven feet of the floors, provide .010 inch thick galvanized steel insulation jackets. This does not include piping exposed in unfinished areas such as boiler rooms, storage rooms, etc.

E. At pipe hangers, for piping carrying fluids with temperatures below 70 degrees, provide a rigid core of insulation to support the pipe. Rigid insulation shall be the same thickness as the adjacent semi-rigid insulation and have the same flame spread and smoke developed ratings. Vapor barrier shall be continuous and integral between the rigid and semi-rigid sections of insulation. Rigid insulation shall be composed of hydrous calcium silicate. Rigid insulation shall be Johns Manville Thermo-12 Gold or equal of Owens Corning.

END OF SECTION

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SECTION 221316

WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 NOTE

A. The requirements of Section 200000 apply to work performed under this Section.

1.2 SCOPE

A. The work under this Section of the Specification shall include the furnishing of labor, materials and equipment for the installation of complete plumbing systems, including interior sanitary soil, waste and vent piping; plumbing fixtures and appliances to provide continuous and satisfactory service.

1.3 CONNECTIONS TO EQUIPMENT

A. Provide labor and materials to connect equipment furnished under this Section of the Specification.

B. Provide labor and materials to connect equipment furnished under other Sections of the Specification and requiring plumbing connections as if the equipment was furnished under this Section of the Specification. Provide traps, water stop valves, etc., for equipment requiring such connections to provide functioning systems.

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Cleanouts shall be provided at ends of runs, at changes of direction and near the base of each vertical soil, waste, or drain pipe. Cleanouts shall be placed on horizontal lines every 50 feet unless the conditions require them at closer intervals. Cleanouts at the base of vertical pipes shall be placed in a fitting just above the floor. Cleanouts shall consist of Y branches or 1/4 bends the full size of the line for piping 4 inches and smaller, and 4 inches for larger pipes. Cleanouts in horizontal lines shall be extended to floor level or grade as necessary. Cleanouts shall be series as listed below:

1. Below concrete floors with no finish or ceramic tile finish.
   a. Zurn - ZN-1400-3
   b. J. R. Smith
   c. Watts
   d. Josam
   e. Ancon
2. Below carpeted floors (flush with concrete with identification screw through carpet).

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a. Zurn - ZN-1400-15
b. J. R. Smith
c. Watts
d. Josam
e. Ancon

3. Below resilient tile floors.
a. Zurn - ZN-1400-7
b. J. R. Smith
c. Watts
d. Josam
e. Ancon

4. Exposed horizontal piping.
a. Zurn - Z-1440A
b. J. R. Smith
c. Watts
d. Josam
e. Ancon

5. Concealed in finished wall-prime coat.
a. Zurn - Z-1440-1
b. J. R. Smith
c. Watts
d. Josam
e. Ancon

6. Base of exposed vertical pipes.
a. Zurn - Z-1445
b. J. R. Smith
c. Watts
d. Josam
e. Ancon

7. Base of concealed vertical pipes.
a. Zurn - Z-1445-1
b. J. R. Smith
c. Watts
d. Josam
e. Ancon

B. Cleanouts shall consist of cast iron ferrules and shall seat against a lead seal. Access covers shall be polished nickel bronze in finished areas, brass below carpeting. Access covers will be secured by non-ferrous tamperproof screws.

2.2 DRAINS

A. Provide floor drains shown on Drawings and/or described below. Drains shall be Zurn, J. R. Smith, Josam or Ancon.

B. Floor drains shall be served by trap primers. Trap primers shall be bronze bodied “Lavatory-Waste” type. Trap primers shall meet the requirements of ASSE Standard 1044. Trap primers shall be set above the floor level of the drains they serve. Extend water line from trap primer to floor drain trap.

1. J. R. Smith – 2698
2. Zurn

3. Precision Plumbing Products

C. Floor drains shall be of the following type:

1. FD-1 -cast iron body, steel anchor flange for use with wooden decks, nickel bronze 4 inch round strainer.
   a. Zurn -FD-2240-NT
   b. J. R. Smith
   c. Watts
   d. Josam
2. FD-2 -cast iron body heavy duty 9 inch round strainer and sediment bucket.
   a. Zurn - Z-520-Y
   b. J. R. Smith
   c. Watts
   d. Josam
   e. Ancon Ancon

PART 3 - EXECUTION

3.1 SANITARY AND DRAIN PIPING

A. Sanitary piping shall be extended from fixtures, appliances, etc., to the existing sanitary sewer. Verify location, size and elevation of the existing line before performing work and notify the Architect if discrepancies are noted.

B. Sanitary and drain piping below the lowest finished floor to their connections to existing utilities shall be schedule 40 polyvinyl chloride sewer pipe.

C. Sanitary and drain piping within the building, above ground shall be schedule 40 polyvinyl chloride sewer pipe.

D. Drain piping from air conditioning unit condensate pans above the ground shall be schedule 40 polyvinyl chloride sewer pipe.

E. Where lines pass under or through footings, encase them in concrete to uniform thickness as approved by the engineer.

F. In connection with underground piping, connections and turns, unless otherwise specified, shall be made with Y fittings and 1/8 bends.

3.2 INSULATION

A. After the systems have been installed and tested, insulation as specified below shall be applied. Materials shall be UL, Inc., approved and shall be applied as recommended by the manufacturer's written instructions. Materials used shall be the products of Owens Corning, PPG, Manville, Knauff Corporation, Certainteed, Armstrong, Eagle Picher, Insul Coustic or Benjamin Foster and shall be equal to those products that meet the Specifications below.

B. Insulate new condensate drain lines. Insulation shall be heavy density long strand fiberglass, sectional insulation with all service vapor barrier jacket and double side adhesive self-sealing lap, Johns Manville Micro-Lok system or equal of Owens Corning. Insulation shall comply with ASTM E84 with a flame spread rating of 25 or less and smoke developed rating of 50 or less. Insulation thickness shall be in accordance with the Energy Code but shall not be less than ½ inch. Fittings, valve bodies, etc., shall be covered with Zeston type precut vinyl insulation jackets with pre-shaped fiberglass insert.

C. On exposed insulated piping in finished areas within seven feet of the floors, provide .010 inch thick galvanized steel insulation jackets. This does not include piping exposed in unfinished areas such as boiler rooms, storage rooms, etc.

D. At pipe hangers, for piping carrying fluids with temperatures below 70 degrees, provide a rigid core of insulation to support the pipe. Rigid insulation shall be the same thickness as the adjacent semi-rigid insulation and have the same flame spread and smoke developed ratings. Vapor barrier shall be continuous and integral between the rigid and semi-rigid sections of insulation. Rigid insulation shall be composed of hydrous calcium silicate. Rigid insulation shall be Johns Manville Thermo-12 Gold or equal of Owens Corning.

END OF SECTION

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SECTION 223500

DOMESTIC WATER HEAT EXCHANGERS

PART 1 - GENERAL

1.1 NOTE

A. The requirements of Section 200000 apply to work performed under this Section.

1.2 SCOPE

A. The Work under this Section of the Specification shall include the furnishing of labor, equipment and materials for the installation of heating, air conditioning and ventilating systems as specified, shown on the Drawings or implied to provide continuous and satisfactory service.

PART 2 - PRODUCTS

2.1 HEAT EXCHANGER

A. Provide shell and tube type heat exchangers of the sizes and capacities indicated on the drawings. The assembly shall be pre-piped steam to water shell and tube water heater with performance matched components and pressure tested before delivery. The instantaneous shell and tube water heater shall be of single wall construction with straight admiralty brass tubes expanded into naval brass tube sheets with a bolted end cover. Heat exchanger will be fixed on one end of the shell and free floating on the opposite end designed and manufactured in accordance with ASME Code Section VIII.

B. Temperature controller (DRV) shall be digital using integrated circuit board technology designed to deliver blended water economically at a safe, accurate temperature for sanitary use in re-circulated hot water systems. The DRV shall have a 2 line, 16 character display of delivered temperature with the option of °F or °C. Display also shows the error codes and alarm conditions. DRV shall be compliant with ASSE Standard 1017 and CSA B125, UL listed and so certified and identified.

C. The assembly shall comprise domestic side check valves, strainers, DRV, thermometers, ball valves, safety shut-off valve, shell and tube exchanger all pre-piped with type L copper on a painted carbon steel frame.

D. Complete assembly to be Lead Free compliant

E. Steam pressure on system to be no more than 15 PSIG Designed to generate 20

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GPM with a 40˚F entering cold water temperature, a 140˚F mixed water set point utilizing 15 PSIG steam at a maximum of 1058 lbs/hr steam load.

F. Water heater assembly shall have all of the following operational capabilities:

1. +/- 2F water temperature control from 0 to full system demand.
2. 2˚F minimum inlet to outlet water temperature differential
3. Automatic shutoff of hot water flow upon cold water inlet supply failure.
4. Automatic shutoff of hot water flow in the event of a power failure
5. Programmable set point range of 81-158°F (27-70°C)
6. Programmable 1st level hi/lo temp alarm display
7. Programmable error temperature error level for double safety shutdown.
8. LCD display which indicates: set point, delivered temperature, error codes and alarm conditions.
9. Isolation valves and clean in place connections to chemically clean the exchanger without dis-assembly of the exchanger .
10. ¼" domestic side pressure relief pop-off valve with 165 psig crack pressure. Self seating.

G. Water heater assembly shall have the following connectivity capabilities:

1. SPCO relay outputs which are energized during operation.
2. RS485 Serial Port for connection to Modbus RTU (on board) or Brainscan® (optional adder)

H. Shell and tube heat exchangers shall be Armstrong or similar of Taco, or Bell & Gossett.

2.2 DOMESTIC WATER CIRCULATING PUMPS

A. Provide an all bronze, lead free in-line circulator to recirculate water to the storage water heater. Pump shall have a flexible coupler, coupler guard and sleeve bearings.

B. Pump shall be Taco, Bell & Gossett or Thrush.

C. Control of circulating pump is specified as part of automatic temperature controls.

PART 3 - EXECUTION

3.1 INSTALLATION, OPERATION, AND MAINTENANCE

A. Installation, Operation, and Maintenance manual shall be supplied with the unit.

B. Installing contractor shall install unit, including field installed components, in accordance with Installation, Operation, and Maintenance manual instructions.

C. Start up and maintenance requirements shall be complied with to ensure safe and

correct operation of the unit.

END OF SECTION

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SECTION 224100

PLUMBING FIXTURES

PART 1 - GENERAL

1.1 NOTE

A. The requirements of Section 200000 apply to work performed under this Section.

1.2 SCOPE

A. The work under this Section of the Specification shall include the furnishing of labor, materials and equipment for the installation of complete plumbing systems, including interior sanitary soil, waste and vent piping; storm, interior domestic hot and cold water piping, plumbing fixtures and appliances to provide continuous and satisfactory service.

1.3 CONNECTIONS TO EQUIPMENT

A. Provide labor and materials to connect equipment furnished under this Section of the Specification.

B. Provide labor and materials to connect equipment furnished under other Sections of the Specification and requiring plumbing connections as if the equipment was furnished under this Section of the Specification. Provide traps, water stop valves, etc., for equipment requiring such connections to provide functioning systems.

PART 2 - PRODUCTS

2.1 PLUMBING FIXTURES

A. Provide plumbing fixtures as shown on the Drawings or as described herein. Exposed metal parts of fixtures, including faucets, waste fittings, waste plugs, strainers, flush valves, traps, supply and waste pipes and escutcheons shall be brass, chromium plated.

B. Mounting Heights of Fixtures

1. To provide for the physically disabled, plumbing fixtures shall be provided for their use at a mounting height suitable for the disabled as set forth by the Federal Government. Fixtures for special uses need not meet this requirement. Fixture mounting heights are generally indicated on the drawings.
2. Cold water, Hot water and drain piping accessible to a wheelchair patient shall be suitably protected against high temperature by molded vinyl piping covers with access to shut-off valves, trap cleanout, etc. Insulation shall have out of sight fastening system, tie bands are not approved. Covers shall be Truebro 105/102.

C. Hot and cold water connections to fixtures shall be provided with a stop valve. Stop valves, risers, etc. shall be commercial/institutional grade as manufactured by Brass Craft, Chicago, Engineered Systems or McGuire.

D. Provide metal supports necessary to adequately and substantially hang and set fixtures. Supports shall be Zurn, Josam or J. R. Smith and suitable for the wall thickness and piping arrangements shown.

E. Plumbing fixtures shall be caulked at wall and floor with silicone caulking material of same color as the fixture.

F. Locate countertop sinks furnished under this Division. Furnish templates to the countertop fabricator for cutting of required holes.

G. For sinks and fixtures specified under other Divisions or other contracts and not provided with faucets, tailpieces, traps, and stop valves; provide necessary fittings and completely connect the sinks and fixtures.

H. Fixtures shall be as indicated on the plumbing fixture schedule on the drawings.

PART 3 - EXECUTION

3.1 MOUNTING HEIGHTS OF FIXTURES

A. To provide for the physically disabled, plumbing fixtures shall be provided for their use at a mounting height suitable for the disabled as set forth by the Federal Government. Fixtures for special uses need not meet this requirement. Fixture mounting heights are generally indicated on the drawings.

B. Hot water and drain piping accessible to a wheelchair patient shall be suitably protected against high temperature by molded vinyl piping covers with access to shut-off valves, trap cleanout, etc. Insulation shall have out of sight fastening system, tie bands are not approved. Covers shall be Truebro 105/102.

END OF SECTION

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SECTION 230923

DIRECT DIGITAL CONTROL (DDC) SYSTEM FOR HVAC

PART 1 - GENERAL

1.1 NOTE

A. The requirements of Section 200000 apply to work performed under this Section.

1.2 SCOPE

A. The Work under this Section of the Specification shall include the furnishing of labor, equipment and materials for the installation of heating, air conditioning and ventilating systems as specified, shown on the Drawings or implied to provide continuous and satisfactory service.

PART 2 - PRODUCTS

2.1 BUILDING MANAGEMENT SYSTEM

A. The Building Management System (BMS) shall be a complete system designed for use from any web based computer on the internet.

B. Building management system shall be Johnson Controls, Automated Logic, or Trane.

C. Building Management System shall be designed for full integration with the buildings security and fire alarm systems.

D. All points of user interface shall be on standard PCs that do not require the purchase of any special software from the BMS manufacturer for use as a building operations terminal. The primary point of interface on these PCs will be a standard Web Browser.

E. The work of the single BMS Contractor shall be as defined individually and collectively in all Sections of this Division together with the associated Point Sheets and Drawings and the associated interfacing work as referenced in the related documents.

F. The BMS work shall consist of the provision of all labor, materials, tools, equipment, software, software licenses, software configurations and database entries, interfaces, wiring, tubing, installation, labeling, engineering, calibration, documentation, samples, submittals, testing, commissioning, training services, permits and licenses, transportation, shipping, handling, administration, supervision, management, insurance, temporary protection, cleaning, cutting and patching, warranties, services, and items, even though these may not be specifically mentioned in these Division documents which are required for the complete, fully functional and commissioned BMS.

G. The BMS as provided shall incorporate, at minimum, the following integrated features, functions and services:

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1. Operator information, alarm management and control functions.
2. Enterprise-level information and control access.
3. Information management including monitoring, transmission, archiving, retrieval, and reporting functions.
4. Diagnostic monitoring and reporting of BMS functions.
5. Offsite monitoring and management access.
6. Energy management
7. Standard applications for terminal HVAC systems.
8. The Building Management System architecture shall consist of the products of a manufacturer regularly engaged in the production of Building Management Systems, and shall be the manufacturer's latest standard of design at the time of bid.

H. Work By Others

1. The demarcation of work and responsibilities between the BMS Contractor and other related trades shall be as outlined in the BMS RESPONSIBILITY MATRIX

BMS RESPONSIBILITY MATRIX				
WORK	FURNISH	INSTALL	Low Volt. WIRING/TUBE	LINE POWER
BMS low voltage and communication wiring	BMS	BMS	BMS	N/A
BMS conduits and raceway	BMS	BMS	BMS	BMS
Automatic dampers	BMS	23	N/A	N/A
BMS Current Switches.	BMS	BMS	BMS	N/A
BMS Control Relays	BMS	BMS	BMS	N/A
Power distribution system monitoring interfaces	26	26	BMS	26
VRV Control system	23	BMS	26	26
All BMS Nodes, equipment, housings, enclosures and panels.	BMS	BMS	BMS	BMS
Smoke Detectors	26	26	26	26
Fire/Smoke Dampers	23	23	BMS	26
Fire Dampers	23	23	N/A	N/A
VFDs	23	26	BMS	26
Fire Alarm shutdown relay interlock wiring	26	26	26	26
Fire Alarm smoke control relay interlock wiring	26	26	BMS	26
Fireman's Smoke Control Override Panel	26	26	26	26
Unit Heater controls	BMS	BMS	BMS	26
Packaged RTU space mounted controls	23	BMS	BMS	26
Packaged RTU factory-mounted controls	23	23	BMS	26
Packaged RTU field-mounted controls	BMS	BMS	BMS	26
Starters, HOA switches	26	26	N/A	26
Control damper actuators	BMS	BMS	BMS	26

I. Standard Material and Labor Warranty:

1. Provide a one-year labor and material warranty on the BMS.

2. If within twelve (12) months from the date of acceptance of product, upon written notice from the owner, it is found to be defective in operation, workmanship or materials, it shall be replaced, repaired or adjusted at the option of the BMS Contractor at the cost of the BMS Contractor.
3. Maintain an adequate supply of materials within 100 miles of the Project site such that replacement of key parts and labor support, including programming. Warranty work shall be done during BMS Contractor's normal business hours.

PART 1 - PRODUCTS

1.1 GENERAL DESCRIPTION

A. The Building Management System (BMS) shall use an open architecture and fully support a multi-vendor environment. To accomplish this effectively, the BMS shall support open communication protocol standards and integrate a wide variety of third-party devices and applications. The system shall be designed for use on the Internet, or intranets using off the shelf, industry standard technology compatible with other owner provided networks.

B. The Building Management System shall consist of the following:

1. Standalone Network Automation Engine(s)
2. Field Equipment Controller(s)
3. Input/Output Module(s)
4. Local Display Device(s)
5. Portable Operator's Terminal(s)
6. Distributed User Interface(s)
7. Network processing, data storage and communications equipment
8. Other components required for a complete and working BMS

C. The system shall be modular in nature, and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, controllers and operator devices, while re-using existing controls equipment.

D. System architectural design shall eliminate dependence upon any single device for alarm reporting and control execution.

1. The failure of any single component or network connection shall not interrupt the execution of control strategies at other operational devices.
2. The System shall maintain all settings and overrides through a system reboot.

E. System architectural design shall eliminate dependence upon any single device for alarm reporting and control execution.

1.2 BMS ARCHITECTURE

A. Automation Network

1. The automation network shall be based on a PC industry standard of Ethernet TCP/IP. Where used, LAN controller cards shall be standard "off the shelf" products available through normal PC vendor channels.
2. All BMS devices on the automation network shall be capable of operating at a communication speed of 100 Mbps, with full peer-to-peer network communication.

3. Network Automation Engines (NAE) shall reside on the automation network.
4. The automation network will be compatible with other enterprise-wide networks. Where indicated, the automation network shall be connected to the enterprise network and share resources with it by way of standard networking devices and practices.

B. Control Network

1. Network Automation Engines (NAE) shall provide supervisory control over the control network and shall support all three (3) of the following communication protocols:
   a. BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135, Clause 9
      i. The NAE shall be BACnet Testing Labs (BTL) certified and carry the BTL Label.
      ii. The NAE shall be tested and certified as a BACnet Building Controller (B-BC).
2. Control networks shall provide either “Peer-to-Peer,” Master-Slave, or Supervised Token Passing communications, and shall operate at a minimum communication speed of 9600 baud.
3. DDC Controllers shall reside on the control network.
4. Control network communication protocol shall be BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135.
5. A BACnet Protocol Implementation Conformance Statement (PICS) shall be provided for each controller device (master or slave) that will communicate on the BACnet MS/TP Bus.
6. The PICS shall be submitted 10 days prior to bidding.

C. Integration

1. Hardwired
   a. Analog and digital signal values shall be passed from one system to another via hardwired connections.
   b. There will be one separate physical point on each system for each point to be integrated between the systems.
2. Direct Protocol (Integrator Panel)
   a. The BMS system shall include appropriate hardware equipment and software to allow bi-directional data communications between the BMS system and 3rd party manufacturers’ control panels. The BMS shall receive, react to, and return information from multiple building systems, including but not limited to the chillers, boilers, variable frequency drives, power monitoring system, and medical gas.
   b. All data required by the application shall be mapped into the Automation Engine’s database, and shall be transparent to the operator.
   c. Point inputs and outputs from the third-party controllers shall have real-time interoperability with BMS software features such as: Control Software, Energy Management, Custom Process Programming, Alarm Management, Historical Data and Trend Analysis, Totalization, and Local Area Network Communications.
3. BACnet Protocol Integration - BACnet
   a. The neutral protocol used between systems will be BACnet over Ethernet and comply with the ASHRAE BACnet standard 135-2003.
   b. A complete Protocol Implementation Conformance Statement (PICS) shall be provided for all BACnet system devices.
   c. The ability to command, share point object data, change of state (COS)

data and schedules between the host and BACnet systems shall be provided.

1.3 USER INTERFACE

A. Dedicated Web Based User Interface

1. Where indicated on plans the BMS Contractor shall provide and install a personal computer or laptop for command entry, information management, network alarm management, and database management functions. All real-time control functions, including scheduling, history collection and alarming, shall be resident in the BMS Network Automation Engines to facilitate greater fault tolerance and reliability.
2. Dedicated User Interface Architecture – The architecture of the computer shall be implemented to conform to industry standards, so that it can accommodate applications provided by the BMS Contractor and by other third party applications suppliers, including but not limited to Microsoft Office Applications. Specifically it must be implemented to conform to the following interface standards.
    a. Microsoft Internet Explorer for user interface functions
    b. Microsoft Office Professional for creation, modification and maintenance of reports, sequences other necessary building management functions
    c. Microsoft Outlook or other e-mail program for supplemental alarm functionality and communication of system events, and reports
    d. Required network operating system for exchange of data and network functions such as printing of reports, trends and specific system summaries
3. PC Hardware – The personal computer(s) shall be configured as a minimum as follows:
    a. Memory – 1 GB (512 MB Minimum)
    b. CPU– Pentium 4 processor. 2.8 Hz Clock Speed (2.0 GHz minimum)
    c. Hard Drive – 80 GB free hard drive space (40GB minimum)
    d. Hard drive backup system – CD/RW, DVD/RW or network backup software provided by IT department
    e. CD ROM Drive – 32X performance
    f. Ports – (2) Serial and (1) parallel, (2) USB ports
    g. Keyboard – 101 Keyboard and 2 Button Mouse
    h. CRT configuration – 1-2 CRTs as follows:
        i. Each Display – 17” Flat Panel Monitor 1280 x 1024 resolution minimum
        ii. 16 bit or higher color resolution
        iii. Display card with multiple monitor support
    i. LAN communications – Ethernet communications board; 3Comm or equal
4. Operating System Software
    a. Windows XP Professional
    b. Where user interface is not provided via browser, provide complete operator workstation software package, including any hardware or software keys. Include the original installation disks and licenses for all included software, device drivers, and peripherals.
    c. Provide software registration cards to the Owner for all included software.
5. Peripheral Hardware

a. Reports printer:
    i. Printer Make – Hewlett Packard DeskJet
    ii. Print Speed – 600 DPI Black, 300 DPI Color
    iii. Buffer – 64 K Input Print Buffer
    iv. Color Printing – Include Color Kit

B. Distributed Web Based User Interface

1. All features and functions of the dedicated user interface previously defined in this document shall be available on any computer connected directly or via a wide area or virtual private network (WAN/VPN) to the automation network and conforming to the following specifications.
2. The software shall run on the Microsoft Internet Explorer (6.0 or higher) browser supporting the following functions:
    a. Configuration
    b. Commissioning
    c. Data Archiving
    d. Monitoring
    e. Commanding
    f. System Diagnostics
3. Minimum hardware requirements:
    a. 512 MB RAM
    b. 2.0 GHz Clock Speed Pentium 4 Microprocessor
    c. 100.0 GB Hard Drive.
    d. 1 Keyboard with 83 keys (minimum).
    e. SVGA 1024x768 resolution display with 64K colors and 16 bit color depth
    f. Mouse or other pointing device

C. Site Management User Interface Application Components

1. Operator Interface
    a. An integrated browser based client application shall be used as the user operator interface program.
    b. The System shall employ an event-driven rather than a device polling methodology to dynamically capture and present new data to the user.
    c. All Inputs, Outputs, Setpoints, and all other parameters as defined within Part 3, shown on the design drawings, or required as part of the system software, shall be displayed for operator viewing and modification from the operator interface software.
    d. The user interface software shall provide help menus and instructions for each operation and/or application.
    e. The system shall support customization of the UI configuration and a home page display for each operator.
    f. The system shall support user preferences in the following screen presentations:
        i. Alarm
        ii. Trend
        iii. Display
        iv. Applications
    g. All controller software operating parameters shall be displayed for the operator to view/modify from the user interface. These include: setpoints, alarm limits, time delays, PID tuning constants, run-times, point statistics, schedules, and so forth.
    h. The Operator Interface shall incorporate comprehensive support for

functions including, but not necessarily limited to, the following:

i. User access for selective information retrieval and control command execution
ii. Monitoring and reporting
iii. Alarm, non-normal, and return to normal condition annunciation
iv. Selective operator override and other control actions
v. Information archiving, manipulation, formatting, display and reporting
vi. BMS internal performance supervision and diagnostics
vii. On-line access to user HELP menus
viii. On-line access to current BMS as-built records and documentation
ix. Means for the controlled re-programming, re-configuration of BMS operation and for the manipulation of BMS database information in compliance with the prevailing codes, approvals and regulations for individual BMS applications

i. The system shall support a list of application programs configured by the users that are called up by the following means:
   i. The Tools Menu
   ii. Hyperlinks within the graphics displays
   iii. Key sequences

j. The operation of the control system shall be independent of the user interface, which shall be used for operator communications only. Systems that rely on an operator workstation to provide supervisory control over controller execution of the sequences of operations or system communications shall not be acceptable.

