PART 2 -- PRODUCTS

2.01 MANUFACTURERS

Acoustical Wall Panels:

1. Basis of Design: Armstrong World Industries, Inc.

2.02 ACOUSTICAL WALL PANELS

A. Acoustical Wall Panels: Type AWP-1:

1. Surface Texture: (fabric) (vinyl)
2. Composition: (mineral fiber) (fiberglass)
3. Finish: (Guilford 701) (Lido) (Spinel) (Zirconia) (Carrara) (Rhythms) (Soundsoak 60/85) (Classic Vinyl) (Signature Vinyl)
4. Color: As selected by architect from manufacturer's standard color offering.
5. Thickness: Mineral Fiber (5/8 inch) (3/4 inch); Fiberglass (1 inch).
6. Width: (24 inches) (30 inches – available for mineral fiber only)
7. Panel Heights: (6 feet) (8 feet) (9 feet) (10 feet)
8. Edge Profile: K2C2 both vertical edges for interface with plastic "H" spline for installation.
9. Noise Reduction Coefficient (NRC): ASTM C 423; Classified with FM label on product carton, A Mounting (0.50) (0.60) (0.65) (0.70) (0.80); D Mounting (0.50) (0.65) (0.70) (0.75) (0.85) (0.90).
10. Flame Spread: ASTM E84; composite rating 25 or less flame spread/200 or less smoke developed.
11. Room/Corner Wall Test: NFPA 265 (UBC 8-2): Pass.
12. Dimensional Stability: Standard – space must be enclosed with HVAC systems operating at all times.
13. Acceptable Product: Soundsoak, Item Number, as manufactured by Armstrong World Industries.

B. Acoustical Wall Panel Accessories:

1. Internal spline ("H" Spline): Item #428
2. J molding, heavy-duty plastic J molding
   a. Item #4062: 1 inch x 10 feet
   b. Item #4064: ¾ inch x 10 feet
   c. Color: (frost grey) (black) (grid white) (light tone) (sand)
3. Fabric-covered High Impact Corner including receiver and spline, Item #3856__.

PART 3 -- EXECUTION

3.01 EXAMINATION

Do not proceed with installation until all wet work such as concrete, terrazzo, plastering and painting has been completed and thoroughly dried out, unless expressly permitted by manufacturer's printed recommendations.

3.02 PREPARATION

Measure each wall area and establish layout of acoustical units to balance border widths at opposite edges of each wall. Coordinate panel layout with mechanical and electrical fixtures.

3.03 INSTALLATION

A. Install wall panels by attaching the panels to an existing wall per the manufacturer's instructions, LA 295818, and in accordance with the authorities having jurisdiction.

B. Attachment of panels to the wall will include the use of internal splines (included) and J molding as required for top and bottom edges.

3.04 ADJUSTING AND CLEANING

A. Replace damaged and broken panels.

B. Routine maintenance of Soundsoak wall panels should consist of frequent vacuuming to minimize dirt accumulation. A dry or wet shampoo can be used on Soundsoak fabric. Work in with a damp sponge and vacuum to remove residue.

*****END OF SECTION*****

SECTION 09720

FIBERGLASS REINFORCED PANELS (FRP)

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Conditions apply to this Section.

1.02 SCOPE OF WORK

A. Work included: Provide sanitary wall and ceiling panels and trim where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

B. Related Work: Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Special Conditions, and Sections in Division 1 of these Specifications.

1.03 QUALITY ASSURANCE

Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods for proper performance of the work of this Section.

1.04 SUBSTITUTIONS

Substitutions will be considered per Article 3.3 of the Instruction to Bidders of the Bid Package Section 00003.

1.05 SUBMITTALS

A. In accordance with Article 3.11 of the General Conditions.

B. Product data: Within 35 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:

1. Manufacturer's Specifications and other data needed to prove compliance with the specified requirements;

2. Samples of the full range of colors and patterns available from the proposed manufacturer in the specified range; if substituting product / color selected.

3. Manufacturer's recommended installation procedures which, when accepted by the Architect, will become the basis for accepting or rejecting actual installation procedures for the Work.

C. Mock-ups:

1. At an area on the site where accepted by the Architect, provide a mock-up panel of the Work of this Section.

a. Make the mock-up panel approximately 4'-0" high by 4'-0" wide and consisting of a minimum of two 2'-0" x 2'-0" panels butted together.

b. Provide one mock-up panel for each color and pattern of vinyl-coated fabric wall covering used on the Work.

c. The mock-ups may be part of the Work, and may be incorporated into the finish work when so accepted by the Architect.

d. Revise as necessary to secure Architect's acceptance.

2. The mock-up panels, when accepted by the Architect, will be used as datum points

for comparison with the remainder of the work of this Section for the purpose of acceptance or rejection.

3. If the mock-up panels are not permitted to be part of the finished work, completely demolish and remove them from the job site upon completion and acceptance of the work of this Section.

D. Maintenance Instructions:

1. Furnish a copy of the vinyl-coated fabric manufacturer's maintenance instructions at project's Final Completion.

2. Include recommended cleaning materials and methods of application therefor together with precautions in cleaning materials' use if such are improperly applied.

1.06 PRODUCT HANDLING

A. Deliver pre-finished panels in undamaged condition as packaged by the manufacturer, in sealed, labeled containers.

B. Store panels in a cool, clean, and dry storage area off the ground. Maintain storage area temperature above 45° F with normal humidity.

1.07 ENVIRONMENTAL REQUIREMENTS

A. Temperatures:

1. Install pre-finished panels only when normal temperatures and humidity conditions approximate the same conditions that will exist when building is occupied.

2. Maintain areas to receive pre-finished panels at a minimum temperature of 65° F measured at floor level.

3. Maintain minimum temperature for 72 hours before, during, and 48 hours after applications of wall coverings.

B. Ventilation:

1. Provide adequate continuous ventilation as required for the various wall coverings, sealers and adhesives used in the spaces scheduled, but in no case, for a time less than that recommended by the manufacturer for full drying or curing.

PART 2 -- PRODUCTS

2.01 FIBERGLASS REINFORCED PANELS (FRP)

A. Provide fiberglass reinforced plastic panels complying with ASTM D5319.

B. Basis of Design: Crane Composites, Inc.: Glasbord Fiberglass Reinforced Plastic (FRP) Panels or approved equal.

C. Colors as indicated on the drawings or will be selected by the Architect.

D. Performance Criteria:

1. Scratch Resistance: ASTM d2583

2. Abrasion Resistance: Taber Abrasion Test using CS-17 abrasive wheels with 1000g weight. Panels shall exhibit weight loss after 25 cycles of no more than 0.038%.

3. Impact Strength: ASTM D5420 showing no visible damage on finish side.

E. Accessories:

1. Moldings, Trim and Caps: One-piece extruded polypropylene or PVC, configured to cover panel edges and corners. Color as selected by Architect from manufacturer's full product range.

2. Adhesive: As recommended by panel manufacturer for the required substrates.

3. Sealants: A single-component, mildew-resistant silicone as recommended by panel manufacturer.

PART 3 -- EXECUTION

3.01 EXAMINATION

A. Examine the areas and conditions under which work of this Section will be performed.

B. Correct conditions detrimental to timely and proper completion of the Work.

C. Ascertain that substrates are straight within a maximum tolerance of 1/8 inch in 10 feet, and not greater than 1/16 inch in one foot.

D. Do not proceed until unsatisfactory conditions are corrected.

E. Coordinate work with other trades as needed to assure that proper substrate are provided to receive work of this Section.

F. Beginning of installation means acceptance of conditions.

3.02 PREPARATION

A. Clean substrates to remove substances that could impair bond of adhesive, including oil, grease, dirt, dust or other contamination.

B. Condition panels by unpacking and placing in installation space no less than 24 hours before installation.

C. Lay out paneling before beginning installation. Locate panel joints to provide equal panel widths at ends of walls and so that trimmed panels at corners are not less than 12 inches wide.

3.03 INSTALLATION

A. General: Comply with panel manufacturer's Installation Guide #6876.

B. Cut and drill panels with carbide tipped saw blades or drill bits, or cut with snips.

C. Install panels with manufacturer's recommended gap for panel field and corner joints. Pre-drill fastener holes in panels, 1/8" greater in diameter than fastener. Install panels in a full spread of adhesive. For trowel type and application of adhesive, follow adhesive manufacturer's recommendations.

D. Install trim accessories with adhesive and nails or staples. Do not fasten through panels.

E. Sealant: Fill grooves in trim accessories with sealant before installing panels and be inside corner trim in a bead of sealant. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths.

3.04 CLEANING

A. Remove temporary coverings and protection of adjacent work areas.

B. Repair or replace any installed products that have been damaged.

C. Clean installed panels in accordance with manufacturer's instructions prior to Owner's acceptance.

D. Remove and lawfully dispose of construction debris from project site.

***** END OF SECTION *****

SECTION 09900

PAINTING

PART 1 -- GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Conditions apply to this section.

1.02 SCOPE OF WORK

A. Section Includes: Painting and finishing of all interior and exterior items and surfaces, unless otherwise indicated or listed under exclusions below:

1. Paint all exposed surfaces, except as otherwise indicated, whether or not colors are designated.
2. Include field painting of exposed exterior and interior structural steel, plumbing, mechanical and electrical work, except as indicated below.
3. Paint exterior plaster where indicated on Drawings.

B. Work Included:

1. The intent and requirements of this section is that all work, items and surfaces which are normally painted and finished in a building of this type and quality, shall be so included in this contract, whether or not said work, item or surface is specifically called out and included in the schedules and notes on the drawings, or is, or is not, specifically mentioned in these specifications.
2. All the requirements of Division Zero and Division One apply to this Section.

C. The following general categories of work and items that are included under other Sections, shall not be a part of this section:

1. Shop prime painting of structural and miscellaneous iron or steel.
2. Shop prime painting of hollow metal work.
3. Shop finished work and items.
4. Any drywall or plaster permanently concealed from view.
5. Any factory finished equipment and other materials with a complete factory applied finish.
6. Finish hardware except where primed for paint finish.
7. Any glass, plastics, floor tiles and sheet vinyl coved or vinyl top set bases.
8. Plumbing fixtures: Toilet room accessories.
9. Lighting fixtures except as noted on drawings or specified.
10. Any acoustical surfaces; unless otherwise specified.

D. The Room Finish Schedules indicated on the drawings indicate the location of interior room surfaces to be painted or finished. The indications are general and do not necessarily define the detail requirements. Include all detailed refinements and further instructions as may be given for the required complete finishing of all spaces and rooms.

1.03 SUBSTITUTIONS

Substitutions will be considered per Article 3.3 of the Instruction to Bidders of the Bid Package Section 00003.

1.04 SUBMITTALS

A. Provide in accordance with Article 3.11 of the General Conditions.

B. Product data:

1. Not less than (30) thirty days before beginning work, submit a complete list of materials proposed for use, together with manufacturer's specifications.

2. Paint materials and products shall be subject to the Architect's approval.

B. Color samples:

1. Prepare all color and finishes on samples, 8-1/2" x 11" in size.

2. Samples shall be submitted as requested until required sheen, color and texture is achieved.

3. Prepare wood samples on type and quality of wood specified for use on project.

4. Label and identify each sample as to location and application.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver paint materials in sealed original labeled containers bearing manufacturer's name, type of paint, stock number, color and instructions for reducing or mixing where applicable.

B. Paint materials and equipment

1. Store only acceptable project materials on site.

2. Store in a suitable location.

3. Restrict storage to paint materials and related materials.

4. Comply with health and fire regulations.

1.06 PROJECT CONDITIONS

A. Comply with manufacturer's recommendations as to environmental conditions under which coatings and coating systems can be applied. Do not apply varnish or paint when temperature is below 55 degrees F. Do not apply exterior paint in damp or rainy weather; ensure that the surface has dried thoroughly before proceeding.

B. Do not apply finish in areas where dust is being generated.

PART 2 -- PRODUCTS

2.01 MATERIALS

A. Products specified are as manufactured by the Frazee Paint Company. Paints of other manufacturers to conform to materials listed and are approved by Architect.

B. Materials selected for coating systems for each type surface shall be the product of a single manufacturer.

C. Accessory materials such as turpentine, thinner, linseed oil, putty and shellac shall be of the highest quality and by approved manufacturer.

D. All paints shall be ready-mixed except field-catalyzed coatings. Mix only in metal pails.

E. Finish coats shall not be thinned without Architect's approval.

F. Unsuitability of specified products: Claims concerning unsuitability of any material specified (or the inability to satisfactorily produce the work) will not be entertained, unless such claim is made in writing to the Architect before the work is started.

G. Number of coats scheduled is minimum. Additional coats shall be applied at no additional cost if necessary to completely hide base materials, produce uniform color and provide satisfactory finish result.

H. All submitted paint products shall be in compliance with all current local, state and federal air quality mandates.

2.02 COLORS

A. All colors are to be selected or approved by the Architect and actual color chips shall be supplied to the Contractor for matching. All undercoats shall be tinted to approximate the finish coat.

B. Approval of final colors: Final coat of paint shall not be applied until the Architect has approved colors.

C. The number of colors to be used shall be as determined by the Architect. Architect reserves the right to vary colors throughout the project.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine the areas and conditions under which work of this Section will be performed.

B. Correct conditions detrimental to timely and proper completion of the Work.

C. Do not proceed until unsatisfactory conditions are corrected.

D. Beginning of installation means acceptance of conditions.

3.02 INSPECTION

A. Examine surfaces scheduled to receive paint and finishes for conditions that will adversely affect execution, permanence or quality of work and which cannot be put into acceptable condition through preparatory work. The Contractor shall notify the General Contractor and Architect in writing of any defects or conditions which will prevent a satisfactory installation.

B. Do not proceed with surface preparation or coating application until conditions are suitable.

C. Commencement of installation construed as acceptance of surfaces.

3.03 PREPARATION OF SURFACES

A. All surfaces to receive paint shall be clean, dry, smooth and dust free before application of any materials. Prepare surfaces as follows:

1. WOOD: Sand smooth and remove dust. Fill open joints, cracks, nail holes and other pits or depressions flush and smooth with putty or wood dough after priming. Color putty to match finish paint coat. Touch up knots or sap streaks with shellac or other approved sealer before priming.

2. CONCRETE: Remove all foreign matter, efflorescence and encrustations. Use a stiff fiber brush to remove loose particles. Fill all depressions and remove all fins and projections not inherent in the base material.

3. PRIMED FERROUS METAL: Remove all foreign matter. Touch up abrasions with ferrous metal primer.

4. UNPRIMED FERROUS METAL: Remove all rust, mill scale and foreign matter by wire brushing, scraping, sandblasting or solvent as required to provide a clean, smooth surface.

5. GALVANIZED METAL: Remove all foreign matter and clean entire surface with mineral spirits. Pretreat with phosphoric acid, etch or vinyl wash. Apply primer the same day as pretreatment is applied.

6. GYPSUM BOARD: Remove all foreign matter. Fill all pits flush and smooth with spackle.

7. PLASTER: Fill hairline cracks, small holes and imperfections on plaster surfaces with patching plaster. Smooth off to match adjacent surfaces. Wash and neutralize high alkali surfaces where they occur.

B. Surfaces, which cannot be prepared or painted as specified, shall be immediately brought to the attention of the Architect in writing.

1. Starting of work without such notification will be considered acceptance by the Contractor of surfaces involved.

2. The Contractor shall replace unsatisfactory work caused by improper or defective surfaces as directed by the Architect at no additional cost to the Owner.

3.04 APPLICATION

A. Do not apply initial coating until moisture content of surface is within limitations recommended by the paint manufacturer.

B. Application:

1. Apply paint with suitable brushes, rollers or spraying equipment.

2. Apply stain in accordance with manufacturer's recommendations.

3. Rate of application shall not exceed that as recommended by the paint manufacturer for surface involved.

C. Comply with recommendations of product manufacturer for drying time between succeeding coats.

D. Leave all parts of molding and ornaments clean and true to details with no undue amount of paint in corners and depressions.

E. Make edges of paint adjoining other material or color clean and sharp with no overlapping.

F. Refinish whole wall where portion of finish is not acceptable.

G. All materials shall be applied evenly with proper film thickness and free of runs, sags, skips and other defects. Enamel and varnishes shall be sanded lightly between coats, dusted and cleaned before recoating.

H. Hardware, hardware accessories, plates, lighting fixtures and similar items in place shall be removed prior to painting and replaced upon completion of each space.

I. Heating and other equipment adjacent to walls shall be disconnected, using workmen skilled in appropriate trades, and moved to permit wall surfaces to be painted. Following completion of painting, they shall be expertly replaced and reconnected.

J. Paint visible surfaces behind vents, registers or grilles flat black.

1. Wash exposed metal with solvent then prime and paint as scheduled.

2. Spray paint wherever practical.

K. Do not paint over Underwriters' labels, fusible links or sprinkler heads.

L. Exposed plumbing and mechanical items: Items without factory finish such as conduits, pipes, access panels and items of similar nature shall be finished to match adjacent wall and ceiling surfaces unless otherwise directed.

3.05 CLEAN-UP

Upon completion of the work, the Contractor will remove all equipment, excess material and debris, remove all paint splatters and leave his area in a neat and orderly condition.

3.06 PAINT FINISH SCHEDULE

A. Finish all surfaces in accordance with the following schedule. Catalog names and numbers refer to products as manufactured by the Frazee Paint Company, San Diego, California, except as otherwise specified.

B. EXTERIOR SURFACES

1. Enamel Finishes:

   Acrylic Semi-gloss -128 SATIN GLIDE

   Acrylic, Non-Blocking Semi-gloss -124 MIRRO GLIDE SG

   Acrylic Non-Blocking Gloss: 143 MIRRO GLIDE GL

   Gloss - Alkyd Gloss -648 ARO-PLATE GL

2. Wood: Flat: Total dry film thickness shall be no less than 5 mils.

   1st Coat: 372 WOOD UNDERCOATER

   2nd Coat: 203 DURATEC

   3rd Coat: 203 DURATEC

3. Wood: Enamel (Total dry film thickness shall be no less than 5 mils):

   1st Coat: 168 PRIME+PLUS

   2nd Coat: Enamel as specified

   3rd Coat: Enamel as specified

4. Wood: Semi-Transparent Stain (Total dry film thickness shall be no less than 3 mils):

   1st Coat: 385 MADERA SEMI-TRANSPARENT STAIN

   2nd Coat: 385 MADERA SEMI-TRANSPARENT STAIN

5. Wood: Opaque Stain:

   1st Coat: 203 DURATEC

   2nd Coat: 209 DURATEC

6. Concrete and Brick: Flat (Total dry film thickness shall be no less than 4.5 mils):

   1st Coat: 266 EPOTILT

   2nd Coat: 203 DURATEC

   3rd Coat: 203 DURATEC

7. Concrete and Brick: Low Luster (Total dry film thickness shall be no less than 4.5 mils):

   1st Coat: 266 EPOTILT

   2nd Coat: 215 ROYAL SUPREME

   3rd Coat: 215 ROYAL SUPREME

8. Concrete Block: Flat:

1st Coat: 262 ACRYLIC BLOCK FILLER

2nd Coat: 203 DURATEC

3rd Coat: 203 DURATEC

9. Concrete Block: Low Luster (Total dry film thickness shall be no less than 8 mils):

1st Coat: 262 ACRYLIC BLOCK FILLER

2nd Coat: 215 ROYAL SUPREME

3rd Coat: 215 ROYAL SUPREME

10. Stucco: Flat (Total dry film thickness shall be no less than 3 mils):

1st Coat: 203 DURATEC

2nd Coat: 203 DURATEC

11. Stucco: Low Luster (Total dry film thickness shall be no less than 3 mils):

1st Coat: 215 ROYAL SUPREME

2nd Coat: 215 ROYAL SUPREME

12. Masonry: Elastomeric (Total dry film thickness shall be no less than 15 mils):

1st Coat: 266 EPOTILT or 262 ACRYLIC BLOCK FILLER (for Concrete Block)

2nd Coat: 216 EMC ELASTO-WALL SMOOTH or218 EMC ELASTO-WALL TEXTURED

3rd Coat: 216 EMC ELASTO-WALL SMOOTH or218 EMC ELASTO-WALL TEXTURED

13. Masonry: Clear Water Repellent: Apply wet on wet

1st Coat: MONOCHEM'S AQUASEAL HEAVY DUTY

2nd Coat: MONOCHEM'S AQUASEAL HEAVY DUTY

14. Iron and Steel: Enamel (Total dry film thickness shall be no less than 4.5 mils):

1st Coat: 661 METAL PRIME

2nd Coat: Enamel as specified

3rd Coat: Enamel as specified

15. Aluminum and Galvanized Metal: Enamel (Total dry film thickness shall be no less than 4.5 mils):

1st Coat: 661 METAL PRIME

2nd Coat: Enamel as specified

3rd Coat: Enamel as specified

16. Iron and Steel: Industrial Gloss (Alkyd) Total dry film thickness shall be no less than 4 mils:

1st Coat: 661 METAL PRIME

2nd Coat: 628 ARO-PLATESG or 648 ARO-PLATE GL

3rd Coat: 628 ARO-PLATE SG or 648 ARO-PLATEGL

17. Aluminum and Galvanized Metal: Industrial Gloss (Total dry film thickness shall be no less than 4 mils):

1st Coat: 661 METAL PRIME

2nd Coat: 628 ARO-PLATE SG or 648 ARO-PLATE GL

3rd Coat: 628 ARO-PLATE SG or 648 ARO-PLATE GL

C. INTERIOR SURFACES

1. Enamel Finishes:

Acrylic Eggshell-022 LO GLO

Acrylic Non-Blocking Low Sheen -126 MIRRO GLIDE LS

Acrylic Semigloss -128 SATIN GLIDE

Acrylic Non-Blocking Semigloss -124 MIRRO GLIDE MIRO GLIDE SG

Alkyd Semigloss-628 AROPLATE SG

Acrylic Non-Blocking Gloss-143 MIRRO GLIDE GL

2. Wood: Enamel (Total dry film thickness shall be no less than 4.5 mils):

1st Coat: 367 FRAFLO

2nd Coat: Enamel as specified

3rd Coat: Enamel as specified

3. Wood: Stained:

1st Coat: 685 WOOD STAIN

2nd Coat: 760 HI SOLIDS WATER WHITE SANDING SEALER

3rd Coat: 729 CLEAR SEMI-GLOSS LACQUER or746 GLOSS LACQUER

4. Wood: Stained, (Non-Yellowing Finish):

1st Coat: 685 WOOD STAIN

2nd Coat: NY550SS CLEAR NON-YELLOWING SANDING SEALER

3rd Coat: NY55020 CLEAR NON-YELLOWING SATIN LACQUER or NY55090 CLEAR NON-YELLOWING GLOSS LACQUER

5. Rough Sawn Wood: Stain, Semi-Transparent:

1st Coat: 385 MADERA SEMI-TRANSPARENT STAIN

2nd Coat: 385 MADERA SEMI-TRANSPARENT STAIN

6. Masonry: Flat (Total dry film thickness shall be no less than 5 mils):

1st Coat: 065 ACRY-PRIME

Plaster: 367 FRAFLO

Block: 262 ACRYLIC BLOCK FILLER

2nd Coat: 002 MAJESTIC or 011 VELVIN

3rd Coat: 002 MAJESTIC or 011 VELVIN

7. Masonry: Enamel (Total dry film thickness shall be no less than 4.5 mils):

1st Coat: 065 ACRY-PRIME

Plaster: 367 FRAFLO

Block: 262 ACRYLIC BLOCK FILLER

2nd Coat: Enamel as specified

3rd Coat: Enamel as specified

8. Gypsum Board: Flat (Total dry film thickness shall be no less than 3 mils):

   1st Coat: 002 MAJESTIC

   2nd Coat: 002 MAJESTIC or 011 VELVIN

   3rd Coat: 011 VELVIN

9. Gypsum Board: Enamel (Total dry film thickness shall be no less than 3.5 mils):

   1st Coat: 061 AQUA SEAL*

   2nd Coat: Enamel as specified

   3rd Coat: Enamel as specified

10. Ferrous Metal: Enamel (Total dry film thickness shall be no less than 4.5 mils):

    1st Coat: 661 METAL PRIME

    2nd Coat: Enamel as specified

    3rd Coat: Enamel as specified

11. Aluminum/Galvanized Metal: Enamel (Total dry film thickness shall be no less than 4.5 mils):

    Pretreat: JASCO PREP & PRIME

    1st Coat: 661 METAL PRIME

    2nd Coat: Enamel as specified

    3rd Coat: Enamel as specified

***** END OF SECTION *****

SECTION 10155

SOLID POLYMER TOILET PARTITIONS

PART 1 -- GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Requirements apply to this Section.