2. Navigation Trees
   a. The system will have the capability to display multiple navigation trees that will aid the operator in navigating throughout all systems and points connected. At minimum provide a tree that identifies all systems on the networks.
   b. Provide the ability for the operator to add custom trees. The operator will be able to define any logical grouping of systems or points and arrange them on the tree in any order. It shall be possible to nest groups within other groups. Provide at minimum 5 levels of nesting.
   c. The navigation trees shall be “dockable” to other displays in the user interface such as graphics. This means that the trees will appear as part of the display, but can be detached and then minimized to the Windows task bar or closed altogether. A simple keystroke will reattach the navigation to the primary display of the user interface.
3. Alarms
   a. Alarms shall be routed directly from Network Automation Engines to PCs and servers. It shall be possible for specific alarms from specific points to be routed to specific PCs and servers. The alarm management portion of the user interface shall, at the minimum, provide the following functions:
      i. Log date and time of alarm occurrence.
      ii. Generate a “Pop-Up” window, with audible alarm, informing a user that an alarm has been received.
      iii. Allow a user, with the appropriate security level, to acknowledge, temporarily silence, or discard an alarm.
      iv. Provide an audit trail on hard drive for alarms by recording user

acknowledgment, deletion, or disabling of an alarm. The audit trail shall include the name of the user, the alarm, the action taken on the alarm, and a time/date stamp.

v. Provide the ability to direct alarms to an e-mail address or alphanumeric pager. This must be provided in addition to the pop up window described above. Systems that use e-mail and pagers as the exclusive means of annunciating alarms are not acceptable.

vi. Any attribute of any object in the system may be designated to report an alarm.

b. The BMS shall annunciate diagnostic alarms indicating system failures and non-normal operating conditions.

c. The BMS shall allow a minimum of 4 categories of alarm sounds customizable through user defined wav.files.

d. The BMS shall annunciate application alarms at minimum, as required by Part 3.

4. Reports and Summaries

a. Reports and Summaries shall be generated and directed to the user interface displays, with subsequent assignment to printers, or disk. As a minimum, the system shall provide the following reports:

i. All points in the BMS

ii. All points in each BMS application

iii. All points in a specific controller

iv. All points in a user-defined group of points

v. All points currently in alarm

vi. All points locked out

vii. All BMS schedules

viii. All user defined and adjustable variables, schedules, interlocks and the like.

b. Summaries and Reports shall be accessible via standard UI functions and not dependent upon custom programming or user defined HTML pages.

c. Selection of a single menu item, tool bar item, or tool bar button shall print any displayed report or summary on the system printer for use as a building management and diagnostics tool.

d. The system shall allow for the creation of custom reports and queries via a standard web services XML interface and commercial off-the-shelf software such as Microsoft Access, Microsoft Excel, or Crystal Reports.

e. Provide the capability to view, command and modify large quantities of similar data in tailored summaries created online without the use of a secondary application like a spreadsheet. Summary definition shall allow up to seven user defined columns describing attributes to be displayed including custom column labels. Up to 100 rows per summary shall be supported. Summary viewing shall be available over the network using a standard Web browser.

f. Provide a focused set of reports that includes essential information required for effective management of energy resources within the facility. Energy reports shall be configurable from predefined, preconfigured templates. Required includes but shall not be limited to:

i. Energy Overview

ii. Load Profile

iii. Simple Energy Cost

iv. Consumption
v. Equipment Runtime
vi. Electrical Energy
vii. Energy Production
viii. Reports shall be selectable by date, time, area and device. Each report shall include a color visual summary of essential energy information.

5. Schedules
   a. A graphical display for time-of-day scheduling and override scheduling of building operations shall be provided. At a minimum, the following functions shall be provided:
      i. Weekly schedules
      ii. Exception Schedules
      iii. Monthly calendars
   b. Weekly schedules shall be provided for each group of equipment with a specific time use schedule.
   c. It shall be possible to define one or more exception schedules for each schedule including references to calendars
   d. Monthly calendars shall be provided that allow for simplified scheduling of holidays and special days for a minimum of five years in advance. Holidays and special days shall be user-selected with the pointing device or keyboard, and shall automatically reschedule equipment operation as previously defined on the exception schedules.
   e. Changes to schedules made from the User Interface shall directly modify the Network Automation Engine schedule database.
   f. Schedules and Calendars shall comply with ASHRAE SP135/2003 BACnet Standard.
   g. Selection of a single menu item or tool bar button shall print any displayed schedule on the system printer for use as a building management and diagnostics tool.
   h. Software shall be provided to configure and implement optimal start and stop programming based on existing indoor and outdoor environmental conditions as well as equipment operating history
6. Password
   a. Multiple-level password access protection shall be provided to allow the user/manager to user interface control, display, and database manipulation capabilities deemed appropriate for each user, based on an assigned password.
   b. Each user shall have the following: a user name (accept 24 characters minimum), a password (accept 12 characters minimum), and access levels.
   c. The system shall allow each user to change his or her password at will.
   d. When entering or editing passwords, the system shall not echo the actual characters for display on the monitor.
   e. A minimum of five levels of access shall be supported individually or in any combination as follows:
      i. Level 1 = View Data
      ii. Level 2 = Command
      iii. Level 3 = Operator Overrides
      iv. Level 4 = Database Modification
      v. Level 5 = Database Configuration
      vi. Level 6 = All privileges, including Password Add/Modify
   f. A minimum of 100 unique passwords shall be supported.

g. Operators shall be able to perform only those commands available for their respective passwords. Display of menu selections shall be limited to only those items defined for the access level of the password used to log-on.

h. The system shall automatically generate a report of log-on/log-off and system activity for each user. Any action that results in a change in the operation or configuration of the control system shall be recorded, including: modification of point values, schedules or history collection parameters, and all changes to the alarm management system, including the acknowledgment and deletion of alarms.

7. Screen Manager
   a. The User Interface shall be provided with screen management capabilities that allow the user to activate, close, and simultaneously manipulate a minimum of 4 active display windows plus a network or user defined navigation tree.
8. Dynamic Color Graphics
   a. The graphics application program shall be supplied as an integral part of the User Interface. Browser or Workstation applications that rely only upon HTML pages shall not be acceptable.
   b. The graphics applications shall include a create/edit function and a runtime function. The system architecture shall support an unlimited number of graphics documents (graphic definition files) to be generated and executed.
   c. The graphics shall be able to display and provide animation based on real-time data that is acquired, derived, or entered.
   d. Graphics runtime functions – A maximum of 16 graphic applications shall be able to execute at any one time on a user interface or workstation with 4 visible to the user. Each graphic application shall be capable of the following functions:
      i. All graphics shall be fully scalable
      ii. The graphics shall support a maintained aspect ratio.
      iii. Multiple fonts shall be supported.
      iv. Unique background shall be assignable on a per graphic basis.
      v. The color of all animations and values on displays shall indicate if the status of the object attribute.
   e. Operation from graphics – It shall be possible to change values (setpoints) and states in system controlled equipment by using drop-down windows accessible via the pointing device
   f. Graphic editing tool – A graphic editing tool shall be provided that allows for the creation and editing of graphic files. The graphic editor shall be capable of performing/defining all animations, and defining all runtime binding.
      i. The graphic editing tool shall in general provide for the creation and positioning of point objects by dragging from tool bars or drop-downs and positioning where required.
      ii. In addition, the graphic editing tool shall be able to add additional content to any graphic by importing backgrounds in the SVG, BMP or JPG file formats.
   g. Aliasing – Many graphic displays representing part of a building and various building components are exact duplicates, with the exception that the various variables are bound to different field values. Consequently, it shall be possible to bind the value of a graphic display

to aliases, as opposed to the physical field tags.

9. Historical trending and data collection
    a. Each Automation Engine shall store trend and point history data for all analog and digital inputs and outputs, as follows:
        i. Any point, physical or calculated, may be designated for trending. Three methods of collection shall be allowed:
            Defined time interval
            Upon a change of value
        ii. Each Automation Engine shall have the capability to store multiple samples for each physical point and software variable based upon available memory, including an individual sample time/date stamp. Points may be assigned to multiple history trends with different collection parameters.
10. Trend data viewing and analysis
    a. Provide a trend viewing utility that shall have access to all database points.
    b. It shall be possible to retrieve any historical database point for use in displays and reports by specifying the point name and associated trend name.
    c. The trend viewing utility shall have the capability to define trend study displays to include multiple trends
    d. Displays shall be able to be single or stacked graphs with on-line selectable display characteristics, such as ranging, color, and plot style.
    e. Display magnitude and units shall both be selectable by the operator at any time without reconfiguring the processing or collection of data. This is a zoom capability.
    f. Display magnitude shall automatically be scaled to show full graphic resolution of the data being displayed.
    g. Trend studies shall be capable of calculating and displaying calculated variables including highest value, lowest value and time based accumulation.
    h. The Display shall support the user's ability to change colors, sample sizes, and types of markers.
11. Database Management
    a. Where a separate SQL database is utilized for information storage the System shall provide a Database Manager that separates the database monitoring and managing functions by supporting two separate windows.
    b. Database secure access shall be accomplished using standard SQL authentication including the ability to access data for use outside of the Building Automation application.
    c. The database managing function shall include summarized information on trend, alarm, event, and audit for the following database management actions:
        i. Backup
        ii. Purge
        iii. Restore
    d. The Database Manager shall support four tabs:
        i. Statistics – shall display Database Server information and Trend, Alarm (Event), and Audit information on the Databases.
        ii. Maintenance – shall provide an easy method of purging records from the Server trend, alarm (event), and audit

databases by supporting separate screens for creating a backup prior to purging, selecting the database, and allowing for the retention of a selected number of day's data.

iii. Backup – Shall provide the means to create a database backup file and select a storage location.

iv. Restore – shall provide a restricted means of restoring a database by requiring the user to log into an Expert Mode in order to view the Restore screen.

e. The Status Bar shall appear at the bottom of all Database Manager Tabs and shall provide information on the current database activity. The following icons shall be provided:

i. Ready
ii. Purging Record from a database
iii. Action Failed
iv. Refreshing Statistics
v. Restoring database
vi. Shrinking a database
vii. Backing up a database
viii. Resetting internet information Services
ix. Starting the Device Manager
x. Shutting down the Device Manager
xi. Action successful

f. The Database Manager monitoring functions shall be accessed through the Monitoring Settings window and shall continuously read database information once the user has logged in.

g. The System shall provide user notification via taskbar icons and e-mail messages when a database value has exceeded a warning or alarm limit.

h. The Monitoring Settings window shall have the following sections:

i. General – Shall allow the user to set and review scan intervals and start times.

ii. Email – Shall allow the user to create and review e-mail and phone text messages to be delivered when a Warning or Alarm is generated.

iii. Warning – shall allow the user to define the Warning limit parameters, set the Reminder Frequency, and link the e-mail message.

iv. Alarm – shall allow the user to define the Alarm limit parameters, set the Reminder Frequency, and link the e-mail message.

v. Database login – Shall protect the system from unauthorized database manipulation by creating a Read Access and a Write Access for each of the Trend, Alarm (Event) and Audit databases as well as an Expert Mode required to restore a database.

i. The Monitoring Settings Taskbar shall provide the following informational icons:

i. Normal – Indicates by color and size that all databases are within their limits.

ii. Warning - Indicates by color and size that one or more databases have exceeded their Warning limit.

iii. Alarm - Indicates by color and size that one or more databases have exceeded their Alarm limit.

j. The System shall provide user notification via Taskbar icons and e-mail messages when a database value has exceeded a warning or alarm limit.

12. Portable Operator Terminal
    a. For systems that do not provide full access to systems configuration and definition via the Browser Based user interface the BMS Contractor shall provide a portable operator terminal for programming purposes. The terminal shall be configured as follows:
        i. Personal Laptop Computer Manufacturer – Dell, Compaq or HP
        ii. 1 GB RAM (256 MB minimum) – XP Professional
        iii. 1.8 GHz Clock Speed Pentium 4 Microprocessor (800 MHz minimum)
        iv. 40 GB Hard Drive (40 GB minimum)
        v. (1) CD-ROM Drive, 32x speed
        vi. (1) Serial (1) Parallel (2) USB ports
        vii. 1 Keyboard with 83 keys (minimum).
        viii. Integral 2 button Track Point or Track Ball.
        ix. 10” SVGA 1024x768 resolution color display
        x. Two PCMCIA Type II or one Type III card slot
        xi. Complete operator workstation software package, including any hardware or software.
        xii. Original printed manuals for all software and peripherals.
        xiii. Original installation disks or CD for all software, device drivers, and peripherals
        xiv. Software registration cards for all included software shall be provided to the Owner.
        xv. Carrying case
        xvi. Spare battery.
        xvii. External power supply/battery charger

13. Proprietary Portable Terminal
    a. Manufacturers providing proprietary portable terminals shall submit technical data sheets for the terminal and all associated software and hardware.
    b. The proprietary terminal shall meet the same operator interface software requirements as specified above.

14. Software
    a. Portable operator terminals shall support all controllers within the system on a direct-connect communications basis.
    b. When used to access First or Second Tier controllers, the portable operator terminal shall utilize the standard operator workstation software, as previously defined.
    c. When used to access Application Specific Controllers, the portable operator terminal shall utilize either the standard operator workstation software, as previously defined, or controller-specific utility software.

1.4 NETWORK AUTOMATION ENGINES (NAE)

A. Network Automation Engine (NAE)

1. The Network Automation Engine (NAE) shall be a fully user-programmable, supervisory controller. The NAE shall monitor the network of distributed application-specific controllers, provide global strategy and direction, and communicate on a peer-to-peer basis with other Network Automation Engines.

2. Automation network – The NAE shall reside on the automation network and shall support a subnet of system controllers.
3. User Interface – Each NAE shall have the ability to deliver a web based User Interface (UI) as previously described. All computers connected physically or virtually to the automation network shall have access to the web based UI.
    a. The web based UI software shall be imbedded in the NAE. Systems that require a local copy of the system database on the user's personal computer are not acceptable.
    b. The NAE shall support up a minimum of four (4) concurrent users.
    c. The web based user shall have the capability to access all system data through one NAE.
    d. Remote users connected to the network through an Internet Service Provider (ISP) or telephone dial up shall also have total system access through one NAE.
    e. Systems that require the user to address more than one NAE to access all system information are not acceptable.
    f. The NAE shall have the capability of generating web based UI graphics. The graphics capability shall be imbedded in the NAE.
    g. Systems that support UI Graphics from a central database or require the graphics to reside on the user's personal computer are not acceptable.
    h. The web based UI shall support the following functions using a standard version of Microsoft Internet Explorer:
        i. Configuration
        ii. Commissioning
        iii. Data Archiving
        iv. Monitoring
        v. Commanding
        vi. System Diagnostics
    i. Systems that require workstation software or modified web browsers are not acceptable.
    j. The NAE shall allow temporary use of portable devices without interrupting the normal operation of permanently connected modems.
4. Processor – The NAE shall be microprocessor-based with a minimum word size of 32 bits. The NAE shall be a multi-tasking, multi-user, and real-time digital control processor. Standard operating systems shall be employed. NAE size and capability shall be sufficient to fully meet the requirements of this Specification.
5. Memory – Each NAE shall have sufficient memory to support its own operating system, databases, and control programs, and to provide supervisory control for all control level devices.
6. Hardware Real Time Clock – The NAE shall include an integrated, hardware-based, real-time clock.
7. The NAE shall include troubleshooting LED indicators to identify the following conditions:
    a. Power - On/Off
    b. Ethernet Traffic – Ethernet Traffic/No Ethernet Traffic
    c. Ethernet Connection Speed – 10 Mbps/100 Mbps
    d. FC Bus A – Normal Communications/No Field Communications
    e. FC Bus B – Normal Communications/No Field Communications
    f. Peer Communication – Data Traffic between NAE Devices
    g. Run – NAE Running/NAE in Startup/NAE Shutting Down/Software Not Running

h. Bat Fault – Battery Defective, Data Protection Battery Not Installed
i. 24 VAC – 24 VAC Present/Loss Of 24VAC
j. Fault – General Fault
k. Modem RX – NAE Modem Receiving Data
l. Modem TX – NAE Modem Transmitting Data

8. Communications Ports – The NAE shall provide the following ports for operation of operator Input/Output (I/O) devices, such as industry-standard computers, modems, and portable operator's terminals.
   a. Two (2) USB port
   b. Two (2) URS-232 serial data communication port
   c. Two (2) RS-485 port
   d. One (1) Ethernet port
9. Diagnostics – The NAE shall continuously perform self-diagnostics, communication diagnosis, and diagnosis of all panel components. The Network Automation Engine shall provide both local and remote annunciation of any detected component failures, low battery conditions, or repeated failures to establish communication.
10. Power Failure – In the event of the loss of normal power, The NAE shall continue to operate for a user adjustable period of up to 10 minutes after which there shall be an orderly shutdown of all programs to prevent the loss of database or operating system software.
    a. During a loss of normal power, the control sequences shall go to the normal system shutdown conditions. All critical configuration data shall be saved into Flash memory.
    b. Upon restoration of normal power and after a minimum off-time delay, the controller shall automatically resume full operation without manual intervention through a normal soft-start sequence.
11. Certification – The NAE shall be listed by Underwriters Laboratories (UL).
12. Controller network – The NAE shall support the following communication protocols on the controller network:
    a. The NAE shall support BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135, Clause 9 on the controller network.
       i. The NAE shall be BACnet Testing Labs (BTL) certified and carry the BTL Label.
       ii. The NAE shall be tested and certified as a BACnet Building Controller (B-BC).
       iii. A BACnet Protocol Implementation Conformance Statement shall be provided for the NAE.
       iv. The Conformance Statements shall be submitted 10 days prior to bidding.
       v. The NAE shall support a minimum of 100 control devices.
    b. The NAE shall support the Field Bus.
       i. The NAE shall support a minimum of 100 N2 control devices.
       ii. The Bus shall conform to Electronic Industry Alliance (EIA) Standard RS-485.
       iii. The Bus shall employ a master/slave protocol where the NAE is the master.
       iv. The Bus shall employ a four (4) level priority system for polling frequency.
       v. The Bus shall be optically isolated from the NAE.
       vi. The Bus shall support the Integrator System.

1.5 DDC SYSTEM CONTROLLERS

A. Field Equipment Controller (FEC)

1. The Field Equipment Controller (FEC) shall be a fully user-programmable, digital controller that communicates via BACnet MS/TP protocol.
    a. The FEC shall support BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135, Clause 9 on the controller network.
        i. The FEC shall be BACnet Testing Labs (BTL) certified and carry the BTL Label.
        ii. The FEC shall be tested and certified as a BACnet Application Specific Controller (B-ASC).
        iii. A BACnet Protocol Implementation Conformance Statement shall be provided for the FEC.
        iv. The Conformance Statement shall be submitted 10 days prior to bidding.
2. The FEC shall employ a finite state control engine to eliminate unnecessary conflicts between control functions at crossover points in their operational sequences. Suppliers using non-state based DDC shall provide separate control strategy diagrams for all controlled functions in their submittals.
3. Controllers shall be factory programmed with a continuous adaptive tuning algorithm that senses changes in the physical environment and continually adjusts loop tuning parameters appropriately. Controllers that require manual tuning of loops or perform automatic tuning on command only shall not be acceptable.
4. The FEC shall be assembled in a plenum-rated plastic housing with flammability rated to UL94-5VB.
5. The FEC shall include troubleshooting LED indicators to identify the following conditions:
    a. Power On
    b. Power Off
    c. Download or Startup in progress, not ready for normal operation
    d. No Faults
    e. Device Fault
    f. Field Controller Bus - Normal Data Transmission
    g. Field Controller Bus - No Data Transmission
    h. Field Controller Bus - No Communication
    i. Sensor-Actuator Bus - Normal Data Transmission
    j. Sensor-Actuator Bus - No Data Transmission
    k. Sensor-Actuator Bus - No Communication
6. The FEC shall accommodate the direct wiring of analog and binary I/O field points.
7. The FEC shall support the following types of inputs and outputs:
    a. Universal Inputs - shall be configured to monitor any of the following:
        i. Analog Input, Voltage Mode
        ii. Analog Input, Current Mode
        iii. Analog Input, Resistive Mode
        iv. Binary Input, Dry Contact Maintained Mode
        v. Binary Input, Pulse Counter Mode
    b. Binary Inputs - shall be configured to monitor either of the following:
        i. Dry Contact Maintained Mode
        ii. Pulse Counter Mode
    c. Analog Outputs - shall be configured to output either of the following
        i. Analog Output, Voltage Mode
        ii. Analog Output, current Mode

d. Binary Outputs - shall output the following:
   i. 24 VAC Triac
e. Configurable Outputs - shall be capable of the following:
   i. Analog Output, Voltage Mode
   ii. Binary Output Mode

8. The FEC shall have the ability to reside on a Field Controller Bus (FC Bus).
   a. The FC Bus shall be a Master-Slave/Token-Passing (MS/TP) Bus supporting BACnet Standard protocol SSPC-135, Clause 9.
   b. The FC Bus shall support communications between the FECs and the NAE.
   c. The FC Bus shall also support Input/Output Module (IOM) communications with the FEC and with the NAE.
   d. The FC Bus shall support a minimum of 100 IOMs and FECs in any combination.
   e. The FC Bus shall operate at a maximum distance of 15,000 Ft. between the FEC and the furthest connected device.
9. The FEC shall have the ability to monitor and control a network of sensors and actuators over a Sensor-Actuator Bus (SA Bus).
   a. The SA Bus shall be a Master-Slave/Token-Passing (MS/TP) Bus supporting BACnet Standard Protocol SSPC-135, Clause 9.
   b. The SA Bus shall support a minimum of 10 devices per trunk.
   c. The SA Bus shall operate at a maximum distance of 1,200 Ft. between the FEC and the furthest connected device.
10. The FEC shall have the capability to execute complex control sequences involving direct wired I/O points as well as input and output devices communicating over the FC Bus or the SA Bus.
11. The FEC shall support, but not be limited to, the following applications:
    a. Central plant applications.
    b. Heating central plant applications
    c. Built-up air handling units for special applications
    d. Terminal & package units
    e. Special programs as required for systems control.

1.6 FIELD DEVICES

A. Input/Output Module (IOM)

1. The Input/Output Module (IOM) provides additional inputs and outputs for use in the FEC.
2. The IOM shall communicate with the FEC over the FC Bus or the SA Bus.
3. The IOM shall support BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135, Clause 9 on the controller network.
   a. The IOM shall be BACnet Testing Labs (BTL) certified and carry the BTL Label.
   b. The IOM shall be tested and certified as a BACnet Application Specific Controller (B-ASC).
   c. A BACnet Protocol Implementation Conformance Statement shall be provided for the FEC.
   d. The Conformance Statement shall be submitted 10 days prior to bidding.
4. The IOM shall be assembled in a plenum-rated plastic housing with flammability rated to UL94-5VB.
5. The IOM shall have a minimum of 4 points to a maximum of 17 points.
6. The IOM shall support the following types of inputs and outputs:

a. Universal Inputs - shall be configured to monitor any of the following:
    i. Analog Input, Voltage Mode
    ii. Analog Input, Current Mode
    iii. Analog Input, Resistive Mode
    iv. Binary Input, Dry Contact Maintained Mode
    v. Binary Input, Pulse Counter Mode
b. Binary Inputs - shall be configured to monitor either of the following:
    i. Dry Contact Maintained Mode
    ii. Pulse Counter Mode
c. Analog Outputs - shall be configured to output either of the following
    i. Analog Output, Voltage Mode
    ii. Analog Output, current Mode
d. Binary Outputs - shall output the following:
    i. 24 VAC Triac
e. Configurable Outputs - shall be capable of the following:
    i. Analog Output, Voltage Mode
    ii. Binary Output Mode

7. The IOM shall include troubleshooting LED indicators to identify the following conditions:
    a. Power On
    b. Power Off
    c. Download or Startup in progress, not ready for normal operation
    d. No Faults
    e. Device Fault
    f. Normal Data Transmission
    g. No Data Transmission
    h. No Communication

B. VAV Zone Controller

1. Pressure independent with integral actuator with advanced precision air-flow sensor.
2. Fully programmable and provide networked peer-to-peer communications using native BACnet-over-ARCNET 156 Kbps or MS/TP.
3. Built-in 0-10 V-dc A0
4. High speed 16-bit microprocessor with 1MByte Flash memory and 512 Kbyte of RAM.
5. Controller to be Automated Logic ZN341V+/ZN141V+.