1.02 SCOPE OF WORK

A. Work included: Provide plastic toilet partitions where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

1. Floor-supported, overhead-braced partitions.

B. Furnish all labor and materials necessary for the completion of work in this section as shown on the contract drawings and specified herein.

C. Work in this section shall include, but is not limited to:

1. Toilet Compartments.
2. Hardware for toilet compartments and plastic partitions.
3. Shop Drawings and working drawings.
4. Manufacturer's guarantee.

1.03 QUALITY ASSURANCE

Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods for proper performance of the work of this Section.

1.04 SUBSTITUTIONS

Substitutions will be considered per Article 3.3 of the Instruction to Bidders of the Bid Package Section 00003.

1.05 SUBMITTALS

A. In accordance with Article 3.11 of the General Conditions.

B. Product data: Within 35 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:

1. Materials list of items to be provided under this Section.
2. Manufacturer's Specifications and other data needed to prove compliance with the specified requirements.
3. Shop Drawings in sufficient detail to show fabrication, installation, anchorage, and interface of the work of this Section with the work of adjacent trades;
4. Color and pattern charts showing colors and patterns available in the specified products from the proposed manufacturer.
5. Manufacturer's recommended installation procedures which, when accepted by the Architect, will become the basis for accepting or rejecting actual installation procedures for the Work.

1.06 WARRANTY

Manufacturer's Warranty

Provide manufacturer's fifteen year warranty against corrosion, breakage and delamination of panels.

Provide manufacturer's five year warranty for chrome hardware and lifetime warranty for stainless steel hardware.

PART 2 -- PRODUCTS

2.01 MANUFACTURER

Basis of Design: The Mills Company, a subsidiary of Bradley Corporation, P.O. Box 309, Menomonee Falls, WI 53052-0309. Phone 800-BRADLEY (800-272-3539), FAX 262-251-5817. http://www.bradleycorp.com

2.02 MATERIALS

Doors, panels, and pilasters to be 1" thick with homogeneous color throughout, constructed from high-density polyethylene (HDPE) resins that are waterproof, non-absorbent, and have a self-lubricating surface that resists markings from pens, pencils, and other writing instruments.

2.03 CONSTRUCTION

A. Panels, doors and pilasters, 1 inch (25 mm) thick, constructed from high density polyethylene resins compounded under high pressure to form a single component, waterproof, non-absorbent, with a self-lubricating surface.
   1. Edges: Rounded to a 3/16 inch (5 mm) radius.
   2. Doors and panels 55 inches (1397 mm) high mounted 14 inches (356 mm) above finished floor, with aluminum heat sink fastened to bottom edge of doors.

B. Pilasters 82 inches (2083 mm) high, [minimum 5 inches (127 mm) wide for integral hinges], same construction as panels and doors, supported by pilaster shoe anchored to floor.

2.01 ACCESSORIES

A. One-piece pilaster shoes, 3 inch (76 mm) high type 304 satin stainless steel, anchored in place with stainless steel screws.

B. Head Rails: 1 x 1-1/2 inch (25 x 38 mm) extruded anodized aluminum with anti-grip profile and cast socket wall brackets.

C. Brackets: Continuous 54 inch (1372 mm) long heavy-duty aluminum, single or double ear style. Brackets: Aluminum, stirrup style.

D. Fasteners, screws and bolts: Tamper proof stainless steel.

E. Hardware: Extruded aluminum 6463-T alloy and chrome-plated non-ferrous cast metal.
   1. Hinge system integrated with doors and pilasters with no exposed metal parts. Hinge mechanism integrated into door and pilaster as a ½ inch (13 mm) diameter gravity cam unit with 3/16 inch (5 mm) stainless steel pin at door bottom and ½ inch (13 mm) nylon pin at top.
   2. Latches fabricated from extruded aluminum with a satin finish for the housing and a black anodized finish for the slide bolt.
   3. Door strike and keeper, 6 inches (152 mm) long fabricated from heavy-duty extruded aluminum with satin finish and wraparound flanges. Bumper is black rubber.
   4. Coat hook with wall bumper, chrome-plated; one per compartment, mounted on door.
   5. Door pull and door stop for each out swinging door.

2.04 OTHER MATERIALS

Provide other materials not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the acceptance of the Architect.

PART 3 -- EXECUTION

3.01 EXAMINATION

A. Examine the areas and conditions under which work of this Section will be performed.

B. Correct conditions detrimental to timely and proper completion of the Work.

C. Do not proceed until unsatisfactory conditions are corrected.

D. Take complete and accurate measurements of complete toilet and urinal compartment locations.

E. Beginning of installation means acceptance of conditions.

3.02 INSTALLATION

A. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

B. Install the work of this Section in strict accordance with the original design, the accepted Shop Drawings, pertinent requirements of governmental agencies having jurisdiction, and the manufacturer's recommended installation procedures as accepted by the Architect, anchoring all components firmly into position for long life under hard use.

C. Adjust doors, except doors to handicapped compartments, to remain at a uniformly open position when unlocked. Handicap compartment doors shall be hung so as to remain closed.

D. Touch-up scratches and abrasions to be completely invisible to the unaided eye from a distance of five feet.

E. Coordinate with General Contractor overhead bracing and wall backing and blocking required for all partitions and grab bars.

1. All such expenses are to be born by the buyer.

*****END OF SECTION*****

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SECTION 10240

EQUIPMENT SCREEN

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Conditions apply to this Section.

1.02 SCOPE OF WORK

A. Section Includes:

1. Pre-formed thermoplastic panel for enclosing roof top mechanical equipment.

2. Aluminum assembly framing for direct attachment of screening panels to mechanical equipment; no base or curb required unless shown otherwise on drawings..

3. Aluminum extrusions to permit easy access to mechanical equipment for servicing.

B. Products Not Installed or Furnished in This Section:

1. Touch-up painting required for scratches and screw heads.

2. Field painting of prime painted screens

1.03 REFERENCES

A. American Society for Testing and Materials: Standard Specifications for ASTM B 221-96 - Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire Profiles, and Tubes.

B. The Aluminum Association, Inc.: AA ADM-1516166 (1994) - Aluminum Design Manual

C. American Society of Civil Engineers: ASCE 7-95 - Minimum Design Loads for Buildings and Other Structures.

1.04 SYSTEM DESCRIPTION

A. Design Criteria:

1. Manufacturer is responsible for the structural design of all materials, assembly and attachments to resist snow, wind, suction and uplift loading at any point without damage or permanent set.

2. Framing shall be designed in accordance with the Aluminum Design Manual to resist the following loading: ASCE 7-95 - Minimum Design Loads for Buildings and Other Structures; American Society of Civil Engineers.

1.05 SUBSTITUTIONS

Substitutions will be considered per Article 3.3 of the Instructions to Bidders of the Bid Package Section 00003.

1.06 SUBMITTALS

A. Provide in accordance with Article 3.11 of the General Conditions

B. Product Data: Submit manufacturer's catalog data, detail sheets, specification and other data sufficient to indicate compliance with these specifications.

C. Shop Drawings: Indicate layouts heights, component connection details, and details of interface with adjacent construction. Mark data to indicate: Roof top mechanical equipment to be enclosed.

D. Samples:

1. Samples of Materials: Thermoplastic panels.

2. Color Selection: Provide option of Manufacturer Custom Color to match Standing Seam Metal Roof.

E. Certification: Manufacturer's Certificate of Compliance certifying that thermoplastic panels supplied meet or exceed requirements specified.

1.07 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with requirements of building authorities having jurisdiction in Project location.

B. Manufacturer Qualifications: Minimum five (5) years documented experience producing systems specified in this section.

C. Pre-Installation Meeting:

1. Convene at job site seven (7) calendar days prior to scheduled beginning of construction activities of this section to review requirements of this section.

2. Require attendance by representatives of the installing subcontractor, (who will represent the system manufacturer) and other entities directly affecting, or affected by, construction activities of this section.

3. Notify Architect four (4) calendar days in advance of scheduled meeting date.

1.08 DELIVERY, STORAGE AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly indicating manufacturer and material.

B. Storage and Handling: Protect materials and finishes during handling and installation to prevent damage.

1.09 PROJECT CONDITIONS

A. Field Measurements: Take measurements of actual Roof top unit for fit without gaps. Indicate measurements on shop drawings fully documenting any field condition that may interfere with the screen system installation.

1.10 COORDINATION

A. Installer for work under this Section shall be responsible for coordination of panel and framing sizes and required options with the Contractor's requirements. Request information on sizes and options required from the Contractor.

B. Submit shop drawings to the Contractor and obtain written approval of shop drawing from the Contractor prior to fabrication.

1.11 WARRANTY

A. If any part of the rooftop equipment screen fails because of a manufacturing defect within one year from the date of substantial completion, the manufacturer will furnish without charge the required replacement part(s). General Contractor shall cover cost of any local transportation, related service labor or diagnostic call charges.

B. This warranty does not cover failure of your rooftop equipment screen if it is damaged by the Owner, or if the failure is caused by improper installation. In no event shall Warrantor be liable for incidental or consequential damages.

PART 2 – PRODUCTS

2.01 MANUFACTURES

A. Acceptable Products: "Envisor Screening System" by CityScapes Incorporated, 4200 Lyman Ct. Hilliard, OH 43026. 1-877-727-3367 www.cityscapesinc.com

B. Substitutions: Unistrut Component Materials.

2.02 MATERIALS

A. Thermoformed plastic Panels: Fabricated from rigid medium impact thermo-formed ABS (Acrylic Butylene Styrenet) sheets. Minimum thickness 3/16".

B. Framing: Aluminum Plate, Shapes and Bar: ASTM B 221, alloy 6061-T5 or 6063-T5.

C. Threaded Fasteners: All screws, bolts, nut and washer shall be Stainless steel.

1. Corner assembly fasteners shall be #10-16 x stainless TEK screws. Length as required to develop full holding capacity of screw when fastened to Mechanical Equipment.

2. Provide lock washer or other locking device at all bolted connections.

2.03 FABRICATION

A. Provide factory-formed panel systems with continuous interlocking panel connections and indicated or necessary components: Form all components true to shape, accurate in size, square and free from distortion or defects. Cut panels to precise lengths indicated on approved shop drawings.

B. Fabricate all panels to slide horizontally to allow access to unit access panels behind.

C. Panel Design, Style, Trim:

1. Panel Style: Vertical

2. Panel Design: Louver

3. Decorative Top Trim Profile: Flat

4. Refer to plans for specific sizes and heights.

D. Trim and Closures: Fabricated from 24 gage metal, and finished with the manufacturers standard coating system, unless shown otherwise on drawings.

E. Framing: Fabricate and assemble components in largest practical sizes, for delivery to the site.

1. Construct corner assemblies to require shape with joints tightly fitted.

2. Supply components required for anchorage of framing. Fabricate anchors and related components of material and finish as required, or as specifically noted.

2.04 FINISHES

A. Aluminum Framing: Mill.

B. Panel Coating: Manufacturer's standard coating system, factory-applied.

1. Color: Selected from full range of manufacturer's standard colors.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Installer's Examination: Examine conditions under which construction activities of this section are to be performed.

1. Submit written notification to Architect and Screen manufacturer if such conditions are unacceptable.

2. Beginning erection constitutes installer's acceptance of conditions.

3.02 INSTALLATION

A. Install units in accordance with the manufacturer's instructions and approved shop drawings. Keep perimeter lines straight, plumb, and level. Provide brackets, anchors, and accessories necessary for a complete installation.

B. Fasten structural supports to HVAC units without damaging operation of the unit.

1. Provide corner and mid-span assemblies as required by approved shop drawings so that the panels are supported uniformly.

2. Fastening bottom rail using bolts to permit ease of access to HVAC units.

C. Insert thermoplastic panels into structural supports, except where fixed attachment points are indicated. Butt thermoplastic panels to adjacent panels for uniform fit. Fasten fixed panels in accordance with the shop drawings.

D. Metal Separation: Where aluminum materials would contact dissimilar materials, insert rubber grommets at attachment points, thus eliminating where dissimilar metals would otherwise be in contact.

E. Do not cut or abrade finishes which cannot be restored. Return items with such finishes to shop for required alterations.

3.03 ERECTION TOLERANCES

A. Maximum misalignment from true position: 1/4".

3.04 CLEANING AND PROTECTION

A. Remove all protective masking from material immediately after installation.

B. Protection:

1. Ensure that finishes and structure of installed systems are not damaged by subsequent construction activities.

2. If minor damage to finishes occurs, repair damage in accordance with manufacturer's recommendations; provide replacement components if repaired finishes are unacceptable to Architect.

C. Prior to Substantial Completion: Remove dust or other foreign matter from component surfaces; clean finishes in accordance with manufacturer's instructions.

1. Clean units in accordance with the manufacturer's instructions.

envisor^{3}®

Product Features

No Rooftop Penetration

Pre-Engineered Screening System

Screening Code Solution

Attractive Alternative to Parapet Walls

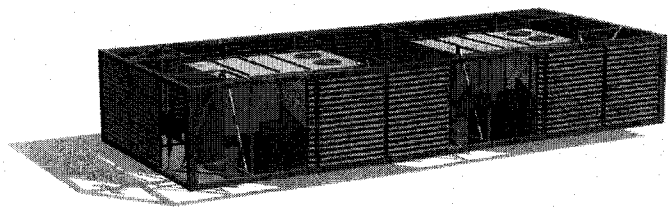
Multiple Panel Designs

Vertical Designs

Wide Range of Designer Colors

Panels Slide for Easy Service Access

Custom Design Capabilities



Our panels are designed to slide side-to-side in either direction for easy access to the equipment for servicing and routine maintenance.

www.cityscapesinc.com

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SECTION 10263

CORNER GUARDS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Requirements apply to this Section.

1.02 SUMMARY

This section includes the following types of wall protection systems: Corner Guards.

1.03 REFERENCES

American Society for Testing and Materials (ASTM)

1.03 QUALITY ASSURANCE

A. Installer qualifications: Engage an installer who has no less than 3 years experience in installation of systems similar in complexity to those required for this project.

B. Manufacturer's qualifications: Not less than 5 years' experience in the production of specified products and a record of successful in-service performance.

C. Single source responsibility: Provide all components of the wall protection system manufactured by the same company to ensure compatibility of color, texture and physical properties.

D. Fire performance characteristics: Provide engineered PETG wall protection system components with UL label indicating that they are identical to those tested in accordance with ASTM E84 for Class 1 characteristics listed below:

1. Flame spread: 25 or less.
2. Smoke developed: 450 or less.

E. Impact Strength: Provide assembled wall protection units that have been tested in accordance with the applicable provisions of ASTM F476.

F. Chemical and stain resistance: Provide wall protection system components with chemical and stain resistance in accordance with ASTM D543.

G. Color match: Provide wall protection components that are color matched in accordance with the following:

Delta Ecmc of no greater than 1.0 using CIELab color space. (Specifier note: Construction Specialties' colors are matched under cool white fluorescent lighting and computer controlled within manufacturing tolerances. Color may vary if alternate lighting sources are present).

H. Single source responsibility: Provide all components of the wall protection system manufactured by the same company to ensure compatibility of color, texture and physical properties.

1.04 SUBSTITUTIONS

Substitutions will be considered per Article 3.3 of the Instruction to Bidders of the Bid Package Section 00003.

1.05 SUBMITTALS

A. Provide in accordance with Article 3.11 of the General Conditions.

B. Product data and detailed specifications for each system component and installation accessory required, including installation methods for each type of substrate.

C. Shop drawings showing locations, extent and installation details of corner guards. Show methods of attachment to adjoining construction.

D. Samples for verification purposes: Submit the following samples, as proposed for this work, for verification of color, texture, pattern and end cap attachment and alignment.

12" (304.8mm) long sample of each model specified including end cap and mounting hardware.

E. Product test reports from a qualified independent testing laboratory showing compliance of each component with requirements indicated.

1.06 DELIVERY, STORAGE AND HANDLING

A. Comply with the requirements of Section 01620.

B. Deliver materials to the project site in unopened original factory packaging clearly labeled to show manufacturer.

C. Store materials in original, undamaged packaging in a cool, dry place out of direct sunlight and exposure to the elements. A minimum room temperature of 40°F (4°C) and a maximum of 100°F (38°C) should be maintained.

D. Material must be stored flat.

1.07 PROJECT CONDITIONS

A. Materials must be acclimated in an environment of 65°-75°F (18°-24°C) for at least 24 hours prior to beginning the installation.

B. Installation areas must be enclosed and weatherproofed before installation commences.

1.08 CLOSE-OUT: Comply with the requirements of Section 01770 – Contract Closeout.

A. Reports:

None required.

B. As-Builts:

Comply with the requirements of Section 01770 – Contract Closeout.

C. Operation and Maintenance Data:

None required

D. Extra Materials:

None required

E. Extended Warranty:

Comply with the requirements of the General Condition Article 3.5 and Section 01740.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

Interior surface protection products specified herein and installed on the submittal drawings shall be manufactured by Construction Specialties, Inc. or approved equal.

2.02 MATERIALS

A. Engineered PETG: Extruded material should be high impact Acrovyn 4000 with shadow-grain texture, nominal .078" (1.98mm) thickness. Chemical and stain resistance should be per

ASTM D543 standards as established by the manufacturer. Colors to be indicated in the finish schedule from one of manufacturer's standard color range.

B. Recycled PETG: PVC-free regrind retainer.

C. Fasteners: All fasteners to be non-corrosive and compatible with aluminum retainers. All necessary fasteners to be supplied by the manufacturer.

2.03 CORNER GUARDS

A. Engineered PETG Corner Guards to be Acrovyn 4000 by Construction Specialties: Surface mounted guards consisting of continuous retainer with snap-on Acrovyn 4000 cover. Color matched end caps to be provided for both partial and full height applications. Attachment hardware shall be appropriate for wall construction.

Model SSM-20N 90° surface mounted corner guard with 2" (51mm) legs, ¼" radiused cover and recycled PETG retainer. See Interior Material Schedule for Color.

2.04 FABRICATION

A. General: Fabricate wall protection systems to comply with requirements indicated for design, dimensions, detail, finishes and member sizes. All based upon required field verified dimensions.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine the areas and conditions under which work of this Section will be performed.

B. Verify that specified items may be installed in accordance with the approved design.

C. Correct conditions detrimental to timely and proper completion of the Work.

D. Do not proceed until unsatisfactory conditions are corrected.

E. Beginning of installation means acceptance of conditions.

3.02 PREPARATION

A. Surface preparation: Prior to installation, clean substrate to remove dirt, debris and loose particles. Perform additional preparation procedures as required by manufacturer's instructions.

B. Protection: Take all necessary steps to prevent damage to material during installation as required in manufacturer's installation instructions.

3.03 INSTALLATION

A. Install the work of this section in strict accordance with the manufacturer's recommendations and the required field verified dimensions.

B. Use only approved mounting hardware, and locating all components firmly into position, level and plumb.

C. Temperature at the time of installation must be between 65°-75°F (18°-24°C) and be maintained for at least 48 hours after the installation.

3.04 CLEANING

A. General: Immediately upon completion of installation, clean rails and accessories in accordance with manufacturer's recommended cleaning method.

B. Remove surplus materials, rubbish and debris resulting from installation as work progresses and upon completion of work.

3.05 PROTECTION

Protect installed materials to prevent damage by other trades. Use materials that may be easily removed without leaving residue or permanent stains.

*****END OF SECTION*****

SECTION 10270

ACCESS FLOORING

PART 1 -- GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract requirements and Division 1, General Conditions apply to this Section.

1.02 SCOPE OF WORK

A. Floor Support framing system.

B. Removable floor panels.

C. System electrostatic grounding.

1.03 PERFORMANCE REQUIREMENTS

A. **Design Load:** Panel supported on actual understructure system shall be capable of supporting a point load of 1250 lbs applied on a one square inch area at any location on the panel without experiencing permanent set as defined by CISCA. The loading method used to determine design (allowable) load shall be in conformance with CISCA Concentrated Load test method but with panel tested on actual understructure instead of steel blocks.

B. **Safety Factor**: Panel supported on actual understructure system shall withstand a point load of no less than (2) two times the design load rating on a one square inch area anywhere on the panel without failure when tested in accordance with CISCA A/F, Section 2 "Ultimate Loading". Failure is defined as the point at which the system will no longer accept the load.

C. **Ultimate Load:** Panel supported on actual understructure system shall be capable of supporting a point load of at least 2500 lbs applied through a load indentor on a one square inch area at any location on the panel without failure (i.e. minimum safety factor of 2) when tested in accordance with CISCA A/F, Section 2, "Ultimate Loading".

D. **Rolling Load**: Panel supported on actual understructure system shall be able to withstand the following rolling loads at any location on the panel without developing a local and overall surface deformation greater than 0.040 inches when tested in accordance with CISCA A/F, Section 3, "Rolling Loads". Note: wheel 1 and wheel 2 tests shall be performed on two separate panels.

CISCA Wheel 1:	Size: 3" dia x 1 13/16" wide	Load: 1125 lbs. Passes:10
CISCA Wheel 2:	Size: 6" dia x 2" wide	Load: 875 lbs. Passes:10,000

*Note: For loads up to 1500 lbs., specify Wheel 2 (A). For loads greater than 1500 lbs., Specify Wheel 2 (B).

E. **Impact Load**: Panel supported on actual understructure (the system) shall be capable of supporting an impact load of 150 lbs. dropped from a height of 36 inches onto a one square inch area (using a round or square indentor) at any location on the panel when tested in accordance with CISCA A/F Section 8, "Drop Impact Load Test".

F. **Panel Drop Test**: Panel shall be capable of being dropped face up onto to a concrete slab from a height of 36", after which it shall continue to meet all load performance requirements as previously defined.

G. **Panel Cutout**: Panel with an 8" diameter interior cutout supported on actual understructure shall be capable of maintaining its design load strength with a minimum safety factor of 2 anywhere on the panel without the use of additional supports.

H. **Flammability**: System shall meet *Class A* Flame spread requirements for flame spread and smoke development. Tests shall be performed in accordance with ASTM-E84-1998, Standard Test Method for Surface Burning Characteristics for Building Materials.

I. **Combustibility**: All components of the access floor system shall qualify as noncombustible by demonstrating compliance with requirements of ASTM E 136, Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 deg C

J. **Recycled Content:** Panel and understructure system shall be required to have a minimum post-consumer recycled content of 18% and a minimum total recycled content of 49%

K. **Axial Load**: Pedestal support assembly shall provide a minimum 6000 lb. axial load without permanent deformation when tested in accordance with CISCA A/F, Section 5, "Pedestal Axial Load Test.".

L. **Overturning Moment**: Pedestal support assembly shall provide an average overturning moment of 1000 in-lbs. when glued to a clean, sound, uncoated concrete surface when tested in accordance with CISCA A/F, Section 6, "Pedestal Overturning Moment Test".. ICBO number for the specific system or structural calculations shall be required attesting to the lateral stability of the system under seismic conditions.

M. **Stringer Concentrated Load:** Stringer shall be capable of withstanding a concentrated load of 450 lbs. placed in its midspan on a one square inch area using a round or square indentor without exceeding a permanent set of 0.010" after the load is removed when tested in accordance with CISCA A/F, Section 4, "Stringer Load Testing".

1.04 SUBSTITUTIONS

Substitutions will be considered per Article 3.3 of the Instruction to Bidders of the Bid Package Section 00003.

1.05 SUBMITTALS

A. Provide in accordance with Article 3.11 of the General Conditions.

B. Submit shop drawings, Product Data and Samples comply with pertinent provisions of Article of the General Conditions.

C. Submit shop drawings indicating floor layout, interruptions to grid, special sized panels, panels requiring drilling or cut-out for services, appurtenances or interruptions, edge details.

D. Submit product date for grid system, panels, and accessories.

E. Manufacture's Owner Manual outlines recommended care and maintenance procedures.

1.06 MAINTENANCE DATA

A. Include: recommended cleaning methods, stain removal methods, and polishes and waxes.

1.07 SEQUENCING AND SCHEDULING

A. Schedule Work to commence after sub-floor work and utilities are installed.

1.08 EXTRA MATERIALS

A. Provide four replacements of floor panel for each system.

B. Provide four spare pedestals and four stringers for each system.

1.09 CLOSE-OUT: Comply with the requirements of Section 01770 – Contract Closeout.

A. Reports:

None required.

B. As-Builts:

See 1.05 B and C for Information.

C. Operation and Maintenance Data:

See 1.06 for Information.

D. Extra Materials:

See Part 1.08 for Information.

E. Extended Warranty:

Comply with the requirements of the General Condition Article 3.5 and Section 01740.

PART 2 -- PRODUCTS

2.01 MANUFACTURERS

A. Access floor system shall be as manufactured by TATE Access Floors , Inc. and shall consist of the ConCore 1250 access floor panel supported by PosiLock understructure system.

B. Alternate products shall meet or exceeed all requirments as indicated herein and must receive prior written approval by the architect or designer.

C. Access Floor manufacture shall be ISO9001:2000 certified demostraiting it has a robust and well documented quality managmant system with continual improvement goals and strategies.

D. Access floor manufacturer's facilities shall be ISO14001:2004 certified demonstrating that they maintain an environmental management system.

E. Access floor manufacturer's facilities shall be OHSAS 18001:2007 certified demonstrating that they maintain an Occupational Health and Safety Management system.

2.02 SUPPORT COMPONENTS

A. Pedestal assemblies shall be corrosive resistant, all steel welded construction, and shall provide an adjustment range of +/- 1" for finished floor heights 6" or greater

B. Pedestal to achieve finished floor elevation 12 inches nominal height above subfloor.

C. Pedestal assemblies shall provide a means of leveling and locking the assembly at a selected height, which requires deliberate action to change height setting and prevents vibration displacement.

D. Pedestal head shall be designed with locating tabs and integral shape to interface with the panel for positive lateral retention and positioning without fasteners. Note: This allows the floor to be installed during the construction process without screws so that access by other related trades can be accomplished quickly and easily. It also enables the user to have a mixed installation of fastened and unfastened panels within the same installation.

E. Hot dip galvanized steel pedestal head shall be welded to a threaded rod which includes a specially designed adjusting nut. The nut shall provide location lugs to engage the pedestal base assembly, such that deliberate action is required to change the height setting.

F. Threaded rod shall provide a specially designed anti-rotation device, such that when the head assembly is engaged in the base assembly, the head cannot freely rotate (for FFH of 6" or greater). Note: This prevents the assembly from inadvertently losing its leveling adjustment when panels are removed from the installation during use.

G. Hot dip galvanized pedestal base assembly shall consist of a formed steel plate with no less than 16 inches of bearing area, welded to a 7/8" square steel tube and shall be designed to engage the head assembly.

H. Stringers shall support each edge of panel

I. Steel stringer shall have conductive galvannealed coating. Zinc electroplating shall be prohibited on stringers and stringer fasteners.

J. Stringers shall be individually and rigidly fastened to the pedestal with one machine screw for each foot of stringer length. Bolts shall provide positive electrical contact between the stringers and pedestals. Connections depending on gravity or spring action are unacceptable.

K. Stringer grid shall be 4' stringers in a basketweave configuration ensuring maximum lateral stability in all directions. (Also available in 2' x 4' and 2' x 2' grid patterns)

2.03 PANEL COMPONENTS

A. Floor panels by TATE or approved equal:

1. Panels shall be 24 " square, all -steel, unitized welded construction to resist deflection anywhere on the panel.
2. Chipboard or particleboard core is unacceptable.
3. Panels shall be protected against corrosion Inside and out with conductive epoxy paint.
4. Panel trim shall be integral to the high-pressure laminate (HPL); Separate trim pieces are not acceptable.
5. Panel type shall be all steel.
6. Top surface of panel shall have an option for four positioning location holes to engage positioning button on the PosiTile carpet tile for precise matching of carpet tile to the panel.
7. Fit between the pedestal head, panel, and screw shall enable an installation with average panel to panel gap of 0.015"
8. Panels shall be 24" square of a molded design formed by the combination of cementitious silicate compound, steel and fibril reinforcements.
9. Panels shall be interchangeable easily placed and removable by a portable lifting device.
10. Furnish panels with radiused corners designed to receive a recessed, flush-mounted, hold-down plate for mechanical interlocking of panels to the pedestal support system.

2.04 ACCESSORIES

1. UL listed Power, Voice & Data Servicenters shall be provided in locations as detailed on the contract drawings. High capacity 11 ¼ inch square PVD Servicenters shall be capable of accommodating four duplex receptacles and three knockouts for standard voice/data faceplates or Tate voice/data interface plates (or grommeted interface plates). Standard capacity 7-5/16 by 6-15/16 inch PVD Servicenters shall be capable of accommodating two duplex receptacles and two Tate voice/data interface plates (or grommeted interface plates). The service outlet box shall be a drop-in design having a hinged Lexan lid with carpet insert and Lexan frame with tapered edge. Service outlet box lid shall be capable of withstanding without failure a load of 800 lb.

2. Cable Cutout Protection: Extruded polyvinyl chloride or neoprene edging 3/8-inch thick, self-extinguishing.
3. Panel Lifting Devices: One per panel, recommended manufacturer's standard type.
4. Gaskets: Closed cell sponge rubber, performed to suit.
5. Edge Trim: Extruded plastic angles.
6. Sealant: Type as specified in section 07900.
7. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the contractor subject to the approval of the Architect.

2.05 FINISHES

A. Finish the surface of floor panels with floor covering material as indicated on the contract drawings. Where floor coverings are by the access floor manufacturer, the type, color and pattern shall be selected from manufacturer's standard. All areas to be furnished with laminated floor panels must be maintained at ambient temperature between 50 deg. to 90 deg. F and at humidity level between 20% to 80% relative and shall remain within these ranges through installation and occupancy.

B. Carpet tile: Access floor system shall be designed to accommodate a modular carpet tile (PosiTile) that precisely matches one carpet tile to one ConCore panel. This is accomplished utilizing four precisely located positioning buttons on the carpet tile which engage into four positioning location holes within the top surface of the access floor panel. The carpet tile's durable backing maintains dimensional stability, and holds the carpet tile flat without adhesives. Adhesives are not necessary and shall not be permitted on the Positile installation except where the carpet is cut and more than two positioners are removed.

C. Edge treatments for factory applied finishes shall be as follows:

High Pressure Laminate: Integral trim edge, separate trim pieces are unacceptable

All Other Finishes: Monolithic or vinyl edge trim pieces applied to the panel's top surface and shall not wrap around the panel's edge.

2.06 FABRICATION TOLERANCES

A. Floor panel flatness measured on a diagonal: +/- 0.035"
B. Floor panel flatness measured along edges: +/- 0.025"
C. Floor panel width or length of required size: +/- 0.010"
D. Floor panel squareness tolerance: +/- 0.015"

PART 3 -- EXECUTION

3.01 EXAMINATION

A. Examine the areas and conditions under which work of this Section will be performed.

B. Structural floor to be level, clean and dry.

C. Verify field measurements are as shown on Drawing and instructed by the manufacturer.

D. Verify that required sub-floor utilities are available, in proper location, and ready for use.

E. Correct conditions detrimental to timely and proper completion of the Work.

F. Do not proceed until unsatisfactory conditions are corrected.

G. Beginning of installation means acceptance of conditions.

3.02 PREPARATION

A. Examine structural subfloor for unevenness, irregularities and dampness that would affect the quality and execution of the work. Do not proceed with installation until structural floor surfaces are level, clean, and dry as completed by others.

B. Concrete sealers, if used, shall be identified and proven to be compatible with pedestal adhesive. Verify that adhesive achieves bond to slab before commencing work.

C. Verify dimensions on contract drawings, including level of interfaces including abutting floor, ledges and doorsills.

D. The General Contractor shall provide clear access, dry subfloor area free of construction debris and other trades throughout installation of access floor system.

E. Area to receive and store access floor materials shall be enclosed and maintained at ambient temperatures between 35° to 95° F and relative humidity levels between 20 to 80%. At least 24 hrs. before installation begins, all floor panels shall be stored at ambient temperatures between 50° to 90° F and relative humidity levels between 20% to 80% and shall remain within these environmental limits throughout occupancy.

3.03 INSTALLATION

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

B. Install additional pedestals where grid pattern is interrupted by room appurtenances and at cutouts.

C. Install stringers and floor panels so idly on pedestals.

D. Install grilles.

E. Seal field cuts of floor panels with edge trim.

F. Understructure shall be aligned such that all uncut panels are interchangeable and fit snugly but do not bind when placed in alternate positions.

G. Installed system shall be free of vibration, rocking, rattles, squeaks and other unacceptable performance.

H. Cut holes in floor panels for installation of Owner's equipment as directed. Include cable cutout protection.

I. Provide floor with edge trim and end closure. Provide lateral braces at stair edges and other locations where a pedestal is not braced.

J. Partially complete floors shall be braced against shifting to maintain the Integrity of the installed system.

K. Provide positive electrical earth grounding of entire floor assembly.

L. Floor system and accessories shall be installed under the supervision of the manufacturer's authorized representative and according to manufacturer's recommendations.

M. Additional pedestals as needed shall support panels where floor is disrupted by columns, walls, and cutouts.

N. No dust or debris producing operations by other trades shall be allowed in areas where access floor is being installed to ensure proper bonding of pedestals to subfloor.

O. Access floor installer shall keep the subfloor broom clean as installation progresses.

P. Acceptance: General contractor shall accept floor in whole or in part prior to allowing use by other trades.

3.04 FASCIA PANELS

A. Install fascia panels at exposed sides.

B. Secure panels to clip angles attached to subfloor and edge of floor panels.

C. Install metal trim at Intersection of fascia panels and floor.

3.05 ADJUSTING

Adjust pedestals to achieve a level floor and to assure adjacent floor panel surfaces are flush.

3.06 CLEANING

A. Clean work under provisions of 01710.

B. Clean exposed surfaces of all components. Vacuum the entire surface.

3.07 PROTECTION OF FINISHED WORK

A. Protect finished installation under provisions of Section 01500.

B. Do not permit traffic over unprotected floor surface.

C. Advise Architect/Engineer if flooring has been overloaded after completion and prior to Substantial Performance.

3.08 SCHEDULES

A. All-Steel System to be in room Operation Command Center 107.

***** END OF SECTION *****

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SECTION 10400

IDENTIFYING DEVICES

PART 1 -- GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Requirements apply to this Section.

1.02 SECTION INCLUDES

A. Molded plastic signs.

B. Aluminum free-standing signs.

C. Aluminum channel letters.

D. Dedication Plaque

1.03 SUBSTITUTIONS

Substitutions will be considered per Article 3.3 of the Instruction to Bidders of the Bid Package Section 00003.

1.04 SUBMITTALS

A. Provide in accordance with Article 3.11 of the General Conditions.

B. Submit the following:

1. samples illustrating full size sample sign, of type, style and color specified including method of attachment.
2. manufacturer's installation instructions.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Package signs, labeled in name groups.

B. Store adhesive tape at ambient room temperatures.

1.06 ENVIRONMENTAL REQUIREMENTS

Do not install signs when ambient temperature is below 70 degrees F. Maintain this minimum during and after installation of signs.

1.07 PRODUCT HANDLING

Adhere to requirements of Section 01770.

1.08 CLOSE-OUT: Comply with the requirements of Section 01770 – Contract Closeout.

A. Reports:

None required.

B. As-Builts:

Comply with the requirements of Section 01770 – Contract Closeout.

C. Operation and Maintenance Data:

None required

D. Extra Materials:

None required

E. Extended Warranty:

Comply with the requirements of the General Condition Article 3.5 and Section 01740.

PART 2 -- PRODUCTS

2.01 MATERIALS – EXTERIOR BUILDING SIGNAGE

A. Basis of Design: A.R.K. Ramos Architectural Signage Systems; Aluminum Channel Letter

B. Letters and/or Numbers – Font/Size/Finish/Color: as indicated on the Drawings.

C. Brackets: PPM-1 bracket sleeved stud.

1. Set in adhesive in masonry.
2. Attach to support in framed wall.

2.02 MATERIALS – ROOM ID SIGNAGE

A. 1/8" thick ES Plastic. Color to be selected by Architect.

B. Graphics to be vinyl die-cut. 3/4" Helvetica Medium caps.

C. Adhesive mounting.

D. All signs to have 1/2" Radius corners.

E. See Schedule for types.

F. All signs installed on glass shall have a full size backing plate adhered to the opporsite side of the glass of the same color as the sign.

2.03 MATERIALS – OTHER INTERIOR SIGNAGE

A. Products: See Drawings for types.

B. Material: 1/8" thick ES Plastic. Size and color as indicated on the drawings. All signs to have 1/2" Radius corners.

C. Graphics: to be vinyl die-cut. Text, Font, size and color as indicated on the drawings.

D. Mounting: Adhesive mounting.

2.04 MATERIALS -- ALUMINUM FREE-STANDING SIGN

A. See Drawings for types and locations.

B. Provide 1/8" thick aluminum sign, on 1-3/4" x 1-3/4" x 1/8" x 7' post; black duranodic aluminum tubing and sign.

C. Letters are to be vinyl die-cut. Test shall conform to access requirements of the CBC.

D. Color to be black anodized with white lettering.

E. Signs are to be sleeve mounted in concrete footings.

2.05 DEDICATION PLAQUE

See Drawings for: location at Flagpole, size, text, and material details.

2.06 ACCESSORIES

A. Mounting Hardware: Chrome screws; base sleeve and studs per manufacturer's recommendations.

B. Tape Mount: Double sided tape, permanent adhesive.

C. Adhesive: Silastic adhesive as recommended by manufacturer.

PART 3 -- EXECUTION

3.01 EXAMINATION

A. Examine the areas and conditions under which work of this Section will be performed.

B. Verify adequate support for Building Signs. Coordinate footings with other trades.

C. Correct conditions detrimental to timely and proper completion of the Work.

D. Do not proceed until unsatisfactory conditions are corrected.

E. Beginning of installation means acceptance of conditions.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install signs after doors and surfaces are finished, in locations indicated.

1. Furnish and install all anchorage devices required to install the item and its appurtenances complete. Provide anchorage in ample time when required to be built in by other trades.

2. All wall-mounted items shall be securely fastened to solid backing or blocking.

C. Center plastic signs on doors, level.

D. Anchor all components firmly into position for long life under hard use.

E. Clean and polish.

*****END OF SECTION*****

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SECTION 10520

FIRE PROTECTION SPECIALTIES

PART 1 -- GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Requirements apply to this Section.

1.02 SCOPE OF WORK

A. Provide and install all Fire extinguishers and Cabinets as shown on the documents and as required by the local Fire Marshall.

B. Accessories as required for a complete and proper project.

1.03 QUALITY ASSURANCE

A. Conform to NFPA 10 requirements for extinguishers.

B. Provide fire extinguishers, cabinets, and accessories by single manufacturer.

1.04 SUBSTITUTIONS

Substitutions will be considered per Article 3.3 of the Instruction to Bidders of the Bid Package Section 00003.

1.05 SUBMITTALS

A. Provide in accordance with Article 3.11 of the General Conditions

B. Submit the following:

1. Physical dimensions, operational features, color and finish, wall-mounting brackets with mounted measurements, anchorage details, rough-in measurements, location, and details.
2. Manufacturer's installation instructions.
3. Manufacturer's operation and maintenance data.
4. Include test, refill or recharge schedules, procedure, and re-certification requirements.

1.06 ENVIRONMENTAL REQUIREMENTS

Do not install extinguishers when ambient temperatures may cause freezing.

1.07 PRODUCT HANDLING

Comply with the requirements of Section 01640.

1.08 CLOSE-OUT: Comply with the requirements of Section 01770 – Contract Closeout.

A. Reports:

None required.

B. As-Builts:

Comply with the requirements of Section 01770 – Contract Closeout.

C. Operation and Maintenance Data:

None required

D. Extra Materials:

None required

E. Extended Warranty:

Comply with the requirements of the General Condition Article 3.5 and Section 01740.

PART 2 -- PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

Larsen's Manufacturing Company or Architect approved equal.

2.02 EXTINGUISHERS

Multi-Purpose Chemical Type: Larsen's Steel tank, Model MP 5, with pressure gage, and UL Rating 2A-10B:C or approved equal.

2.03 CABINETS

Typical Extinguisher Cabinet:

A. Provide Larsen's 2409-5R Vertical Duo Panel cabinet.

B. Primer finish.

2.04 ACCESSORIES

A. Mounting Hardware: Appropriate to cabinet - see manufacturer's installation instructions.

B. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect.

2.05 FABRICATION

A. Form body of cabinet with tight inside corners and seams.

B. Pre-drill holes for anchorage.

C. Form perimeter trim and door stiles by welding, filling, and grinding smooth.

D. Hinge doors for 180 degree opening.

E. Glaze doors with resilient channel gasket glazing.

2.06 FINISHES

A. Extinguisher: Red enamel.

B. Cabinet Trim and Door: Primed to be painted to match adjacent surface.

C. Cabinet Interior: Enamel white.

PART 3 -- EXECUTION

3.01 INSPECTION

A. Examine the areas and conditions under which work of this Section will be performed.

B. Verify that rough openings for cabinet are correctly sized and located.

C. Correct conditions detrimental to timely and proper completion of the Work.

D. Do not proceed until unsatisfactory conditions are corrected.

E. Beginning of installation means acceptance of conditions.

3.02 INSTALLATION

A. Install cabinets plumb and level in wall openings so that there is 54 inches from finished floor to door handle.

B. Secure rigidly in place in accordance with manufacturer's instructions.

***** END OF SECTION *****

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SECTION 10800

TOILET AND BATH ACCESSORIES

PART 1 -- GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Requirements apply to this Section.

1.02 SCOPE OF WORK

A. Public-use washroom accessories.

B. Public-use shower room accessories.

C. Custodial accessories.

1.03 QUALITY ASSURANCE

A. Manufacturer: Provide products manufactured by a company with a minimum of 10 years successful experience manufacturing similar products.

B. Single Source Requirements: To the greatest extent possible provide products from a single manufacturer.

C. Accessibility Requirements: Comply with requirements applicable in the jurisdiction of the project, including but not limited to ADA and ICC/ANSI A117.1 requirements as applicable.

D. Hazardous Materials: Comply with EU Directive "Restrictions of Hazardous Substances (RoHS) requirements."

1.04 SUBSTITUTIONS

Substitutions will be considered per Article 3.3 of the Instruction to Bidders of the Bid Package Section 00003.

1.05 SUBMITTALS

A. Provide in accordance with Article 3.11 of the General Conditions.

B. Product Data: Submit manufacturer's data sheets for each product specified, including the following.

1. Installation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Cleaning and maintenance instructions.
4. Replacement parts information.

C. Schedule: Submit a toilet accessory schedule, indicating the type and quantity to be installed in each washroom. Use room numbers as indicated on the Drawings.

1.06 KEYING

Supply two (2) keys for each accessory to Owner. Master Key all accessories.

1.07 REGULATORY REQUIREMENTS

Conform to Title 24 and City codes for installing work in conformance with ANSI A117.1.

1.08 DELIVERY, STORAGE, AND HANDLING

Deliver, store and handle materials and products in strict compliance with manufacturer's instructions and recommendations. Protect from damage

1.09 SEQUENCING AND SCHEDULING

Coordinate the work of this Section with the placement of internal wall reinforcement and reinforcement of toilet partitions to receive anchor attachments.

1.010 WARRANTY

A. Manufacturer's Warranty for Washroom Accessories: Manufacturer's standard 1 year warranty for materials and workmanship.

B. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage or frame corrosion defects within specified warranty period. Warranty Period – 15 years from date of Substantial Completion.

PART 2 -- PRODUCTS

2.01 MANUFACTURER

Basis of Design Products: Subject to compliance with requirements, provide commercial toilet accessories manufactured by Bradley Corporation, Menomonee Falls, WI 53051, (800) 272-3539, fax: (262) 251-5817, Website: www.bradleycorp.com .

2.02 TOILET ACCESSORY SCHEDULE

As indicated on the Drawings.

2.03 MATERIALS

A. Stainless Steel Sheet: ASTM A 666 Type 304 (18-8); satin finish exposed surfaces unless otherwise indicated.

B. Steel Sheet: ASTM A 1008/A 1008M, Designation CS, manufacturer's standard thickness.

C. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 hot-dip zinc coating, manufacturer's standard thickness.

D. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

E. Fasteners:

1. Exposed: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant.

2. Concealed: Galvanized steel.

F. Chrome Plating: ASTM B 456, Service Condition Number SC 2, moderate service.

G. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0mm thick.

H. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

2.04 PRODUCTS

As indicated on the Drawings.

2.05 FACTORY FINISHING

Stainless Steel: Architectural satin finish.

PART 3 -- EXECUTION

3.01 EXAMINATION

A. Examine the areas and conditions under which work of this Section will be performed.

B. Verify that site conditions are ready to receive work and dimensions are as instructed by the manufacturer.

C. Correct conditions detrimental to timely and proper completion of the Work.

D. Do not proceed until unsatisfactory conditions are corrected.

E. Beginning of installation means acceptance of conditions.

3.02 PREPARATION

A. Deliver inserts and rough-in frames to site at appropriate time for building-in.

B. Provide complete information, diagrams, templates, and instructions for the installation of all items, in sufficient time so that all backing, blocking, framing and formwork can be properly installed, and so that the work of other trades will not be delayed.

C. Verify exact location of accessories for installation.

3.03 INSTALLATION

A. Install products in strict compliance with manufacturer's written instructions and recommendations, including the following:

1. Verify blocking has been installed properly.
2. Verify location does not interfere with door swings or use of fixtures.
3. Comply with manufacturer's recommendations for backing and proper support.
4. Use fasteners and anchors suitable for substrate and project conditions
5. Install units rigid, straight, plumb, and level, in accordance with manufacturer's installation instructions and approved shop drawings.
6. Conceal evidence of drilling, cutting, and fitting to room finish.

B. Test for proper operation

3.04 CLEANING AND PROTECTION

A. Clean exposed surfaces of compartments, hardware, and fittings using methods acceptable to the manufacturer.

B. Touch-up, repair or replace damaged products until Substantial Completion.

***** END OF SECTION *****

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SECTION 11027

KNOX BOXES

PART 1 -- GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Requirements apply to this Section.

1.02 SCOPE OF WORK

This Section describes the requirements for furnishing and installing lock boxes.

1.03 QUALITY ASSURANCE

Coordinate ordering lock boxes with local Fire District.

1.04 SUBSTITUTIONS

Substitutions will be considered per Article 3.3 of the Instruction to Bidders of the Bid Package Section 00003.

1.05 SUBMITTALS

A. Provide in accordance with Article 3.11 of the General Conditions.

B. Product Data: Manufacturer's descriptive and technical data and installation details.

1.06 CLOSE-OUT: Comply with the requirements of Section 01770 – Contract Closeout.

A. Reports:

None required.

B. As-Builts:

Comply with the requirements of Section 01770 – Contract Closeout.

C. Operation and Maintenance Data:

None required

D. Extra Materials:

None required

E. Extended Warranty:

Comply with the requirements of the General Condition Article 3.5 and Section 01740.

PART 2 -- PRODUCTS

2.01 LOCK BOXES

A. Basis of Design: Knox Company

1. Construction: Heavy-duty, high security
2. Door: ⅝-inch solid steel with gasket
3. Size: 9½-inches high x 9½-inches wide x 5-inches deep
4. Mounting: Recessed
5. Finish: Aluminum Finish

B. Model:

1. Model #4400 at Doors
2. Model #3770 at Gates
3. Vehicular Gate Key Control Switch: Knox #3502

C. Fastenings: Non-ferrous, type to suit installation conditions

PART 3 -- EXECUTION

3.01 EXAMINATION

A. Examine the areas and conditions under which work of this Section will be performed.

B. Verify that specified items may be installed in accordance with the approved design.

C. Correct conditions detrimental to timely and proper completion of the Work.

D. Do not proceed until unsatisfactory conditions are corrected.

E. Beginning of installation means acceptance of conditions.

3.02 INSTALLATION

A. Install lock boxes at locations indicated in accordance with manufacturer's instructions.

B. Securely fasten in place with sides plumb and level.

C. Exposed surfaces shall be free from scratches, tool marks, and other damage and defects.

***** END OF SECTION *****

SECTION 12500

WINDOW TREATMENT

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Conditions apply to this Section.