C. Networked Thermostat (TEC)

1. The Networked Thermostat shall be capable of controlling a rooftop unit, VAV box, cabinet unit heater or other similar equipment with single-speed fan control.
2. The TEC shall communicate over the Field Controller Bus using BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135, Clause 9.
3. The TEC shall be BACnet Testing Labs (BTL) certified and carry the BTL Label.
    a. The TEC shall be tested and certified as a BACnet Application Specific Controller (B-ASC).
    b. A BACnet Protocol Implementation Conformance Statement shall be provided for the TEC.
    c. The Conformance Statement shall be submitted 10 days prior to bidding.

d. The Networked Thermostat shall communicate over the FC Bus using BACnet Standard protocol SSPC-135, Clause 9.
e. The Networked Thermostat shall be capable of remote read/write and parameter adjustment from the web based User Interface (UI) through an NAE.
f. The Networked Thermostat shall include an intuitive UI providing plain text messages.
g. Two line, 8 character backlit display
h. LED indicators for Fan, Heat, and Cool status
i. Five (5) User Interface Keys
    i. Mode
    ii. Fan
    iii. Override
    iv. Up
    v. Down
j. The display shall continuously scroll through the following parameters:
    i. Room Temperature
    ii. System Mode
    iii. Schedule Status – Occupied/Unoccupied/Override
    iv. Applicable Alarms

4. The Networked Thermostat shall provide the flexibility to support any one of the following inputs:
    a. Integral Indoor Air Temperature Sensor
    b. Duct Mount Air Temperature Sensor
    c. Indoor Air Temperature Sensor with Occupancy Override and LED Indicator
    d. Two configurable binary inputs
5. The Networked Thermostat shall provide the flexibility to support either of the following outputs:
    a. One (1) fan control
    b. One Proportional (0 to 10V)
6. The Networked Thermostat shall provide a minimum of six (6) levels of keypad lockout.
7. The Networked Thermostat shall provide the flexibility to adjust the following parameters:
    a. Adjustable Temporary Occupancy from 0 to 24 hours
    b. Adjustable heating/cooling deadband from 2º F to 5º F
    c. Adjustable heating/cooling cycles per hour from 4 to 8
8. Where required by application and indicated on plans or room schedules provide the Networked Thermostat with an integral Passive Infra-Red (PIR) occupancy sensor.
9. The Networked Thermostat shall employ nonvolatile electrically erasable programmable read-only memory (EEPROM) for all adjustable parameters.

D. Network Sensors (NS)

1. The Network Sensors (NS) shall have the ability to monitor the following variables as required by the systems sequence of operations:
    a. Zone Temperature
    b. Zone Humidity
    c. Zone Setpoint
    d. Discharge Air Temperature
    e. Zone CO2
2. The NS shall transmit the information back to the controller on the Sensor-

Actuator Bus (SA Bus) using BACnet Standard protocol SSPC-135, Clause 9.

3. The NS shall be BACnet Testing Labs (BTL) certified and carry the BTL Label.
   a. The NS shall be tested and certified as a BACnet Smart Sensors (B-SS).
   b. A BACnet Protocol Implementation Conformance Statement shall be provided for the NS.
   c. The Conformance Statement shall be submitted 10 days prior to bidding.
4. The Network Zone Temperature Sensors shall include the following items:
   a. A backlit Liquid Crystal Display (LCD) to indicate the Temperature, Humidity and Setpoint
   b. An LED to indicate the status of the Override feature
   c. A button to toggle the temperature display between Fahrenheit and Celsius
   d. A button to initiate a timed override command
   e. Available in either surface mount or wall mount
   f. Available with either screw terminals or phone jack
5. The Network Discharge Air Sensors shall include the following:
   a. 4 inch or 8 inch duct insertion probe
   b. 10 foot pigtail lead
   c. Dip Switches for programmable address selection
   d. Ability to provide an averaging temperature from multiple locations
   e. Ability to provide a selectable temperature from multiple locations
6. The Network CO2 Zone Sensors shall include the following:
   a. Available in either surface mount or wall mount
   b. Available with screw terminals or phone jack.

1.7 SYSTEM TOOLS

A. System Configuration Tool (SCT)

1. The Configuration Tool shall be a software package enabling a computer platform to be used as a stand-alone engineering configuration tool for a Network Automation Engine (NAE).
2. The configuration tool shall provide an archive database for the configuration and application data.
3. The configuration tool shall have the same look-and-feel at the User Interface (UI) regardless of whether the configuration is being done online or offline.
4. The configuration tool shall include the following features:
   a. Basic system navigation tree for connected networks
   b. Integration of BACnet enabled devices
   c. Customized user navigation trees
   d. Point naming operating parameter setting
   e. Graphic diagram configuration
   f. Alarm and event message routing
   g. Graphical logic connector tool for custom programming
   h. Downloading, uploading, and archiving databases
5. The configuration tool shall have the capability to automatically discover field devices on connected buses and networks. Automatic discovery shall be available for the following field devices:
   a. BACnet Devices
   b. N2 Bus devices
6. The configuration tool shall be capable of programming the Field Equipment Controllers.

a. The configuration tool shall provide the capability to configure, simulate, and commission the Field Equipment Controllers.
b. The configuration tool shall allow the FECs to be run in Simulation Mode to verify the applications.
c. The configuration tool shall contain a library of standard applications to be used for configuration.

7. The configuration tool shall be capable of programming the field devices.
   a. The configuration tool shall provide the capability to configure, simulate, and commission the field devices.
   b. The configuration tool shall allow the field devices to be run in Simulation Mode to verify the applications.
   c. The configuration tool shall contain a library of standard applications to be used for configuration
8. A wireless access point shall allow a wireless enabled portable PC to make a temporary Ethernet connection to the automation network.
   a. The wireless connection shall allow the PC to access configuration tool through the web browser using the User Interface (UI).
   b. The wireless use of configuration tool shall be the same as a wired connection in every respect.
   c. The wireless connection shall use the Bluetooth Wireless Technology.
   d. Input Devices

B. General Requirements

1. Installation, testing, and calibration of all sensors, transmitters, and other input devices shall be provided to meet the system requirements.

C. Temperature Sensors

1. General Requirements:
   a. Sensors and transmitters shall be provided, as outlined in the input/output summary and sequence of operations.
   b. The temperature sensor shall be of the resistance type, and shall be either two-wire 1000 ohm nickel RTD, or two-wire 1000 ohm platinum RTD.
   c. The following point types (and the accuracy of each) are required, and their associated accuracy values include errors associated with the sensor, lead wire, and A to D conversion:

Point Type	**Accuracy**
Room Temp	± .5°F.
Duct Temperature	± .5°F.
All Others	± .75°F.

2. Room Temperature Sensors
   a. Room sensors shall be constructed for either surface or wall box mounting.
   b. Room sensors shall have the following options when specified:
      i. Setpoint reset slide switch providing a +3 degree (adjustable) range.
      ii. Individual heating/cooling setpoint slide switches.
      iii. A momentary override request push button for activation of

after-hours operation.
iv. Analog thermometer.

3. Room Temperature Sensors with Integral Display
   a. Room sensors shall be constructed for either surface or wall box mounting.
   b. Room sensors shall have an integral LCD display and four button keypad with the following capabilities:
      i. Display room and outside air temperatures.
      ii. Display and adjust room comfort setpoint.
      iii. Display and adjust fan operation status.
      iv. Timed override request push button with LED status for activation of after-hours operation.
      v. Display controller mode.
      vi. Password selectable adjustment of setpoint and override modes.
      vii. Thermo wells
   c. When thermo wells are required, the sensor and well shall be supplied as a complete assembly, including wellhead and Greenfield fitting.
   d. Thermo wells shall be pressure rated and constructed in accordance with the system working pressure.
   e. Thermo wells and sensors shall be mounted in a threadolet or 1/2" NFT saddle and allow easy access to the sensor for repair or replacement.
   f. Thermo wells shall be constructed of 316 stainless steel.
4. Outside Air Sensors
   a. Outside air sensors shall be designed to withstand the environmental conditions to which they will be exposed. They shall also be provided with a solar shield.
   b. Sensors exposed to wind velocity pressures shall be shielded by a perforated plate that surrounds the sensor element.
   c. Temperature transmitters shall be of NEMA 3R construction and rated for ambient temperatures.
5. Duct Mount Sensors
   a. Duct mount sensors shall mount in an electrical box through a hole in the duct, and be positioned so as to be easily accessible for repair or replacement.
   b. Duct sensors shall be insertion type and constructed as a complete assembly, including lock nut and mounting plate.
   c. For outdoor air duct applications, a weatherproof mounting box with weatherproof cover and gasket shall be used.
6. Averaging Sensors
   a. For ductwork greater in any dimension that 48 inches and/or where air temperature stratification exists, an averaging sensor with multiple sensing points shall be used.
   b. For plenum applications, such as mixed air temperature measurements, a string of sensors mounted across the plenum shall be used to account for stratification and/or air turbulence. The averaging string shall have a minimum of 4 sensing points per 12-foot long segment.
   c. Capillary supports at the sides of the duct shall be provided to support the sensing string.

D. Humidity Sensors

1. The sensor shall be a solid-state type, relative humidity sensor of the Bulk

Polymer Design. The sensor element shall resist service contamination.

2. The humidity transmitter shall be equipped with non-interactive span and zero adjustments, a 2-wire isolated loop powered, 4-20 mA, 0-100% linear proportional output.
3. The humidity transmitter shall meet the following overall accuracy, including lead loss and Analog to Digital conversion. 3% between 20% and 80% RH @ 77 Deg F unless specified elsewhere.
4. Outside air relative humidity sensors shall be installed with a rain proof, perforated cover. The transmitter shall be installed in a NEMA 3R enclosure with sealtite fittings and stainless steel bushings.
5. A single point humidity calibrator shall be provided, if required, for field calibration. Transmitters shall be shipped factory pre-calibrated.
6. Duct type sensing probes shall be constructed of 304 stainless steel, and shall be equipped with a neoprene grommet, bushings, and a mounting bracket.

E. Differential Pressure Transmitters

1. General Air Pressure Transmitter Requirements:
   a. Pressure transmitters shall be constructed to withstand 100% pressure over-range without damage, and to hold calibrated accuracy when subject to a momentary 40% over-range input.
   b. Pressure transmitters shall transmit a 0 to 5 VDC, 0 to 10 VDC, or 4 to 20 mA output signal.
   c. A minimum of a NEMA 1 housing shall be provided for the transmitter. Transmitters shall be located in accessible local control panels wherever possible.
2. Building Differential Air Pressure Applications (-1” to +1” w.c.)
   a. The differential pressure transmitter shall be of industrial quality and transmit a linear, 4 to 20 mA output in response to variation of differential pressure or air pressure sensing points.
   b. The differential pressure transmitter shall have non-interactive zero and span adjustments that are adjustable from the outside cover and meet the following performance specifications:
      i. -1.00 to +1.00 w.c. input differential pressure ranges. (Select range appropriate for system application)
      ii. 4-20 mA output.
      iii. Maintain accuracy up to 20 to 1 ratio turndown.
      iv. Reference Accuracy: +0.2% of full span.
3. Low Differential Air Pressure Applications (0” to 5” w.c.)
   a. The differential pressure transmitter shall be of industrial quality and transmit a linear, 4 to 20 mA output in response to variation of differential pressure or air pressure sensing points.
   b. The differential pressure transmitter shall have non-interactive zero and span adjustments that are adjustable from the outside cover and meet the following performance specifications:
      i. (0.00 - 1.00” to 5.00”) w.c. input differential pressure ranges. (Select range appropriate for system application.)
      ii. 4-20 mA output.
      iii. Maintain accuracy up to 20 to 1 ratio turndown.
      iv. Reference Accuracy: +0.2% of full span.
4. Medium Differential Air Pressure Applications (5” to 21” w.c.)
   a. The pressure transmitter shall be similar to the Low Air Pressure Transmitter, except that the performance specifications are not as severe. Differential pressure transmitters shall be provided that meet

the following performance requirements:

i. Zero & span: (c/o F.S./Deg. F): .04% including linearity, hysteresis and repeatability.

ii. Accuracy: 1% F.S. (best straight line) Static Pressure Effect: 0.5% F.S. (to 100 PSIG.

iii. Thermal Effects: <+.033 F.S./Deg. F. over 40°F. to 100°F. (calibrated at 70°F.).

5. Standalone pressure transmitters shall be mounted in a bypass valve assembly panel. The panel shall be constructed to NEMA 1 standards. The transmitter shall be installed in the panel with high and low connections piped and valved. Air bleed units, bypass valves, and compression fittings shall be provided.

F. Flow Monitoring

1. Air Flow Monitoring

a. Fan Inlet Air Flow Measuring Stations

i. At the inlet of each fan and near the exit of the inlet sound trap, airflow traverse probes shall be provided that shall continuously monitor the fan air volumes and system velocity pressure.

ii. Each traverse probe shall be of a dual manifolded, cylindrical, type 3003 extruded aluminum configuration, having an anodized finish to eliminate surface pitting and unnecessary air friction. The multiple total pressure manifold shall have sensors located along the stagnation plane of the approaching airflow. The manifold should not have forward projecting sensors into the air stream. The static pressure manifold shall incorporate dual offset static tops on the opposing sides of the averaging manifold so as to be insensitive to flow-angle variations of as much as + 20° in the approaching air stream.

iii. The airflow traverse probe shall not induce a measurable pressure drop, nor shall the sound level within the duct be amplified by its singular or multiple presence in the air stream. Each airflow-measuring probe shall contain multiple total and static pressure sensors placed at equal distances along the probe length. The number of sensors on each probe and the quantity of probes utilized at each installation shall comply with the ASHRAE Standards for duct traversing.

iv. Airflow measuring stations shall be manufactured by Air Monitor Corp., Tek-Air Systems, Inc., Ebtron, or Dietrich Standard.

b. Single Probe Air Flow Measuring Sensor

i. The single probe airflow-measuring sensor shall be duct mounted with an adjustable sensor insertion length of up to eight inches. The transmitter shall produce a 4-20 mA or 0-10 VDC signal linear to air velocity. The sensor shall be a hot wire anemometer and utilize two temperature sensors and a heater element temperature. The other sensor shall measure the downstream air temperature. The temperature differential shall be directly related to airflow velocity.

c. Duct Air Flow Measuring Stations

i. Each device shall be designed and built to comply with, and

provide results in accordance with, accepted practice as defined for system testing in the ASHRAE Handbook of fundamentals, as well as in the Industrial Ventilation Handbook.

ii. Airflow measuring stations shall be fabricated of 14-gauge galvanized steel welded casing with 90 Deg. connecting flanges in configuration and size equal to that of the duct into which it is mounted. Each station shall be complete with an air directionalizer and parallel cell profile suppressor (3/4" maximum cell) across the entering air stream and mechanically fastened to the casing in such a way to withstand velocities up to 6000 feet per minute. This air directionalizer and parallel cell honeycomb suppressor shall provide 98% free area, equalize the velocity profile, and eliminate turbulent and rotational flow from the air stream prior to the measuring point.

iii. The total pressure measurement side (high side) will be designed and spaced to the Industrial Ventilation Manual 16th Edition, Page 9-5. The self-averaging manifolding will be manufactured of brass and copper components.

iv. The static pressure sensing probes (low side) shall be bullet-nosed shaped, per detailed radius, as illustrated in Industrial Ventilation Manual 16th Edition, Page 9-5.

v. The main take-off point from both the total pressure and the static pressure manifolds must be symmetrical.

vi. Total and static pressure manifolds shall terminate with external ports for connection to control tubing. An identification label shall be placed on each unit casing, listing model number, size, area, and specified airflow capacity.

vii. Installation Considerations

a) The maximum allowable pressure loss through the Flow and Static Pressure elements shall not exceed .065" w.c. at 1000 feet per minute, or .23" w.c. at 2000 feet per minute. Each unit shall measure the airflow rate within an accuracy of plus 2% as determined by U.S. – GSA certification tests, and shall contain a minimum of one total pressure sensor per 36 square inches of unit measuring area.

b) The units shall have a self-generated sound rating of less than NC40, and the sound level within the duct shall not be amplified nor shall additional sound be generated.

c) Where the stations are installed in insulated ducts, the airflow passage of the station shall be the same size as the inside airflow dimension of the duct. Station flanges shall be two inch to three inch to facilitate matching connecting ductwork.

d) Where control dampers are shown as part of the airflow measuring station, opposed blade precision controlled volume dampers integral to the station and complete with actuator, pilot positioner, and linkage shall be provided.

e) Stations shall be installed in strict accordance with the manufacturer's published requirements, and in

accordance with ASME Guidelines affecting non-standard approach conditions.

viii. Acceptable manufacturers: Air Monitor Corp., Tek-Air, Ebtron, and Dietrich Standard.

d. Static Pressure Traverse Probe

i. Duct static traverse probes shall be provided where required to monitor duct static pressure. The probe shall contain multiple static pressure sensors located along exterior surface of the cylindrical probe.

e. Shielded Static Air Probe

i. A shielded static pressure probe shall be provided at each end of the building. The probe shall have multiple sensing ports, an impulse suppression chamber, and airflow shielding. A suitable probe for indoor and outdoor locations shall be provided.

G. Power Monitoring Devices

1. Current Measurement (Amps)

a. Current measurement shall be by a combination current transformer and a current transducer. The current transformer shall be sized to reduce the full amperage of the monitored circuit to a maximum 5 Amp signal, which will be converted to a 4-20 mA DDC compatible signal for use by the Facility Management System.

b. Current Transformer – A split core current transformer shall be provided to monitor motor amps.

i. Operating frequency – 50 - 400 Hz.
ii. Insulation – 0.6 Kv class 10Kv BIL.
iii. UL recognized.
iv. Five amp secondary.
v. Select current ration as appropriate for application.
vi. Acceptable manufacturers: Veris Industries

c. Current Transducer – A current to voltage or current to mA transducer shall be provided. The current transducer shall include:

i. 6X input over amp rating for AC inrushes of up to 120 amps.
ii. Manufactured to UL 1244.
iii. Accuracy: +.5%, Ripple +1%.
iv. Minimum load resistance 30kOhm.
v. Input 0-20 Amps.
vi. Output 4-20 mA.
vii. Transducer shall be powered by a 24VDC regulated power supply (24 VDC +5%).

H. Smoke Detectors

1. Ionization type air duct detectors shall be furnished as specified elsewhere in Division 26 for installation under Division 20. All wiring for air duct detectors shall be provided under Division 26, Fire Alarm System.

I. Status and Safety Switches

1. General Requirements

a. Switches shall be provided to monitor equipment status, safety conditions, and generate alarms at the BMS when a failure or abnormal condition occurs. Safety switches shall be provided with two sets of contacts and shall be interlock wired to shut down respective

equipment.

2. Current Sensing Switches
   a. The current sensing switch shall be self-powered with solid-state circuitry and a dry contact output. It shall consist of a current transformer, a solid state current sensing circuit, adjustable trip point, solid state switch, SPDT relay, and an LED indicating the on or off status. A conductor of the load shall be passed through the window of the device. It shall accept over-current up to twice its trip point range.
   b. Current sensing switches shall be used for run status for fans, pumps, and other miscellaneous motor loads.
   c. Current sensing switches shall be calibrated to show a positive run status only when the motor is operating under load. A motor running with a broken belt or coupling shall indicate a negative run status.
3. Air Filter Status Switches
   a. Differential pressure switches used to monitor air filter status shall be of the automatic reset type with SPDT contacts rated for 2 amps at 120VAC.
   b. A complete installation kit shall be provided, including: static pressure tops, tubing, fittings, and air filters.
   c. Provide appropriate scale range and differential adjustment for intended service.
4. Air Flow Switches
   a. Differential pressure flow switches shall be bellows actuated mercury switches or snap acting micro-switches with appropriate scale range and differential adjustment for intended service.
5. Air Pressure Safety Switches
   a. Air pressure safety switches shall be of the manual reset type with SPDT contacts rated for 2 amps at 120VAC.
   b. Pressure range shall be adjustable with appropriate scale range and differential adjustment for intended service.
6. Low Temperature Limit Switches
   a. The low temperature limit switch shall be of the manual reset type with Double Pole/Single Throw snap acting contacts rated for 16 amps at 120VAC.
   b. The sensing element shall be a minimum of 15 feet in length and shall react to the coldest 18-inch section. Element shall be mounted horizontally across duct in accordance with manufacturers recommended installation procedures.
   c. For large duct areas where the sensing element does not provide full coverage of the air stream, additional switches shall be provided as required to provide full protection of the air stream.
   d. The low temperature limit switch shall be equal to Johnson Controls A70.

1.8 OUTPUT DEVICES

A. Actuators

1. General Requirements
   a. Damper and valve actuators shall be electronic and/or pneumatic, as specified in the System Description section.
2. Electronic Damper Actuators
   a. Electronic damper actuators shall be direct shaft mount.
   b. Modulating and two-position actuators shall be provided as required by

the sequence of operations. Damper sections shall be sized Based on actuator manufacturer's recommendations for face velocity, differential pressure and damper type. The actuator mounting arrangement and spring return feature shall permit normally open or normally closed positions of the dampers, as required. All actuators (except terminal units) shall be furnished with mechanical spring return unless otherwise specified in the sequences of operations. All actuators shall have external adjustable stops to limit the travel in either direction, and a gear release to allow manual positioning.

c. Modulating actuators shall accept 24 VAC or VDC power supply, consume no more than 15 VA, and be UL listed. The control signal shall be 2-10 VDC or 4-20 mA, and the actuator shall provide a clamp position feedback signal of 2-10 VDC. The feedback signal shall be independent of the input signal and may be used to parallel other actuators and provide true position indication. The feedback signal of one damper actuator for each separately controlled damper shall be wired back to a terminal strip in the control panel for trouble-shooting purposes.

d. Two-position or open/closed actuators shall accept 24 or 120 VAC power supply and be UL listed. Isolation, smoke, exhaust fan, and other dampers, as specified in the sequence of operations, shall be furnished with adjustable end switches to indicate open/closed position or be hard wired to start/stop associated fan. Two-position actuators, as specified in sequences of operations as "quick acting," shall move full stroke within 20 seconds. All smoke damper actuators shall be quick acting.

3. Electronic Valve Actuators

a. Electronic valve actuators shall be manufactured by the valve manufacturer.

b. Each actuator shall have current limiting circuitry incorporated in its design to prevent damage to the actuator.

c. Modulating and two-position actuators shall be provided as required by the sequence of operations. Actuators shall provide the minimum torque required for proper valve close-off against the system pressure for the required application. The valve actuator shall be sized Based on valve manufacturer's recommendations for flow and pressure differential. All actuators shall fail in the last position unless specified with mechanical spring return in the sequence of operations. The spring return feature shall permit normally open or normally closed positions of the valves, as required. All direct shaft mount rotational actuators shall have external adjustable stops to limit the travel in either direction.

d. Modulating Actuators shall accept 24 VAC or VDC and 120 VAC power supply and be UL listed. The control signal shall be 2-10 VDC or 4-20 mA and the actuator shall provide a clamp position feedback signal of 2-10 VDC. The feedback signal shall be independent of the input signal, and may be used to parallel other actuators and provide true position indication. The feedback signal of each valve actuator (except terminal valves) shall be wired back to a terminal strip in the control panel for trouble-shooting purposes.

e. Two-position or open/closed actuators shall accept 24 or 120 VAC power supply and be UL listed. Butterfly isolation and other valves, as specified in the sequence of operations, shall be furnished with

adjustable end switches to indicate open/closed position or be hard wired to start/stop the associated pump or boiler.

B. Control Dampers

1. The BMS Contractor shall furnish all automatic dampers. All automatic dampers shall be sized for the application by the BMS Contractor or as specifically indicated on the Drawings.
2. All dampers used for throttling airflow shall be of the opposed blade type arranged for normally open or normally closed operation, as required. The damper is to be sized so that, when wide open, the pressure drop is a sufficient amount of its close-off pressure drop to shift the characteristic curve to near linear.
3. All dampers used for two-position, open/close control shall be parallel blade type arranged for normally open or closed operation, as required.
4. Damper frames and blades shall be constructed of either galvanized steel or aluminum. Maximum blade length in any section shall be 60". Damper blades shall be 16-gauge minimum and shall not exceed eight (8) inches in width. Damper frames shall be 16-gauge minimum hat channel type with corner bracing. All damper bearings shall be made of reinforced nylon, stainless steel or oil-impregnated bronze. Dampers shall be tight closing, low leakage type, with synthetic elastomer seals on the blade edges and flexible stainless steel side seals. Dampers of 48"x48" size shall not leak in excess of 8.0 cfm per square foot when closed against 4" w.g. static pressure when tested in accordance with AMCA Std. 500.
5. Airfoil blade dampers of double skin construction with linkage out of the air stream shall be used whenever the damper face velocity exceeds 1500 FPM or system pressure exceeds 2.5" w.g., but no more than 4000 FPM or 6" w.g. Acceptable manufacturers are Johnson Controls D-7250 D-1250 or D-1300, Ruskin CD50, and Vent Products 5650.
6. One piece rolled blade dampers with exposed or concealed linkage may be used with face velocities of 1500 FPM or below.
7. Multiple section dampers may be jack-shafted to allow mounting of piston pneumatic actuators and direct connect electronic actuators. Each end of the jackshaft shall receive at least one actuator to reduce jackshaft twist.