1.02 SCOPE OF WORK

Furnish and install Manual Roller Shades (Premium Quality)

1.03 REFERENCES

Flame-Resistant materials shall pass or exceed the following tests:

- National Fire Protection Association (NFPA) 701 (small scale for horizontal applications)
- California Administrative Code Title 19

1.04 QUALITY ASSURANCE

A. Manufacturer, subsidiary or licensed agent shall be approved to supply the products specified, and to honor any claims against product presented in accordance with warranty.

B. Installer or agent shall be qualified to install specified products by prior experience, demonstrated performance and acceptance of requirements of manufacturer, subsidiary, or licensed agent. Installer shall be responsible for an acceptable installation.

C. Provide Manual Roller Shades of only one manufacturer for entire project.

1.05 SUBSTITUTIONS

Substitutions will be considered per Article 3.3 of the Instruction to Bidders of the Bid Package Section 00003.

1.06 SUBMITTALS

A. Provide in accordance with Article 3.11 of the General Conditions

B. Product Data: Manufacturer's descriptive literature shall be submitted indicating materials, finishes, construction and installation instructions and verifying that product meets requirements specified. Manufacturer's recommendations for maintenance and cleaning shall be included.

C. Drawings and Diagrams: Wiring diagrams of any motorized components or units, working and assembly drawings shall be supplied as requested.

D. Samples: Responsible contracting officer or agent shall supply one sample shade of each type specified in this contract for approval. Supplied units shall be furnished complete with all required components, mounting and associated hardware, instructions and warranty.

1.07 PRODUCT HANDLING

A. Adhere to requirements of Section 01770.

B. Product shall be delivered to site in manufacturer's original packaging.

C. Product shall be handled and stored to prevent damage to materials, finishes and operating mechanisms.

1.08 JOB CONDITIONS

A. Prior to shade installation, building shall be enclosed.

B. Interior temperature shall be maintained between 60° F. and 90° F. during and after installation; relative humidity shall not exceed 80%. Wet work shall be complete and dry.

1.09 OPERATION AND MAINTENANCE DATA

Submit operation and maintenance data maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

1.09 CLOSE-OUT: Comply with the requirements of Section 01770 – Contract Closeout.

A. Reports:

None required.

B. As-Builts:

Comply with the requirements of Section 01770 – Contract Closeout.

C. Operation and Maintenance Data:

See 1.08 for Information.

D. Extra Materials:

None required

E. Extended Warranty:

Comply with the requirements of the General Condition Article 3.5 and Section 01740.

1. Warranties listed in this Section shall be in addition to, and not a limitation of other rights the owner may have under the contract documents.
2. Lifetime Limited Warranty. Fabrics warranted for 5 years. Specific product warranties available from manufacturer or its authorized agent.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURER

As indicated on the Drawings

2.02 MANUAL ROLLER SHADES

As indicated on the Drawings

2.03 FABRICATION

Shade measurements shall be accurate to within ± 1/8" or as recommended in writing by manufacturer.

2.04 FINISHES

As indicated on the Drawings

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine the areas and conditions under which work of this Section will be performed.

B. Verify that specified items may be installed in accordance with the approved design.

C. Correct conditions detrimental to timely and proper completion of the Work.

D. Do not proceed until unsatisfactory conditions are corrected.

E. Beginning of installation means acceptance of conditions.

3.02 INSTALLATION

A. Installation shall comply with manufacturer's specifications, standards and procedures as detailed on contract drawings.

B. Adequate clearance shall be provided to permit unencumbered operation of shade and hardware.

C. Clean finish installation of dirt and finger marks. Leave work area clean and free of debris.

3.03 DEMONSTRATION

Demonstrate operation method and instruct owner's personnel in the proper operation and maintenance of the blinds.

*****END OF SECTION*****

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SECTION 13910

FIRE PROTECTION BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Conditions apply to this Section.

1.02 SECTION INCLUDES

A. Pipe, fittings, valves, and connections for sprinkler, standpipe and fire hose, and combination sprinkler and standpipe systems.

1.03 RELATED REQUIREMENTS

A. Section 13925 - Fire Suppression Sprinklers: Sprinkler systems design.

B. Section 13975 - Standpipes and Fire Hoses: Standpipe design.

1.04 REFERENCE STANDARDS

A. ASME (BPV IX) - Boiler and Pressure Vessel Code, Section IX - Welding and Brazing Qualifications; The American Society of Mechanical Engineers; 2010.

B. ASME B16.3 - Malleable Iron Threaded Fittings; The American Society of Mechanical Engineers; 2011.

C. ASME B16.5 - Pipe Flanges and Flanged Fittings; The American Society of Mechanical Engineers; 2009 (ANSI/ASME B16.5).

D. ASME B16.9 - Factory-made Wrought Steel Buttwelding Fittings; The American Society of Mechanical Engineers; 2007.

E. ASME B16.11 - Forged Steel Fittings, Socket-welding and Threaded; The American Society of Mechanical Engineers; 2011.

F. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

G. ASTM A135/A135M - Standard Specification for Electric-Resistance Welded Steel Pipe; 2009.

H. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2011a.

I. ASTM A795/A795M - Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use; 2008.

J. ASTM A 536/A 536M - Standard Specification for Ductile Iron Castings; 2004

K. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; American Water Works Association; 2010 (ANSI/AWWA C105/A21.5).

L. NFPA 13 - Standard for the Installation of Sprinkler Systems; National Fire Protection Association; 2013.

M. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems; National Fire Protection Association; 2010.

N. UL 262 - Gate Valves for Fire-Protection Service; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

O. UL 312 - Check Valves for Fire-Protection Service; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.05 SUBSTITUTIONS

Substitutions will be considered per Article 3.3 of the Instruction to Bidders of the Bid Package Section 00003.

1.06 SUBMITTALS

A. Provide in accordance with Article 3.11 of the General Conditions.

B. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

C. Grooved joint couplings and fittings shall be shown on drawings and product submittals, and shall be specifically identified with the applicable style or series designation

D. Project Record Documents: Record actual locations of components and tag numbering.

E. Operation and Maintenance Data: Include installation instructions and spare parts lists.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01600 - Product Requirements, for additional provisions.

PART 2 - PRODUCTS

2.01 FIRE PROTECTION SYSTEMS

A. Sprinkler Systems: Conform work to NFPA 13.

B. Standpipe and Hose Systems: Conform to NFPA 14.

C. Welding Materials and Procedures: Conform to ASME Code.

D. Grooved Joint Components: All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.

E. Castings: All castings used for coupling housings, fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability.

2.02 BURIED PIPING

A. PVC Pipe: Class 200 PVC C-900

B. Steel Pipe: ASTM A53/A53M Schedule 40 or ASTM A 135/A 135M Schedule 10, black, with AWWA C105 polyethylene jacket, or double layer, half-lapped polyethylene tape.

1. Steel Fittings: ASME B16.9, wrought steel, buttwelded; with double layer, half-lapped polyethylene tape.

2. Casing: Closed glass cell insulation.

2.03 ABOVE GROUND PIPING

A. Steel Pipe: ASTM A795 Schedule 10, ASTM A53 Schedule 40, or ASTM A135/A135M UL listed light wall type, black.

1. Steel Fittings: ASME B16.9, wrought steel, buttwelded, ASTM A 234/A 234M, wrought carbon steel or alloy steel, ASME B16.5, steel flanges and fittings, or ASME B16.11, forged steel socket welded and threaded.

2. Malleable Iron Fittings: ASME B16.3, threaded fittings.

3. Mechanical Grooved Couplings: Two ductile iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, ASTM A449 electroplated steel bolts, nuts, and washers; galvanized for galvanized pipe.

   a. Rigid Type: Housings shall be cast with offsetting angle-pattern bolt pads to provide rigidity and system support and hanging in accordance with NFPA-13. Couplings shall be fully installed at visual pad-to-pad offset contact. (Tongue and recess type couplings, or any coupling that requires exact gapping of bolt pads on each side of the coupling at specified torque ratings, are not allowed.)

      1) 1-1/4" through 8": Installation-Ready, for direct stab installation without field disassembly. Victaulic Style 009-EZ and Style 107H.

      2) Victaulic FireLock™ Style 005 and Zero-Flex Style 07

   b. Flexible Type: For use in locations where vibration attenuation and stress relief are required, and for seismic applications in accordance with the manufacturer's recommendations. Victaulic Installation-Ready Style 177 or Style 75 / 77.

   c. Gaskets:

      1) Dry Systems, Ambient Temp Range - FlushSeal®, Grade EPDM, Type A

      2) Freezer Applications, -40°F to 0°F - FlushSeal®, Grade L, Silicone

      3) Water / Wet Systems, Ambient Temp Range - Grade EPDM, Type A

2.04 PIPE HANGERS AND SUPPORTS

A. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.

B. Hangers for Pipe Sizes 2 inches and Over: Carbon steel, adjustable, clevis.

C. Wall Support for Pipe Sizes to 3 inches: Cast iron hook.

D. Wall Support for Pipe Sizes 4 inches and Over: Welded steel bracket and wrought steel clamp.

E. Vertical Support: Steel riser clamp.

2.05 GATE VALVES

A. Up to and including 2 inches:

   1. Manufacturers:

      a. Victaulic: www.victaulic.com

      b. Nibco, Inc: www.nibco.com.

      c. Milwaukee Valve Company: www.milwaukeevalve.com.

      d. Stockham: www.stockham.com

   2. Bronze body, bronze trim, rising stem, handwheel, solid wedge or disc, threaded ends.

B. Over 2 inches:

   1. Manufacturers:

      a. Victaulic: www.victaulic.com. Victaulic Series 771

b. Nibco, Inc: www.nibco.com.

c. Milwaukee Valve Company: www.milwaukeevalve.com.

d. Stockham: www.stockham.com

2. Iron body, bronze trim, rising stem pre-grooved for mounting tamper switch, handwheel, OS&Y, solid rubber covered bronze or cast iron wedge, flanged or grooved ends.

2.06 GLOBE OR ANGLE VALVES

A. Up to and including 2 inches:

1. Manufacturers:

a. Nibco, Inc: www.nibco.com.

b. Milwaukee Valve Company: www.milwaukeevalve.com.

c. Stockham: www.stockham.com

2. Bronze body, bronze trim, rising stem and handwheel, inside screw, renewable rubber disc, threaded ends, with backseating capacity repackable under pressure.

B. Over 2 inches:

1. Manufacturers:

a. Nibco, Inc: www.nibco.com.

b. Milwaukee Valve Company: www.milwaukeevalve.com.

c. Stockham: www.stockham.com

2. Iron body, bronze trim, rising stem, handwheel, OS&Y, plug-type disc, flanged ends, renewable seat and disc.

2.07 BALL VALVES

A. Up to and including 2 inches:

1. Manufacturers:

a. Victaulic: www.victaulic.com. Victaulic Series 728

b. Nibco, Inc: www.nibco.com.

c. Milwaukee Valve Company: www.milwaukeevalve.com.

d. Stockham: www.stockham.com

2. Bronze two piece body, brass, chrome plated bronze, or stainless steel ball, teflon seats and stuffing box ring, lever handle and balancing stops, grooved ends or threaded ends with union.

3. UL listed and FM approved valves shall include a weatherproof actuator housing with handwheel and supervisory switches.

B. Over 2 inches:

1. Manufacturers:

a. Victaulic: www.victaulic.com. Series 726 (unlisted valves)

b. Nibco, Inc: www.nibco.com.

c. Milwaukee Valve Company: www.milwaukeevalve.com.

d. Stockham: www.stockham.com

2. Cast steel body, chrome plated steel ball, teflon seat and stuffing box seals, lever handle or gear drive handwheel for sizes 10 inches and over, flanged or grooved ends.

2.08 BUTTERFLY VALVES

A. Cast or Ductile Iron Body

1. Manufacturers:

a. Victaulic: www.victaulic.com; Product Series 705.

2. Ductile iron body, electroless-nickel coated ductile iron disc, pressure responsive Nitrile seat, stainless steel stem, and grooved ends. (Stem shall be offset from the disc centerline to provide full 360-degree circumferential seating.)

3. UL listed and FM approved.

4. Valves shall include a weatherproof actuator housing with handwheel and supervisory switches

2.09 CHECK VALVES

A. Over 2 inches:

1. Manufacturers:

a. Victaulic: www.victaulic.com; Product Series 717.

b. Nibco, Inc: www.nibco.com.

c. Milwaukee Valve Company: www.milwaukeevalve.com.

d. Stockham: www.stockham.com

2. Ductile iron body, bronze disc, stainless steel spring and shaft, resilient seal, threaded, wafer, grooved, or flanged ends.

PART 3 - EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Goove or Bevel plain end ferrous pipe.

B. Remove scale and foreign material, from inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Unions and flanges for servicing and disconnect are not required in installations using grooved mechanical joint couplings. (The couplings shall serve as unions and disconnect points.)

3.02 INSTALLATION

A. Install sprinkler system and service main piping, hangers, and supports in accordance with NFPA 13.

1. In grooved installations, use Victaulic rigid couplings with offsetting angle-pattern bolt pads, which permit support and hanging in accordance with NFPA-13.

B. Install standpipe piping, hangers, and supports in accordance with NFPA 14.

C. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

D. Install piping to conserve building space, to not interfere with use of space and other work.

E. Group piping whenever practical at common elevations.

F. Sleeve pipes passing through partitions, walls, and floors.

G. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

H. Pipe Hangers and Supports:

1. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
2. Place hangers within 12 inches of each horizontal elbow.
3. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
4. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
5. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

I. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.

J. Grooved joints shall be installed in accordance with the manufacturer's latest published installation instructions. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. Gaskets shall be of an elastomer grade suitable for the intended service, and shall be molded and produced by the coupling manufacturer. The grooved coupling manufacturer's factory trained representative shall provide on-site training for contractor's field personnel in the use of grooving tools and installation of grooved joint products. The representative shall periodically visit the jobsite and review contractor is following best recommended practices in grooved product installation. (A distributor's representative is not considered qualified to conduct the training or jobsite visit(s).

K. Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding. Refer to Section 09900.

L. Do not penetrate building structural members unless indicated.

M. Provide sleeves when penetrating footings, floors, and walls. Seal pipe and sleeve penetrations to achieve fire resistance equivalent to fire separation required.

N. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

O. Install valves with stems upright or horizontal, not inverted. Remove protective coatings prior to installation.

P. Provide drain valves at main shut-off valves, low points of piping and apparatus.

*****END OF SECTION*****

SECTION 13925

FIRE SUPPRESSION SPRINKLERS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Conditions apply to this Section.

1.02 SECTION INCLUDES

A. Wet-pipe sprinkler system.

B. System design, installation, and certification.

C. Fire department connections.

1.03 REFERENCE STANDARDS

A. FM P7825 - Approval Guide; Factory Mutual Research Corporation; current edition.

B. NFPA 13 - Standard for the Installation of Sprinkler Systems; National Fire Protection Association; 2013.

C. UL (FPED) - Fire Protection Equipment Directory; Underwriters Laboratories Inc.; current edition.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Pre-installation Meeting: Convene one week before starting work of this section.

1.05 SUBSTITUTIONS

Substitutions will be considered per Article 3.3 of the Instruction to Bidders of the Bid Package Section 00003.

1.06 SUBMITTALS

A. Provide in accordance with Article 3.11 of the General Conditions.

B. Product Data: Provide data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

1. Sprinklers shall be referred to on drawings, submittals, and other documentation, by the sprinkler identification or model number as specifically published in the appropriate agency listing or approval. Trade names or other abbreviated designations shall not be allowed

C. Shop Drawings:

1. Indicate hydraulic calculations, detailed pipe layout, hangers and supports, sprinklers, components and accessories. Indicate system controls.

2. Submit shop drawings to authority having jurisdiction for approval. Submit proof of approval to Architect.

D. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.

E. Manufacturer's Certificate: Certify that system has been tested and meets or exceeds specified requirements and code requirements.

F. Operation and Maintenance Data: Include components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. Extra Sprinklers: Type and size matching those installed, in quantity required by referenced NFPA design and installation standard.

2. Sprinkler Wrenches: For each sprinkler type.

1.07 QUALITY ASSURANCE

A. Maintain one copy of referenced design and installation standard on site.

B. Conform to UL requirements.

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

D. Installer Qualifications: Company specializing in performing the work of this section with minimum threee years experience approved by manufacturer.

E. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Store products in shipping containers and maintain in place until installation. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Sprinklers, Valves, and Equipment:

1. Victaulic Company: www.victaulic.com.

2. Tyco Fire Products: www.tyco-fire.com.

3. Viking Corporation: www.vikinggroupinc.com.

2.02 SPRINKLER SYSTEM

A. Sprinkler System: Provide coverage for entire building.

B. Occupancy: Ordinary hazard, Group 1; comply with NFPA 13.

C. Water Supply: Determine volume and pressure from water flow test data.

D. Interface system with building fire and smoke alarm system.

E. Provide fire department connections where indicated.

F. Storage Cabinet for Spare Sprinklers and Tools: Steel, located adjacent to alarm valve.

2.03 SPRINKLERS

A. Sprinklers shall be glass bulb type, with hex-shaped wrench boss integrally cast into the sprinkler body.

1. Wrenches shall be provided by the sprinkler manufacturer that directly engage the

hex-shaped wrench boss integrally cast in the sprinkler body. Basis of Design: Victaulic FireLock Series.

2. Sprinklers with rubber-O-rings are not permitted

B. Suspended Ceiling Type: Semi-recessed pendant type with matching push on escutcheon plate.

1. Response Type: Quick.
2. Coverage Type: Standard.
3. Finish: Brass.
4. Escutcheon Plate Finish: Enamel, color as selected.
5. Product: Victaulic Model V27.

C. Storage Sprinklers: Concealed upright type with guard.

1. Response Type: Standard.
2. Finish: Chrome plated.
3. Product: Victaulic Model V38 and V39.

D. Guards: Finish to match sprinkler finish.

E. Escutcheons and guards shall be listed, supplied, and approved for use with the sprinkler by the sprinkler manufacturer

2.04 PIPING SPECIALTIES

A. Wet Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, aluminum-bronze clapper with elastomer seal or rubber faced clapper to automatically actuate water motor alarm and electric alarm, with pressure retard chamber and variable pressure trim; with test and drain valve. Alarm valve internal components shall be replaceable without removing the valve from the installed position.

1. Product: Victaulic Series 751.

B. Fire Department Connections:

1. Type: Free standing type with ductile iron pedestal red enamel finish.
2. Outlets: Two way with thread size to suit fire department hardware; threaded dust cap and chain of matching material and finish.
3. Drain: 3/4 inch automatic drip, outside.
4. Label: "Sprinkler - Fire Department Connection".
5. At the low-point near each fire department connection, install a 90-degree elbow with drain connection to allow for system drainage to prevent freezing. Basis of Design: Victaulic #10-DR

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install in accordance with referenced NFPA design and installation standard.

B. Install equipment in accordance with manufacturer's instructions.

C. Provide approved double check valve assembly at sprinkler system water source connection.

D. Locate fire department connection with sufficient clearance from walls, obstructions, or adjacent siamese connectors to allow full swing of fire department wrench handle.

E. Locate outside alarm gong on building wall as indicated.

F. Place pipe runs to minimize obstruction to other work.

G. Place piping in concealed spaces above finished ceilings.

H. Center sprinklers in one direction only in ceiling tile with location in other direction variable, dependent upon spacing and coordination with ceiling elements.

1. The Victaulic Aquaflex multiple-use open-gate stainless steel flexible drop system may be used to properly locate sprinkler heads. The drop system shall be supplied with required supporting members and bracing

I. Sprinkler bulb protector shall be removed by hand after installation. Do not use tools or any other device(s) to remove the protector that could damage the bulb in any way.

J. Do not install sprinklers that have been dropped, damaged, or show a visible loss of fluid. Never install sprinklers with cracked bulbs.

K. Apply masking tape or paper cover to ensure concealed sprinklers, cover plates, and sprinkler escutcheons do not receive field paint finish. Remove after painting. Replace painted sprinklers.

L. Flush entire piping system of foreign matter.

M. Install guards on sprinklers where indicated.

N. Hydrostatically test entire system.

O. Require test be witnessed by Fire Marshal.

*****END OF SECTION*****

SECTION 13975

STANDPIPES

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Conditions apply to this Section.

1.02 SECTION INCLUDES

A. Standpipe system.

B. Fire department connection.

1.03 REFERENCE STANDARDS

A. FM P7825 - Approval Guide; Factory Mutual Research Corporation; current edition.

B. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems; National Fire Protection Association; 2010.

C. UL (FPED) - Fire Protection Equipment Directory; Underwriters Laboratories Inc.; current edition.

1.04 ADMIINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.

1.05 SUBSTITUTIONS

Substitutions will be considered per Article 3.3 of the Instruction to Bidders of the Bid Package Section 00003.

1.06 SUBMITTALS

A. Provide in accordance with Article 3.11 of the General Conditions.

B. Product Data: Provide manufacturer's catalog sheet for equipment indicating rough-in size, finish, and accessories.

C. Shop Drawings: Indicate supports, components, accessories, and sizes.

1. Submit shop drawings and product data to Owner's insurance underwriter for approval.

2. Submit proof of approval to Architect.

D. Project Record Documents: Record actual locations of components.

E. Operation Data: Include manufacturer's data.

F. Maintenance Data: Include servicing requirements and test schedule.

G. Certificates: Provide certificate of compliance from authority having jurisdiction indicating approval of field acceptance tests.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01600 - Product Requirements, for additional provisions.

2. Extra Hose Nozzles: One.

3. Extra Hoses: One.

PART 2 - PRODUCTS

2.01 FIRE DEPARTMENT CONNECTION

A. Type: Flush mounted wall type with brass finish.

B. Outlets: Two way with thread size to suit fire department hardware; threaded dust cap and chain of matching material and finish.

C. Drain: 3/4 inch automatic drip, outside.

D. Label: "Standpipe - Fire Department Connection".

*****END OF SECTION*****

SECTION 15010

BASIC MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Conditions apply to this Section.

1.02 SECTION INCLUDES

A. Basic Mechanical Requirements specifically applicable to Division 15 Sections, in addition to Division 1 - General Requirements.

1.03 DESCRIPTION

A. Furnish materials and perform labor required to execute this work as indicated on the drawings, as specified and as required to complete the work of this section, except as otherwise herein specifically excluded.

1.04 WORK INCLUDED

A. The complete Heating, Ventilating and Air Conditioning (HVAC) and Plumbing systems (including Medical Gas and Fire Protection systems), including but not limited to these major items.

1. Coordinate work of this Section with related trades.
2. Verify applicable dimensions at the jobsite.
3. Duct systems; supply, return and exhaust complete with fire dampers, combination fire-smoke dampers, and manual dampers.
4. Diffusers and registers.
5. Exhaust supply, return fans and air curtains.
6. Furnishing and installation of miscellaneous hangers, supports, sleeves, inserts, anchors and other auxiliary equipment for systems under this Division.
7. Duct lining and insulation.
8. Soil waste and vent system inside and outside the building including connections to fixtures, equipment, sewer connections, clean-outs.
9. Water piping systems inside and outside the building, including connections to fixtures, equipment, water meters and vaults; pressure regulating stations, backflow preventers.
10. Interruptible and non-interruptible fuel gas systems inside and outside the building, including connections, gas meters, earthquake valves, and pressure regulating stations.
11. Plumbing fixtures, carriers, fittings, trim, hose bibs, wall hydrants, and accessories.
12. Installation and connection of Owner furnished equipment.
13. Natural gas piping system including connections to equipment and site.
14. Water heating systems, including water heating equipment, circulating pumps, connections.

15. Shop drawings.
16. Equipment identification.
17. Equipment and systems adjustments and balancing.
18. Air, water and gas systems testing, adjusting and balancing.
19. Written operating and maintenance instructions.
20. Record drawings.
21. Guarantee

1.05 WORK SPECIFIED ELSEWHERE

A. Concrete, Architectural Sheet Metal, Door and Exterior Wall Louvers, Painting and Electrical.

1.06 SITE INSPECTION

A. Contractor shall familiarize himself with the conditions at the site. No allowance will be made subsequently for any error through negligence in observing the site conditions. Contractor shall observe and make cost allowance for any mechanical and/or electrical items that must be relocated to accommodate the installation or servicing of any item covered under this contract.