C. Control Relays

1. Control Pilot Relays
   a. Control pilot relays shall be of a modular plug-in design with retaining springs or clips.
   b. Mounting Bases shall be snap-mount.
   c. DPDT, 3PDT, or 4PDT relays shall be provided, as appropriate for application.
   d. Contacts shall be rated for 10 amps at 120VAC.
   e. Relays shall have an integral indicator light and check button.
2. Lighting Control Relays
   a. Lighting control relays shall be latching with integral status contacts.
   b. Contacts shall be rated for 20 amps at 277 VAC.
   c. The coil shall be a split low-voltage coil that moves the line voltage contact armature to the ON or OFF latched position.
   d. Lighting control relays shall be controlled by:
      i. Pulsed Tri-state Output – Preferred method.
      ii. Pulsed Paired Binary Outputs.
      iii. A Binary Input to the Facility Management System shall

monitor integral status contacts on the lighting control relay. Relay status contacts shall be of the “dry-contact” type.

e. The relay shall be designed so that power outages do not result in a change-of-state, and so that multiple same state commands will simply maintain the commanded state. Example: Multiple OFF command pulses shall simply keep the contacts in the OFF position.

1.9 MISCELLANEOUS DEVICES

A. Local Control Panels

1. All control panels shall be factory constructed, incorporating the BMS manufacturer’s standard designs and layouts. All control panels shall be UL inspected and listed as an assembly and carry a UL 508 label listing compliance. Control panels shall be fully enclosed, with perforated sub-panel, hinged door, and slotted flush latch.
2. In general, the control panels shall consist of the DDC controller(s), display module as specified and indicated on the plans, and I/O devices—such as relays, transducers, and so forth—that are not required to be located external to the control panel due to function. Where specified the display module shall be flush mounted in the panel face unless otherwise noted.
3. All I/O connections on the DDC controller shall be provide via removable or fixed screw terminals.
4. Low and line voltage wiring shall be segregated. All provided terminal strips and wiring shall be UL listed, 300-volt service and provide adequate clearance for field wiring.
5. All wiring shall be neatly installed in plastic trays or tie-wrapped.
6. A convenience 120 VAC duplex receptacle shall be provided in each enclosure, fused on/off power switch, and required transformers.

B. Power Supplies

1. DC power supplies shall be sized for the connected device load. Total rated load shall not exceed 75% of the rated capacity of the power supply.
2. Input: 120 VAC +10%, 60Hz.
3. Output: 24 VDC.
4. Line Regulation: +0.05% for 10% line change.
5. Load Regulation: +0.05% for 50% load change.
6. Ripple and Noise: 1 mV rms, 5 mV peak to peak.
7. An appropriately sized fuse and fuse block shall be provided and located next to the power supply.
8. A power disconnect switch shall be provided next to the power supply.

C. Thermostats

1. Electric room thermostats of the heavy-duty type shall be provided for unit heaters, cabinet unit heaters, and ventilation fans, where required. All these items shall be provided with concealed adjustment. Finish of covers for all room-type instruments shall match and, unless otherwise indicated or specified, covers shall be manufacturer’s standard finish.

PART 2 - PERFORMANCE / EXECUTION

2.1 BMS SPECIFIC REQUIREMENTS

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A. Graphic Displays

1. Provide a color graphic system flow diagram display for each system with all points as indicated on the point list. All terminal unit graphic displays shall be from a standard design library.
2. User shall access the various system schematics via a graphical penetration scheme and/or menu selection.

B. Custom Reports:

1. Provide custom reports as required for this project:

C. Actuation / Control Type

1. Primary Equipment, Air Handling Equipment, Terminal Equipment
   a. All damper and valve actuation shall be electric.

2.2 INSTALLATION PRACTICES

A. BMS Wiring

1. All conduit, wiring, accessories and wiring connections required for the installation of the Building Management System, as herein specified, shall be provided by the BMS Contractor unless specifically shown on the Electrical Drawings under Division 16 Electrical. All wiring shall comply with the requirements of applicable portions of Division 16 and all local and national electric codes, unless specified otherwise in this section.
2. All BMS wiring materials and installation methods shall comply with BMS manufacturer recommendations.
3. The sizing, type and provision of cable, conduit, cable trays, and raceways shall be the design responsibility of the BMS Contractor. If complications arise, however, due to the incorrect selection of cable, cable trays, raceways and/or conduit by the BMS Contractor, the Contractor shall be responsible for all costs incurred in replacing the selected components.
4. Class 2 Wiring
   a. All Class 2 (24VAC or less) wiring shall be installed in conduit unless otherwise specified.
   b. Conduit is not required for Class 2 wiring in concealed accessible locations. Class 2 wiring not installed in conduit shall be supported every 5’ from the building structure utilizing metal hangers designed for this application. Wiring shall be installed parallel to the building structural lines. All wiring shall be installed in accordance with local code requirements.
5. Class 2 signal wiring and 24VAC power can be run in the same conduit. Power wiring 120VAC and greater cannot share the same conduit with Class 2 signal wiring.
6. Provide for complete grounding of all applicable signal and communications cables, panels and equipment so as to ensure system integrity of operation. Ground cabling and conduit at the panel terminations. Avoid grounding loops.

B. BMS Line Voltage Power Source

1. 120-volt AC circuits used for the Building Management System shall be taken from panel boards and circuit breakers provided by Division 16.
2. Circuits used for the BMS shall be dedicated to the BMS and shall not be used for any other purposes.
3. DDC terminal unit controllers may use AC power from motor power circuits.

C. BMS Raceway

1. All wiring shall be installed in conduit or raceway except as noted elsewhere in this specification. Minimum control wiring conduit size 1/2".
2. Where it is not possible to conceal raceways in finished locations, surface raceway (Wiremold) may be used as approved by the Architect.
3. All conduits and raceways shall be installed level, plumb, at right angles to the building lines and shall follow the contours of the surface to which they are attached.
4. Flexible Metal Conduit shall be used for vibration isolation and shall be limited to 3 feet in length when terminating to vibrating equipment. Flexible Metal Conduit may be used within partition walls. Flexible Metal Conduit shall be UL listed.

D. Penetrations

1. Provide fire stopping for all penetrations used by dedicated BMS conduits and raceways.
2. All openings in fire proofed or fire stopped components shall be closed by using approved fire resistive sealant.
3. All wiring passing through penetrations, including walls shall be in conduit or enclosed raceway.
4. Penetrations of floor slabs shall be by core drilling. All penetrations shall be plumb, true, and square.

E. BMS Identification Standards

1. Node Identification. All nodes shall be identified by a permanent label fastened to the enclosure. Labels shall be suitable for the node location.
2. Cable types specified in Item A shall be color coded for easy identification and troubleshooting.

F. BMS Panel Installation

1. The BMS panels and cabinets shall be located as indicated at an elevation of not less than 2 feet from the bottom edge of the panel to the finished floor. Each cabinet shall be anchored per the manufacturer's recommendations.
2. The BMS contractor shall be responsible for coordinating panel locations with other trades and electrical and mechanical contractors.

G. Input Devices

1. All Input devices shall be installed per the manufacturer recommendation
2. Locate components of the BMS in accessible local control panels wherever possible.

H. HVAC Input Devices – General

1. All Input devices shall be installed per the manufacturer recommendation
2. Locate components of the BMS in accessible local control panels wherever possible.
3. The mechanical contractor shall install all in-line devices such as temperature wells, pressure taps, airflow stations, etc.
4. Input Flow Measuring Devices shall be installed in strict compliance with ASME guidelines affecting non-standard approach conditions.
5. Outside Air Sensors
   a. Sensors shall be mounted on the North wall to minimize solar radiant heat impact or located in a continuous intake flow adequate to monitor

outside air conditions accurately.

b. Sensors shall be installed with a rain proof, perforated cover.

6. Building Differential Air Pressure Applications (-1" to +1" w.c.):
   a. Transmitters exterior sensing tip shall be installed with a shielded static air probe to reduce pressure fluctuations caused by wind.
   b. The interior tip shall be inconspicuous and located as shown on the drawings.
7. Air Flow Measuring Stations:
   a. Where the stations are installed in insulated ducts, the airflow passage of the station shall be the same size as the inside airflow dimension of the duct.
   b. Station flanges shall be two inch to three inch to facilitate matching connecting ductwork.
8. Duct Temperature Sensors:
   a. Duct mount sensors shall mount in an electrical box through a hole in the duct and be positioned so as to be easily accessible for repair or replacement.
   b. The sensors shall be insertion type and constructed as a complete assembly including lock nut and mounting plate.
   c. For ductwork greater in any dimension than 48 inches or where air temperature stratification exists such as a mixed air plenum, utilize an averaging sensor.
   d. The sensor shall be mounted to suitable supports using factory approved element holders.
9. Space Sensors:
   a. Shall be mounted per ADA requirements.
   b. Provide lockable tamper-proof covers in public areas and/or where indicated on the plans.
10. Low Temperature Limit Switches:
    a. Install on the discharge side of the first coil in the air stream.
    b. Mount element horizontally across duct in a serpentine pattern insuring each square foot of coil is protected by 1 foot of sensor.
    c. For large duct areas where the sensing element does not provide full coverage of the air stream, provide additional switches as required to provide full protection of the air stream.
11. Air Differential Pressure Status Switches:
    a. Install with static pressure tips, tubing, fittings, and air filter.

I. HVAC Output Devices

1. All output devices shall be installed per the manufacturers recommendation. The mechanical contractor shall install all in-line devices such as control valves, dampers, airflow stations, pressure wells, etc.
2. Actuators: All control actuators shall be sized capable of closing against the maximum system shut-off pressure. The actuator shall modulate in a smooth fashion through the entire stroke. When any pneumatic actuator is sequenced with another device, pilot positioners shall be installed to allow for proper sequencing.
3. Control Dampers: Shall be opposed blade for modulating control of airflow. Parallel blade dampers shall be installed for two position applications.
4. Electronic Signal Isolation Transducers: Whenever an analog output signal from the Building Management System is to be connected to an external control system as an input (such as a chiller control panel), or is to receive as an input a signal from a remote system, provide a signal isolation transducer.

Signal isolation transducer shall provide ground plane isolation between systems. Signals shall provide optical isolation between systems.

2.3 TRAINING

A. The BMS contractor shall provide the following training services:

1. One day of on-site orientation by a system technician who is fully knowledgeable of the specific installation details of the project. This orientation shall, at a minimum, consist of a review of the project as-built drawings, the BMS software layout and naming conventions, and a walk through of the facility to identify panel and device locations.

2.4 COMMISSIONING

A. All aspects of the Building Management System work shall have commissioning performed.

B. Acceptance Check Sheet

1. Prepare a check sheet that includes all points for all functions of the BMS as indicated on the point list included in this specification.
2. Submit the check sheet to the Engineer for approval
3. The Engineer will use the check sheet as the basis for acceptance with the BMS Contractor.

2.5 PROMPTLY RECTIFY ALL LISTED DEFICIENCIES AND SUBMIT TO THE ENGINEER THAT THIS HAS BEEN DONE.

PART 3 - EXECUTION

3.1 INSTALLATION, OPERATION, AND MAINTENANCE

A. Installation, Operation, and Maintenance manual shall be supplied with the unit.

B. Installing contractor shall install unit, including field installed components, in accordance with Installation, Operation, and Maintenance manual instructions.

C. Start up and maintenance requirements shall be complied with to ensure safe and correct operation of the unit.

END OF SECTION

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SECTION 232113

HYDRONIC PIPING

PART 1 - GENERAL

1.1 NOTE

A. The requirements of Section 200000 apply to work performed under this Section.

1.2 SCOPE

A. The Work under this Section of the Specification shall include the furnishing of labor, equipment and materials for the installation of heating, air conditioning and ventilating systems as specified, shown on the Drawings or implied to provide continuous and satisfactory service.

PART 2 - PRODUCTS

2.1 PIPING

A. Chilled water supply and return, and heating system hot water supply and return piping shall be provided as indicated below unless otherwise noted.

1. Piping - black steel, schedule 40
2. Fittings
   a. 2-1/2 inches and larger, black steel welded
   b. 2 inches and smaller, black cast iron banded
3. Unions
   a. 2-1/2 inches and larger, 150 pound slip on forged steel welding flanges with bolts, nuts and gasket
   b. 2 inches and smaller, black malleable iron, ground joint
4. Joints
   a. 2-1/2 inches and larger, welded
   b. 2 inches and smaller, threaded

B. Piping 2 inches and smaller may, at the Contractor's option, be type "L" hard drawn copper tubing ASTM B.88 made up with wrought copper sweat fittings ANSI A40.3 using 95-5 tin antimony solder.

C. Grooved pipe couplings as manufactured by Victaulic Company of America or Gustin Bacon may be installed on steel at connections to air conditioning units, pumps, throughout the piping system and elsewhere where unions would be provided to provide flexibility in piping.

2.2 VALVES

A. Provide valves at branch connections to mains and at piece of equipments, arranged so service may be shut off and the equipment removed without disturbing

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the piping or draining the whole system. Valves at equipment shall be size of line serving the equipment. Install valves in accessible locations.

B. Where valves are over 7 feet from floor and will require frequent operation, provide chain wheel, guide and hood or gear operator and chain to permit operation of valve from the floor.

C. Service valves shall be in accordance with following schedule:

	Nibco	Crane	Jenkins	Stockham
Gate – 2" and smaller	T-111	428	47	B-100
Gate – 2½" and larger	F-617-0	465-1/2	651A	G-623
Globe - 2" and smaller	T-211-Y	1	746	B-13T
Globe – 2½" and larger	F-718-B	351	613	G-512
Check – 2" and smaller	T-413-Y	34-1/2	92A	B-319
Check - 2½" and larger	F-918-B	373	624	G-931

Valves on piping 2-1/2 inch and larger shall be flanged. Valves on copper piping shall have solder ends.

D. In lieu of bronze gate valves, bronze ball valves may be used. Valves shall be "Full Port"; NIBCO Figure No. T-585 (1/2 inch to 1 inch) or NIBCO T-595 (1-1/4 inches to 2 inches). Jenkins 900T, Consolidated or Apollo 70-100.

E. Balancing shut-off valves shall be non-lubricated plug valve, DeZurik Figure No. 425 or WKM with adjustable stop and tapping on the downstream side for pressure gauge connections on balancing services. This valve may also be used in lieu of gate and globe valves where shown.

F. Ball valves may also be used for balancing service, where line velocity does not exceed 10 feet per second. Ball valves must include memory stop; NIBCO Figure No. T-580-M, as shown on the drawings.

G. Check valves at pump discharge in vertical lines and where indicated shall be silent non-slam wafer type with spring actuator and renewable seat and disc NIBCO

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Figure No. W-910, Miller 162, Williams-Hager 329, Smolensky or Victaulic Series 711.

H. Butterfly valves may be used for shut-off or balancing service, in lieu of gate or globe valves, 2-1/2 inches and larger, where water temperature does not exceed 225 degrees Fahrenheit. Butterfly valves shall be lug type with EPDM liners and lever-lock operator equal to NIBCO Figure No. LD-2000-3. In piping 8 inches and larger, a Gear Operator shall be used equal to NIBCO Figure No. LD-2000-5.

I. Where grooved coupling pipe is used, Victaulic Series 700 valves may be used.

J. Backflow preventor in potable water line to heating system is specified as part of the work in Section 221116.

2.3 PIPING ACCESSORIES

A. Provide piping accessories including thermometers, pressure gauges, specialty items, etc., as specified below and/or indicated on the drawings.

B. Strainers shall be Walworth 3699-1/2, Sarco SB; bronze, smaller than 2-1/2 inches. Bailey 125 pound No. 100, Zurn 125 pound No. 540 FBS, or Crane No. 989-1/2, cast iron 2-1/2 inches and larger. Provide with small mesh basket during testing and cleaning period. Replace basket prior to air and water balance.

C. Unions shall be installed where required or detailed to permit removal of equipment, control valves, etc., from the piping systems without dismantling the system. Unions shall be malleable iron brass to iron seat, ground joint, same materials as pipe, Crane, Walworth or Jenkins. Provide di-electric fittings where pipe sections and fittings of dissimilar materials are joined.

D. Flexible connections of reinforced rubber or teflon construction shall be provided in suction lines and discharge line to pumps and chillers. Connections shall be arranged to correct minor misalignment, to facilitate disconnecting the piping and to reduce vibration transmission. Flexible connections shall be Resistoflex Corporation, complete with limit bolts and grommets, Mercer or Mason.

E. Combination temperature and pressure tappings shall be 1/4 inch fitting to receive either a temperature or pressure probe, 1/8 inch OD. Fitting shall be solid brass with two neoprene valve cores. Provide two pressure gauge adapters with 1/8 inch probe and two five inch stem pocket testing thermometers with 0 to 220 degree range. Fitting shall be Pete's plug. At Contractor's option, where thermometer well, pressure gauge tapping and/or flow indicator is required adjacent to a balancing valve, a combination device such as Autoflow FV series or flowset HB/U+ may be substituted.

F. Thermometers shall be 5 inch dial bi-metal with stainless steel case set into separable wells in the piping system. Range for hot water shall be 20-240. Thermometers to be Weksler Economy bottom side or rear mounted to be easily visible from the floor.

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G. Water pressure gauges shall be Weksler type P, phenol case 4-1/2 inch range P.S.I.G. dial, with bourdon tube, recalibrating type, black case. Gauges shall be installed on 1/2 inch pipe with gate valve in connection. Equivalent products of Weiss, Manning-Maxwell and Moore "Ashcroft", Trerice or Marsh will be acceptable.

H. Flow indicators of venturi type or orifice plate type shall be installed where noted on the drawings. Provide 2 reading devices and the necessary conversion charts. Indicators shall be as manufactured by Taco, Bell & Gossett or Sarco.

I. Provide automatic air vents at the high points of the piping systems in the mechanical room. Vents shall be piped to the nearest floor drain. Vents to be Fisher, Illinois or Taco. At the other locations where piping turns down in the direction of flow and at terminal devices, install key operated needle valve air vents.

J. Flow switches shall be McDonnell-Miller FS4, suitable for the diameter of the pipe.

K. Valves and fittings at base mounted pumps may at the Contractor's option, be combined into a suction diffuser on inlet and combination balancing shut- off check valve on discharge, fittings shall be Taco or Bell & Gossett.

L. At the Contractor's option, at equipment such as unit ventilators, unit heaters, heating coils, etc., Autoflow series SV valves or Flowset HB/YS/U+ may be used in lieu of combination shut-off valve, strainer and temperature-pressure test port on the supply pipe. On the return pipe Autoflow series FV valves or flowset HB/vt may be used in lieu of combination flow control, shut-off and temperature-pressure test port. Valves shall be installed in unit cabinets.

M. Steam thermostatic traps shall be Sarco low pressure type for steam pressures from 25 inch Hg vacuum to 25 psi. Traps shall be angle or straight through type, as required by the pipe layout. Valve body and cap shall be made of brass with a natural brass finish. Bellows and valve head shall be stainless steel. Provide a brass union nut at the inlet. Valve seat shall be made of brass and shall be removeable.

PART 3 - EXECUTION

3.1 INSULATION

A. After the systems have been installed and tested, insulation as specified below shall be applied. Materials shall be Underwriters Laboratory, Inc., approved and shall be applied as recommended by the manufacturer's written instructions. Materials used shall be the products of Owens Corning, Manville, Knauff Corporation, Armstrong, Certainteed, Miracle Adhesive, Moneco or Benjamin Foster and shall be similar to those products that meet the specifications below.

B. Piping

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1. Hot water heating piping shall be covered with long strand glass fiber insulation with all service vapor barrier jacket with self-sealing pressure sensitive lap, Manville AP-T, of a thickness to be compliant with the applicable energy code requirements. For piping up to 1-1/4 inches in size, the minimum thickness shall be 1-1/2 inches. For piping 1-1/2 inches in size and larger, the minimum thickness shall be 2 inches. Fittings shall be covered with 2000 [300] (lower flame spread) precut PVC fitting covers with fiberglass insulation insert. Cover shall be sealed to adjacent insulation with vapor retarder mastic and then covered with pressure sensitive tape.
2. Chilled water piping and dual temperature piping systems shall be covered with same insulation as specified for heating water except that minimum insulation shall be 1-1/2 inch thickness up to and including three inch pipe and 2 inch thickness for larger pipes.
3. On exposed insulated piping in finished areas within seven feet of the floor, provide .010 inch thick galvanized steel insulation jackets. This does not include piping exposed in unfinished areas such as boiler rooms, storage rooms, etc.
4. At pipe hangers for piping carrying fluids with temperatures below 70 degrees, provide rigid core of insulation to support the pipe. Rigid insulation shall be the same thickness as the adjacent insulation and shall have the same flame spread and smoke developed ratings.

C. Equipment

1. Chilled water pumps shall be insulated on cold surfaces with 22 gauge galvanized metal pump cover internally lined with 1 inch of 3 PCF fiberglass board. Fill voids between insulation and board with light density blanket. Vapor seal joints. Cover with glass cloth and finish with Benjamin Foster 30-35 lagging adhesive. Insulation shall be arranged so that pump may be serviced with minimum damage to the insulation.

3.2 TESTING AND BALANCING WATER SYSTEMS

A. The hydronic distribution system shall be balanced and adjusted to distribute the quantities as noted on the drawings. Demonstrate to the Architect's satisfaction knowledgeability in this work and familiarity with the test instruments to be used. If the Architect does not approve of the Contractor's qualifications, the Contractor shall engage the services of an independent test organization specializing in this work and is a member of the Associated Air Balance Council or other nationally recognized air balancing organization.

B. Test equipment must be approved by the Architect and properly calibrated prior to starting work. Repairs, alterations, adjustments and readjustments necessary to meet the design conditions shall be made.

C. The balancing agency shall review the drawings before installation and advise the Contractor of additional dampers required in the ductwork, flow devices and balancing valves in the water piping, etc., to effectively and properly balance the systems. These devices shall be installed at no additional cost to the Owner.

D. At the completion of the balancing and adjusting and prior to the operating test, submit to the Architect three (3) certified typewritten reports to be retained by the

Architect. Reports shall include:

1. Pressure and/or temperature difference across various pieces of equipment
2. Water quantities at flow indicators.
3. Schedule of equipment.
4. Speed of belt driven equipment.
5. Nameplate data on motors installed under this contract.
6. Actual operating voltage and ampacity readings on motors.
7. Separate six hour operating tests shall be made during the cooling season and during the heating season in which an hourly record shall be made of the following:
   a. Settings of control equipment.
   b. Outside weather conditions.
   c. Thermostat readings.
   d. Dry and wet bulb temperatures in spaces.

   Outside temperatures shall be below 40 degrees Fahrenheit during the heating test and above 85 degrees Fahrenheit during the cooling test.

END OF SECTION

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SECTION 232123

HYDRONIC PUMPS

PART 1 - GENERAL

1.1 NOTE

A. The requirements of Section 200000 apply to work performed under this Section.

1.2 SCOPE

A. The Work under this Section of the Specification shall include the furnishing of labor, equipment and materials for the installation of heating, air conditioning and ventilating systems as specified, shown on the Drawings or implied to provide continuous and satisfactory service.

PART 2 - PRODUCTS

2.1 PUMPS - BASE MOUNTED

A. Provide base mounted pumps of the size and capacity as noted on the drawings.

B. Base mounted pumps shall be floor mounted, centrifugal, vertical split case, end suction, bronze fitted, iron body, with sealed ball bearings and mechanical seal. The impeller and casing shall be equipped with renewable wear rings locked in place. Pump shall be directly driven through couplings. The pump and motor shall be mounted on a heavy steel base, which shall be grouted and anchored to a concrete base. Provide guard over coupling and filter for seal.

C. Pumps shall be selected to operate at or near their point of peak efficiency, allowing for operation at capacities of approximately 25 percent beyond design capacity. Impeller diameter shall not exceed 90 percent of the maximum impeller diameter available for the model. Motor shall be selected to be non-overloading at plus or minus 20 percent of the design capacity of the pump. Submit pump curves for review.

D. Pumps shall have flanged suction and discharge connections with tapped gauge connections in both flanges. Flanges shall be 150 psig rating.

E. Pump casings shall be hydrostatically tested at 1-1/2 times design working pressure. Pump manufacturer shall be responsible for aligning in the field prior to start up of flexibly coupled units. Alignment shall be with dial indicator with accuracy of plus or minus .002 inches. Provide a certified written report that the pumps have been aligned by factory authorized representatives to within manufacturer’s recommendations.