1.07 ORDINANCES, REGULATIONS AND CODES

A. References to Technical Societies, Trade Organizations, Governmental Agencies is made in Division 15 in accordance with the following abbreviations.

1. AFI - Air Filter Institute
2. AMCA - Air Moving & Conditioning Association
3. ARI - Air Conditioning & Refrigeration Institute
4. ASHRAE - American Society of Heating, Refrigerating and Air Conditioning Engineers
5. ASME - American Society of Mechanical Engineers
6. ASTM - American Society of Testing Materials
7. AWSC - American Welding Society Code
8. ANSI - American National Standards Institute
9. CBC - California Building Code
10. CCR - California Code of Regulations
11. CEC - California Electrical Code
12. CFC - California Fire Codes
13. CMC - California Mechanical Code
14. CPC - California Plumbing Code
15. FIA - Factory Insurance Association
16. NAFM - National Association of Fan Manufacturers
17. NEMA - National Electrical Manufacturer's Association
18. NFPA - National Fire Protection Association
19. ORS - Office of Regulatory Services
20. SCAQMD - South Coast Air Quality Management District

21. SMACNA - Sheet Metal and Air Conditioning Contractors National Association
22. UFC - Uniform Fire Code
23. UL - Underwriter's Laboratories
24. UPC - Uniform Plumbing Code

B. Requirements of Regulatory Agencies: Materials and installation shall comply with applicable local, state, and national codes and ordinances. Rulings and interpretations of the enforcing agencies shall be considered as part of the local codes. No extras will be permitted for furnishing items required by the local codes but not specified or shown on the drawings.

C. Codes and Standards:

1. UBC and California Amendments (California Building Code - Part 2, Title 24, CCR).
2. UMC and California Amendments (California Mechanical Code - Part 4, Title 24 CCR).
3. UPC and California Amendments (California Plumbing Code - Part 5, Title 24 CCR).
4. Uniform Fire Code with State Amendments (California Fire Code - Part 9, Title 24 CCR).
5. National Fire Protection Associations - National Fire Code.

D. Nothing in these drawings and specifications is to be construed to permit work in violation thereof. Ordinances, regulations and codes are to be construed as minimum requirements.

E. The responsibility of the Architect to conduct construction reviews of the Contractor's performance is not intended to include the adequacy of the Contractor's safety measures in, on, or near the construction site.

F. Ventilating, refrigeration and electrical equipment and appliances are required to be approved by the Underwriters' Laboratories, Inc., or other nationally recognized testing agency and installed per the testing agency's specifications.

1.08 PERMITS, FEES AND INSPECTIONS

A. Obtain and pay for all necessary permits, fees, assessments, complimentary drawings, required by any legally constituted public authorities having jurisdiction.

1.09 DRAWINGS AND SPECIFICATIONS

A. The Architect's decision will be final on interpretation of the Drawings and Specifications.

B. The Drawings and Specifications are complimentary. Any work called for on the Drawings and not mentioned in the Specifications, or vice versa, shall be performed as though fully set forth in both.

C. Piping, ductwork and other equipment shown as existing has been taken from the Owner's drawings. Contractor shall verify exact location in field before proceeding with the work.

D. Where codes, standards, drawings or specifications conflict, the most stringent shall prevail, unless prior approval for variance is obtained. Specific details on the drawings shall supercede the specification in the event of a conflict.

E. Alternate support or seismic detail shall have prior approval by the Architect; and the Contractor shall obtain agency approval without any additional cost or time to the contract and without any time penalty on the work schedule.

1.10 SUBMITTALS

A. Provide in accordance with Article 3.11 of the General Conditions.

B. Before starting work, the Contractor shall furnish for the approval of the Architect, Shop Drawings and Submitalls with Itemized Equipment Lists, complete in all details that they proposes to install. All items shall be submitted at the same time.

C. Submittals must be specific to this project with respect to model number, capacities, performance, etc., generic submittals will not be accepted.

D. Variations or deviations on submitted items from that specified must be clearly tagged and / or identified

E. Submittals shall include, but not necessarily be limited to the following which are mandatory:

1. Draw Equipment Layouts to ¼" scale, including equipment, piping accessories, and showing clearances for operating and servicing.
2. Schedule of pipe, fittings, valves, with manufacturer and catalog number.
3. Specialties, valves, gauges and thermometers of all types.
4. Foundations, supports, hangers, inserts.
5. Earthquake supports and calculations.
6. Expansion loops, expansion joints, guides, and anchors.
7. Insulation.
8. Ventilation and air conditioning equipment, specialties and the air control systems.
9. Fans, fan characteristic curves, fan tests.
10. Dampers, louvers, grilles, registers, diffusers.
11. Shop fabrication drawings and installation drawings of ductwork and piping layouts. Submit for approval prior to fabrication. Drawings shall indicate dimensions from bottom of piping and ductwork to finish floor level.
12. Wiring diagrams, control panel board, motor starters and controls for electrically operated equipment furnished by mechanical trades.
13. Automatic control system diagrams.
14. Exhaust, supply and return fans.
15. Access panels.
16. Clean-outs
17. Fixture carriers.
18. Hangers, inserts, supports, anchors.
19. Hose bibs.
20. Hot water circulators.
21. Pipe, fittings and specialties.
22. Pipe isolators.
23. Plumbing fixtures, fittings, trim, drains and receptors.
24. Pressure regulators.
25. Roof flashing.
26. Sleeves, escutcheons, caulking, waterproofing, fireproofing.
27. Strainers

28. Water hammer arrestors.
29. Water heating equipment.
30. Expansion joints, guides and anchors.
31. Shop fabrications drawings and calculations.
32. Special and miscellaneous products furnished under this section and not listed herein.

1.11 RECORD DRAWINGS AND MANUALS

A. Record Set During the Work: At site, maintain at least one set of Drawings as a Field Record Set. Also maintain at least one copy of all Addenda, Modifications, approved submittals, correspondence, and transmittals at site. Keep Drawings and data in good order and readily available to Architect and Owner.

B. Changes: Clearly and correctly mark Record Drawings to show changes made during the construction process at the time the changed work is installed. No such changes shall be made in the work unless authorized by the Architect.

C. Final Record Drawings: Conform to Division 1 requirements.

D. Preparation of Final Record Drawings: Contractor shall transfer recorded changes in the work indicated on the Field Record Set to the record set. Changes shall be neatly and clearly drawn and noted by skilled draftsmen, and shown technically correct.

E. Approval: Prior to Architect's inspection for Substantial Completion, submit the Final Record Drawings to the Architect for review, and make such revisions as may be necessary for Final Record Drawings to be a true, complete, and accurate record of the work.

F. Manuals: Obtain data from the various manufacturers and submit instruction, operation, and maintenance manuals as required and to the extent required under other Sections.

G. Contents: Each manual shall have an index listing the contents. Information in the manuals shall include not less than:

1. General introductions and overall equipment description, purpose, functions and simplified theory of operation.
2. Specifications
3. Installation instructions, procedures, sequences, and precautions, including tolerances for level, horizontal and vertical alignment.
4. Grouting requirements.
5. List showing lubricants for each item of mechanical equipment and recommended lubrication intervals.
6. Start-up and beginning operation procedures.
7. Operational procedures.
8. Shutdown procedures.
9. Maintenance and calibration procedures
10. Parts lists
11. Name, address and telephone number of each manufacturer's local representative.

H. Manual Submittals: Unless otherwise specified, each submittal shall include two copies of each manual, one of which will be returned to the Contractor, marked to show the required review. When approved, deliver four copies to Architect unless otherwise specified.

I. "As-Built" drawings of ductwork and piping, including all elbows, transitions, damper and

valve locations shall be provided prior to commencement of air and water balance.

1.12 QUALITY OF EQUIPMENT, MATERIALS AND WORKMANSHIP

A. Unless otherwise specified, equipment and materials used in the installation shall be new and in perfect condition when installed. Articles provided for the same general purpose or use shall be of the same make. Workmanship shall be of the best quality and none but competent mechanics skilled in their trades shall be employed. Furnish the services of an experienced superintendent, who shall be constantly in charge of the work, together with all necessary journeymen, helpers and laborers required.

1.13 SEISMIC DESIGN

A. Contractor shall be responsible for anchors and connections of mechanical work to the building structure including calculations for approval by structural engineer or for approval by inspector of record, as applies, for items or work, where approval is deferred or where alternate support or anchorage detail is proposed to prevent damage as a result of an earthquake, including manufactured equipment, the connection and integrity of shop fabricated and field fabricated materials and equipment. The anchorage of all pipes, ducts, conduits, fixtures, equipment, etc. shall withstand the lateral forces and shall accommodate calculated building displacement as required by the California Building Code, and local city/county codes. (Building equipment and connections therefore shall be designed to resist lateral seismic forces equal to 1.0 of equipment weight to working allowable stress. Cantilever posts supporting equipment shall be designed to resist lateral seismic forces equal to 0.5 of equipment weight to allowable working stress. Conform to the following:

1. In accordance with Title 24, 2007 CBC Section 1613, details shall be provided for the seismic anchorage of all mechanical and electrical equipment, anchorage details shall be based upon appropriate design calculations.

2. For equipment weighing 400 pounds or more anchorage details and appropriate design calculations shall be submitted as part of the mechanical and electrical drawings. "Deferred Approval" items will not be permitted unless specifically approved by the plan check supervisor.

    a. Exception: Attachments of equipment weighting less than 400 pounds and supported directly on the floor or roof structure, furniture, or temporary or movable equipment and equipment weighing less than 20 pounds that is supported by vibration isolation devices suspended from the roof, wall or floor, need not be detailed on the plans provided the following notes are included on the mechanical and electrical plans.

3. The seismic anchorage of mechanical and electrical equipment shall conform to C.C.R. Title 24, 2007 CBC Section 1613. Anchorage details for roof/floor-mounted equipment shall be shown on plans.

1.14 SUBSTITUTIONS AND CHANGES

A. Substitutions will be considered per Article 3.3 of the Instruction to Bidders of the Bid Package Section 00003.

B. The design has been based on data from certain manufacturers, suitable for each application. Recommendations for alternative manufacturers are made for each product, except when "no substitutions permitted" is indicated.

B. It is the intent of the Owner to have this project constructed with materials, products and system originally designed and specified into the project.

C. Alternatives that may require the modification, realignment and/or adjustment of other associated components, including impact on other trades, shall be accomplished at no additional cost or time to the contract and shall have the approval of the Architect.

D. Substitutions shall be submitted addressing all features listed in the specifications. Features that deviate from the plans and specifications shall be clearly identified including justification for deviations. Design West Engineers will review initial submittal on substitutes only. Subsequent submittals made to correct deficiencies in original submittals will be reviewed at Contractor's expense based on Design West Engineer's hourly rate for engineering services.

1.15 APPROVALS

A. The Architect will have the right to accept or reject equipment, materials, workmanship, tests and determine when the Contractor has complied with the requirements herein specified.

1.16 SELECTION AND ORDERING OF EQUIPMENT AND MATERIALS

A. Immediately after award of the Contract and after the approval of submittals by the Architect, the Contractor shall arrange for the purchase and delivery of equipment and materials required, in sample quantities and at the proper time. He shall deliver to the Architect a complete list of equipment and materials ordered, giving descriptions, plate numbers, brochures, name of the wholesalers, date of the orders and approximate delivery dates.

1.17 LOCATIONS AND ACCESSIBILITY

A. Drawings show pipe and ductwork diagrammatically. Conform to Drawings as closely as possible in layout work. Vary run of piping, run and shape of ductwork and make offsets during progress of work as required to meet structural and other interferences as approved by Architect. Install piping and ductwork to best suit field conditions after coordinating with other trades. Run exposed piping and ductwork parallel to, or at right angle to, building walls. Keep horizontal lines as close to bottom of structures as possible. Conform to ceiling heights established on Drawings.

B. Install equipment in such a manner as to be readily accessible for maintenance and repairs. Install piping, ducts and conduit in such a manner as to preserve headroom, avoid obstructions and keep openings and passageways clear.

C. Installation at valves, thermometers, gauges, cleanouts, dampers, controls, steam and water specialties, duct access doors or any other indicating equipment or specialties requiring reading, adjustment, inspection, maintenance shall be conveniently and accessible located with reference to the finished building.

D. Where wall and ceiling access doors are required but not shown, such doors shall be furnished under other sections and as directed by the Architect. Coordinate this requirement with appropriate trade.

E. If changes in the indicated locations or arrangements are required, they shall be made without additional charges.

F. In an existing area, where required, remove, reinstall, reconnect or replace, etc., any existing work to accommodate new work without any additional cost to the Owner. Material shall match existing, unless otherwise specified or approved in writing by the Architect.

G. Provide sheaves and belts if required, to Test, Adjust and Balance Agency, to allow air moving equipment to meet flow requirements specified at no additional cost to the Owner.

1.18 COORDINATION OF TRADES

A. Contractor shall coordinate all trades in the interest of obtaining the most practical overall arrangement of equipment, piping, conduit, and ducts and to maintain maximum headroom and accessibility.

B. No extras will be allowed for changes made necessary by interference between trades.

C. Submit Composite Drawings in accordance with Special Conditions. Include dimensioned plans, elevations, sections and details and give complete information particularly as to the kinds and types of materials and equipment, size and location of sleeves, inserts,

attachments, chases, openings, conduits, ducts, boxes, lighting, structural interferences. Coordinate these Composite Drawings and field layouts in the field for proper relationship to work of applicable trades based on field conditions. Contractor shall have competent personnel readily available for coordinating, checking, and supervision of field layouts. The procedures for submittals and resubmittals, and final distribution shall be as specified in Section 01300. Do not start installation of work involved under Composite Drawings until the Architect reviews applicable submittal. Discrepancies between the Drawings and Composite Drawings shall be specifically noted and identified on the Composite Drawings. Drawings for the various trades involved shall be submitted as required and reviewed prior to preparation of Composite Drawings.

1. Equipment Foundations and Bases: Furnish certified details and drawings for approval before fabrication. Furnish parts necessary for each foundation sub base and support.
2. Pipe Sleeves and Inserts: Furnish and install pipe sleeves and pipe support inserts before concrete is poured.
3. Roof, Wall and Floor Openings: Furnish Shop Drawings showing exact locations and sizes of openings through roofs, walls and floors.
4. Concrete: Conform to Concrete Section of the Specifications.

1.19 GUARANTEES

A. Contractor shall guarantee workmanship, equipment and materials installed under his contract for a period of not less than one (1) year from the date of Substantial Completion. Should any defects occur during this period, the Contractor shall promptly repair or replace the defective item and any other damage caused to the building free of charge to the Owner, including cost of labor and materials.

B. Guarantee included in this section to cover:

1. Faulty or inadequate design of equipment or material installed
2. Improper assembly or erection
3. Defective workmanship or material
4. Incorrect or inadequate operation or other failure

C. He shall guarantee the complete and perfect operation of the entire system and that equipment will be supported in such a way as to be free of objectionable vibration and noise

D. Furnish the parts and labor to replace any items found to be defective in the refrigeration equipment with the guarantee period

E. In addition to other guarantees, furnish free maintenance for the refrigeration equipment, including replacement of refrigerant and oil, for a period of one (1) year. This shall include regular monthly maintenance and "On Call" service if required.

F. For equipment bearing a manufacturer's warranty in excess of one year, furnish a copy of the warranty to the Owner, who shall be named as beneficiary.

1.20 PROTECTION OF EQUIPMENT AND MATERIALS

A. Provide adequate storage facilities for equipment and materials on the site and shall make provisions to protect such materials and equipment from damage.

1.21 CLOSING-IN OF UNINSPECTED WORK

A. Contractor shall not allow or cause any of the work, specifically ductwork and piping, to be covered up or enclosed until it has been inspected, tested, and approved by the Architect. Should any of work be covered up or enclosed before such inspection and test, he shall at his

own expense, uncover the work and after it has been inspected, tested, and approved, make repairs with such materials as may be necessary to restore work to its original and proper condition.

1.22 BUILDING FOOTING CLEARANCES

A. Under no circumstances shall pipes, ducts, or conduits penetrate footings. They shall cross below footings or through sleeves above footings. Those running parallel to footings shall have the minimum clearance from the cone of influence indicated on the Drawings or as required by Code.

1.23 DAMAGE BY LEAKS

A. Contractor shall be responsible for all damage to any part of the premises caused by rain leaks through or around ducts or pipes, leaks or breaks in piping, equipment or fixtures furnished or installed by him for a period of one (1) year from the date of Substantial Completion.

1.24 EQUIPMENT LABELS

A. Equipment provided under this Section shall be provided with the manufacturer's metal identification labels attached to each individual piece of equipment showing complete performance characteristics, size, model and serial number.

1.25 PRELIMINARY OPERATION

A. Should the Owner request that any portion of the plant, apparatus, or equipment be operated for the Owner's beneficial use prior to the final completion and acceptance of the work, the Contractor shall conform to Beneficial Occupancy Provisions of the General Conditions. Such operation shall be under the supervision and direction of the Contractor. Such preliminary operation shall not be construed as an acceptance of any of the work.

1.26 MAINTAINING EXISTING SERVICES

A. The premises and existing building at the site will be in use at the time the work of this Section is in progress. Contractor shall conduct his work so as to cause no inconvenience or danger to the personnel on the premises.

B. He shall maintain continuity of service to the existing mechanical systems, except for designated intervals during which connections can be made. The scheduling of the shut down period shall be at a time directed by the Architect.

C. In some instances, it may be necessary to defer work in certain areas and locations until such time as existing facilities can be relocated or rearranged by the Owner. Therefore, whenever it becomes necessary for the Contractor to perform work under this contract in areas in which the Owner's work is being performed. This contractor shall advise the Architect relative to this requirement and shall follow closely the directive issued by the Architect insofar as time and procedure are concerned. Allow Owner 72 hours prior notice.

D. This contractor shall include in his bid all premium time to which he may be subjected for performing work in such procedure and at such time as may be necessary to cause the least interference with the function of the Owner.

1.27 ELECTRICAL WORK

A. Coordinate with Division 16 in making the line and low voltage electrical connections and be responsible for the operation of the equipment furnished under this section.

B. Voltage for electrical work will be included in Division 16. However, any control wiring which is required that is not shown on the control diagram shall be as described under this Section. In the event that the Contractor chooses to provide equipment that requires extra expense in the power or control wiring, he shall pay additional electrical costs.

C. Safety switches, starters, circuit breakers, unless provided as a portion of package equipment, and the electrical connections of mechanical equipment to the electrical power service shall be provided under Division 16.

D. Interconnecting wiring, safety switches, relays, controllers and motor starters which are integral components of packaged equipment shall be provided as an integral part of that equipment.

E. All interconnecting power wiring and conduits shall be provided by Division 16.

F. Control wiring shall be provided by Division 15, unless otherwise indicated on the drawings.

G. Conduit for control wiring shall be provided by Division 16.

*****END OF SECTION*****

SECTION 15075

MECHANICAL IDENTIFICATION

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Conditions apply to this Section.

1.02 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Stencils.

D. Pipe Markers.

1.03 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; The American Society of Mechanical Engineers; 2007.

1.04 SUBSTITUTIONS

Substitutions will be considered per Article 3.3 of the Instruction to Bidders of the Bid Package Section 00003.

1.05 SUBMITTALS

A. Provide in accordance with Article 3.11 of the General Conditions.

B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Brady Corporation: www.bradycorp.com.

B. Champion America, Inc: www.Champion-America.com.

C. Seton Identification Products: www.seton.com/aec.

2.02 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved letters.

1. Letter Color: White.

2. Letter Height: 1/4 inch.

3. Background Color: Black.

2.03 TAGS

A. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

2.04 STENCILS

A. Stencils: With clean cut symbols and letters of following size:

1. 3/4 to 1-1/4 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 1/2 inch high letters.
2. 1-1/2 to 2 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 3/4 inch high letters.
3. 2-1/2 to 6 inch Outside Diameter of Insulation or Pipe: 12 inch long color field, 1-1/4 inch high letters.
4. 8 to 10 inch Outside Diameter of Insulation or Pipe: 24 inch long color field, 2-1/2 inch high letters.
5. Over 10 inch Outside Diameter of Insulation or Pipe: 32 inch long color field, 3-1/2 inch high letters.
6. Ductwork and Equipment: 2-1/2 inch high letters.

B. Stencils shall be identified as indicated below including direction of flow

1. Refrigerant Suction Line - R.S.L.
2. Refrigerant Liquid Line - R.L.L.
3. Gravity Condensate - G.C.
4. Domestic Cold Water - D.C.W.
5. Domestic Hot Water - D.H.W.
6. Domestic Hot Water Return - D.H.W.R.

C. Stencil Paint: Semi-gloss enamel, colors conforming to ASME A13.1.

2.05 PIPE MARKERS

A. Comply with ASME A13.1.

B. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

PART 3 - EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install plastic pipe markers in accordance with manufacturer's instructions.

C. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

D. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

E. Identify air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates. Small devices, such as in-line pumps, may be identified with tags.

F. Identify control panels and major control components outside panels with plastic nameplates.

G. Identify thermostats relating to terminal boxes or valves with nameplates.

H. Identify valves in main and branch piping with tags.

I. Identify air terminal units and radiator valves with numbered tags.

J. Tag automatic controls, instruments, and relays. Key to control schematic.

K. Identify piping, concealed or exposed, with plastic pipe markers. Use tags on piping 3/4 inch diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

*****END OF SECTION*****

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SECTION 15086

DUCT INSULATION

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Conditions apply to this Section.

1.02 SECTION INCLUDES

A. Duct insulation.

B. Duct Liner.

C. Insulation jackets.

1.03 REFERENCE STANDARDS

A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2010.

B. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2010.

C. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2010.

D. ASTM C553 - Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2011.

E. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2010.

F. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material); 2012.

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2012.

H. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2010.

I. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association; 2006.

J. SMACNA (DCS) - HVAC Duct Construction Standards; Sheet Metal and Air Conditioning Contractors' National Association; 2005.

K. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.04 SUBSTITUTIONS

Substitutions will be considered per Article 3.3 of the Instruction to Bidders of the Bid Package Section 00003.

1.05 SUBMITTALS

A. Provide in accordance with Article 3.11 of the General Conditions.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section with not less than three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.08 FIELD CONDITIONS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 - PRODUCTS

2.01 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84, NFPA 255, or UL 723.

2.02 GLASS FIBER, FLEXIBLE

A. Manufacturer:

1. Johns Manville Corporation: www.jm.com.
2. Owens Corning Corp: www.owenscorning.com.
3. CertainTeed Corporation: www.certainteed.com.

B. Insulation: ASTM C553; flexible, noncombustible blanket.

1. 'K' value: 0.25 at 75 degrees F, when tested in accordance with ASTM C518.
2. Governing body regulation values or as listed on the drawings as more stringent then 'K' value above, insulation value shall be superceeded with said value

C. Vapor Barrier Jacket:

1. Kraft paper with glass fiber yarn and bonded to aluminized film.
2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.

2.03 GLASS FIBER, RIGID

A. Manufacturer:

1. Johns Manville Corporation: www.jm.com.
2. Owens Corning Corp: www.owenscorning.com.
3. CertainTeed Corporation: www.certainteed.com.

B. Insulation: ASTM C612; rigid, noncombustible blanket.

1. 'K' value:.16 at 75 degrees F, when tested in accordance with ASTM C518.

2. Governing body regulation values or as listed on the drawings as more stringent then 'K' value above, insulation value shall be superceeded with said value

C. Vapor Barrier Jacket:

1. Kraft paper with glass fiber yarn and bonded to aluminized film.
2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.

2.04 JACKETS

A. Canvas Jacket: UL listed 6 oz/sq yd plain weave cotton fabric treated with dilute fire retardant lagging adhesive.

B. Mineral Fiber (Outdoor) Jacket: Asphalt impregnated and coated sheet, 50 lb/square.

C. Aluminum Jacket: ASTM B209 (ASTM B209M).

1. Thickness: 0.016 inch sheet.

2.05 DUCT LINER

A. Manufacturers:

1. Johns Manville Corporation: www.jm.com.
2. Owens Corning Corp: www.owenscorning.com.
3. CertainTeed Corporation: www.certainteed.com.