F. Pumps shall be Bell & Gossett, Taco or Armstrong.

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A.

PART 3 - EXECUTION

3.1 WATER TREATMENT

A. Engage the services of a reputable water treatment contractor, such as Arc Company, Inc., Mogul or HVAC Services, Inc., to provide a water treatment system including tests, service, chemicals and equipment as specified hereinafter.

B. Conduct a water analysis of the water supply to provide the following information which shall be submitted in a typewritten report to the Architect:

1. pH
2. Total Alkalinity
3. Chlorides
4. Silica
5. Hardness
6. Total Dissolved Solids

C. During the building one year warranty period:

1. Make monthly service visits on closed, recirculating systems to adjust feeding equipment, apply chemicals, obtain and analyze samples and regulate bleed-off, in order to maintain the conditions specified below.
2. Maintain complete records of the treatment program for systems, and provide a copy of these records to the Owner and to any other party on request.
3. Instruct Contractor in field on piping and wiring of chemical feeding equipment.
4. Provide necessary labor, chemicals and feeding equipment required for the specified treatment.
5. At the end of the warranty period, provide the Owner with complete written instructions for chemical feeding, bleed-off, blowdown control and testing procedures. Demonstrate these procedures to the Owner's personnel.

D. Conditions shall be maintained at the following levels:

1. Heating Water:
   a. Ph - 7.0 to 9.0
   b. Buffered Nitrite
      i) <180 degrees F-1000 PPM
      ii) >180 degrees F-2000 PPM
2. Chilled Water:
   a. Ph - 7.0 to 9.0
   b. Buffered Nitrite - 500 PPM
   c. Organic Growth - none
3. Low Pressure Boiler:
   a. Ph - 7.0 to 9.0
   b. Buffered Nitrite - 2000 PPM(Chromate may be used for this system in lieu of Buffered Nitrite and must be maintained at 1000 PPM.)
   c. Cycles - 10

E. Provide the following feed equipment to introduce chemicals to the system only when the system operates:

1. Closed recirculating systems - Heating, chilled and dual temperature.
   a. Steel bypass feeder installed across circulating pump suction and discharge lines, with tank and piping insulated using the same thickness and type of insulation as provided for the piping system.
2. Low pressure heating boiler - cooling or process steam.
   a. Five gallon bypass feeder installed across the boiler feed pump with tank and piping insulated using the same thickness and type of insulation as provided for the piping system.

F. If the alkalinity exceeds 125 PPM or the hardness exceeds 300 PPM, install an acid feed system. System shall maintain the above specified limits and shall include the following equipment:

1. Pre-wired control panel with Leeds & Northrup Ph monitor and sensing electrodes.
2. Wallace & Tiernan Model 94-200 acid feed pump at 120 volt, single phase.
3. Thirty gallon polyethylene acid storage tank.
4. Acid transfer pump.
5. Neptune Relief Valve.

END OF SECTION

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SECTION 233113

METAL DUCTS

PART 1 - GENERAL

1.1 NOTE

A. The requirements of Section 200000 apply to work performed under this Section.

1.2 SCOPE

A. The Work under this Section of the Specification shall include the furnishing of labor, equipment and materials for the installation of heating, air conditioning and ventilating systems as specified, shown on the Drawings or implied to provide continuous and satisfactory service.

PART 2 - PRODUCTS

2.1 DUCTWORK

A. Provide ductwork and plenums of the sizes shown on the Drawings and the materials, gauges and construction as listed below.

B. Ductwork shall not be fabricated or installed until clearances and dimensions have been verified in the field. Discrepancies between the duct sizes and configurations shown on the Contract Documents and those required to meet field conditions shall be brought to the attention of the Architect for his direction. Ductwork fabricated or installed prior to field verification that the ductwork will fit is done at the Contractor's risk and expense.

C. For details of duct construction not specified below refer to the latest editions of the Sheet Metal and Air Conditioning Contractors National Association (SMACNA) Manuals. Duct systems shall be defined as follows with the applicable manual.

1. All systems "HVAC Duct Construction Standards" metal and flexible.

D. Ductwork shall be galvanized steel except as specified hereinafter of sizes indicated with sheets shaped and constructed as noted in the SMACNA Manual.

E. Shower room exhaust ductwork shall be 3S-1/2 hard aluminum duct. Joints on bottom of ducts and 1/2 of the vertical sides shall be caulked to be water tight. Ducts shall slope up and away from the grilles and registers.

F. Flexible ductwork shall consist of a coated spring steel wire helix, polymeric liner, fiberglass insulation and fiberglass reinforced metallized film vapor barrier. Flexible ductwork shall be listed by Underwriters Laboratories under UL 181 standards as Class I flexible Air Duct Material and shall comply with NFPA Standards 90A and 90B. Flexible duct shall be rated for two inches positive and negative pressure and

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2500 fpm maximum velocity. Flexible ducts shall be Thermoflex M-KE, Wiremold or General.

G. Where ducts are noted to be acoustically lined, they shall be lined with one inch thickness of coated and edge sealed lining system. Liner and insulation shall meet requirements of UL 181 and NFPA 90A/B. Liner shall meet bacteriological standards of ASTM C 1071. Seams and cut edges shall be sealed from airstream using metal brackets. Use of adhesive-backed tape is unacceptable. Insulation shall be 3 lb/cubic foot density with an R-Value of 4.0 per inch thickness. Duct sizes shown on drawings are the interior sizes of insulated duct. As a minimum, supply and return ducts from heating, ventilating and air conditioning units for a distance of fifteen feet from the units shall be acoustically lined. Duct lining shall be Owens Corning Aeroflex Plus or equal of Johns Manville, Certain Teed or Knauf.

H. Ductwork shall be galvanized steel except as specified hereinafter of sizes indicated with sheets shaped and constructed as noted in the SMACNA Manual.

Pressure Classification In Inches W.C.	System
1.0	Exhaust/Relief System (except as noted herein)
2.0	Return Air System, Ventilation System
2.0	Supply Air System: Constant Volume Systems or Outlet Side of VAV Boxes and Mixing Boxes
4.0	Primary Supply Air Systems: Upstream of Inlet Side of VAV Boxes

I. Duct connections to air handling units and elsewhere as required to compensate for expansion and contraction and noise reduction shall be made with UL approved glass fabric such as Ventglas as manufactured by Vent Fabrics, Inc.

J. On low pressure systems duct details shall be as follows:

1. Square elbows Figure 2-2
2. Hangers Figure 4-4
3. Tee connections Figure 2-7
4. Register on trunk Figure 2-16
5. Volume dampers Figures 2-14 and 2-15

K. Provide manual volume dampers as shown on the Drawing and additionally as required to properly balance the air distribution systems as directed by the independent Test and Balance Agency.

L. Fire dampers shall be provided where indicated and elsewhere as required to comply with requirements of NFPA 90A and Building Code Requirements. Fire dampers shall be multi-leaf accordion type, held open by adequate heavy gauge wires and suitable, calibrated fusible links. Fire dampers shall be Ruskin, Prefco, Nailor or Air Balance, Inc. Fire dampers shall be of a suitable type and rating for the wall construction in which they are to be installed. See the finish schedule on the Architectural Drawings. Fire dampers shall have UL label of acceptance or proof of acceptance to meet local requirements for the wall construction in which

they are installed. Vertical dampers (horizontal air flow) shall close by gravity. Horizontal dampers (vertical air flow) shall be closed by suitable and positive spring closing devices. Provide adequately sized hinged access doors with cam locks to allow access to fire dampers for replacement of fusible link and resetting damper.

1. Dampers located in duct sections that are not adjacent to wall mounted air devices shall be type B dampers. Damper frames shall provide a pocket which shall store damper leaves in open position outside of air stream and shall allow 100% free air flow when open.

2. Verify that field conditions allow for the installation of type B dampers. Where field conditions do not allow the use of type B dampers, provide type A dampers. Dampers shall be designed and constructed to provide a minimum of 90% free area when the damper leaves are in the open position.

3. Behind air devices, provide thin line, type A fire dampers. Dampers shall be flangeless type with 1-7/8” galvanized steel frame with 20 gauge steel enclosure.

M. Blank-off unused portions of louvers with an aluminum clad plywood panel. Provide rigid insulation board to meet the energy code, at a minimum of R8. Aluminum shall have textured black finish and shall face outside. Inside shall have black painted plywood finish. Blank-off material shall be Weyerhauser Pre-finished Siding/Panel 15 with Ebony exterior finish and black painted plywood interior finish.

PART 3 - EXECUTION

3.1 INSULATION

A. After the systems have been installed and tested, insulation as specified below shall be applied. Materials shall be Underwriters Laboratory, Inc., approved and shall be applied as recommended by the manufacturer's written instructions. Materials used shall be the products of Owens Corning, Manville, Knauff Corporation, Armstrong, Certainteed, Miracle Adhesive, Moneco or Benjamin Foster and shall be similar to those products that meet the specifications below.

B. Ductwork

1. Exposed supply ductwork and return air ductwork except where ductwork located in the room supplied and exposed outside air ductwork shall be insulated with 1-1/2 inch thickness of 6 PCF fiberglass board with reinforced foil faced ASJ vapor barrier jacket secured to duct with Graham weld pins or perforated base stick clips set in Moneco M46420 adhesive. Pins shall be covered with finish cap to match insulation. Butt joints and seams and cover with vapor barrier mastic. Finish with a coat of lagging adhesive such as Benjamin Foster 30-35 or Moneco 55-10 embedding 8.5 glass cloth fabric over the adhesive. Use corner beads on edges of the duct.

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2. Concealed supply air duct, return air duct and outside air duct shall be covered with 1-1/2 inch thickness of 3/4 pcf flexible fiberglass duct covering with reinforced foil and kraft paper vapor barrier FRK jacket. Insulation shall be applied to duct over 100 percent coverage of duct adhesive such as Benjamin Foster 85-20. Edges shall be butted together with a vapor barrier lap of 2 inch minimum. Seal joint and punctures with Benjamin Foster 30-35. Where ducts are over 24 inches in width, weld pins and caps shall be used to secure insulation to underside of duct. Secure laps with adhesive and flared staples on 4 inch center.
3. Ductwork that is internally lined with energy code compliant liner is not required to be insulated externally as indicated herein.

3.2 TESTING AND BALANCING AIR SYSTEMS

A. The air distribution system shall be balanced and adjusted to distribute the air quantities as noted on the drawings. Demonstrate to the Architect's satisfaction knowledgeability in this work and familiarity with the test instruments to be used. If the Architect does not approve of the Contractor's qualifications, the Contractor shall engage the services of an independent test organization specializing in this work and is a member of the Associated Air Balance Council or other nationally recognized air balancing organization.

B. Test equipment must be approved by the Architect and properly calibrated prior to starting work. Repairs, alterations, adjustments and readjustments necessary to meet the design conditions shall be made.

C. The balancing agency shall review the drawings before installation and advise the Contractor of additional dampers required in the ductwork, flow devices and balancing valves in the water piping, etc., to effectively and properly balance the systems. These devices shall be installed at no additional cost to the Owner.

D. At the completion of the balancing and adjusting and prior to the operating test, submit to the Architect three (3) certified typewritten reports to be retained by the Architect. Reports shall include:

1. Velocities and air quantities at supply returns and exhaust outlets installed under this contract.
2. Pressure and/or temperature difference across various pieces of equipment.
3. Air temperature delivered from heating and cooling equipment.
4. Schedule of equipment.
5. Speed of belt driven equipment.
6. Nameplate data on motors installed under this contract.
7. Actual operating voltage and ampacity readings on motors.
8. Separate six hour operating tests shall be made during the cooling season and during the heating season in which an hourly record shall be made of the following:
    a. Settings of control equipment.
    b. Outside weather conditions.
    c. Thermostat readings.
    d. Dry and wet bulb temperatures in spaces.

Outside temperatures shall be below 40 degrees Fahrenheit during the heating test and above 85 degrees Fahrenheit during the cooling test.

END OF SECTION

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SECTION 233713

AIR DEVICES

PART 1 - GENERAL

1.1 NOTE

A. The requirements of Section 200000 apply to work performed under this Section.

1.2 SCOPE

A. The Work under this Section of the Specification shall include the furnishing of labor, equipment and materials for the installation of heating, air conditioning and ventilating systems as specified, shown on the Drawings or implied to provide continuous and satisfactory service.

PART 2 - PRODUCTS

2.1 AIR DEVICES

A. Provide air devices to complete the heating, air conditioning and ventilating systems. Air devices in ceiling shall have flat white lacquered finish unless noted otherwise. Coordinate the appropriate border and mount for the specific application.

B. Air devices shall be as manufactured by Price, Titus, Tuttle & Bailey, Anemostat, Krueger, or Metalaire.

C. Supply air diffusers in the ceiling shall be square or rectangular pattern with removable directional multi-blade core. Pattern shall be four-way, unless noted otherwise on drawings. Construction shall be steel. Where diffuser is to be installed in a lay-in ceiling, diffuser shall have panels to fit into 24 x 24 modular lay-in ceiling. Provide diffusers with horizontal to vertical pattern, adjusting tabs and opposed blade damper. Where indicated on the Drawings to be connected to flexible ductwork, provide square to round adaptor.

1. Price SMD

D. Ceiling return registers shall be horizontal fixed bar set at 35 degrees or fixed curved bar with opposed blade damper. Register shall be steel construction with white finish. Omit damper where indicated as grilles.

1. Price 530D

E. Ceiling exhaust registers shall be aluminum bars set at 1/2 inch centers on 40 degree angle. Provide with opposed blade damper (delete damper where noted as grilles). Finish shall be white enamel.

1. Price 620D

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F. Ceiling exhaust registers shall be steel bars set at 1/2 inch centers on 40 degree angle. Provide with opposed blade damper (delete damper where noted as grilles). Finish shall be white enamel.

1. Price 520

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation of air devices shall be per manufacturers recommendations. Air devices in ceiling shall have flat white lacquered finish unless noted otherwise. Coordinate the appropriate border and mount for the specific application.

END OF SECTION

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SECTION 235700

HEAT EXCHANGERS FOR HVAC

PART 1 - GENERAL

1.1 NOTE

A. The requirements of Section 200000 apply to work performed under this Section.

1.2 SCOPE

A. The Work under this Section of the Specification shall include the furnishing of labor, equipment and materials for the installation of heating, air conditioning and ventilating systems as specified, shown on the Drawings or implied to provide continuous and satisfactory service.

PART 2 - PRODUCTS

2.1 HEAT EXCHANGER

A. Provide shell and tube type heat exchangers of the sizes and capacities indicated on the drawings.

B. Units shall be designed and constructed per the ASME code, Section VIII, Division 1. The fabricated steel shell shall be designed for a rated working pressure of 150 PSI at 375 degrees F.

C. Units in size up to 10 inch in diameter shall be provided with cast iron head with threaded connections rated at a working pressure of 150 PSI at 375 degrees F. Units 12 inch in diameter and larger shall have fabricated steel heads with flanged connections.

D. The tubesheet and separators shall be of steel construction. Tube supports/separators to be locked in position with tie-rods of copper construction.

E. The tubing used in the construction of the exchanger shall meet the specification in Section VIII and described in Section II of the ASME code. The approved tubing material shall be copper.

F. A UL manufacturer's data report, national board registered, signed by an independent ASME code inspector shall be provided with each exchanger.

G. Shell and tube heat exchangers shall be Taco, or similar of Bell & Gossett, or Armstrong.

2.2 EXPANSION TANKS

A. Provide expansion tanks of size noted on drawings for the heating water system.

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Tank shall be flange grade steel treated to be corrosion resistant and given final enamel coat of paint, steel with butyl diaphragm separating air charged section and system water. Provide with saddles for suspended mounting or floor support as required for the installation.

B. Tanks shall be ASME Section VIII code designed and stamped for maximum working pressure of 115 psi and temperature of 240 degrees fahrenheit and air tested at 160 psi. Tanks shall be precharged to the setting of the make up water pressure reducing valve. Provide saddles and hangers for support of tanks.

C. Tank shall be as manufactured by Amtrol or Taco.

2.3 AIR SEPARATOR – TANGENTIAL

A. Provide tangential separators of the size noted and where located on the Drawings. The tangential air separator shall create a vortex pattern which allows entrained air to escape and be vented.

B. At the vent connection at the top of the separator, provide an air eliminator device to vent the air to the atmosphere as fast as it is separated from the water. A level sensing device in the air eliminator shall regulate the valve. Valve shall be tightly closed when no air is to be vented and shall operate full open when required by the amount of air to be vented.

C. Air separator shall be Amtrol model listed on the drawings. Air eliminator device shall be Amtrol model 700.

PART 3 - EXECUTION

3.1 INSTALLATION, OPERATION, AND MAINTENANCE

A. Installation, Operation, and Maintenance manual shall be supplied with the unit.

B. Installing contractor shall install unit, including field installed components, in accordance with Installation, Operation, and Maintenance manual instructions.

C. Start up and maintenance requirements shall be complied with to ensure safe and correct operation of the unit.

END OF SECTION

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SECTION 237433

DEDICATED OUTDOOR AIR UNITS

PART 1 - GENERAL

1.1 NOTE

A. The requirements of Section 200000 apply to work performed under this Section.

1.2 SCOPE

A. The Work under this Section of the Specification shall include the furnishing of labor, equipment and materials for the installation of heating, air conditioning and ventilating systems as specified, shown on the Drawings or implied to provide continuous and satisfactory service.

PART 2 - PRODUCTS

2.1 DEDICATED OUTDOOR AIR UNITS

A. Provide dedicated outdoor air units of the capacities listed on the drawings. Unit shall include compressors, evaporator coils, filters, supply fans, dampers,air-cooled condenser coils, condenser fans,reheat coil,hot water coils,and unit controls. Unit shall be factory assembled and tested includingleak testing of the DX coils,leak testing of the hot water coils,pressure testing of the refrigeration circuit,and run testing of the completed unit. Run test report shall be supplied with the unit in the service compartment's literature pocket. Unit shall have decals and tags to indicate lifting and rigging, service areas and caution areas for safety and to assist service personnel. Unit components shall be labeled, includingpipe stub outs,refrigeration system components andelectrical and controls components. Estimated sound power levels (dB) shall be shown on the unit ratings sheet. Installation, Operation, and Maintenance manual shall be supplied within the unit. Laminated color-coded wiring diagram shall match factory installed wiring and shall be affixed to the interior of the control compartment's hinged access door. Unit nameplate shall be provided in two locations on the unit, affixed to the exterior of the unit and affixed to the interior of the control compartment's hinged access door.

B. Cabinet walls, access doors, and roof shall be fabricated of double wall, impact resistant, rigid polyurethane foam panels. Unit insulation shall have a minimum thermal resistance R-value of 13. Foam insulation shall have a minimum density of 2 pounds/cubic foot and shall be tested in accordance with ASTM D1929-11 for a minimum flash ignition temperature of 610°F. Unit construction shall be double wall with G90 galvanized steel on both sides and a thermal break. Double wall construction with a thermal break prevents moisture accumulation on the insulation, provides a cleanable interior, prevents heat transfer through the panel, and prevents exterior condensation on the panel. Unit shall be designed to reduce air leakage and infiltration through the cabinet. Cabinet leakage shall not exceed

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1% of total airflow when tested at 3 times the minimum external static pressure provided in AHRI Standard 340/360. Panel deflection shall not exceed L/240 ratio at 125% of design static pressure, at a maximum 8 inches of positive or negative static pressure, to reduce air leakage. Deflection shall be measured at the mid point of the panel height and width. Continuous sealing shall be included between panels and between access doors and openings to reduce air leakage. Piping and electrical conduit through cabinet panels shall include sealing to reduce air leakage. Roof of the air tunnel shall be sloped to provide complete drainage. Cabinet shall have rain break overhangs above access doors. Access to filters, dampers, cooling coils, reheat coil, compressors, and electrical and controls components shall be through hinged access doors with quarter turn, zinc cast, lockable handles. Full length stainless steel piano hinges shall be included on the doors. Exterior paint finish shall be capable of withstanding at least 2,500 hours, with no visible corrosive effects, when tested in a salt spray and fog atmosphere in accordance with ASTM B 117-95 test procedure. Units with cooling coils shall include double sloped 304 stainless steel drain pans. Unit shall be provided with base discharge and return air openings. All openings through the base pan of the unit shall have upturned flanges of at least 1/2 inch in height around the opening. Unit shall include lifting lugs on the top of the unit. Unit shall include factory installed, painted galvanized steel condenser coil guards on the face of the condenser coil.

C. Unit shall be provided with factory installed and factory wired, non-fused disconnect switch. Unit shall be provided with phase and brown out protection which shuts down all motors in the unit if the electrical phases are more than 10% out of balance on voltage, the voltage is more than 10% under design voltage or on phase reversal.

D. Unit shall include direct drive, unhoused, backward curved, plenum supply fans. Blowers and motors shall be dynamically balance and mounted on rubber isolators. Motors shall be premium efficiency ODP with ball bearings rated for 200,000 hours service with external lubrication points. Variable frequency drives shall be factory wired and mounted in the unit. Fan motors shall be premium efficiency.

E. Evaporator coils shall be designed for use with R-410A refrigerant and constructed of copper tubes with aluminum fins mechanically bonded to the tubes and galvanized steel end casings. Fin design shall be sine wave rippled. Coils shall have interlaced circuitry and shall be standard capacity. Coils shall be hydrogen or helium leak tested. Coils shall be furnished with factory installed expansion valves.

F. Unit shall be factory charged with R-410A refrigerant. Compressors shall be scroll type with thermal overload protection and carry a 5 year non-prorated warranty, from the date of original equipment shipment from the factory. Compressors shall be mounted in an isolated service compartment which can be accessed without affecting unit operation. Lockable hinged compressor access doors shall be fabricated of double wall, rigid polyurethane foam injected panels to prevent the transmission of noise outside the cabinet. Compressors shall be isolated from the base pan with the compressor manufacturer's recommended rubber vibration

isolators, to reduce any transmission of noise from the compressors into the building area. Each refrigeration circuit shall be equipped with expansion valve type refrigerant flow control. Each refrigeration circuit shall be equipped with automatic reset low pressure and manual reset high pressure refrigerant safety controls, Schrader type service fittings on both the high pressure and low pressure sides and a factory installed replaceable core liquid line filter driers. Unit shall include a variable capacity scroll compressor on the lead refrigeration circuit which shall be capable of modulation from 10-100% of its capacity. Lead refrigeration circuit shall be provided with hot gas reheat coil, modulating valves, electronic controller, supply air temperature sensor and a control signal terminal which allow the unit to have a dehumidification mode of operation, which includes supply air temperature control to prevent supply air temperature swings and overcooling of the space. Each refrigeration circuit shall be equipped with a liquid line sight glass. Lag refrigeration circuit shall be provided with factory installed hot gas bypass to protect against evaporator frosting and to prevent excessive compressor cycling.

G. Condenser fans shall be a vertical discharge, axial flow, direct drive fans. Coils shall be designed for use with R-410A refrigerant. Coils shall be multi-pass and fabricated from aluminum microchannel tubes. Coils shall be designed for a minimum of 10°F of refrigerant sub-cooling. Coils shall be hydrogen or helium leak tested. Condenser fans shall be high efficiency electrically commutated motor driven with factory installed head pressure control module. Condenser airflow shall continuously modulate based on head pressure and cooling operation shall be allowed down to 35°F with adjustable compressor lockout.

H. Hot water heating coils shall be certified in accordance with AHRI Standard 410 and be hydrogen or helium leak tested. Coils shall be constructed of copper tubes with aluminum fins mechanically bonded to the tubes and galvanized steel end casings. Fin design shall be sine wave rippled. Coils shall be two rows, single serpentine circuitry, and 8 fins per inch. Coils shall be located in the reheat position downstream of the cooling coil. Control valves shall be field supplied and field installed.

I. Unit shall include 2 inch thick, pleated panel filters with an ASHRAE efficiency of 30% and MERV rating of 8, upstream of the cooling coil. Unit shall include 100% motor operated outside air damper assembly constructed of extruded aluminum, hollow core, airfoil blades with rubber edge and end seals. Damper blades shall be gear driven and designed to haveno more than 20 cfm of leakage per sq ft. at 4 in. w.g. air pressure differential across the damper. Low leakage dampers shall be Class 2 AMCA certified, in accordance with AMCA Standard 511.Damper assembly shall be controlled by spring return, 2 position actuator. Unit shall include outside air opening bird screen and outside air hood.

J. Unit shall be provided with a safety shutdown terminal block for field installation of a smoke detector which shuts off the unit's control circuit.

K. Dedicated outdoor air unit shall be manufactured by Aaon or similar by Greenheck or Daikin.

PART 3 - EXECUTION

3.1 INSTALLATION, OPERATION, AND MAINTENANCE

A. Installation, Operation, and Maintenance manual shall be supplied with the unit.

B. Installing contractor shall install unit, including field installed components, in accordance with Installation, Operation, and Maintenance manual instructions.

C. Start up and maintenance requirements shall be complied with to ensure safe and correct operation of the unit.

END OF SECTION

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SECTION 238219

FAN COIL UNITS

PART 1 - GENERAL

1.1 NOTE

A. The requirements of Section 200000 apply to work performed under this Section.

1.2 SCOPE

A. The Work under this Section of the Specification shall include the furnishing of labor, equipment and materials for the installation of heating, air conditioning and ventilating systems as specified, shown on the Drawings or implied to provide continuous and satisfactory service.

PART 2 - PRODUCTS

2.1 FAN COIL UNITS

A. Provide fan coil units of the type and capacity indicated on the drawings. The units shall include a chassis, coil(s), fan deck with blower(s)/blower housing and motor(s). Steel parts exposed to moisture shall be galvanized and insulated to prevent condensation. The complete fan assembly shall be easily removable for service and maintenance. A quick-connect motor electric plug shall be provided. Unit shall be supplied with return plenum complete with filter frame and filter. The plenum shall be fabricated of 18 gauge galvanized steel. The inside plenum surface shall be insulated with 1/2" matt-faced fiber glass insulation. Plenum insulation shall meet minimum K value of 0.24 (BTU-in)/(hr-ft2-F) and rated for maximum air velocity of 5000 fpm. Fiberglass insulation conforms to:

1. ASTM C1071 (including C665)
2. UL 181 for erosion
3. 25/50 rating for flame spread/smoke developed per ASTM E-84, UL 723 and NFPA 90A

B. Supply fans shall be a DWDI forward-curved type. Fan assemblies including fan, motor and sheaves shall be dynamically balanced by the manufacturer on all three planes at all bearing supports. Manufacturer must ensure maximum fan RPM is below the first critical speed. The complete fan assembly, including motor and main drain pan shall be easily removable. Units shall be certified in accordance with the Room Fan Coil Unit certification program that is based on ARI Standard 440. An ECM blower motor shall be provided on all units. Factory motor wiring shall be set for optimum fan performance. The unit shall be shipped at one fixed setting. The ECM motor shall utilize a permanent magnet rotor, which is connected to the shaft through resilient rings to absorb high frequency torque ripple. ECM motor shall be programmed for constant CFM or constant torque. ECM blower

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motor shall be 3 speeds, single phase with means for proportional field adjustment of each speed.

C. Supply fans shall be driven by permanent split-capacitor motors that are run-tested in the assembled unit and permanently lubricated. All motors shall have integral thermal overload protection with a maximum ambient operating temperature of 104°F. Motors shall be capable of starting at 78 percent of rated voltage and operating at 90 percent of rated voltage on all speed settings. Motors can operate up to 10 percent overvoltage. Motor wires shall include a quick-disconnect motor plug.

D. Chilled water coil fins shall have full drawn collars to provide a continuous surface cover over the entire tube for maximum heat transfer. Seamless copper tubes shall be mechanically expanded into the fins to provide a continuous primary-to-secondary compression bond over the entire finned length for maximum heat transfer rates. Bare copper tubes shall not be visible between fins. Coil casing shall be constructed of galvanized steel. Water coils shall be provided with headers of seamless copper tubing with intruded tube holes to permit expansion and contraction without creating undue stress or strain. Coil connections shall be copper sweat connections with connection size to be determined by manufacturer based upon the most efficient coil circuiting. Vent and drain connections shall be furnished on the coil connection, external to the cabinet. Vent connections provided at the highest point to assure proper venting. Drain connections shall be provided at the lowest point. All steel parts exposed to moisture shall be galvanized. Unit shall include a noncorrosive, ABS main drain pan, positively sloped in every plane and insulated with closed-cell insulation. The drain pan shall be designed to ensure no pooling of condensate water per ASHRAE 62.2.

E. Heating water coil fins shall have full drawn collars to provide a continuous surface cover over the entire tube for maximum heat transfer. Seamless copper tubes shall be mechanically expanded into the fins to provide a continuous primary-to-secondary compression bond over the entire finned length for maximum heat transfer rates. Bare copper tubes shall not be visible between fins. Coils shall be provided with headers of seamless copper tubing with intruded tube holes to permit expansion and contraction without creating undue stress or strain. Coil connections shall be copper sweat connections with connection size to be determined by manufacturer based upon the most efficient coil circuiting. Vent and drain connections shall be furnished on the coil connection, external to the cabinet. Vent connections shall be provided at the highest point to ensure proper venting. Drain connections shall be provided at the lowest point.

F. Fan coil units shall be provided with factory-installed valve / piping package(s)available for the primary and secondary coils. All piping packages shall be factory assembled and tested at 400 psig (2760 kPa) and re-tested for leak when factory soldered to the coil(s) at 300 psig (2069 kPa) Maximum Working Pressure of the piping package shall be 300 psig (2069 kPa). The valve package shall be designed so that any condensation is directed into the secondary drain pan. With the secondary drain pan provided, insulation of the piping package is not required. The valve package shall be provided with:

1. Interconnecting copper piping and shut-off ball valves.

2. Connecting supply and return lines to the unit. Four-pipe packages shall include a venting valve for the preheat or reheat coil.
3. A manual circuit setter in the supply water pipe. The circuit setter acts as both a flow-setting device and a shut-off valve. It allows water flow through the fan coil to be set quickly and accurately. The valve shall have a memory stop so that the correct setting can be found quickly.
4. An automatic circuit setter. The circuit setter includes a cartridge within the valve body that is sized to allow a specific flow rate through the coil. This valve sets flow through the coil without any action required by a system piping balancer.
5. P/T ports to measure the temperature or pressure drop across the valve. This pressure drop can be compared to factory-supplied curves that relate the pressure drop to a specific flow rate.
6. Unions at the coil connections.
7. A 20 mesh strainer on the supply side that is easily removed for cleaning, with a blow-off valve. The strainer shall have a pressure rating of up to 400 psig (2,758 kPa).
8. Isolating ball valve on the supply side.
9. Balancing flow valve (auto-fixed or manual) with isolating ball valve on the return.
10. Control valves in the supply water pipe.
11. Two-Way/Two-Position Valves that are fully open or fully closed in response to a line voltage (115 or 265-277 VAC) or a 24 VAC signal from the Daikin Applied thermostat or controller. Some means of relieving pump head pressure should be accounted for when two-way valves are selected. Normally open or normally closed valves are available. Both are spring-return.

G. Filters shall be 1” (25 mm) throwaway. They shall be concealed from sight and easily removable.

H. Unit shall be supplied with a DDC interface board. DDC Interface board shall have three 24-volt relays with line-voltage contactors to operate the fan motor speeds. DDC interface board shall have terminal connections for interfacing to:

1. Wall-Mounted Thermostat
2. Low-voltage, on-off valve actuators.
3. A return air sensor.
4. A pipe temperature sensor for changeover from heating to cooling on two-pipe systems.
5. Condensate overflow switch.
6. Room occupancy sensor.

I. Dedicated outdoor air unit shall be manufactured by Daikin or similar by Greenheck or EFI.

PART 3 - EXECUTION

3.1 INSTALLATION, OPERATION, AND MAINTENANCE

A. Installation, Operation, and Maintenance manual shall be supplied with the unit.

B. Installing contractor shall install unit, including field installed components, in accordance with Installation, Operation, and Maintenance manual instructions.

C. Start up and maintenance requirements shall be complied with to ensure safe and correct operation of the unit.

END OF SECTION

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SECTION 238239.13

CABINET UNIT HEATERS

PART 1 - GENERAL

1.1 NOTE

A. The requirements of Section 200000 apply to work performed under this Section.

1.2 SCOPE

A. The Work under this Section of the Specification shall include the furnishing of labor, equipment and materials for the installation of heating, air conditioning and ventilating systems as specified, shown on the Drawings or implied to provide continuous and satisfactory service.

PART 2 - PRODUCTS

2.1 CABINET UNIT HEATERS

A. Provide cabinet unit heaters constructed and rated in accordance with the standards of the Air Moving and Conditioning Association and ASHRAE and have a U.L. approved disconnect means.

B. Heating elements shall be copper tube aluminum fin suitable for operation with hot water.

C. Motors shall be especially designed for continuous operation and shall be multi speed permanent split capacitor type.

D. Cabinet unit heaters shall be constructed of 18-gauge cold rolled steel with standard factory baked enamel finish selected by the Architect. Units shall have a removable front panel for access to interior. Recessed units shall have overlapping plaster type flange on all four sides separate from unit access panel. Discharge and recirculating grilles shall be louver type stamped in the front panel or top.

E. Fans in the cabinet unit heaters shall be the forward curved, double inlet type, mounted on a steel shaft with permanently sealed and lubricated ball bearings.

F. Provide permanent filter frames with replaceable media.

G. Provide built in return air thermostat compatible with automatic temperature control system. Provide disconnect switch.

H. Unit heaters shall be Vulcan, Sterling, Daikin or Modine.

PART 3 - EXECUTION

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3.1 INSTALLATION, OPERATION, AND MAINTENANCE

A. Installation, Operation, and Maintenance manual shall be supplied with the unit.

B. Installing contractor shall install unit, including field installed components, in accordance with Installation, Operation, and Maintenance manual instructions.

C. Start up and maintenance requirements shall be complied with to ensure safe and correct operation of the unit.

END OF SECTION

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SECTION 238239.16

PROPELLER UNIT HEATERS

PART 1 - GENERAL

1.1 NOTE

A. The requirements of Section 200000 apply to work performed under this Section.

1.2 SCOPE

A. The Work under this Section of the Specification shall include the furnishing of labor, equipment and materials for the installation of heating, air conditioning and ventilating systems as specified, shown on the Drawings or implied to provide continuous and satisfactory service.

PART 2 - PRODUCTS

2.1 PROPELLER UNIT HEATERS

A. Provide horizontal, hot water heating, propeller unit heater of the capacities noted and where shown on the drawings.

B. Heaters shall be complete with casing, finned tube heating element, propeller fan, fan guard, motor and discharge louvers.

C. Heating element shall be copper tube aluminum fin suitable for hot water use.

D. Horizontal hot water propeller unit heaters shall be Vulcan, Sterling, Daikin or Modine.

PART 3 - EXECUTION

3.1 INSTALLATION, OPERATION, AND MAINTENANCE

A. Installation, Operation, and Maintenance manual shall be supplied with the unit.

B. Installing contractor shall install unit, including field installed components, in accordance with Installation, Operation, and Maintenance manual instructions.

C. Start up and maintenance requirements shall be complied with to ensure safe and correct operation of the unit.

END OF SECTION

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SECTION 260519

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:
   1. Building wire rated 600 V or less.
   2. Metal-clad cable, Type MC, rated 600 V or less.
   3. Connectors, splices, and terminations rated 600 V and less.

1.03 SUBMITTALS

A. Product Data: For each type of product.

B. Field quality-control reports.

PART 2 - PRODUCTS

2.01 BUILDING WIRE

A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Encore Wire Corporation.
   2. Cerro Wire.
   3. Southwire Company.

C. Standards:
   1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
   2. RoHS compliant.
   3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.

E. Conductor Insulation:
   1. Type THHN and Type THWN-2: Comply with UL 83.

2.02 METAL-CLAD CABLE, TYPE MC

A. Description: A factory assembly of one or more current-carrying insulated conductors in an overall metallic sheath.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Encore Wire Corporation.
2. Cerro Wire.
3. Southwire Company.

C. Standards:
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. Comply with UL 1569.
3. RoHS compliant.
4. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Circuits: Single circuit.

E. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.

F. Ground Conductor: Insulated.

G. Conductor Insulation: Type TFN/THHN/THWN-2: Comply with UL 83.

H. Armor: Steel, interlocked.

2.03 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. 3M Electrical Products.
2. Ideal Industries, Inc.
3. O-Z/Gedney; a brand of Emerson Industrial Automation.
4. TE Connectivity Ltd.

C. Provide compression/crimp lugs for conductor connections.

PART 3 - EXECUTION

3.01 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.

3.02 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Exposed Feeders in Unfinished Areas: Type THHN/THWN-2, single conductors in raceway.

B. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN/THWN-2, single conductors in raceway.

C. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.

D. Exposed Branch Circuits in Unfinished Areas, Including in Crawlspaces: Type THHN/THWN-2, single conductors in raceway.

E. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Metal-clad cable, Type MC, in walls or partitions extend to 6 feet above accessible ceilings then transition to single conductor in raceways.

F. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.

3.03 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

3.04 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

D. Crimp compression type lugs in accordance with manufacturer’s instructions.

3.05 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.06 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly.

3.07 FIELD QUALITY CONTROL

A. Perform tests and inspections.
   1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
   2. Perform each of the following visual and electrical tests:
      a. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.
      b. Inspect for correct identification.
      c. Inspect cable jacket and condition.
      d. Continuity test on each conductor and cable.

B. Cables will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports to record the following:
   1. Procedures used.
   2. Results that comply with requirements.
   3. Results that do not comply with requirements, and corrective action taken to achieve compliance with requirements.

END OF SECTION

SECTION 260526

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes grounding and bonding systems and equipment.

1.03 SUBMITTALS

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

B. Field quality-control reports.

1.04 QUALITY ASSURANCE

A. Testing Agency Qualifications: Certified by NETA.

PART 2 - PRODUCTS

2.01 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

2.02 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Burndy; Part of Hubbell Electrical Systems.
   2. ERICO International Corporation.
   3. O-Z/Gedney; a brand of Emerson Industrial Automation.

2.03 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:
   1. Solid Conductors: ASTM B 3.
   2. Stranded Conductors: ASTM B 8.
   3. Tinned Conductors: ASTM B 33.
   4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
   5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
   6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

2.04 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

C. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

D. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.

E. Cable-to-Cable Connectors: Compression type, copper or copper alloy.

F. Conduit Hubs: Mechanical type, terminal with threaded hub.

G. Straps: Solid copper, cast-bronze clamp. Rated for 600 A.

H. U-Bolt Clamps: Mechanical type, copper or copper alloy, terminal listed for direct burial.

I. Water Pipe Clamps:
   1. Mechanical type, two pieces with stainless-steel bolts.
      a. Material: Die-cast zinc alloy.
      b. Listed for direct burial.
   2. U-bolt type with malleable-iron clamp and copper ground connector.

2.05 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet.

PART 3 - EXECUTION

3.01 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install bare copper conductor. Size as indicated on the drawings.
   1. Bury at least 24 inches below grade.

C. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
   1. Install bus horizontally, on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.

D. Conductor Terminations and Connections:
   1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
   2. Underground Connections: Welded connectors.
   3. Connections to Structural Steel: Welded connectors.

3.02 GROUNDING AND BONDING

A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses. Comply with NFPA 70.

3.03 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

3.04 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.
   1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
   2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
   1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
   2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
   3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

D. Grounding and Bonding for Piping:
   1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
   2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.

3.05 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections:
   1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
   2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
   3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at individual ground rods. Make tests at ground rods before any conductors are connected.
      a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
      b. Perform tests by fall-of-potential method according to IEEE 81.

C. Grounding system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

E. Report measured ground resistances to meet the following values:
   1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.

F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Engineer promptly and include recommendations to reduce ground resistance.

END OF SECTION

SECTION 260529

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:
   1. Steel slotted support systems.
   2. Conduit and cable support devices.
   3. Support for conductors in vertical conduit.
   4. Structural steel for fabricated supports and restraints.
   5. Mounting, anchoring, and attachment components, including powder-actuated fasteners, mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.

PART 2 - PRODUCTS

2.01 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32-inch-diameter holes at a maximum of 8 inches o.c. in at least one surface.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. B-line, an Eaton business.
      b. ERICO International Corporation.
      c. Thomas & Betts Corporation; A Member of the ABB Group.
      d. Unistrut; Part of Atkore International.
   2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
   3. Material for Channel, Fittings, and Accessories: Galvanized steel.
   4. Channel Width: Selected for applicable load criteria.
   5. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
   6. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.

D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.

E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
   1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
      a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
         1) Hilti, Inc.
         2) ITW Ramset/Red Head; Illinois Tool Works, Inc.
         3) MKT Fastening, LLC.
         4) Simpson Strong-Tie Co., Inc.
   2. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
      a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
         1) B-line, an Eaton business.
         2) Empire Tool and Manufacturing Co., Inc.
         3) Hilti, Inc.
         4) ITW Ramset/Red Head; Illinois Tool Works, Inc.
         5) MKT Fastening, LLC.
   3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
   4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
   5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
   6. Toggle Bolts: Stainless-steel springhead type.
   7. Hanger Rods: Threaded steel.

PART 3 - EXECUTION

3.01 APPLICATION

A. Comply with the following standards for application and installation requirements of hangers and supports, except where requirements on Drawings or in this Section are stricter:
   1. NECA 1.
   2. NECA 101

B. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."

C. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

D. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
   1. Secure raceways and cables to these supports with two-bolt conduit clamps.

3.02 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT and RMC may be supported by openings through structure members, according to NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
   1. To Wood: Fasten with lag screws or through bolts.
   2. To New Concrete: Bolt to concrete inserts.
   3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
   4. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
   5. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.
   6. To Light Steel: Sheet metal screws.
   7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.03 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
   1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 260533

RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:
   1. Metal conduits, tubing, and fittings.
   2. Nonmetal conduits, tubing, and fittings.
   3. Metal wireways and auxiliary gutters.
   4. Boxes.

1.03 DEFINITIONS

A. GRC: Galvanized rigid steel conduit.

1.04 SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Source quality-control reports.

PART 2 - PRODUCTS

2.01 METAL CONDUITS, TUBING, AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Allied Tube & Conduit; a part of Atkore International.
   2. Republic Conduit.
   3. Thomas & Betts Corporation; A Member of the ABB Group.
   4. Western Tube and Conduit Corporation.
   5. Wheatland Tube Company.

B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. GRC: Comply with ANSI C80.1 and UL 6.

D. EMT: Comply with ANSI C80.3 and UL 797.

E. FMC: Comply with UL 1; zinc-coated steel.

F. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

G. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
   1. Fittings for EMT:
      a. Material: Steel.

b. Type: Compression.

2. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.

H. Joint Compound for GRC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.02 NONMETALLIC CONDUITS AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. CANTEX INC.
2. Lamson & Sessions.
3. RACO; Hubbell.
4. Thomas & Betts Corporation; A Member of the ABB Group.

B. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

D. Solvents and Adhesives: As recommended by conduit manufacturer.

2.03 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. B-line, an Eaton business.
2. Hoffman; a brand of Pentair Equipment Protection.
3. MonoSystems, Inc.
4. Square D.

B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 for indoor, Type 3R for outdoor, and sized according to NFPA 70.
1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Screw-cover type unless otherwise indicated.

E. Finish: Manufacturer's standard enamel finish.

2.04 BOXES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Crouse-Hinds, an Eaton business.
2. EGS/Appleton Electric.
3. Hoffman; a brand of Pentair Equipment Protection.
4. Hubbell Incorporated.
5. RACO; Hubbell.
6. Spring City Electrical Manufacturing Company.
7. Thomas & Betts Corporation; A Member of the ABB Group.
8. Wiremold / Legrand.

B. General Requirements for Boxes: Boxes installed in wet locations shall be listed for use in wet locations.

C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

E. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.

F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

G. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.

H. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

I. Device Box Dimensions: 4 inches square by 2-1/8 inches deep and 4 inches by 2-1/8 inches by 2-1/8 inches deep.

J. Gangable boxes are prohibited.

PART 3 - EXECUTION

3.01 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
1. Exposed Conduit: GRC.
2. Concealed Conduit, Aboveground: GRC.
3. Underground Conduit: RNC, Type EPC-40-PVC, transition to GRC riser.
4. Connection to Vibrating Equipment: LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
6. GRC for all stub ups and within 10 feet of building foundation walls.

B. Indoors: Apply raceway products as specified below unless otherwise indicated:
1. Exposed: EMT.
2. Concealed in Ceilings and Interior Walls and Partitions: MC cable, to 6 feet in accessible ceiling then transition to EMT.
3. Connection to Vibrating Equipment: FMC, except use LFMC in damp or wet locations.
4. Damp or Wet Locations: GRC.

5. Boxes: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in damp or wet locations.

C. Minimum Raceway Size: 3/4-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. EMT: Use compression, steel fittings. Comply with NEMA FB 2.10.
3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

3.02 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

E. Arrange stub-ups so curved portions of bends are not visible above finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.

G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

H. Support conduit and MC cable within 12 inches of enclosures to which attached.

I. Raceways Embedded in Slabs:
1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-footintervals.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
4. Change from RNC, Type EPC-40-PVC to GRC before rising above floor.

J. Stub-ups to Above Recessed Ceilings:
1. Use EMT for raceways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

K. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

L. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

M. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

N. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

O. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

P. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

Q. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
   1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
   2. Where an underground service raceway enters a building or structure.
   3. Where otherwise required by NFPA 70.

R. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

S. Expansion-Joint Fittings:
   1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.
   2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
      a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
      b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
      c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
      d. Attics: 135 deg F temperature change.
   3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least

0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.

4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

T. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
   1. Use LFMC in damp or wet locations subject to severe physical damage.
   2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

U. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

V. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

W. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

X. Locate boxes so that cover or plate will not span different building finishes.

Y. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

Z. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

3.03 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies.

3.04 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.
   1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

END OF SECTION

SECTION 260553

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:
   1. Identification for raceways.
   2. Identification for cables.
   3. Identification for conductors.
   4. Underground-line warning tape.
   5. Warning labels.
   6. Equipment identification labels.
   7. Miscellaneous identification products.

1.03 ACTION SUBMITTALS

A. Product Data: For each electrical identification product indicated.

B. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

1.04 QUALITY ASSURANCE

A. Comply with ANSI A13.1 and IEEE C2.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.05 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.01 POWER AND CONTROL RACEWAY IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.

B. Colors for Raceways Carrying Circuits at 600 V or Less:
   1. Black letters on an orange field.
   2. Legend: Indicate voltage.

C. Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.

2.02 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

B. Self-Adhesive, Self-Laminating Polyester Labels: Preprinted, 3-mil-thick flexible label with acrylic pressure-sensitive adhesive that provides a clear, weather- and chemical-resistant, self-laminating, protective shield over the legend. Labels sized to fit the conductor diameter such that the clear shield overlaps the entire printed legend.

C. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

2.03 UNDERGROUND-LINE WARNING TAPE

A. Tape:
   1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
   2. Printing on tape shall be permanent and shall not be damaged by burial operations.
   3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing:
   1. Comply with ANSI Z535.1 through ANSI Z535.5.
   2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE.
   3. Inscriptions for Orange-Colored Tapes: COMMUNICATIONS CABLE.

C. Reinforced, detectable three-layer laminate, consisting of a printed pigmented woven scrim, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core, bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
   1. Overall Thickness: 8 mils.
   2. Foil Core Thickness: 0.35 mil.
   3. Weight: 34 lb/1000 sq. ft..
   4. 3-InchTensile According to ASTM D 882: 300 lbf, and 12,500 psi.

2.04 WARNING LABELS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

2.05 EQUIPMENT IDENTIFICATION LABELS

A. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch.

B. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

C. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

2.06 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self extinguishing, one piece, self locking, Type 6/6 nylon.
   1. Minimum Width: 3/16 inch.
   2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.
   3. Temperature Range: Minus 40 to plus 185 deg F.
   4. Color: Black except where used for color-coding.

B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self extinguishing, one piece, self locking, Type 6/6 nylon.
   1. Minimum Width: 3/16 inch.
   2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.
   3. Temperature Range: Minus 40 to plus 185 deg F.
   4. Color: Black.

C. Plenum-Rated Cable Ties: Self extinguishing, UV stabilized, one piece, self locking.
   1. Minimum Width: 3/16 inch.
   2. Tensile Strength at 73 deg F, According to ASTM D 638: 7000 psi.
   3. UL 94 Flame Rating: 94V-0.
   4. Temperature Range: Minus 50 to plus 284 deg F.
   5. Color: Black.

2.07 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

F. Attach plastic raceway and cable labels that are not self-adhesive type with clear vinyl tape with adhesive appropriate to the location and substrate.

G. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

H. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:
   1. Outdoors: UV-stabilized nylon.
   2. In Spaces Handling Environmental Air: Plenum rated.

I. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape 12 inches above concrete-encased ducts and duct banks. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.

J. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

3.02 IDENTIFICATION SCHEDULE

A. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
   1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder and branch-circuit conductors.
      a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
      b. Colors for 208/120-V Circuits:
         1) Phase A: Black.
         2) Phase B: Red.
         3) Phase C: Blue.
      c. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

B. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.

1. Install underground-line warning tape for both direct-buried cables and cables in raceway.

C. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
   1. Labeling Instructions:
      a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label; where two lines of text are required, use labels 2 inches high.
      b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
      c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
      d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
   2. Equipment to Be Labeled:
      a. Enclosures and electrical cabinets.
      b. Access doors and panels for concealed electrical items.

END OF SECTION

SECTION 260923

LIGHTING CONTROL DEVICES

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. All lighting control devices shall be by the same manufacturer unless noted otherwise.

1.02 SUMMARY

A. Section Includes:
   1. Time switches.
   2. Photoelectric switches.
   3. Indoor occupancy and vacancy sensors.
   4. Switchbox-mounted occupancy sensors.