B. Insulation: Incombustible glass fiber complying with ASTM C 1071; flexible blanket, rigid board, and preformed round liner board; impregnated surface and edges coated with poly vinyl acetate polymer, or acrylic polymer shown to be fungus and bacteria resistant by testing to ASTM G 21.

1. Apparent Thermal Conductivity: Maximum of.24 at 75 degrees F.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that ducts have been tested before applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Insulated ducts conveying air below ambient temperature:

1. Finish with tape and vapor barrier jacket.
2. Continue insulation through walls, sleeves, hangers, and other duct penetrations.

D. Insulated ducts conveying air above ambient temperature:

E. Exterior Applications: Provide insulation with vapor barrier jacket. Cover with with calked aluminum jacket with seams located on bottom side of horizontal duct section.

F. External Duct Insulation Application:

1. Install without sag on underside of duct. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert

spacers.

2. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.

G. Duct and Plenum Liner Application:

1. Secure insulation with mechanical liner fasteners. Refer to SMACNA HVAC Duct Construction Standards for spacing.
2. Seal and smooth joints. Seal and coat transverse joints.
3. Duct dimensions indicated are net inside dimensions required for air flow. Increase duct size to allow for insulation thickness.

3.03 SCHEDULES - INSULATE DUCTS PER TITLE-24 REQUIREMENTS

*****END OF SECTION*****

SECTION 15145

PLUMBING PIPING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Conditions apply to this Section.

1.02 SECTION INCLUDES

A. Pipe, pipe fittings, valves, and connections for piping systems.

1. Sanitary sewer and vent.
2. Domestic water.
3. Natural Gas.

1.02 REFERENCE STANDARDS

A. ANSI Z21.22 - American National Standard for Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems; 1999, and addenda A&B (R2004).

B. ASME B16.3 - Malleable Iron Threaded Fittings; The American Society of Mechanical Engineers; 2011.

C. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers; 2012 (ANSI B16.18).

D. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers; 2001 (R2010).

E. ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings - DWV; The American Society of Mechanical Engineers; 2011.

F. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV; The American Society of Mechanical Engineers; 2012.

G. ASME B31.1 - Power Piping; The American Society of Mechanical Engineers; 2012 (ANSI/ASME B31.1).

H. ASME B31.2 - Fuel Gas Piping; The American Society of Mechanical Engineers; 1968.

I. ASME B31.9 - Building Services Piping; The American Society of Mechanical Engineers; 2011 (ANSI/ASME B31.9).

J. ASME (BPV IX) - Boiler and Pressure Vessel Code, Section IX - Welding and Brazing Qualifications; The American Society of Mechanical Engineers; 2010.

K. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

L. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2011a.

M. ASTM B32 - Standard Specification for Solder Metal; 2008.

N. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2009.

O. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2005 (Reapproved 2011).

P. ASTM C425 - Standard Specification for Compression Joints for Vitrified Clay Pipe and Fittings; 2004 (Reapproved 2009).

Q. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; 2011.

R. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2012.

S. ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings; 2004 (Reapproved 2011).

T. ASTM D2239 - Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter; 2012.

U. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems; 2004 (Reapproved 2009).

V. ASTM D2661 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings; 2011.

W. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings; 2012.

X. ASTM D2751 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings; 2005.

Y. ASTM F628 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe with a Cellular Core; 2008.

Z. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers; 1992 (Reapproved 2008).

AA. AWS A5.8/A5.8M - Specification for Filler Metals for Brazing and Braze Welding; American Welding Society; 2011 and errata.

AB. CISPI 301-09 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications; Cast Iron Soil Pipe Institute; 2009.

AC. CISPI 310-10 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; Cast Iron Soil Pipe Institute; 2011.

AD. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2009.

AE. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2010.

AF. NFPA 54 - National Fuel Gas Code; National Fire Protection Association; 2012.

AG. ASME - Boiler and Pressure Vessel Code

AH. AGA - American Gas Association Code

1.03 SUBSTITUTIONS

Substitutions will be considered per Article 3.3 of this Instruction to Bidders of the Bid Package Section 00003.

1.04 SUBMITTALS

A. Provide in accordance with Article 3.11 of the General Conditions.

B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with State of California, standards.

1. Maintain one copy on project site.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

C. Welding Materials and Procedures: Conform to ASME (BPV IX) and applicable state labor regulations.

D. Welder Qualifications: Certified in accordance with ASME (BPV IX).

E. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

1.06 REGULATORY REQUIREMENTS

A. Perform Work in accordance with State of California plumbing code.

B. Conform to applicable code for installation of backflow prevention devices.

C. Provide certificate of compliance from authority having jurisdiction indicating approval of installation of backflow prevention devices.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 - PRODUCTS

2.01 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. ABS Pipe: ASTM D2751 or ASTM F628.

1. Fittings: ABS.

2. Joints: Solvent welded with ASTM D2235 cement.

2.02 SANITARY SEWER PIPING, ABOVE GRADE

A. Cast Iron Pipe: CISPI 301, hubless, service weight.

1. Fittings: Cast iron.

2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.

2.03 WATER PIPING, ABOVE GRADE

A. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), Drawn (H).

1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.

2. Joints: ASTM B32, alloy Sn95 solder.

2.04 NATURAL GAS PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M Schedule 40 black.

1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.

2. Joints: NFPA 54, threaded or welded to ASME B31.1.

B. Polyethylene Pipe: ASTM D 2513, SDR 11

1. Fittings: ASTM D 2683 or ASTM D 2513 socket type.

2. Joints: Fusion welded

2.05 FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 3 Inches and Under:

1. Copper tube and pipe: Class 150 bronze unions with soldered joints.

B. Grooved and Shouldered Pipe End Couplings:

1. Housing: Malleable iron clamps to engage and lock, designed to permit some angular deflection, contraction, and expansion; steel bolts, nuts, and washers; galvanized for galvanized pipe.

2. Sealing gasket: "C" shape composition sealing gasket.

2.06 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.

1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.

2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.

3. Trapeze Hangers: Welded steel channel frames attached to structure.

4. Vertical Pipe Support: Steel riser clamp.

B. Plumbing Piping - Drain, Waste, and Vent:

1. Conform to ASME B31.9.

2. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.

3. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.

C. Plumbing Piping - Water:

1. Conform to ASME B31.9.

2. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.

3. Hangers for Cold Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.

4. Hangers for Hot Pipe Sizes 2 Inches to 4 Inches: Carbon steel, adjustable, clevis.

2.07 BALL VALVES

A. Manufacturers:

1. Tyco Flow Control: www.tycoflowcontrol.com.

2. Apollo Valves: www.apollovalves.com.
3. Nibco, Inc: www.nibco.com.
4. Milwaukee Valve Company: www.milwaukeevalve.com.
5. Stockham: www.stockham.com

B. Construction, 4 Inches and Smaller: MSS SP-110, Class 150, 400 psi CWP, bronze, two piece body, chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, solder ends with union.

C. Construction, 4 Inches and Smaller: MSS SP-110, _____ psi CWP, bronze, two piece body, chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, solder ends with union.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

D. Install piping to maintain headroom, conserve space, and not interfere with use of space.

E. Group piping whenever practical at common elevations.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 15122.

G. Provide access where valves and fittings are not exposed.

H. Install valves with stems upright or horizontal, not inverted.

I. Install water piping to ASME B31.9.

J. Pipe Hangers and Supports:

1. Install in accordance with ASME B31.9.
2. Support horizontal piping as scheduled.
3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
4. Place hangers within 12 inches of each horizontal elbow.
5. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

3.04 APPLICATION

A. Install unions downstream of valves and at equipment or apparatus connections.

B. Install globe valves for throttling, bypass, or manual flow control services.

C. Provide spring loaded check valves on discharge of water pumps.

3.05 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Disinfect water distribution system in accordance with Section 02515.

B. Prior to starting work, verify system is complete, flushed and clean.

3.06 SERVICE CONNECTIONS

A. Provide new sanitary sewer services. Before commencing work check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.

B. Provide new water service complete with approved reduced pressure backflow preventer and water meter with by-pass valves, pressure reducing valve, and sand strainer.

C. Provide new gas service complete with gas meter and regulators. Gas service distribution piping to have initial minimum pressure of 7 inch wg. Provide regulators on each line serving gravity type appliances, sized in accordance with equipment.

3.07 SCHEDULES - SEE SHEET P-4.1 FOR PIPE SUPPORT SCHEDULE

*****END OF SECTION*****

SECTION 15146

PLUMBING SPECIALTIES

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Conditions apply to this Section.

1.02 SECTION INCLUDES

A. Floor drains.

B. Cleanouts.

C. Hose bibbs.

D. Water hammer arrestors.

E. Thermostatic mixing valves.

1.03 REFERENCE STANDARDS

A. ASME A112.6.3 - Floor and Trench Drains; The American Society of Mechanical Engineers; 2001 (R2007).

B. ASSE 1011 - Hose Connection Vacuum Breakers; American Society of Sanitary Engineering; 2004 (ANSI/ASSE 1011).

C. ASSE 1012 - Backflow Preventer with Intermediate Atmospheric Vent; American Society of Sanitary Engineering; 2009 (ANSI/ASSE 1012).

D. ASSE 1013 - Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers; American Society of Sanitary Engineering; 2011.

E. ASSE 1019 - Vacuum Breaker Wall Hydrants, Freeze Resistant Automatic Draining Type; American Society of Sanitary Engineering; 2011 (ANSI/ASSE 1019).

F. PDI-WH 201 - Water Hammer Arresters; Plumbing and Drainage Institute; 2010.

1.04 SUBSTITUTIONS

Substitutions will be considered per Article 3.3 of the Instruction to Bidders of the Bid Package Section 00003.

1.05 SUBMITTALS

A. Provide in accordance with Article 3.11 of the General Conditions.

B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.

C. Certificates: Certify that oil interceptors meet or exceed specified requirements.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Accept specialties on site in original factory packaging. Inspect for damage.

PART 2 - PRODUCTS

2.01 DRAINS

A. Manufacturers

1. Josam Company: www.josam.com
2. Jay R. Smith Manufacturing Company: www.jayrsmith.com
3. Zurn Industries, Inc: www.zurn.com
4. Mifab: www.mifab.com

B. Floor Drain

1. ASME A112.6.3; galvanized cast iron two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze strainer.

C. Floor Sink

1. Cast iron 8 inch square, 6 inch deep flanged receptor with seepage holes, acid resistant coated interior, loose set acid resistant coated cast iron grate, and aluminum dome bottom strainer.

2.02 CLEANOUTS

A. Manufacturers:

1. Jay R. Smith Manufacturing Company: www.jayrsmith.com
2. Josam Company: www.josam.com
3. Zurn Industries, Inc: www.zurn.com
4. Mifab: www.mifab.com

2.03 HOSE BIBBS

A. Manufacturers:

1. Woodford: www.woodfordmfg.com
2. Zurn Industries, Inc: www.zurn.com
3. Mifab: www.mifab.com

2.04 WATER HAMMER ARRESTORS

A. Manufacturers:

1. Precision Plumbing Products: www.pppinc.com
2. Watts Regulator Company: www.wattsregulator.com
3. Zurn Industries, Inc: www.zurn.com
4. Mifab: www.mifab.com

2.05 MIXING VALVES

A. Thermostatic Mixing Valves:

1. Valve: Chrome plated cast brass body, stainless steel or copper alloy bellows, integral temperature adjustment.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.

C. Install floor cleanouts at elevation to accommodate finished floor.

D. Install approved portable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibbs.

E. Pipe relief from backflow preventer to nearest drain.

*****END OF SECTION*****

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SECTION 15410

PLUMBING FIXTURES

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Conditions apply to this Section.

1.02 SECTION INCLUDES

A. Water closets.

B. Urinals.

C. Lavatories.

D. Sinks.

E. Showers.

1.03 REFERENCE STANDARDS

A. ANSI Z124.2 - American National Standard for Plastic Shower Units; 1995.

B. ASME A112.6.1M - Supports for Off-the-Floor Plumbing Fixtures for Public Use; The American Society of Mechanical Engineers; 1997 (Reaffirmed 2002).

C. ASME A112.18.1 - Plumbing Supply Fittings; The American Society of Mechanical Engineers; 2011.

D. ASME A112.19.1M - Enameled Cast Iron Plumbing Fixtures; The American Society of Mechanical Engineers; 2008 (R2011).

E. ASME A112.19.2 - Vitreous China Plumbing Fixtures and Hydraulic Requirements for Water Closets and Urinals; The American Society of Mechanical Engineers; 2008.

F. ASME A112.19.3 - Stainless Steel Plumbing Fixtures (Designed for Residential Use); The American Society of Mechanical Engineers; 2008.

G. ASME A112.19.4M - Porcelain Enameled Formed Steel Plumbing Fixtures; The American Society of Mechanical Engineers; 1994 (R2004).

H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2012.

1.04 SUBSTITUTIONS

Substitutions will be considered per Article 3.3 of the Instruction to Bidders of the Bid Package Section 00003.

1.05 SUBMITTALS

A. Provide in accordance with Article 3.11 of the General Conditions.

B. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

C. Manufacturer's Instructions: Indicate installation methods and procedures.

D. Maintenance Data: Include fixture trim exploded view and replacement parts lists.

1.06 QUALITY ASSURANCE

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

1.07 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Accept fixtures on site in factory packaging. Inspect for damage.

B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

PART 2 - PRODUCTS

2.01 FLUSH VALVE WATER CLOSETS

A. Water Closets: Vitreous china, ASME A112.19.2, floor mounted, siphon jet flush action, china bolt caps.

1. Flush Volume: 1.28 gallon, maximum.
2. Flush Valve: Exposed (top spud).
3. Flush Operation: Manual, oscillating handle.
4. Handle Height: 44 inches or less.
5. Manufacturers:
    a. American Standard Inc: www.americanstandard.com.
    b. Sloan Valve Company: www.sloanvalve.com.
    c. Kohler Company: www.kohler.com.
    d. Zurn Industries, Inc: www.zurn.com.
    e. Substitutions: See Section 01600 - Product Requirements.

B. Flush Valves: ASME A112.18.1, diaphragm type, complete with vacuum breaker stops and accessories.

1. Exposed Type: Chrome plated, escutcheon, integral screwdriver stop.

C. Seats:

1. Manufacturers:
    a. Olsonite: www.olsonite.com.
    b. Zurn Industries, Inc: www.zurn.com.
    c. Substitutions: See Section 01600 - Product Requirements.
2. Solid white plastic, open front, extended back, self-sustaining hinge, brass bolts, without cover.

2.02 WALL HUNG URINALS

A. Wall Hung Urinal Manufacturers:

1. Zurn Industries, Inc; EcoVantage Zurn Z5799: www.zurn.com.

B. Urinals: Vitreous china, ASME A112.19.2, wall hung with side shields and concealed carrier.

1. Flush Volume: 0.125 gallon, maximum.
2. Flush Style: Washout.

3. Flush Valve: Exposed (top spud).
4. Flush Operation: Sensor operated.
5. Trap: Integral.
6. Removable stainless steel strainer.

C. Flush Valves: ASME A112.18.1, diaphragm type, complete with vacuum breaker stops and accessories.

1. Sensor-Operated Type: Solenoid operator, battery powered, infrared sensor and over-ride push button.
2. Exposed Type: Chrome plated, escutcheon, integral screwdriver stop.

2.03 LAVATORIES

A. Lavatory Manufacturers:

1. American Standard Inc: www.americanstandard.com.
2. Kohler Company: www.kohler.com.
3. Zurn Industries, Inc: www.zurn.com.

B. Vitreous China Wall Hung Basin: ASME A112.19.2; vitreous china wall hung lavatory, ___ by ___ inch minimum, with 4 inch high back, rectangular basin with splash lip, front overflow, and soap depression.

C. Steel Counter Top Basin:

1. ASME A112.19.4M; porcelain on steel self-rimming counter top lavatory, with drillings on 4 inch centers, front overflow, soap depression, seal of putty, calking, or concealed vinyl gasket.

D. Vitreous China Counter Top Basin:

1. ASME A112.19.2; vitreous china self-rimming counter top lavatory, 20 1/4 x 17 1/2 inches with drillings on 4 inch centers, front overflow, seal of putty, calking, or concealed vinyl gasket.

E. Supply Faucet Manufacturers:

1. Chicago Faucets, a Geberit company: www.chicagofaucets.com.
2. Zurn Industries, Inc: www.zurn.com.

F. Supply Faucet:

ASME A112.18.1; chrome plated combination supply fitting with pop-up waste, water economy aerator with maximum 0.5 gpm flow, indexed handles.

1. ASME A112.18.1; chrome plated metered mixing faucet with low voltage operated solenoid operator and infrared sensor, 0.5 gpm aerator and cover plate, open grid strainer.

2.04 SINKS

A. Sink Manufacturers:

1. American Standard, Inc: www.americanstandard-us.com.
2. Kohler Company: www.kohler.com.

B. Single Compartment Bowl:

1. ASME A112.19.3; See Plans for dimensions, 19 gage thick, Type 304 stainless steel, self-rimming and undercoated, with ledge back drilled for trim.

a. Drain: 1-1/2 inch chromed brass drain.

C. Accessories: Chrome plated 17 gage brass P-trap with clean-out plug and arm with escutcheon, wheel handle stop, rigid supplies.

2.05 SHOWERS

A. Trim:

1. ASME A112.18.1; concealed shower supply with pressure balanced mixing valves, integral service stops, bent shower arm with adjustable spray ball joint shower head with maximum 1.5 flow, and escutcheon.

B. Low-Flow Shower Head:

1. ASME A112.18.1; chrome plated vandal-proof institutional head with integral wall bracket, built-in 1.5 gpm flow control.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.

B. Verify that electric power is available and of the correct characteristics.

C. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

3.02 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.03 INSTALLATION

A. Install each fixture with trap, easily removable for servicing and cleaning.

B. Provide chrome plated rigid or flexible supplies to fixtures with loose key or integral stops, reducers, and escutcheons.

C. Install components level and plumb.

D. Install and secure fixtures in place with wall carriers and bolts.

E. Seal fixtures to wall and floor surfaces with sealant as specified in Section 07900, color to match fixture.

3.04 INTERFACE WITH WORK OF OTHER SECTIONS

A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.05 ADJUSTING

A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.06 CLEANING

A. Clean plumbing fixtures and equipment.

3.07 PROTECTION

A. Protect installed products from damage due to subsequent construction operations.

B. Do not permit use of fixtures by construction personnel.

C. Repair or replace damaged products before Date of Substantial Completion.

3.08 SCHEDULES

A. Fixture Heights: Install fixtures to heights above finished floor as indicated.

1. Water Closet:
    a. Standard: 15 inches to top of bowl rim.
    b. Accessible: 18 inches to top of seat.
2. Water Closet Flush Valves:
    a. Standard: 11 inches min. above bowl rim.
    b. Recessed: 10 inches min. above bowl rim.
3. Urinal:
    a. Standard: 22 inches to top of bowl rim.
    b. Accessible: 17 inches to top of bowl rim.
4. Lavatory:
    a. Standard: 31 inches to top of basin rim.
    b. Accessible: 34 inches to top of basin rim.
5. Shower Heads:
    a. Adult Male: 69.5 inches to bottom of head.
    b. Adult Female: 64.5 inches to bottom of head.

B. Fixture Rough-In - See sheet P-0.1

*****END OF SECTION*****

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SECTION 15430

PLUMBING EQUIPMENT

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Conditions apply to this Section.

1.02 SECTION INCLUDES

A. Water heaters.

B. Pumps.

1. Circulators.

1.03 REFERENCE STANDARDS

A. ANSI Z21.10.1 - Gas Water Heaters - Volume I - Storage Water Heaters with Input Ratings of 75,000 Btu per Hour or Less; 2011.

B. ANSI Z21.10.3 - Gas Water Heaters - Volume III - Storage Water Heaters with Input Ratings Above 75,000 Btu per Hour, Circulating and Instantaneous Water Heaters; 2011.

C. UL 174 - Standard for Household Electric Storage Tank Water Heaters; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

D. UL 1453 - Standard for Electric Booster and Commercial Storage Tank Water Heaters; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.04 SUBSTITUTIONS

Substitutions will be considered per Article 3.3 of the Instruction to Bidders of the Bid Package Section 00003.

1.05 SUBMITTALS

A. Provide in accordance with Article 3.11 of the General Conditions.

B. Product Data

1. Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.

2. Indicate pump type, capacity, power requirements.

3. Provide certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.

4. Provide electrical characteristics and connection requirements.

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

1.06 QUALITY ASSURANCE

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

B. Identification: Provide pumps with manufacturer's name, model number, and rating/capacity identified by permanently attached label.

1.07 CERTIFICATIONS

A. Gas Water Heaters: Certified by CSA International to ANSI Z21.10.1 or ANSI Z21.10.3, as

applicable.

B. Electric Water Heaters: UL listed and labeled to UL 174 or UL 1453.

C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.01 WATER HEATER MANUFACTURERS

A. A.O. Smith Water Products Co: www.hotwater.com.

2.02 COMMERCIAL GAS FIRED WATER HEATERS

A. Type: Automatic, natural gas-fired, vertical storage.

B. Tank: Glass lined welded steel ASME labeled; multiple flue passages, 4 inch diameter inspection port, thermally insulated with minimum 2 inches glass fiber, encased in corrosion-resistant steel jacket; baked-on enamel finish; floor shield and legs.

C. Tank: Glass lined welded steel ASME labeled; multiple flue passages, 4 inch diameter inspection port, thermally insulated with minimum 2 inches glass fiber, encased in corrosion-resistant steel jacket; baked-on enamel finish; floor shield and legs.

D. Accessories: Provide:

1. Water Connections: Brass.
2. Dip tube: Brass.
3. Drain Valve.
4. Anode: Magnesium.
5. Temperature and Pressure Relief Valve: ASME labeled.

E. Controls: Automatic water thermostat with temperature range adjustable from 120 to 180 degrees F, automatic reset high temperature limiting thermostat factory set at 195 degrees F, gas pressure regulator, multi-ribbon or tubular burner, 100 percent safety shut-off pilot and thermocouple, flue baffle and draft hood.

2.03 IN-LINE CIRCULATOR PUMPS

A. Manufacturers:

1. Armstrong Pumps Inc: www.armstrongpumps.com.
2. ITT Bell & Gossett: www.bellgossett.com.
3. Taco Pumps: www.taco-hvac.com.

B. Casing: Bronze, rated for 125 psig working pressure, with stainless steel rotor assembly.

C. Impeller: Bronze.

D. Shaft: Alloy steel with integral thrust collar and two oil lubricated bronze sleeve bearings.

E. Seal: Carbon rotating against a stationary ceramic seat.

F. Drive: Flexible coupling.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions of certification, if any.

B. Coordinate with plumbing piping and related fuel piping work to achieve operating system.

C. Pumps:

1. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

3.02 SCHEDULES - SEE SHEET P-0.1

*****END OF SECTION*****

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SECTION 15735

PACKAGED ROOF TOP AIR CONDITIONING UNITS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Conditions apply to this Section.

1.02 SECTION INCLUDES

A. Packaged roof top unit.

B. Unit controls.

C. Roof mounting curb and base.

D. Maintenance service.

1.03 REFERENCE STANDARDS

A. AHRI 210/240 - Standard for Performance Rating of Unitary Air Conditioning and Air-Source Heat Pump Equipment; Air-Conditioning, Heating, and Refrigeration Institute; 2008.

B. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilation Systems; National Fire Protection Association; 2012.

1.04 SUBSTITUTIONS

Substitutions will be considered per Article 3.3 of the Instruction to Bidders of the Bid Package Section 00003.

1.05 SUBMITTALS

A. Provide in accordance with Article 3.11 of the General Conditions.

B. Product Data: Provide capacity and dimensions of manufactured products and assemblies required for this project. Indicate electrical service with electrical characteristics and connection requirements, and duct connections.

C. Shop Drawings: Indicate capacity and dimensions of manufactured products and assemblies required for this project. Indicate electrical service with electrical characteristics and connection requirements, and duct connections.

D. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.

E. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect units from physical damage by storing off site until roof mounting curbs are in place, ready for immediate installation of units.

1.07 WARRANTY

A. Provide a five year warranty to include coverage for refrigeration compressors.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Carrier Corporation: www.carrier.com

B. York International Corporation/Johnson Controls: www.york.com.

2.02 AIR CONDITIONING UNITS

A. General: Roof mounted units having gas burner and electric refrigeration.

B. Description: Self-contained, packaged, factory assembled and prewired, consisting of cabinet and frame, supply fan, heat exchanger and burner, controls, air filters, refrigerant cooling coil and compressor, condenser coil and condenser fan.

C. Disconnect Switch: Factory mount disconnect switch in control panel.

2.03 FABRICATION

A. Cabinet: Steel with baked enamel finish, including access panels with screwdriver operated flush cam type fasteners. Structural members shall be minimum 18 gage, with access doors or panels of minimum 20 gage.

B. Heat Exchangers: Aluminized steel, of welded construction.

C. Supply Fan: Forward curved centrifugal type, resiliently mounted with V-belt drive, adjustable variable pitch motor pulley, and rubber isolated hinge mounted high efficiency motor. Isolate complete fan assembly. Refer to Section 15073.

D. Air Filters: media with extended surface media filters. Refer to Section 15860.

E. Roof Mounting Curb: 24 inches high galvanized steel, channel frame with gaskets, nailer strips.

2.04 BURNER

A. Gas Burner: Atmospheric type burner with adjustable combustion air supply, pressure regulator, gas valves, manual shut-off, intermittent spark or glow coil ignition, flame sensing device, and automatic 100 percent shut-off pilot.

B. Gas Burner Safety Controls: Energize ignition, limit time for establishment of flame, prevent opening of gas valve until pilot flame is proven, stop gas flow on ignition failure, energize blower motor, and after air flow proven and slight delay, allow gas valve to open.

C. High Limit Control: Temperature sensor with fixed stop at maximum permissible setting, de-energize burner on excessive bonnet temperature and energize burner when temperature drops to lower safe value.

D. Supply Fan Control: Temperature sensor sensing bonnet temperatures and independent of burner controls, with provisions for continuous fan operation.

2.05 EVAPORATOR COIL

A. Provide copper tube aluminum fin coil assembly with galvanized drain pan and connection.

B. Provide capillary tubes or thermostatic expansion valves for units of 6 tons capacity and less, and thermostatic expansion valves and alternate row circuiting for units 7.5 tons cooling capacity and larger.

2.06 COMPRESSOR

A. Provide semi-hermetic compressors, 3600 rpm maximum, resiliently mounted with positive lubrication, crankcase heater, high and low pressure safety controls, motor overload protection, suction and discharge service valves and gage ports, and filter drier.

2.07 CONDENSER COIL

A. Provide copper tube aluminum fin coil assembly with subcooling rows and coil guard.

B. Provide direct drive propeller fans, resiliently mounted with fan guard, motor overload

protection, wired to operate with compressor. Provide high efficiency fan motors.

C. Provide refrigerant pressure switches to cycle condenser fans.

2.08 MIXED AIR CASING

A. Dampers: Provide remote controlled outside and return air dampers with damper operator and remote CO2 sensor for adjusting outside air quantity.

B. Gaskets: Provide tight fitting dampers with edge gaskets.

C. Damper Operator: Pneumatic piston or gear driven type with spring return and pilot positioner.

D. Mixed Air Controls: Maintain selected supply air temperature and return dampers to minimum position on call for heating and above 75 degrees F ambient, or when ambient air temperature exceeds return air temperature.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that roof is ready to receive work and opening dimensions are as indicated on shop drawings.

B. Verify that proper power supply is available.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NFPA 90A.

C. Mount units on factory built roof mounting curb providing watertight enclosure to protect ductwork and utility services. Install roof mounting curb level.

3.03 SYSTEM STARTUP

A. Prepare and start equipment. Adjust for proper operation.

3.04 CLOSEOUT ACTIVITIES

A. Demonstrate operation to Owner's maintenance personnel.

3.05 MAINTENANCE

A. Provide service and maintenance of packaged roof top units for one year year from Date of Substantial Completion.

B. Provide routine maintenance service with a two month interval as maximum time period between calls.

C. Include maintenance items as outlined in manufacturer's operating and maintenance data, including minimum of six filter replacements, minimum of one fan belt replacement, and controls check-out, adjustments, and recalibration.

D. After each service call, submit copy of service call work order or report that includes description of work performed.

3.06 SCHEDULES - SEE SHEET M-0.1

*****END OF SECTION*****

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SECTION 15810

DUCTS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Conditions apply to this Section.

1.02 SECTION INCLUDES

A. Metal ductwork.

B. Nonmetal ductwork.

C. Casing and plenums.

D. Duct cleaning.

1.03 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2008.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2011.

C. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; National Fire Protection Association; 2012.

D. NFPA 90B - Standard for the Installation of Warm Air Heating and Air Conditioning Systems; National Fire Protection Association; 2012.

E. SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual; Sheet Metal and Air Conditioning Contractors' National Association; 2012, 2nd Edition.

F. SMACNA (DCS) - HVAC Duct Construction Standards; 2005.

G. SMACNA (FGD) - Fibrous Glass Duct Construction Standards; Sheet Metal and Air Conditioning Contractors' National Association; 2003.

H. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.04 PERFORMANCE REQUIREMENTS

A. No variation of duct configuration or sizes permitted except by written permission. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.

1.05 SUBSTITUTIONS

Substitutions will be considered per Article 3.3 of the Instruction to Bidders of the Bid Package Section 00003.

1.06 SUBMITTALS

A. Provide in accordance with Article 3.11 of the General Conditions

B. Product Data: Provide data for duct materials, duct liner, and duct connections.

C. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.07 REGULATORY REQUIREMENTS

A. Construct ductwork to NFPA 90A standards.

1.08 FIELD CONDITIONS

A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures within acceptable range during and after installation of duct sealants.

PART 2 - PRODUCTS

2.01 DUCT ASSEMBLIES

2.02 MATERIALS

A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.

B. Flexible Ducts:

1. UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound spring steel wire.

a. Pressure Rating: 10 inches WG positive and 1.0 inches WG negative.

b. Maximum Velocity: 4000 fpm.

c. Temperature Range: -20 degrees F to 210 degrees F.

C. Insulated Flexible Ducts:

1. UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound spring steel wire; fiberglass insulation; polyethylene vapor barrier film.

a. Pressure Rating: 10 inches WG positive and 1.0 inches WG negative.

b. Maximum Velocity: 4000 fpm.

c. Temperature Range: -20 degrees F to 210 degrees F.

D. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.

E. Hanger Rod: ASTM A 36/A 36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

2.03 DUCTWORK FABRICATION

A. Fabricate ductwork gauge in accordance with current (CMC) California Mechanical Code and support in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

B. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

C. T's, bends, and elbows: Construct according to (CMC) California Mechanical Code and SMACNA (DCS).

D. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

E. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA HVAC Duct Construction Standards.

F. Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.

G. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver

frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

2.04 DUCT MANUFACTURERS

A. Metal-Fab, Inc: www.mtlfab.com.

B. SEMCO Incorporated: www.semcoinc.com.

C. United McGill Corporation: www.unitedmcgill.com.

2.05 MANUFACTURED DUCTWORK AND FITTINGS

A. Manufacture in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

2.06 CASINGS

A. Fabricate casings in accordance with SMACNA HVAC Duct Construction Standards and construct for operating pressures indicated.

B. Mount floor mounted casings on 4 inch high concrete curbs. At floor, rivet panels on 8 inch centers to angles. Where floors are acoustically insulated, provide liner of 18 gage galvanized expanded metal mesh supported at 12 inch centers, turned up 12 inches at sides with sheet metal shields.

C. Mount floor mounted casings on 4 inch high concrete curbs. At floor, rivet panels on 8 inch centers to angles. Where floors are acoustically insulated, provide liner of 18 gage galvanized expanded metal mesh supported at 12 inch centers, turned up 12 inches at sides with sheet metal shields.

D. Reinforce door frames with steel angles tied to horizontal and vertical plenum supporting angles. Install hinged access doors where indicated or required for access to equipment for cleaning and inspection.

E. Fabricate acoustic casings with reinforcing turned inward. Provide 16 gage back facing and 22 gage perforated front facing with 3/32 inch diameter holes on 5/32 inch centers. Construct panels 3 inches thick packed with 4.5 lb/cu ft minimum glass fiber media, on inverted channels of 16 gage.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA HVAC Duct Construction Standards.

B. Install in accordance with manufacturer's instructions.

C. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.

D. Install and seal metal and flexible ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

E. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

F. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

G. Use crimp joints with or without bead for joining round duct sizes 8 inch and smaller with

crimp in direction of air flow.

H. Use double nuts and lock washers on threaded rod supports.

I. Connect terminal units to supply ducts with one foot maximum length of flexible duct. Do not use flexible duct to change direction.

J. Connect diffusers or light troffer boots to low pressure ducts with 7 feet maximum length of flexible duct held in place with strap or clamp.

K. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

L. At exterior wall louvers, seal duct to louver frame and install blank-out panels.

3.02 CLEANING

A. Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment that could be harmed by excessive dirt with temporary filters, or bypass during cleaning.

3.03 SCHEDULES

A. Ductwork Material:

1. Low Pressure Supply (Heating Systems): Steel, Aluminum, Fibrous Glass.
2. Low Pressure Supply (System with Cooling Coils): Steel, Aluminum, Fibrous Glass.
3. Return and Relief: Steel, Aluminum.
4. General Exhaust: Steel, Aluminum.
5. Outside Air Intake: Steel.
6. Combustion Air: Steel.

B. Ductwork Pressure Class:

1. Supply (Heating Systems): 1/2 inch
2. Supply (System with Cooling Coils): 1/2 inch.
3. Return and Relief: 1/2 inch.
4. Outside Air Intake: 1/2 inch.
5. Combustion Air: 1/2 inch.
6. Emergency Generation Ventilation: 1/2 inch

*****END OF SECTION*****

SECTION 15820

DUCT ACCESSORIES

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Conditions apply to this Section.

1.02 SECTION INCLUDES

A. Air turning devices/extractors.

B. Backdraft dampers.

C. Flexible duct connections.

D. Volume control dampers.

1.03 REFERENCE STANDARDS

A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; National Fire Protection Association; 2012.

B. SMACNA (DCS) - HVAC Duct Construction Standards; 2005.

C. UL 33 - Heat Responsive Links for Fire-Protection Service; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

D. UL 555 - Standard for Fire Dampers; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

E. UL 555S - Standard for Leakage Rated Dampers for Use in Smoke Control Systems; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.04 SUBSTITUTIONS

Substitutions will be considered per Article 3.3 of the Instruction to Bidders of the Bid Package Section 00003.

1.05 SUBMITTALS

A. Provide in accordance with Article 3.11 of the General Conditions.

B. Product Data: Provide for shop fabricated assemblies including volume control dampers, duct access doors, and hardware used. Include electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions: Provide instructions for fire dampers and combination fire and smoke dampers.

1.06 QUALITY ASSURANCE

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect dampers from damage to operating linkages and blades.

PART 2 - PRODUCTS

2.01 AIR TURNING DEVICES/EXTRACTORS

A. Manufacturers:

1. Krueger: www.krueger-hvac.com.
2. PCI Industries, Inc; Pottorff Brand: www.portorff.com.
3. Ruskin Company: www.ruskin.com.
4. Titus: www.titus-hvac.com.

B. Multi-blade device with radius blades attached to pivoting frame and bracket, steel construction, with worm drive mechanism with removable key operator.

2.02 BACKDRAFT DAMPERS

A. Manufacturers:

1. Louvers & Dampers, Inc: www.louvers-dampers.com.
2. Nailor Industries Inc: www.nailor.com.
3. PCI Industries, Inc; Pottorff Brand: www.portorff.com.
4. Ruskin Company: www.ruskin.com.

B. Gravity Backdraft Dampers, Size 18 x 18 inches or Smaller, Furnished with Air Moving Equipment: Air moving equipment manufacturer's standard construction.

2.03 FLEXIBLE DUCT CONNECTIONS

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards and as indicated.

B. Flexible Duct Connections: Fabric crimped into metal edging strip.

2.04 VOLUME CONTROL DAMPERS

A. Manufacturers:

1. Louvers & Dampers, Inc: www.louvers-dampers.com.
2. Nailor Industries Inc: www.nailor.com.
3. PCI Industries, Inc; Pottorff Brand: www.portorff.com.
4. Ruskin Company: www.ruskin.com.

B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards and as indicated.

C. Single Blade Dampers: Fabricate for duct sizes up to 6 x 30 inch.

D. Quadrants:

1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA HVAC Duct Construction Standards. Refer to Section 15810 for duct construction and pressure class.

B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

C. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.

D. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment; see Section 15072.

E. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

*****END OF SECTION*****

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SECTION 15850

AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Conditions apply to this Section.

1.02 SECTION INCLUDES

A. Diffusers.

B. Registers/grilles.

C. Door grilles.

D. Louvers.

E. Goosenecks.

1.03 REFERENCE STANDARDS

A. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; Air Movement and Control Association International, Inc.; 2012.

B. ARI 890 - Standard for Air Diffusers and Air Diffuser Assemblies; Air-Conditioning and Refrigeration Institute; 2008.

C. ASHRAE Std 70 - Method of Testing for Rating the Performance of Air Outlets and Inlets; American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc.; 2006.

D. SMACNA (DCS) - HVAC Duct Construction Standards; 2005.

1.04 SUBSTITUTIONS

Substitutions will be considered per Article 3.3 of the Instruction to Bidders of the Bid Package Section 00003.

1.05 SUBMITTALS

A. Provide in accordance with Article 3.11 of the General Conditions.

B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

1.06 QUALITY ASSURANCE

A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Krueger: www.krueger-hvac.com.

B. Price Industries; Model _____: www.price-hvac.com.

C. Titus: www.titus-hvac.com.

2.02 RECTANGULAR CEILING DIFFUSERS

A. Type: Square, stamped, multi-core diffuser to discharge air in 360 degree pattern with sectorizing baffles where indicated.

B. Frame: Surface mount type. In plaster ceilings, provide plaster frame and ceiling frame.

C. Fabrication: Aluminum with baked enamel off-white finish.

2.03 CEILING SUPPLY REGISTERS/GRILLES

A. Type: Streamlined and individually adjustable curved blades to discharge air along face of grille, two-way deflection.

B. Frame: 1 inch margin with countersunk screw mounting and gasket.

C. Fabrication: Aluminum extrusions with factory off-white enamel finish.

D. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face.

2.04 CEILING EXHAUST AND RETURN REGISTERS/GRILLES

A. Type: Streamlined blades, 3/4 inch minimum depth, 3/4 inch maximum spacing, with blades set at 45 degrees, vertical face.

B. Frame: 1 inch margin with countersunk screw mounting.

C. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face where not individually connected to exhaust fans.

2.05 DOOR GRILLES

A. Type: V-shaped louvers of 20 gage thick steel, 1 inch deep on 1/2 inch centers.

B. Frame: 20 gage steel with auxiliary frame to give finished appearance on both sides of door, with factory prime coat finish.

2.06 LOUVERS

A. Type: 4 inch deep with blades on 45 degree slope with center baffle and return bend, heavy channel frame, 1/2 inch square mesh screen over exhaust and 1/2 inch square mesh screen over intake.

B. Fabrication: 12 gage thick extruded aluminum, welded assembly, with factory prime coat finish color to be selected.

C. Mounting: Furnish with interior flat flange for installation.

2.07 GOOSENECKS

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards of minimum 18 gage galvanized steel.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.

C. Install diffusers to ductwork with air tight connection.

D. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.

3.02 SCHEDULES SHOWN ON SHEET M-0.1

*****END OF SECTION*****

SECTION 15928

INSTRUMENTS AND CONTROL ELEMENTS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Divisions 1, General Conditions apply to this Section.

1.02 SECTION INCLUDES

A. Air supply system.

B. Thermostats.

C. Time clocks.

D. Miscellaneous accessories.

1.03 REFERENCE STANDARDS

A. AMCA 500-D - Laboratory Methods for Testing Dampers for Rating; Air Movement and Control Association International, Inc.; 2012.

1.04 SUBSTITUTIONS

Substitutions will be considered per Article 3.3 of the Instruction to Bidders of the Bid Package Section 00003.

1.05 SUBMITTALS

A. Provide in accordance with Article 3.11 of the General Conditions.

Product Data: Provide description and engineering data for each control system component. Include sizing as requested. Provide data for each system component and software module.

B. Shop Drawings: Indicate complete operating data, system drawings, wiring diagrams, and written detailed operational description of sequences. For automatic dampers indicate arrangement, velocities, and static pressure drops for each system.

C. Manufacturer's Instructions: Provide for all manufactured components.

D. Project Record Documents: Record actual locations of control components, including panels, thermostats, and sensors. Accurately record actual location of control components, including panels, thermostats, and sensors.

1. Revise shop drawings to reflect actual installation and operating sequences.

E. Operation and Maintenance Data: Include inspection period, cleaning methods, recommended cleaning materials, and calibration tolerances.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Carrier Controls.

B. Other Acceptable Manufacturers:

1. BAC.

2. LonWorks.

3. Automated Logic.

2.02 EQUIPMENT - GENERAL

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

2.03 CONTROL PANELS

A. Unitized cabinet type for each system under automatic control with relays and controls mounted in cabinet and temperature indicators, pressure gages, pilot lights, push buttons and switches flush on cabinet panel face.

2.04 INPUT/OUTPUT SENSORS

A. Temperature Sensors

B. Static Pressure Sensors

C. Equipment Operation Sensors:

1. Status Inputs for Fans: Differential pressure switch with adjustable range of 0 to 5 inches wg.

D. Damper Position Indication: Potentiometer mounted in enclosure with adjustable crank arm assembly connected to damper to transmit 0 - 100 percent damper travel.

E. Carbon Monoxide Detectors:

1. Single or multichannel dual level detectors, using solid state sensors with three year minimum life. Sensor replacement shall take maximum 15 minutes. Suitable over temperature range of 23 to 130 degrees F.

2.05 THERMOSTATS

A. Line Voltage Thermostats:

1. Integral manual On/Off/Auto selector switch, single or two pole as required.

2. Dead band: Maximum 2 degrees F.

B. Room Thermostat Accessories:

1. Insulating Bases: For thermostats located on exterior walls.

2. Aspirating Boxes: Where indicated for thermostats requiring flush installation.

C. Airstream Thermostats:

1. Remote bulb or bimetallic rod and tube type, proportional action with adjustable setpoint in middle of range and adjustable throttling range.

2.06 TIME CLOCKS

A. Seven day programming switch timer with synchronous timing motor and seven day dial, continuously charged Ni-cad battery driven power failure 8 hour carry over and multiple switch trippers to control systems for minimum of two and maximum of eight signals per day with two normally open and two normally closed output switches.

2.07 TRANSMITTERS

A. Building Static Pressure Transmitter:

1. One pipe, direct acting, double bell, scale range 0.01 to 6.0 inch wg positive or negative, and sensitivity of 0.0005 inch wg. Transmit electronic signal to receiver with matching scale range.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that systems are ready to receive work.

B. Beginning of installation means installer accepts existing conditions.

C. Sequence work to ensure installation of components is complementary to installation of similar components in other systems.

D. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

E. Ensure installation of components is complementary to installation of similar components.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Check and verify location of thermostats with plans and room details before installation. Locate 60 inches above floor. Align with lighting switches. Refer to Section 16140.

C. Provide mixing dampers of opposed blade construction arranged to mix streams. Provide pilot positioners on mixed air damper motors. Provide separate minimum outside air damper section adjacent to return air dampers with separate damper motor.

D. Mount control panels adjacent to associated equipment on vibration free walls or free standing angle iron supports. One cabinet may accommodate more than one system in same equipment room. Provide engraved plastic nameplates for instruments and controls inside cabinet and engraved plastic nameplates on cabinet face.

E. Provide conduit and electrical wiring in accordance with Section 16155. Electrical material and installation shall be in accordance with appropriate requirements of Division 16.

*****END OF SECTION*****

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SECTION 15950

TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Conditions apply to this Section.

1.02 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems.

B. Measurement of final operating condition of HVAC systems.

1.03 REFERENCE STANDARDS

A. AABC MN-1 - AABC National Standards for Total System Balance; Associated Air Balance Council; 2002.

B. ASHRAE Std 111 - Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; 1988, with 1997 Errata.

C. SMACNA (TAB) - HVAC Systems Testing, Adjusting, and Balancing; Sheet Metal and Air Conditioning Contractors' National Association; 2002.

1.04 SUBSTITUTIONS

Substitutions will be considered per Article 3.3 of the Instruction to Bidders of the Bid Package Section 00003.

1.05 SUBMITTALS

A. Provide in accordance with Article 3.11 of the General Conditions.

B. The contractor shall procure the services of an independent Air Balance and Testing Agency, approved by the Engineer, which specializes in the balancing and testing of heating, ventilating, and air conditioning systems. The independent agency shall be certified and in good standing with the AABC.

C. Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.

D. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.

1. Submit to Architect.
2. Include certification that the plan developer has reviewed the contract documents, the equipment and systems, and the control system with Architect and other installers to sufficiently understand the design intent for each system.
3. Include at least the following in the plan:
    a. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
    b. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.

c. Identification and types of measurement instruments to be used and their most recent calibration date.

d. Discussion of what notations and markings will be made on the duct and piping drawings during the process.

e. Final test report forms to be used.

f. Expected problems and solutions, etc.

g. Criteria for using air flow straighteners or relocating flow stations and sensors.

h. Details of how TOTAL flow will be determined; for example:

1) Air: Sum of terminal flows via control system calibrated readings or via hood readings of all terminals, supply (SA) and return air (RA) pitot traverse, SA or RA flow stations.

i. Specific procedures that will ensure that both air and water side are operating at the lowest possible pressures and methods to verify this.

j. Confirmation of understanding of the outside air ventilation criteria under all conditions.

k. Method of verifying and setting minimum outside air flow rate will be verified and set and for what level (total building, zone, etc.).

l. Method of checking building static and exhaust fan and/or relief damper capacity.

m. Time schedule for deferred or seasonal TAB work, if specified.

n. False loading of systems to complete TAB work, if specified.

o. Exhaust fan balancing and capacity verifications, including any required room pressure differentials.

p. Procedures for field technician logs of discrepancies, deficient or uncompleted work by others, contract interpretation requests and lists of completed tests (scope and frequency).

q. Procedures for formal progress reports, including scope and frequency.

r. Procedures for formal deficiency reports, including scope, frequency and distribution.

E. Field Logs: Submit at least twice a week to Commissioning Authority.

F. Progress Reports.

G. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.

1. Submit to the Commissioning Authority within two weeks after completion of testing, adjusting, and balancing.

2. Revise TAB plan to reflect actual procedures and submit as part of final report.

3. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect and for inclusion in operating and maintenance manuals.

4. Include actual instrument list, with manufacturer name, serial number, and date of calibration.

5. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.

6. Units of Measure: Report data in both I-P (inch-pound) and SI (metric) units.
7. Include the following on the title page of each report:
    a. Name of Testing, Adjusting, and Balancing Agency.
    b. Address of Testing, Adjusting, and Balancing Agency.
    c. Telephone number of Testing, Adjusting, and Balancing Agency.
    d. Project name.
    e. Project location.
    f. Project Architect.
    g. Project Engineer.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:
    1. AABC MN-1, AABC National Standards for Total System Balance.
    2. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.
    3. SMACNA HVAC Systems Testing, Adjusting, and Balancing.
    4. Maintain at least one copy of the standard to be used at project site at all times.

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

C. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.

D. TAB Agency Qualifications:
    1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
    2. Certified by the following:
        a. AABC, Associated Air Balance Council: www.aabchq.com; upon completion submit AABC National Performance Guaranty.

E. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

3.02 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
    1. Systems are started and operating in a safe and normal condition.
    2. Temperature control systems are installed complete and operable.
    3. Proper thermal overload protection is in place for electrical equipment.

4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
5. Duct systems are clean of debris.
6. Fans are rotating correctly.
7. Fire and volume dampers are in place and open.
8. Air coil fins are cleaned and combed.
9. Access doors are closed and duct end caps are in place.
10. Air outlets are installed and connected.
11. Duct system leakage is minimized.

B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.