1.03 SUBMITTALS

A. Product Data: For each type of product.

B. Field quality-control reports.

C. Sample Warranty: For manufacturer's warranties.

D. Operation and Maintenance Data: For each type of lighting control device to include in operation and maintenance manuals.

1.04 WARRANTY

A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace lighting control devices that fail(s) in materials or workmanship within specified warranty period.
   1. Warranty Period: Two year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 TIME SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Intermatic, Inc., ET 8215C.
   2. NSi Industries LLC (Tork).

B. Electronic Time Switches: Solid state, programmable, with alphanumeric display; complying with UL 917.
   1. Listed and labeled as defined in NFPA 70 and marked for intended location and application.
   2. Contact Configuration: DPST.
   3. Contact Rating: 30-A ballast load, 120-/240-V ac.
   4. Programs: Multiple channels; eight on-off set points on a 24-hour schedule and an annual holiday schedule that overrides the weekly operation on holidays.

5. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program on selected channels.
6. Astronomic Time: All channels.
7. Automatic daylight savings time changeover.
8. Battery Backup: Not less than seven days reserve, to maintain schedules and time clock.
9. Provide with all functions as required to comply with the Project Documents.

2.02 OUTDOOR PHOTOELECTRIC SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Intermatic, Inc.
2. NSi Industries LLC.

B. Description: Solid state, with DPST dry contacts rated for 1800 VA inductive, to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A, and compatible with ballasts and LED lamps.
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Light-Level Monitoring Range: 1.5 to 10 fc, with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of the photocell to prevent fixed light sources from causing turn-off.
3. Time Delay: Fifteen-second minimum, to prevent false operation.
4. Surge Protection: Metal-oxide varistor.
5. Mounting: Twist lock complies with NEMA C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.
6. Failure Mode: Luminaire stays ON.

2.03 INDOOR OCCUPANCYAND VACANCY SENSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Lutron.
2. Cooper Controls; Eaton.
3. Hubbell Building Automation, Inc.
4. Leviton Manufacturing Co., Inc.
5. Lithonia Lighting; Acuity Controls.
6. WattStopper; a Legrand® Group brand.

B. General Requirements for Sensors:
1. Ceiling-mounted, digital and solid-state indoor occupancy and vacancy sensors.
2. Dual technology. Infrared and ultrasonic.
3. Separate power pack (for low voltage sensors).
4. Hardwired connection to switch; and lighting control system.
5. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

6. Operation:
    a. Combination Sensor: Unless otherwise indicated, sensor shall be programmed to turn lights on when coverage area is occupied and turn them off when unoccupied, or to turn off lights that have been manually turned on; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
7. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A.
8. Power: Low voltage or line voltage. As indicated on the Project Documents.
9. Power Pack: Dry contacts rated for 20-A ballast or LED load at 120- and 277-V ac, for 20-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, Class 2 power source rated for loads served, as defined by NFPA 70 (for low voltage sensors).
10. Mounting:
    a. Sensor: Suitable for mounting in any position on a standard outlet box.
    b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
    c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
11. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
12. Bypass Switch: Override the "on" function in case of sensor failure.

C. Dual-Technology Type: Ceiling mounted; detect occupants in coverage area using PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is selectable in the field by operating controls on unit.
1. Sensitivity Adjustment: Separate for each sensing technology.
2. Detector Sensitivity: Detect occurrences of 6-inch-minimum movement of any portion of a human body that presents a target of not less than 36 sq. in., and detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch-high ceiling.
4. Detection Coverage (Room, Wall Mounted): Detect occupancy anywhere within a 180-degree pattern centered on the sensor over an area of 1000 square feet when mounted48 inches above finished floor.

2.04 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Lutron.
2. Cooper Controls; Eaton.
3. Hubbell Building Automation, Inc.
4. Leviton Manufacturing Co., Inc.
5. Lithonia Lighting; Acuity Controls.
6. WattStopper; a Legrand® Group brand.

B. General Requirements for Sensors: Automatic-wall-switch occupancy sensor with manual on-off switch, suitable for mounting in a single gang switchbox, with provisions for connection to BAS using hardwired connection.
   1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   2. Occupancy Sensor Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn lights off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
   3. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F.
   4. Switch Rating: Not less than 800-VA ballast or LED load at 120 V, 1200-VA ballast or LED load at 277 V.

C. Wall-Switch Sensor:
   1. Standard Range: 180-degree field of view, field adjustable from 180 to 40 degrees; with a minimum coverage area of 900 sq. ft.
   2. Sensing Technology: Dual technology - PIR and ultrasonic.
   3. Switch Type: SP, field-selectable automatic "on," or manual "on," automatic "off."
   4. Capable of controlling load in three-way application.
   5. Voltage: Match the circuit voltage.
   6. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
   7. Concealed, "off" time-delay selector at 30 seconds and 5, 10, and 20 minutes.
   8. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and helps eliminate false "off" switching.
   9. Color: As selected by the Architect.
   10. Faceplate: Color matched to switch.

2.05 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG.

C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 14 AWG.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine lighting control devices before installation. Reject lighting control devices that are wet, moisture damaged, or mold damaged.

B. Examine walls and ceilings for suitable conditions where lighting control devices will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 SENSOR INSTALLATION

A. Comply with NECA 1.

B. 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 systems, and partition assemblies.

C. Install and aim sensors in locations to achieve not less than 90-percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.03 CONTACTOR INSTALLATION

A. Comply with NECA 1.

B. Mount electrically held lighting contactors with elastomeric isolator pads to eliminate structure-borne vibration unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.04 WIRING INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 3/4 inch.

C. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

D. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.

E. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.05 IDENTIFICATION

A. Identify components and power and control wiring according to Section 260553 "Identification for Electrical Systems."
   1. Identify controlled circuits in lighting contactors.
   2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.

B. Label time switches and contactors with a unique designation.

3.06 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
   1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
   2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Lighting control devices will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.07 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

END OF SECTION

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SECTION 262416

PANELBOARDS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:
   1. Panelboards.

1.03 DEFINITIONS

A. ATS: Acceptance testing specification.

B. GFCI: Ground-fault circuit interrupter.

C. GFEP: Ground-fault equipment protection.

D. MCCB: Molded-case circuit breaker.

E. VPR: Voltage protection rating.

1.04 SUBMITTALS

A. Product Data: For each type of panelboard.
   1. Include materials, switching and overcurrent protective devices, SPDs, accessories, and components indicated.
   2. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. Include the following:
   1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
   2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: ISO 9001 or 9002 certified.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Handle and prepare panelboards for installation according to NEMA PB 1.

1.07 FIELD CONDITIONS

A. Environmental Limitations:
   1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and

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humidity conditions at occupancy levels during the remainder of the construction period.

2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
   a. Ambient Temperature: Not exceeding minus 22 deg F to plus 104 deg F.
   b. Altitude: Not exceeding 6600 feet.

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:
   1. Ambient temperatures within limits specified.
   2. Altitude not exceeding 6600 feet.

1.08 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.
   1. Panelboard Warranty Period: 12 months from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PANELBOARDS COMMON REQUIREMENTS

A. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA PB 1.

D. Comply with NFPA 70.

E. Enclosures: Flush and surface-mounted, dead-front cabinets.
   1. Rated for environmental conditions at installed location.
      a. Indoor Dry and Clean Locations: NEMA 250, Type 1 unless noted otherwise.
   2. Height: 84 inches maximum.
   3. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box. Trims shall cover all live parts and shall have no exposed hardware.
   4. Finishes:
      a. Panels and Trim: Galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
      b. Back Boxes: Galvanized steel.

F. Incoming Mains:
   1. Location: Convertible between top and bottom.
   2. Main Breaker: As shown on the Drawings. Main lug interiors up to 400 amperes shall be field convertible to main breaker.

G. Phase, Neutral, and Ground Buses:

1. Material: Tin-plated aluminum.
    a. Plating shall run entire length of bus.
    b. Bus shall be fully rated the entire length.
2. Interiors shall be factory assembled into a unit. Replacing switching and protective devices shall not disturb adjacent units or require removing the main bus connectors.
3. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
4. Full-Sized Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure. Do not mount neutral bus in gutter.

H. Conductor Connectors: Suitable for use with conductor material and sizes.
1. Material: Tin-plated aluminum.
2. Terminations shall allow use of 75 deg C rated conductors without derating.
3. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.
4. Main and Neutral Lugs: Mechanical type, with a lug on the neutral bar for each pole in the panelboard.
5. Ground Lugs and Bus-Configured Terminators: Mechanical type, with a lug on the bar for each pole in the panelboard.

I. NRTL Label: Panelboards shall be labeled by an NRTL acceptable to authority having jurisdiction for use as service equipment.

J. Future Devices: Panelboards or load centers shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

K. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.
1. Panelboards and overcurrent protective devices rated 240 V or less shall have short-circuit ratings as shown on Drawings, but not less than 10,000 A rms symmetrical.

2.02 PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton.
2. Siemens Energy.
3. Square D; by Schneider Electric. (Basis-of-Design – Main Distribution Panel: I-Line; House Panel: NQ)

B. Panelboards: NEMA PB 1.

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
1. For doors more than 36 inches high, provide two latches, keyed alike.

D. Mains: Circuit breaker, unless noted otherwise.

E. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units. Plug on for load centers.

F. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.03 DISCONNECTING MEANS AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Eaton.
   2. Siemens Energy.
   3. Square D; by Schneider Electric.

B. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.
   1. Thermal-Magnetic Circuit Breakers:
      a. Inverse time-current element for low-level overloads.
      b. Instantaneous magnetic trip element for short circuits.
      c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
   2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
   3. Electronic Trip Circuit Breakers:
      a. RMS sensing.
      b. Field-replaceable rating plug or electronic trip.
      c. Digital display of settings, trip targets, and indicated metering displays.
      d. Multi-button keypad to access programmable functions and monitored data.
      e. Ten-event, trip-history log. Each trip event shall be recorded with type, phase, and magnitude of fault that caused the trip.
      f. Integral test jack for connection to portable test set or laptop computer.
      g. Field-Adjustable Settings:
         1) Instantaneous trip.
         2) Long- and short-time pickup levels.
         3) Long and short time adjustments.

2.04 IDENTIFICATION

A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.

B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.

C. Circuit Directory: Directory card inside panelboard door, mounted in transparent card holder.
   1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

D. Circuit Directory: Computer-generated circuit directory mounted inside panelboard door with transparent plastic protective cover.
   1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.

B. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.

C. Examine panelboards before installation. Reject panelboards that are damaged, rusted, or have been subjected to water saturation.

D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Comply with NECA 1.

C. Install panelboards and accessories according to NEMA PB 1.1.

D. Equipment Mounting:
   1. Attach panelboard to the vertical finished or structural surface behind the panelboard.

E. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

F. Mount panelboard cabinet plumb and rigid without distortion of box.

G. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

H. Mount surface-mounted panelboards to steel slotted supports 1 1/4 inch in depth. Orient steel slotted supports vertically.

I. Install overcurrent protective devices and controllers not already factory installed.
   1. Set field-adjustable, circuit-breaker trip ranges.
   2. Tighten bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written instructions.

J. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.

K. Install filler plates in unused spaces.

L. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

3.03 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

D. Install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems" identifying source of remote circuit.

3.04 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:
   1. Test continuity of each circuit.

C. Tests and Inspections:
   1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers and low-voltage surge arrestors stated in NETA ATS, Paragraph 7.6 Circuit Breakers and Paragraph 7.19.1 Surge Arrestors, Low-Voltage. Certify compliance with test parameters.
   2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

D. Panelboards will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.05 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges

C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes. Prior to making circuit changes to achieve load balancing, inform Architect of effect on phase color coding.
   1. Measure loads during period of normal facility operations.
   2. Perform circuit changes to achieve load balancing outside normal facility operation schedule or at times directed by the Architect. Avoid disrupting services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.

3. After changing circuits to achieve load balancing, recheck loads during normal facility operations. Record load readings before and after changing circuits to achieve load balancing.
4. Tolerance: Maximum difference between phase loads, within a panelboard, shall not exceed 20 percent.

END OF SECTION

SECTION 262726

WIRING DEVICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:
   1. Receptacles, receptacles with integral GFCI, and associated device plates.
   2. Weather-resistant receptacles.
   3. Snap switches and wall-box dimmers.
   4. Wall-switch and exterior occupancy sensors.
   5. Communications outlets.

1.03 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

D. RFI: Radio-frequency interference.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Receptacles for Owner-Furnished Equipment: Match plug configurations.

1.05 SUBMITTALS

A. Product Data: For each type of product.

B. Field quality-control reports.

C. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
   1. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
   2. Leviton Mfg. Company Inc. (Leviton).
   3. Pass & Seymour/Legrand (Pass & Seymour).

B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

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2.02 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:
   1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
   2. Devices shall comply with the requirements in this Section.

2.03 STRAIGHT-BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Hubbell; HBL5361 (single), HBL5362 (duplex).
      b. Leviton; 5891 (single), BR20 (duplex).
      c. Pass & Seymour; 5361 (single), 5362 (duplex).

2.04 GFCI RECEPTACLES

A. General Description:
   1. Straight blade, feed-through type.
   2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
   3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Hubbell; GFR5352L.
      b. Pass & Seymour; 2095.
      c. Leviton; 7899.

2.05 TOGGLE SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Switches, 120/277 V, 20 A:
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Single Pole:
         1) Hubbell; HBL1221.
         2) Leviton; 1221-2.
         3) Pass & Seymour; CSB20AC1.
      b. Two Pole:
         1) Hubbell; HBL1222.
         2) Leviton; 1222-2.
         3) Pass & Seymour; CSB20AC2.

c. Three Way:
   1) Hubbell; HBL1223.
   2) Leviton; 1223-2.
   3) Pass & Seymour; CSB20AC3.
d. Four Way:
   1) Hubbell; HBL1224.
   2) Leviton; 1224-2.
   3) Pass & Seymour; CSB20AC4.

2.06 WALL-BOX DIMMERS

A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.

B. Control: Continuously adjustable slider; with single-pole or three-way switching. Comply with UL 1472.

C. LED Lamp Dimmer Switches: Modular, compatible with dimmer LED drivers, trim potentiometer to adjust low-end dimming; dimmer-driver combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

2.07 WALL PLATES

A. Single and combination types shall match corresponding wiring devices.
   1. Plate-Securing Screws: Metal with head color to match plate finish.
   2. Material for Finished Spaces: Smooth high impact thermoplastic. Finish color to match device color.
   3. Material for Unfinished Spaces: Galvanized steel.
   4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with while-in-use lockable cover.

2.08 FINISHES

A. Device Color:
   1. Wiring Devices Connected to Normal Power System: As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.

B. Wall Plate Color: Match device color.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. All wiring devices shall be mounted at 24 inches above finished floor, unless otherwise indicated. All light switches and dimmers shall be mounted at elevation in compliance with ADA requirements.

C. Coordination with Other Trades:

1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

D. Conductors:
1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:
    a. Cut back and pigtail, or replace all damaged conductors.
    b. Straighten conductors that remain and remove corrosion and foreign matter.
    c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.

E. Device Installation:
1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

F. Receptacle Orientation:
1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.

G. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

H. Dimmers:
1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

I. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

3.02 GFCI RECEPTACLES

A. Install non-feed-through-type GFCI receptacles.

3.03 IDENTIFICATION

A. Comply with Section 260553 "Electrical Identification."

B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with white-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.04 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

B. Tests for Convenience Receptacles:
1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

C. Wiring device will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION

SECTION 262913.03

MANUAL AND MAGNETIC MOTOR CONTROLLERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:
   1. Manual motor controllers.
   2. Enclosures.
   3. Identification.

1.03 SUBMITTALS

A. Product Data: For each type of product.
   1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Operation and Maintenance Manuals.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Store controllers indoors in clean, dry space with uniform temperature to prevent condensation. Protect controllers from exposure to dirt, fumes, water, corrosive substances, and physical damage.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. NEMA Compliance: Fabricate motor controllers to comply with ICS 2.

2.02 MANUAL MOTOR CONTROLLERS

A. Motor-Starting Switches (MSS): "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off or on.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Eaton.
      b. Rockwell Automation, Inc.
      c. Siemens Industry, Inc.
      d. Square D; by Schneider Electric.
   2. Standard: Comply with NEMA ICS 2, general purpose, Class A.
   3. Configuration: Nonreversing.
   4. Pilot Light: Red.

B. Fractional Horsepower Manual Controllers (FHPMC): "Quick-make, quick-break" toggle action; marked to show whether unit is off, on, or tripped.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Eaton.
      b. Rockwell Automation, Inc.
      c. Siemens Industry, Inc.
      d. Square D; by Schneider Electric.
   2. Configuration: Nonreversing.
   3. Overload Relays: Inverse-time-current characteristics; NEMA ICS 2, Class 10 tripping characteristics; heaters matched to nameplate full-load current of actual protected motor; external reset push button; bimetallic type.
   4. Pilot Light: Red.

2.03 ENCLOSURES

A. Comply with NEMA 250, type designations as indicated on Drawings, complying with environmental conditions at installed location.

B. The construction of the enclosures shall comply with NEMA ICS 6.

2.04 IDENTIFICATION

A. Controller Nameplates: As described in Section 260553 "Identification for Electrical Systems," for each compartment.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and space conditions for compliance with requirements for motor controllers, their relationship with the motors, and other conditions affecting performance of the Work.

3.02 INSTALLATION

A. Comply with NECA 1.

B. Maintain minimum clearances and workspace at equipment according to manufacturer's written instructions and NFPA 70.

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

D. Setting of Overload Relays: Select and set overloads on the basis of full-load current rating as shown on motor nameplate. Adjust setting value for special motors as required by NFPA 70 for motors that are high-torque, high-efficiency, and so on.

3.03 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.04 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:
   1. Comply with the provisions of NFPA 70B, "Testing and Test Methods" Chapter.
   2. Visual and Mechanical Inspection:
      a. Compare equipment nameplate data with drawings and specifications.
      b. Inspect physical and mechanical condition.
      c. Inspect anchorage, alignment, and grounding.
      d. Verify the unit is clean.
      e. Motor-Running Protection:
         1) Verify overload element rating is correct for its application.
         2) If motor-running protection is provided by fuses, verify correct fuse rating.

C. Motor controller will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION

SECTION 265119

LED INTERIOR LIGHTING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes:
   1. LED luminaires.
   2. LED emergency lighting and exit signs.
   3. Lighting fixture supports.

B. Related Requirements:
   1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.

1.03 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. LED: Light-emitting diode.

F. Lumen: Measured output of lamp and luminaire, or both.

G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.04 SUBMITTALS

A. Product Data: For each type of interior lighting product.
   1. Arrange in order of luminaire designation.
   2. Include data on features, accessories, and finishes.
   3. Include physical description and dimensions of luminaires.
   4. Include life, output (lumens, CCT, and CRI), and energy efficiency data.
   5. Photometric data and adjustment factors based on laboratory tests, complying with IES Lighting Measurements Testing and Calculation Guides, of each luminaire type. The adjustment factors shall be for lamps and accessories identical to those indicated for the luminaire as applied in this Project.
      a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Product Certificates: For each type of luminaire.

D. Sample warranty.

E. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.

1.05 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.

B. Provide luminaires from a single manufacturer for each luminaire type.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.07 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

B. Warranty Period: Five years from date of Substantial Completion for lighting fixtures, emergency lighting, exit signs, and batteries. Battery warranty may be prorated.

PART 2 - PRODUCTS

2.01 LUMINAIRE SCHEDULE (Refer to Drawings)

2.02 LUMINAIRE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application. Provide fixtures as indicated on the Drawings.

B. UL listed.

C. Recessed luminaires shall comply with NEMA LE 4.

D. CRI of minimum 80. CCT of 3500 K or as indicated on the Drawings.

E. Rated lamp life of minimum 50,000 hours to L70.

F. Lamps dimmable from 100 percent to 0 percent of maximum light output.

G. Internal driver, unless otherwise indicated.

H. Nominal Operating Voltage: As indicated on the Drawings.

I. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

J. Housings: As indicated on the Drawings.

2.03 MATERIALS

A. Metal Parts:
   1. Free of burrs and sharp corners and edges.
   2. Sheet metal components shall be steel unless otherwise indicated.

3. Form and support to prevent warping and sagging.

B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

C. Diffusers and Globes:
1. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
2. Glass: Annealed crystal glass unless otherwise indicated.
3. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

2.04 METAL FINISHES

A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.05 LUMINAIRE SUPPORT

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.

C. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gage.

D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 TEMPORARY LIGHTING

A. Permanent luminaires are not permitted to use for temporary lighting.

3.03 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Install lamps in each luminaire.

D. Supports:
   1. Sized and rated for luminaire weight.
   2. Able to maintain luminaire position after cleaning and relamping.
   3. Provide support for luminaire without causing deflection of ceiling or wall.
   4. Luminaire mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and vertical force of 400 percent of luminaire weight.

E. Flush-Mounted Luminaire Support:
   1. Secured to outlet box.
   2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
   3. Trim ring flush with finished surface.

F. Wall-Mounted Luminaire Support:
   1. Secured to outlet box that is attached to structural members in walls.
   2. Do not attach luminaires directly to gypsum board.

G. Suspended Luminaire Support:
   1. As indicted on the Drawings.
   2. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

H. Ceiling-Grid-Mounted Luminaires:
   1. Secure to any required outlet box.
   2. Secure luminaire to the luminaire opening using approved fasteners in a minimum of four locations, spaced near corners of luminaire.
   3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.

I. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

3.04 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.05 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
   1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
   2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to generator power and retransfer to normal.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION

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SECTION 265619

LED EXTERIOR LIGHTING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:
   1. Exterior solid-state luminaires that are designed for and exclusively use LED lamp technology.
   2. Luminaire supports.

B. Related Requirements:
   1. Section 260923"Lighting Control Devices" for automatic control of lighting, including time switches, occupancy sensors, photoelectric switches, and multipole lighting relays and contactors.
   2. Section 262726 "Wiring Devices" for light switches.

1.03 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color rendering index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. Lumen: Measured output of lamp and luminaire, or both.

F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.04 SUBMITTALS

A. Product Data: For each type of exterior lighting product.
   1. Arrange in order of luminaire designation.
   2. Include data on features, accessories, and finishes.
   3. Include physical description and dimensions of luminaire.
   4. Lamps, include life, output (lumens, CCT, and CRI), and energy-efficiency data.
   5. Photometric data and adjustment factors based on laboratory tests, complying with IES Lighting Measurements Testing and Calculation Guides, of each luminaire type. The adjustment factors shall be for lamps and accessories identical to those indicated for the luminaire as applied in this Project.
      a. Manufacturer's Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the NVLAP for Energy Efficient Lighting Products.

B. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

C. Source quality-control reports.

D. Sample warranty.

E. Operation and Maintenance Data: For luminaires to include in operation and maintenance manuals.

1.05 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturers' laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.

B. Provide luminaires from a single manufacturer for each luminaire type.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering prior to shipping.

1.07 FIELD CONDITIONS

A. Verify existing and proposed utility structures prior to the start of work associated with luminaire installation.

B. Mark locations of exterior luminaires for approval by Architect prior to the start of luminaire installation.

1.08 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures, including luminaire support components.
      b. Faulty operation of luminaires and accessories.
      c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   2. Warranty Period: 5 year(s) from date of Substantial Completion for lighting fixtures.

PART 2 - PRODUCTS

2.01 LUMINAIRE REQUIREMENTS

A. Luminaire Schedule: As indicated on the Drawings.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. NRTL Compliance: Luminaires shall be listed and labeled for indicated class and division of hazard by an NRTL.

D. UL Compliance: Comply with UL 1598 and listed for wet location.

E. CRI of minimum 80. CCT as indicated on the Drawings.

F. L70 lamp life of minimum 50,000 hours.

G. Internal driver.

H. Nominal Operating Voltage: As indicated on the Drawings.

I. Lamp Rating: Lamp marked for outdoor use.

J. Source Limitations: Obtain luminaires from single source from a single manufacturer.

K. In-Line Fuses: Separate in-line fuse for each luminaire

2.02 MATERIALS

A. Metal Parts: Free of burrs and sharp corners and edges.

B. Sheet Metal Components: Corrosion-resistant aluminum. Form and support to prevent warping and sagging.

C. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses.

D. Diffusers and Globes:
   1. Acrylic Diffusers: 100 percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
   2. Glass: Annealed crystal glass unless otherwise indicated.
   3. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

E. Lens and Refractor Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

F. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:
   1. White Surfaces: 85 percent.
   2. Specular Surfaces: 83 percent.
   3. Diffusing Specular Surfaces: 75 percent.

G. Housings:
   1. Rigidly formed, weather- and light-tight enclosure that will not warp, sag, or deform in use.
   2. Provide filter/breather for enclosed luminaires.

2.03 FINISHES

A. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

B. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
   1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

2.04 LUMINAIRE SUPPORT COMPONENTS

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for luminaire electrical conduit to verify actual locations of conduit connections before luminaire installation.

C. Examine walls, roofs, canopy ceilings, and overhang ceilings for suitable conditions where luminaires will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 GENERAL INSTALLATION REQUIREMENTS

A. Comply with NECA 1.

B. Fasten luminaire to structural support.

C. Supports:
   1. Sized and rated for luminaire weight.
   2. Able to maintain luminaire position after cleaning and relamping.
   3. Support luminaires without causing deflection of finished surface.
   4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

D. Wall-Mounted Luminaire Support:
   1. Secured to outlet box that is attached to structural members in walls.

E. Wiring Method: Install cables in raceways. Conceal raceways and cables.

F. Install luminaires level, plumb, and square with finished grade unless otherwise indicated.

G. Coordinate layout and installation of luminaires with other construction.

H. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" and 260533 "Raceways and Boxes for Electrical Systems" for wiring connections and wiring methods.

3.03 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

3.04 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.05 FIELD QUALITY CONTROL

A. Inspect each installed luminaire for damage. Replace damaged luminaires and components.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
   1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
   2. Verify operation of photoelectric controls.

C. Luminaire will be considered defective if it does not pass tests and inspections.

D. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.06 DEMONSTRATION

A. Train Owner’s maintenance personnel to adjust, operate, and maintain luminaires.

END OF SECTION

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SECTION 275223

NURSE CALL/CODE BLUE SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes visual/tone nurse-call system.

1.03 ACTION SUBMITTALS

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

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
   1. Detail equipment cabinets and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   2. Cabling Diagrams: Single-line block diagrams showing cabling interconnection of all components for this specific equipment. Include cable type for each interconnection.
   3. Station Installation Details: For built-in equipment, dimensioned and to scale.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Field quality-control reports.

C. Warranty: Sample of special warranty.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For nurse-call equipment to include in emergency, operation, and maintenance manuals.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Electrical Components, Devices, and Accessories: Listed and labeled according to UL 1069 as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.07 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace batteries that fail in materials or workmanship within specified warranty period. Special warranty for batteries applies to materials only, on a prorated basis for specified period.

1. Warranty Period: Include the following warranty periods, from date of Substantial Completion:
    a. Nickel-Cadmium Batteries, Lithium Batteries, and Wet-Cell Batteries:
        1) Full Warranty: Five years.
        2) Pro Rata: 15 years.

PART 2 - PRODUCTS

2.01 NURSE-CALL SYSTEM GENERAL REQUIREMENTS

A. Station Zones: Able to program 256 station zones for each master station in the network with eight priority levels and addressable visual and audible annunciation of audible devices such as smoke detectors and door contacts.

B. Expansion Capability: Equipment ratings, housing volume, spare keys, switches, relays, annunciator modules, terminals, and cable conductor quantities adequate to increase the number of stations in the future by 25 percent above those indicated without adding internal or external components or main trunk cable conductors.

C. Resistance to Electrostatic Discharge: System, components, and cabling, and the selection, arrangement, and connection of materials and circuits, shall be protected against damage or diminished performance when subjected to electrostatic discharges of up to 25,000 V in an environment with a relative humidity of 20 percent or less.

D. Equipment: Microprocessor, electronic, modular.

E. Master Nurse-Call Station: Programmed via a PC.

F. Wall-Mounted Component Connection Method: Components connect to system wiring in back boxes with factory-wired plug connectors.

G. Telephone Interface: Permit use of wired and wireless telephones to execute nurse-call master station functions.

2.02 VISUAL/TONE NURSE-CALL SYSTEM

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    1. Aiphone Corporation.
    2. Alpha Communications.
    3. Cornell Communications, Inc.
    4. Intercall Systems, Inc.
    5. Jeron Electronic Systems, Inc.
    6. Rauland-Borg Corporation.
    7. TekTone Sound & Signal Mfg., Inc.

B. Operational Requirements:
    1. Patient Station Call: Lights a steady call-placed lamp on the station, steady lamps in the zone light and corridor dome light associated with the patient's room, and steady lamps at the central annunciator and other system display devices and displays message on master and staff/duty stations. At the same time, it sounds a programmed tone at intervals, at the respective annunciator and master and

staff/duty stations. Legends at the central annunciator and master station identify the calling station.

2. Pull-Cord-Call Station Call: Flashes a call-placed lamp on the station and distinctive-color lamps in the zone light and corridor dome light and at the central annunciator and staff/duty stations. At the same time, it sounds a programmed tone at intervals, at the central annunciator and master and staff/duty stations. A legend at the master station identifies the calling station, priority as programmed, and bed identification.
3. Emergency-Call Station Call: Produces the same responses as pull-cord-call station calls except rapidly flashing red emergency digital display and tone repetition rates are more frequent, tone frequency is higher, and lamps in the zone light and corridor dome light are a different color. Indicator lamps may be extinguished and the system reset only at the calling station. Displays message on pocket pagers, sounds programmed tone on phones, and displays message on display equipped phones.
4. System Reset: Operating reset button at the originating station cancels signals associated with the call. Illuminates a green digital display on the patient station and log presence on the master station.
5. Cord-Set Removal: Initiates a patient station call when the cord set is removed from the jack in the patient station faceplate. Displays location and "cord removed" message on master station, pocket pagers, and display equipped phones. Inserting a cord-set plug or a dummy plug into the jack and operating the station reset button resets the call.
6. Emergency Bath Station Call: Illuminates the digital display on the emergency bath station; rapidly flashes white dome lamp; displays location, priority, and bath on master station; and sounds programmed tone on master station display equipped phones and pocket pagers.
7. Staff/Duty Station Operation: Operation shall be identified to patient station except the message staff shall display on all devices when the staff call button is activated.
8. Privacy Key Activation: When privacy key is activated on patient station, the system shall disconnect the patient station microphone and slowly flash yellow privacy digital display on the patient station. Displays "privacy" on master station when selecting this room/bed.

C. Central Annunciator:
   1. Lamp type.
   2. Lamp Legends: Machine lettered and legible from a distance of at least 48 inches when a call is present. Legend shall identify initiating station and priority of call.
   3. Power-on Indicator: Digital, or push-to-test switch.
   4. Audible Signal: Electronic tone.

D. Central Equipment Cabinet:
   1. Lockable metal.
   2. Houses power supplies, controls, terminal strips, and other components.
   3. Power-on indicator lamp.
   4. Battery Backup Unit: Sealed nickel-cadmium, wet-cell battery supplies power through an automatic switch when normal power fails, for a period of not less

than six minutes at rated output. System shall lose no unanswered calls or calls in progress during the transfer operation.
    a. Automatic retransfer to normal power, after a 15-minute time delay.
    b. Two-rate battery charger with an automatic trickle rate and a recharge rate.

E. Single-Patient Station: Call-placed lamp, reset push button, and polarized receptacle matching cord-set plug; mounted in a single faceplate.

F. Staff/Duty Stations: A minimum of two call lamps, one for routine calls and one for emergency calls; and an audible tone signal device.

2.03 SYSTEM COMPONENTS

A. Emergency-Call Station: Locking-type push button, labeled "Push to Call Help"; reset trigger to release push button and cancel call; and call-placed lamp, mounted in a single faceplate.

B. Emergency-Bath Station:
1. Consists of a sliding, chemical-resistant, ABS red fascia marked with the word "URGENT" in bold letters.
2. Capable of being activated with nylon pull cord or by sliding the face of the unit downwards.
3. Activation of the station shall illuminate a reassurance digital display on the face of the unit in addition to notifying the master station.
4. Water resistant and able to withstand routine cleaning and chemical disinfectants.
5. Uses magnetic reed switch technology for reliability and corrosion resistance.
6. Mounts on a single-gang electrical box wire to the respective patient station or input controller.

C. Staff, Emergency Station:
1. Consists of a sliding, chemical-resistant, ABS red fascia marked with the word "EMERGENCY" in bold letters.
2. Capable of being activated with nylon pull cord or by sliding the face of the unit downwards.
3. Activation of the station shall illuminate a reassurance digital display on the face of the unit in addition to notifying the master station.
4. Mounts on a single-gang electrical box wire to the input controller.

D. Pull-Cord-Call Station:
1. Pull-Down Switch: Lever-locking type, labeled "Pull Down to Call Help."
2. Reset trigger.
3. Call-placed lamp.
4. Water-resistant construction.

E. Indicator Lamps: Digital type with rated life of 20 years unless otherwise indicated.

F. Station Faceplates:
1. Stainless steel, a minimum of 0.0375 inch thick.
2. Finish: Brushed.
3. Machine-engraved labeling identifies indicator lamps and controls.

G. Corridor Dome Lights and Zone Lights:

1. Three-lamp signal lights.
2. Lamps: LED. Front replaceable without tools, low voltage with rated life of 7500 hours. Barriers are such that only one color is displayed at a time.
3. Lenses: Heat-resistant, shatterproof, translucent polymer that will not deform, discolor, or craze when exposed to hospital cleaning agents.
4. Filters: Two per unit, amber and red.

H. Cable:
1. Conductors: Jacketed single and multiple, twisted-pair copper cables.
2. Sizes and Types: As recommended by equipment manufacturer.
3. Cable for Use in Plenums: Listed and labeled for plenum installation.

I. Grounding Components: Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

2.04 CONDUCTORS AND CABLES

A. Data Cable and Hardware: Category 6 balanced twisted-pair cabling and hardware.

B. Power Conductors and Cables: Copper, solid, No. 20 AWG.

C. Grounding Conductors and Cables: Copper, stranded, No. 16 AWG.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Wiring Method:
1. Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters.
   a. Install plenum cable in environmental air spaces, including plenum ceilings.
   b. Conceal raceway and cables except in unfinished spaces.
2. Conduit and Boxes: Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems." Flexible metal conduit shall not be used.
   a. Outlet boxes shall be no smaller than 2 inches wide, 3 inches high, and 2-1/2 inches deep.

B. Install cables without damaging conductors, shield, or jacket.

C. Do not bend cables, while handling or installing, to radii smaller than as recommended by manufacturer.

D. Pull cables without exceeding cable manufacturer's recommended pulling tensions.
1. Pull cables simultaneously if more than one is being installed in same raceway.
2. Use pulling compound or lubricant if necessary. Use compounds that will not damage conductor or insulation.
3. Use pulling means, including fish tape, cable, rope, and basket-weave wire or cable grips, that will not damage media or raceway.

E. In unfinished areas only, install exposed raceways and cables parallel and perpendicular to surfaces or exposed structural members, and follow surface contours. Secure and support cables by straps, staples, or similar fittings designed and installed so as not to damage cables. Secure cable at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, or fittings.

F. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

G. Separation of Wires: Separate speaker/microphone, line-level, speaker-level, and power-wiring runs. Run in separate raceways or, if exposed or in same enclosure, provide 12-inch minimum separation between conductors to speaker/microphones and adjacent parallel power and telephone wiring. Provide separation as recommended by equipment manufacturer for other conductors.

H. Splices, Taps, and Terminations: Make splices, taps, and terminations on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Install terminal cabinets where there are splices, taps, or terminations for eight or more conductors.

I. Impedance and Level Matching: Carefully match input and output impedances and signal levels at signal interfaces. Provide matching networks if required.

J. Identification of Conductors and Cables: Comply with requirements in Section 260553 "Identification for Electrical Systems" for cable administration, cable schedule, and cable and wire identification.

K. Equipment Identification:
   1. Comply with requirements in Section 260553 "Identification for Electrical Systems" for equipment labels and signs and labeling installation requirements.
   2. Label stations, controls, and indications using approved consistent nomenclature.

3.02 GROUNDING

A. Ground cable shields and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other signal impairments.

B. Signal Ground Terminal: Locate at main equipment cabinet. Isolate from power system and equipment grounding except at connection to main building ground bus.

C. Grounding Provisions: Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

3.03 FIELD QUALITY CONTROL

A. Perform tests and inspections.
   1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:
   1. Schedule tests a minimum of seven days in advance.
   2. Report: Submit a written record of test results.
   3. Operational Test: Perform an operational system test and demonstrate proper operations, adjustment, and sensitivity of each station. Perform tests that include originating station-to-station and "All Call" messages and pages at each nurse-call station. Verify proper routing, volume levels, and freedom from noise and distortion. Test each available message path from each station on the system.

4. Test Procedure:
    a. Frequency Response: Determine frequency response of two transmission paths by transmitting and recording audio tones.
    b. Signal-to-Noise Ratio: Measure the ratio of signal to noise of the complete system at normal gain settings using the following procedure: Disconnect a speaker/microphone and replace it in the circuit with a signal generator using a 1000-Hz signal. Measure the ratio of signal to noise and repeat the test for four speaker microphones.
    c. Distortion Test: Measure distortion at normal gain settings and rated power. Feed signals at frequencies of 300, 400, 1000, and 3000 Hz into each nurse-call equipment amplifier, and measure the distortion in the amplifier output.

C. Retesting: Rectify deficiencies indicated by tests and completely retest work affected by such deficiencies at Contractor's expense. Verify, by the system test, that the total system meets these Specifications and complies with applicable standards. Report results in writing.

D. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified.

E. Prepare test and inspection reports.

3.04 DEMONSTRATION

A. Train Owner's maintenance personnel and caregiver staff to adjust, operate, and maintain nurse-call equipment.

END OF SECTION

SECTION 283111

DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:
   1. Fire-alarm control unit.
   2. Manual fire-alarm boxes.
   3. System smoke detectors.
   4. Notification appliances.
   5. Addressable interface device.
   6. Digital alarm communicator transmitter.
   7. Fire alarm wire and cable.

B. Final connections inside the Fire Alarm Control Panel, programming and testing shall be done by Tele-Plus Corporation, Contact: Andy Stevens, 1-800-542-2733 or 301-797-9500, astevens@telepluscorp.com.

1.03 DEFINITIONS

A. LED: Light-emitting diode.

B. NICET: National Institute for Certification in Engineering Technologies.

1.04 SYSTEM DESCRIPTION

A. Noncoded, UL-certified addressable system, with voice communications and multiplexed signal transmission, dedicated to fire-alarm service only.

1.05 SUBMITTALS

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

B. Shop Drawings: For fire-alarm system. Include plans, elevations, sections, details, and attachments to other work.
   1. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
   2. Include voltage drop calculations for notification appliance circuits.
   3. Include battery-size calculations.
   4. Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
   5. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale and coordinating installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm

indicators. Locate detectors according to manufacturer's written recommendations.

6. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.

C. General Submittal Requirements:
   1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
   2. Shop Drawings shall be prepared by persons with the following qualifications:
      a. Trained and certified by manufacturer in fire-alarm system design.
      b. NICET-certified fire-alarm technician, Level III minimum.
      c. Licensed or certified by authorities having jurisdiction.

D. Delegated-Design Submittal: Fire alarm system shall comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
   1. Drawings showing the location of all system components, ratings, and installation details as needed to comply with listing conditions of the components. Drawing shall also show all connections between fire alarm control panel, signal extenders panels, elevator control panels, fire alarm annunciator panel, HVAC control panel, smoke control panel, initiation devices, notification appliances, and supervisory devices.
   2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72.

E. Qualification Data: For qualified Installer.

F. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. Deliver copies to authorities having jurisdiction and include the following:
   1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
   2. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
   3. Record copy of site-specific software.
   4. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:
      a. Frequency of testing of installed components.
      b. Frequency of inspection of installed components.
      c. Requirements and recommendations related to results of maintenance.
      d. Manufacturer's user training manuals.
   5. Manufacturer's required maintenance related to system warranty requirements.
   6. Abbreviated operating instructions for mounting at fire-alarm control unit.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level II technician.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by Edwards Signaling/United Technologies.

2.02 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices and systems:
1. Manual stations.
2. Smoke detectors.
3. Verified automatic alarm operation of smoke detectors.
4. Automatic sprinkler system water flow.

B. Fire-alarm signal shall initiate the following actions:
1. Continuously operate alarm notification appliances.
2. Identify alarm at fire-alarm control unit and remote annunciators.
3. Transmit an alarm signal to the remote alarm receiving station.
4. Record events in the system memory.

C. Supervisory signal initiation shall be by one or more of the following devices and actions:
1. Valve supervisory switch.
2. Low-air-pressure switch of a dry-pipe sprinkler system.

D. System trouble signal initiation shall be by one or more of the following devices and actions:
1. Open circuits, shorts, and grounds in designated circuits.
2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3. Loss of primary power at fire-alarm control unit.
4. Ground or a single break in fire-alarm control unit internal circuits.
5. Abnormal ac voltage at fire-alarm control unit.
6. Break in standby battery circuitry.
7. Failure of battery charging.
8. Abnormal position of any switch at fire-alarm control unit or annunciator.
9. Low-air-pressure switch operation on a dry-pipe.

E. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire-alarm control unit and remote annunciators.

2.03 FIRE-ALARM CONTROL UNIT/PANEL

A. General Requirements for Fire-Alarm Control Unit:

1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864 and listed and labeled by an NRTL.
    a. System software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), retaining the information through failure of primary and secondary power supplies.
    b. Include a real-time clock for time annotation of events on the event recorder.
2. Addressable initiation devices that communicate device identity and status.
    a. Smoke sensors shall additionally communicate sensitivity setting and allow for adjustment of sensitivity at fire-alarm control unit.
    b. Temperature sensors shall additionally test for and communicate the sensitivity range of the device.
3. Addressable control circuits for operation of mechanical equipment.

B. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.
1. Annunciator and Display: Liquid-crystal type, 3 line(s) of 80 characters, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands and to indicate control commands to be entered into the system for control of smoke-detector sensitivity and other parameters.

C. Circuits:
1. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class A.
    a. Initiating Device Circuits: Style D.
    b. Notification Appliance Circuits: Style Z.
    c. Signaling Line Circuits: Style 6.

D. Smoke-Alarm Verification:
1. Initiate audible and visible indication of an "alarm-verification" signal at fire-alarm control unit.
2. Activate an NRTL-listed and -approved "alarm-verification" sequence at fire-alarm control unit and detector.
3. Sound general alarm if the alarm is verified.
4. Cancel fire-alarm control unit indication and system reset if the alarm is not verified.

E. Notification-Appliance Circuit:
1. Audible appliances shall sound in a three-pulse temporal pattern, as defined in NFPA 72.
2. Where notification appliances provide signals to sleeping areas, the alarm signal shall be a 520-Hz square wave with an intensity 15 dB above the average ambient sound level or 5 dB above the maximum sound level, or at least 75 dBA, whichever is greater, measured at the pillow.
3. Visual alarm appliances shall flash in synchronization where multiple appliances are in the same field of view, as defined in NFPA 72.

F. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory and digital alarm communicator transmitters and digital alarm radio transmitters shall be powered by 24-V dc source.
   1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.

G. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.
   1. Batteries: Sealed lead calcium.

H. Notification Appliance Circuit Extenders: UL listed, fully compatible with fire alarm control panel.

I. Instructions: Computer printout or typewritten instruction card. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

2.04 MANUAL FIRE-ALARM BOXES

A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
   1. Single-action mechanism requiring one action to initiate an alarm, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.

2.05 SYSTEM SMOKE DETECTORS

A. General Requirements for System Smoke Detectors:
   1. Comply with UL 268; operating at 24-V dc, nominal.
   2. Detectors shall be two-wire type. Provide four-wire type for critical control functions such as air-handler shutdowns.
   3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
   4. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
   5. Integral Visual-Indicating Light: LED type indicating detector has operated and power-on status.

B. Photoelectric Smoke Detectors:
   1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
   2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
      a. Primary status.
      b. Device type.
      c. Present average value.
      d. Present sensitivity selected.
      e. Sensor range (normal, dirty, etc.).

2.06 NOTIFICATION APPLIANCES

A. General Requirements for Notification Appliances: Connected to a signaling line circuit, equipped for mounting as indicated and with screw terminals for system connections.

B. Horns/Visual: Operating over a single pair of conductors. Comply with UL 464. Horns shall produce a sound-pressure level of 85 dBA, measured 10 feet from the horn, using the coded signal prescribed in UL 464 test protocol.

C. Visible Notification Appliances: Operating over a single pair of conductors. Xenon strobe lights comply with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch-high letters on the lens.
   1. Rated Light Output:
      a. 15/30/75/110 cd, selectable in the field.
   2. Mounting: Wall mounted unless otherwise indicated.
   3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
   4. Flashing shall be in a temporal pattern, synchronized with other units.
   5. Strobe Leads: Factory connected to screw terminals.
   6. Mounting Faceplate: Factory finished, red.

2.07 ADDRESSABLE INTERFACE DEVICE

A. Description: Microelectronic monitor module, NRTL listed for use in providing a system address for alarm-initiating devices for wired applications with normally open contacts.

2.08 DIGITAL ALARM COMMUNICATOR TRANSMITTER

A. Digital alarm communicator transmitter shall be wireless type and acceptable to the remote central station and shall comply with UL 632 and be listed and labeled by an NRTL. Communication mesh network topology fully compatible with existing campus system. AES Corporation, Model 7788F-ULP with antenna, cabling, and power supply.

B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically communicate with campus-wide self-healing mesh wireless network.

C. Local functions and display at the digital alarm communicator transmitter shall include the following:
   1. Verification that both telephone lines are available.
   2. Programming device.
   3. LED display.
   4. Manual test report function and manual transmission clear indication.
   5. Communications failure with the central station or fire-alarm control unit.

D. Digital data transmission shall include the following:
   1. Address of the alarm-initiating device.
   2. Address of the supervisory signal.
   3. Address of the trouble-initiating device.
   4. Loss of ac supply or loss of power.

5. Low battery.
6. Abnormal test signal.
7. Communication bus failure.

E. Primary Power: 120 V ac power supply transformer/adapter.

F. Secondary Power: Integral rechargeable battery and automatic charger.

G. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

2.09 FIRE ALARM WIRE AND CABLE

A. General Wire and Cable Requirements: NRTL listed and label as complying with NFPA 70, Article 760.

B. Signaling Line Circuits: Twisted, shielded pair, not less than No. 18 AWG.
1. Circuit Integrity Cable: Twisted shielded pair, NFPA 70, Article 760, Classification CI, for power-limited fire alarm signal service Type FPL. NRTL listed and labeled as complying with UL 1424 and UL 2196 for a two-hour rating.

C. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation, and complying with requirements in UL 2196 for a two-hour rating.
1. Low-Voltage Circuits: No. 16 AWG, minimum, in pathway.
2. Line-Voltage Circuits: No. 12 AWG, minimum, in pathway.

PART 3 - EXECUTION

3.01 EQUIPMENT INSTALLATION

A. Comply with NFPA 72 for installation of fire-alarm equipment.

B. Install wall-mounted equipment, with tops of cabinets not more than 72 inches above the finished floor.

C. Smoke- or Heat-Detector Spacing:
1. Comply with NFPA 72, "Smoke-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke-detector spacing.
2. Comply with NFPA 72, "Heat-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for heat-detector spacing.
3. Smooth ceiling spacing shall not exceed 30 feet.
4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Appendix A or Appendix B in NFPA 72.
5. HVAC: Locate detectors not closer than 3 feet from air-supply diffuser or return-air opening.
6. Lighting Fixtures: Locate detectors not closer than 12 inches from any part of a lighting fixture.

D. Audible Alarm-Indicating Devices: Install not less than 6 inches below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.

E. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches below the ceiling.

F. Device Location-Indicating Lights: Locate in public space near the device they monitor.

G. Fire-Alarm Control Unit: Surface mounted, with tops of cabinets not more than 72 inches above the finished floor.

H. Annunciator: Install with top of panel not more than 72 inches above the finished floor.

3.02 CONNECTIONS

A. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 3 feet from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
   1. Supervisory connections at valve supervisory switches.
   2. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.

3.03 FIRE ALARM WIRING INSTALLATION

A. Comply with NECA 1 and NFPA 72.

B. Wiring Method: Install wiring in metal pathway.
   1. Install plenum cable in environmental air spaces, including plenum ceilings.
   2. Fire alarm circuits and equipment control wiring associated with the fire alarm system shall be installed in a dedicated pathway system. This system shall not be used for any other wire or cable.

C. Wiring Method:
   1. Cables and pathways used for fire alarm circuits, and equipment control wiring associated with the fire alarm system, may not contain any other wire or cable.
   2. Fire-Rated Cables: Two-hour, fire-rated fire alarm cables, NFPA 70.
   3. Signaling Line Circuits: Power-limited fire alarm cables shall not be installed in the same cable or pathway as signaling line circuits.

D. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

E. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures when circuit connections are made.

F. Color Coding: Color code fire alarm conductors differently from the normal building power wiring. Use one color code for alarm circuit wiring and another for supervisory circuits. Color code audible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.

G. Risers: Install at least two vertical cable risers to serve the fire alarm system. Separate risers in close proximity to each other with a minimum one-hour-rated wall, so the loss of one riser does not prevent the receipt or transmission of signals from other floors or zones.

H. Wiring to Remote Alarm Transmitting Device: 1-inch conduit between the fire alarm control panel and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

3.04 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Electrical Identification."

B. Install framed instructions in a location visible from fire-alarm control unit.

3.05 GROUNDING

A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

3.06 FIELD QUALITY CONTROL

A. Field tests shall be witnessed by Architect.

B. Perform tests and inspections.
   1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:
   1. Visual Inspection: Conduct visual inspection prior to testing.
      a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
      b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
   2. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
   3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
   4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
   5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
   6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form"

in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.

D. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

E. Fire-alarm system will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

G. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.07 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

END OF SECTION