C. Beginning of work means acceptance of existing conditions.

3.03 ADJUSTMENT TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

3.04 RECORDING AND ADJUSTING

A. Field Logs: Maintain written logs including:

1. Running log of events and issues.
2. Discrepancies, deficient or uncompleted work by others.
3. Contract interpretation requests.
4. Lists of completed tests.

B. Ensure recorded data represents actual measured or observed conditions.

C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

D. Mark on the drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.

E. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

3.05 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities.

B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

E. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

F. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

G. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

H. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

I. Where modulating dampers are provided, take measurements and balance at extreme conditions.

J. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.02 inches negative static pressure.

3.06 SCOPE

A. Test, adjust, and balance the following:

1. Plumbing Pumps
2. Forced Air Furnaces
3. Packaged Roof Top Heating/Cooling Units
4. Computer Room Air Conditioning Units
5. Fans

*****END OF SECTION*****

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SECTION 16010

BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Conditions apply to this Section.

1.02 SCOPE

A. This section supplements all sections of this division and shall apply to all phases of work hereinafter specified, shown on the drawings, or required to provide a complete installation of electrical systems for the Project. The work required under this division is not limited to the electrical specifications and drawings. Refer to all bid documents including Civil, Architectural, Structural, and Mechanical documents which may designate Work to be accomplished. The intent of the Specifications is to provide a complete and operable electrical system, which shall include all documents that are a part of the entire Project Contract.

1. Work included: Furnish all labor, material, tools, equipment, facilities, transportation, skilled supervision necessary for, and incidental to, performing operations in connection with furnishing, delivery, and installation of the work in this division complete as shown or noted on the Drawings and specified herein.

B. Related Work Specified Elsewhere:

1. Refer to all sections in the general contract conditions, Contract Requirements and Division 1, General Requirements.

C. Work Installed but Furnished by Others:

1. The electrical work includes the installation or connection of certain materials and equipment furnished by others. Verify installation details. Foundations for apparatus and equipment will be furnished by others unless otherwise noted or detailed.

1.03 GENERAL REQUIREMENTS

A. Guarantee See General Conditions:

1. Except as may be specified under other Sections in the specification, guarantee equipment furnished under the specifications for a period of one year, except for equipment required to have a longer guarantee period, from date of final completion. Guarantee all work against defective workmanship, material, and improper installation. Upon notification of failure, correct deficiency immediately and without additional cost to the Owner.

2. Standard warranty of manufacturer shall apply for replacement of parts after expiration of the above period. Manufacturer shall furnish replacement parts to the Owner or his service agency as approved. Furnish to the Owner, through the Architect, printed manufacturer's warranties complete with material included and expiration dates, upon completion of project. Conform to Division 01.

B. Equipment Safety: All electrical materials and equipment shall be new and shall be listed by Underwriter's Laboratories and bear their label, or listed and certified by a nationally recognized testing authority where UL does not have an approval. Custom made equipment must have complete test data submitted by the manufacturer attesting to its safety.

C. Codes and Regulations:

1. Design, manufacturer, testing and method of installation of all apparatus and materials furnished under the requirements of these specifications shall conform to the latest publications or standard rules of the following:
    a. Institute of Electrical and Electronic Engineers - IEEE
    b. National Electrical Manufacturers' Association - NEMA
    c. Underwriters' Laboratories, Inc. - UL
    d. National Fire Protection Association - NFPA
    e. American Society for Testing and Materials - ASTM
    f. American National Standards Institute - ANSI
    g. California Electrical Code - CEC, Title 24, Part 3
    h. California Code of Regulations, Title 8, Subchapter 5
    i. California Building Code-CBC, Title 24 Parts 1 &2
    j. State & Municipal Codes in Force in the Specific Project Area
    k. Occupational Safety & Health Administration - OSHA
    l. California State Fire Marshal
    m. California Fire Code- CFC, Title 24 Part 9
    n. National Electrical Testing Association - NETA
2. The term "Code", when used within the specifications, shall refer to the Publications, Standards, ordinances and codes, listed above. In the case where the codes have different levels of requirements the most stringent rules shall apply.

D. Requirements of Regulatory Agencies:
1. Codes, Permits, and Fees: Where the Contract Documents exceed minimum requirements, the Contract Documents take precedence. Where code conflicts occur, the most stringent shall apply. The most stringent condition shall be as interpreted by the Engineer.
    a. Comply with all requirements for permits, licenses, fees and Code. Permits, licenses, fees, inspections and arrangements required for the Contractor at his expense shall obtain the Work, unless otherwise specified.
    b. Comply with the requirements of the applicable utility companies serving the Project. Make all arrangements with the utility companies for proper coordination of the Work.

E. Shop Drawings:
1. See Article 3.11 of the General Conditions for additional requirements.
2. Time Schedules for Submission and Ordering: The Contractor shall prepare, review and coordinate his schedule of submissions carefully, determining the necessary lead time for preparing, submitting, checking, ordering and delivery of materials and equipment for timely arrival. The Contractor shall be responsible for conformance with the overall construction schedule.
3. Submittals will be checked for general compliance with specifications only. The Contractor shall be responsible for deviations from the drawings or specifications and for errors or omissions of any sort in submittals.
4. Submit a complete list of materials and equipment proposed for the job, including manufacturer's names and catalog numbers.

5. Shop drawings shall be submitted in completed groups of materials (i.e., lighting fixtures or switchgear). The Contractor shall add and sign the following paragraph on equipment and materials submitted for review. "It is hereby certified that the (equipment) (material) shown and marked in this submittal is that proposed to be incorporated into the project; is in compliance with the Contract Drawings and specifications and can be installed in the allocated spaces". Failure to add the above written statement for compliance will result in return of submittals without review.

    a. Bind catalog cuts, plate numbers, descriptive bulletins and drawings, 11" x 17" (275 mm x 435 mm) or smaller, in sets with covers neatly showing titles.

    b. The Contractor shall verify dimensions of equipment and be satisfied as to Code compliance for fit prior to submitting shop drawings for approval.

    c. Where current limiting devices are specified, submit technical data to substantiate adequate protection of equipment cascaded downstream. Submittals shall not be reviewed unless supporting calculations and data are submitted therewith.

    d. Include complete catalog information such as construction, ratings, insulation systems, as applicable.

    e. For any material specified to meet UL or trade standards, furnish the manufacturers or vendor's certification that the material furnished for the work does in fact equal or exceed such specifications.

    f. Reference listings to the specifications' Sections and Article to which each is applicable.

    g. Equipment Floor Plans: After approval of material is secured prepare a floor plan of each electrical and communication equipment space, room or yard, drawn to scale at 1/2 inch equals 1 foot and submit for approval in the same manner as for shop drawings. The layout drawings shall be exact scale.

6. Contractor shall prepare coordinated drawings when required by Division 01 or where noted otherwise.

F. Interpretations: The Contractor through the Architect must make Requests for interpretations of drawings and specifications. Any such requests made by equipment manufacturers or suppliers will be referred to the Contractor.

G. Standard of Quality

1. The contract Drawings and Specifications establish the "MINIMUM STANDARD OF QUALITY" each product and/or system must meet to be considered acceptable. Products of other manufactures will be considered if the product and/or system meet or exceed the "MINIMUM STANDARD OF QUALITY" established by this Contract Document.

2. Items for similar application shall be of the same manufacturer.

3. The label of listing by UL shall appear on all materials and equipment for which standards have been established by the agency.

4. Where codes as listed in Section General Requirement Section of the Specifications that establish label or approved requirements, furnish all materials and equipment with either the required labels affixed or the necessary written approval.

5. Provide the type and quantity of electrical materials and equipment necessary to complete Work and all systems in operation, tested and ready for use.

6. Provide and install all incidental items that belong to the Work described and which

are required for complete systems.

7. All switchboards, distribution boards, panel boards and circuit breakers shall be of the same manufacturer.
8. All wiring devices such as switches and receptacles shall be of the same manufacturer.

H. Substitutions: Refer to to Article 3.3 of the instruction to Bidders of the Bid Package Section 00003

I. Submit comprehensive material list, shop drawings and complete technical data for the following equipment and materials:

1. General Requirements:
    a. Main service and distribution switchboards.
    b. Panelboards.
    c. Conduits
    d. Conductors, include all selected insulation types.
    e. Fuses
    f. Disconnect switches and Starters.
    g. Pullboxes, manholes and handholes.
    h. Standard lighting fixtures, specially fabricated fixtures, ballasts and lamps, with samples and sample of standard finish available (where requested).
    i. Control devices, standard and special receptacles, switches, outlets and finish device plates.
    j. Cabinets for signal and telephone system, special terminals and cabinets. Include all cabinet dimensions.
    k. Fire alarm system.
    l. Transformers
    m. Generator
    n. UPS System

J. Utility Service:

1. Contractor shall verify the locations shown on the drawings and shall include extensions of lines to building service from locations which are acceptable to the Owner.
2. Verify electrical, civil, architectural and structural, dimensional and other requirements with the Owner.
3. Should any major modifications to the work indicated be necessary to comply with the Owner requirements, notify the Architect.
4. Contractor shall contact the utility company representatives to establish pre-construction coordination, obtain all necessary meters and/or approvals, and schedule utility work to coordinate with the construction schedule.
5. All utility services shall be installed per the utility company requirements. Verify final construction requirements with utility company service planners prior to construction.

K. Record Drawings: Refer to Division 01, Contract Closeout.

L. Work Responsibilities:

1. The drawings indicate diagrammatically the desired locations or arrangement of conduit runs, outlets, junction boxes and equipment and are to be followed. Execute the work so as to secure the best possible installation in the available space and to overcome local difficulties due to space limitations. The Contractor is responsible for the correct placing of his work. Where conflicts occur in plans and/or specifications, the most stringent application shall apply and shall be part of the base bid.
2. Locations shown on architectural plan or on wall elevations shall take precedence over electrical plan locations, but where a major conflict is evident, notify the Architect.
3. In the event minor changes in the indicated locations or arrangement are necessary due to developed conditions in the building construction or rearrangement of furnishings or equipment or due to interference with other trades, such changes shall be made without extra cost.
4. Verify dimensions and the correct location of Owner-Furnished equipment before proceeding with the roughing-in of connections.
5. All scaled and figured dimensions are approximate of typical equipment of the class indicated. Before proceeding with work carefully check and verify dimensions and sizes with the drawings to see that the furnished equipment will fit into the spaces provided without violation of applicable Codes.
6. Should any changes to the work indicated on the drawings or described in the specifications be necessary in order to comply with the above requirements, notify the Architect.
7. Contractor shall be responsible for coordination of coordinated drawings when required by the Architect.
8. Replace or repair, without additional compensation any work which does not comply with or which is installed in violation of any of these requirements.

M. Installation General: For special requirements, refer to specific equipment under these requirements.

1. Unless otherwise specified elsewhere in the specifications, do all excavating necessary for the proper installation of the electrical work.
2. Locations of Openings: Locate chases, shafts and openings required for the installation of the electrical work during framing of the structure. Do any additional cutting and patching required. Cutting or drilling in any structural member is prohibited without approval of the Architect. Furnish all access panels to make all boxes, connections and devices accessible as required by CEC.
3. Location of Sleeves: Where conduits pass through concrete walls, suspended slabs or metal deck floors, install sleeves of adequate size to permit installation of conduit. Sleeves shall be installed prior to pouring of concrete and shall have ends flush with the wall or extend 2 inches above floor surfaces. Verify locations.
4. Wherever conduit extends through roof, install flashings in accordance with drawings and details.
5. Contractor shall be responsible for cutting and patching which may be required for the proper installation of the electrical work.
6. Protect work, materials and equipment and provide adequate and proper storage facilities during the progress of the work. Storage outdoors shall be weather protected and shall include space heaters to prevent condensation. Provide for the safety and good condition of all work until final acceptance of the work. Replace

all damaged or defective work, materials and equipment before requesting final acceptance.

7. Conduit and Equipment to be Installed: Clean thoroughly to remove plaster, spattered paint, cement and dirt on both exterior and interior. All underground conduits shall be mandrelled prior to pulling wire.

8. Conduit and Equipment to be Painted: Clean conduit exposed to view in completed structure by removing plaster and dirt. Remove grease, oil and similar material from conduit and equipment by wiping with clean rags and suitable solvents in preparation for paint.

9. Items with Factory Finish: Remove cement, plaster, grease and oil, and leave surfaces, including cracks and corners, clean and polished. Touch up scratched or bare spots to match finish.

10. Site Cleaning: Remove from site all packing cartons, scrap materials and other rubbish on a weekly basis. Vacuum out all cabinets, switchgear and panels and junction boxes prior to pulling any conductors.

11. Electrical equipment and materials exposed to public and in finished areas shall be finish-painted after installation in accordance with the Painting Section. All exposed screw-type fasteners, exterior, or interior in restrooms, shall be vandal-resistant spanner type; include tool.

N. Excavation, Cutting and Patching:

1. Excavating, trenching and backfilling required for the work of this Division in accordance with the applicable requirements of Division 2. Excavating and backfilling connected with electrical work, repaving cuts and providing and maintaining protective measures for the electrical work excavation required by the governing authorities having jurisdiction shall be performed as a part of the work of this Division.

2. Verify openings indicated on the drawings. Provide all cutting, patching and reinforcement of the construction of the building as required to install electrical work.

O. Tests

1. Equipment and systems for which the National Electrical Testing Association (NETA) has an approved or recommended procedure, shall be tested in accordance with that procedure. Test values shall equal values recommended by NETA. Copies of test reports shall be submitted as required under shop drawing submittals.

2. Resistance to ground tests shall be accomplished by a qualified independent testing firm to measure resistance to ground at grounding electrodes. Make tests before slabs or affected areas are poured in order that corrective measures, if required, may be taken. Submit a report showing the results of these measurements. If the resistances exceed values specified elsewhere or NETA test procedure recommendations, perform corrective measures required to reduce resistance to acceptable values.

3. Prior to energizing any motor, measure the service voltage for phase balance and report if unbalance exceeds 1% from mean.

4. Measure the three-phase voltage at no load and at maximum load conditions and submit to the engineer a report showing the results of these measurements.

5. Upon completion of the work and adjustment of all equipment, conduct an operating test. Conduct the test in the presence of an authorized representative of the Owner's Representative. Demonstrate system and equipment to operate in accordance with requirements of the Contract Documents and to be free from electrical and

mechanical defects. Provide systems free from short circuits and grounds and show an insulation resistance between phase conductors and ground not less than the requirements of the governing electric code. Test circuits for proper neutral connection.

6. Complete tests prior to final inspection of project, including corrective work based on the results of the tests.
7. Perform special tests on systems and equipment as specified herein using personnel qualified to perform such tests.

P. Protection: Protect finish parts of the materials and equipment against damage during the progress of the work and until final completion and acceptance. Cover materials and equipment in storage and during construction in such a manner that no finished surfaces will be damaged or marred. Keep moving parts clean, dry and lubricated.

Q. Cleaning Up:

1. Upon completion of the work and at various time during the progress of the work, remove from the building all surplus materials, rubbish and debris resulting from the work of this Division.
2. Thoroughly clean switchgear including busses, apparatus, exposed conduit, metal work including the exterior and interior, and accessories for the work of this Division, of cement, plaster and other deleterious materials; remove grease and oil spots with cleaning solvent; carefully wipe surfaces and scrape cracks and corners clean.
3. Thoroughly polish chromium or plated work. Remove dirt and stains from lighting fixtures.
4. Leave the entire installation in a clean condition.

R. Completion:

1. The work will not be reviewed for final acceptance until operating and maintenance data, manufacturer's literature, panel directories and nameplates specified herein have been approved and properly posted or installed and final cleaning of equipment and premises has been completed.
2. When the installation is complete and adjustments have been made, operate the system for a period of one week, during which time demonstrate that systems are completed and operating in conformance with the specifications.

S. Operating and Maintenance Data: Submit complete and at one time, prior to acceptance of the installation, 4 copies of manufacturer's instructions for operation and maintenance of electrical equipment, including replacement parts lists. As specified in Division 01

T. Inspection and Acceptance Procedures: The Architect will submit observation reports periodically during the construction phase detailing Contract deficiencies. The Contractor is responsible for making corrections immediately. Notice of Completion of the project will not be made until all items have been corrected.

U. Final Completion of Electrical Systems:

1. Prior to Final Completion of operating electrical systems, the Contractor shall:
   a. Provide materials of the type and quality specified and as necessary for proper operation, tested and ready for use.
   b. Furnish the required Operating and Maintenance Data/Manuals.
   c. Clean up of the project pertaining to this Division of the work.
   d. After installation has been completed and adjustments made, operate the

system for a period of one week, during which time, demonstrate to the Architect that systems are complete and operating in conformance with Contract Documents.

e. Conduct tests required and as specified in this Division and submit test reports and corrective actions taken.

f. Submission of warranties and guarantees.

2. Final Completion of Work Shall be Contingent On:

a. Contractor replacing defective materials and workmanship.

b. Upon completion of work and adjustments made, Contractor shall conduct an operating test for each system for approval at such time as Architect directs. Conduct test in presence of authorized representative of Architect and demonstrate that systems and equipment do operate in accordance with requirements of the Contract Documents and are free from electrical and mechanical defects.

c. Contractor shall provide the necessary training programs and instructions to the Owner's representative. Number of hours shall be a minimum of four (4) hours for each system or days as required under separate Sections of these Specifications. Complete operation and maintenance manuals shall be provided at least two (2) weeks prior to training.

d. Submit copies of manufacturer's instructions and maintenance of electrical equipment including replacement parts lists. Each set shall include one set of shop drawings of equipment installed.

V. Submittals for Change Orders: When changes are made during the construction phase, deletions and additions shall be presented in a manner that will indicate the cost of each item of material and corresponding labor. Markup shall be then added in accordance with the requirements of the General Conditions as modified by the Supplementary Conditions.

W. The Contractor at a time convenient to the Owner shall provide instruction to the Owner's operating personnel in the proper operation and maintenance of all equipment and systems. The instructors shall have received factory training and shall be thoroughly familiar with the equipment installed. The operating personnel shall receive the number of days instruction as indicated in other sections.

1.04 PROJECT RECORD DOCUMENTS

A. Record Set During the Work: At site, maintain at least one set of Drawings as a Field Record Set. Also maintain at least one copy of all Addenda, Modifications, approved submittals, correspondence, and transmittals at site. Keep Drawings and data in good order and readily available to Architect and Owner.

B. Changes: Clearly and correctly mark Record Drawings to show changes made during the construction process at the time the changed work is installed. No such changes shall be made in the work unless authorized by the Architect.

C. Final Record Drawings: Conform to Division 01 requirements.

D. Preparation of Final Record Drawings: Contractor shall transfer recorded changes in the work indicated on the Field Record Set to the record set. Changes shall be neatly and clearly drawn and noted by skilled draftsmen, and shown technically correct.

E. Approval: Prior to Architect's inspection for Substantial Completion, submit the Final Record Drawings to the Architect for review, and make such revisions as may be necessary for Final Record Drawings to be a true, complete, and accurate record of the work.

F. Manuals: Obtain data from the various manufacturers and submit instruction, operation, and

maintenance manuals as required and to the extent required under other Sections.

G. At all times when the work is in progress, maintain at the workplace, fabrication shop or Project Site as applies, a complete separate, clean, undamaged set of the latest stamped, actioned submittals. As work progresses, maintain records of "as installed" conditions on this set in suitable ink or chemical fluid. Update the set daily. After successful completion of Project Site testing specified herein, and after completion of Punch List corrections, copy all records of "as installed" conditions on to originals.

H. Quantity:

1. Review sets: As for Shop and Field Drawings.
2. Record set: Refer to Division 01.

I. Content: All drawings required under "Field and Shop Drawings". Show "as installed" condition. Where room designations according to Project permanent signage differ from construction designations in the Contract Documents, show both designations.

J. Warranty Certificates: Comply with Division 01.

1.05 SUBSTITUTIONS

Substitutions will be considered per Article 3.3 of the Instruction to Bidders of the Bid Package Section 00003.

1.06 SUBMITTALS

Provide in accordance with Article 3.11 of the General Conditions.

PART 2 - PRODUCT

2.01 NOT USED

PART 3 - INSTALLATION

3.01 NOT USED

*****END OF SECTION *****

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SECTION 16060

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Conditions apply to this Section.

1.02 SECTION INCLUDES

A. Grounding and bonding requirements.

B. Conductors for grounding and bonding.

C. Connectors for grounding and bonding.

D. Ground bars.

E. Ground rod electrodes.

F. Ground access wells.

G. Pre-fabricated signal reference grids.

H. Grounding and bonding components.

I. Provide all components necessary to complete the grounding system(s) consisting of:

1. Metal underground water pipe.
2. Metal frame of the building.
3. Concrete-encased electrode.
4. Rod electrodes.

1.03 REFERENCE STANDARDS

A. IEEE 81 - Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System; 1983.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.

C. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings; National Electrical Manufacturers Association; 2007.

D. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2009.

E. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. NFPA 780 - Standard for the Installation of Lightning Protection Systems; National Fire Protection Association; 2011.

G. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not install ground rod electrodes until final backfill and compaction is complete.

1.05 PERFORMANCE REQUIREMENTS

A. Grounding System Resistance: 25 ohms.

1.06 SUBSTITUTIONS

Substitutions will be considered per Article 3.3 of the Instruction to bidders of the Bid Package Section 00003.

1.07 SUBMITTALS

A. Provide in accordance with Article 3.11 of the General Conditions.

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

C. Other Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in Part 3 "Field Quality Control" Article, including the following:

1. Test wells.
2. Ground rods.
3. Ground rings.
4. Grounding arrangements and connections for separately derived systems.
5. Grounding for sensitive electronic equipment.

D. Qualification Data: For testing agency and testing agency's field supervisor.

E. Field quality-control test reports.

F. Operation and Maintenance Data: For grounding to include the following in emergency, operation, and maintenance manuals:

1. Instructions for periodic testing and inspection of grounding features at grounding connections for separately derived systems based on NETA MTS and CECB.
    a. Tests shall be to determine if ground resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if they do not.
    b. Include recommended testing intervals.

G. See Section 01300 - Administrative Requirements for submittals procedures.

H. Product Data: Provide for grounding electrodes and connections.

I. Project Record Documents: Record actual locations of components and grounding electrodes.

1.08 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 – PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS

A. Do not use products for applications other than as permitted by NFPA 70 and product listing.

B. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.

C. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

D. Grounding System Resistance:

1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Architect. Precipitation within the previous 48 hours does not constitute normally dry conditions.

2. Grounding Electrode System: Not greater than 25 ohms to ground, when tested according to IEEE 81 using "fall-of-potential" method.

2.02 GROUNDING AND BONDING COMPONENTS

A. General Requirements:

1. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) or testing firm acceptable to authority having jurisdiction as suitable for the purpose indicated.

2. Provide products listed and labeled as complying with UL 467 where applicable.

B. Conductors for Grounding and Bonding, in addition to requirements of Section 16123:

1. Use insulated copper conductors unless otherwise indicated.

a. Exceptions:

1) Use bare copper conductors where installed underground in direct contact with earth.

2) Use bare copper conductors where directly encased in concrete (not in raceway).

C. Connectors for Grounding and Bonding:

1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.

2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.

3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.

D. Ground Bars:

1. Description: Copper rectangular ground bars with mounting brackets and insulators.

2. Size: As indicated.

3. Holes for Connections: As indicated or as required for connections to be made.

E. Ground Rod Electrodes:

1. Comply with NEMA GR 1.

2. Material: Copper-bonded (copper-clad) steel.

3. Size: 3/4 inch diameter by 10 feet length, unless otherwise indicated.

F. Ground Access Wells:

1. Description: Open bottom round or rectangular well with access cover for testing and

inspection; suitable for the expected load at the installed location.

2. Size: As required to provide adequate access for testing and inspection, but not less than minimum size requirements specified.
3. Depth: As required to extend below frost line to prevent frost upheaval, but not less than 10 inches.
4. Cover: Factory-identified by permanent means with word "GROUND".

G. Pre-Fabricated Signal Reference Grids:

1. Description: Factory pre-fabricated grid manufactured from 2 inch (50 mm) by 26 gage flat copper strips spaced on 24 inch centers, factory-welded at each crossover.
2. Low Impedance Risers: Factory fabricated 2 inch (50 mm) by 26 gage flat copper strip designed for connecting equipment enclosures to pre-fabricated signal reference grid.

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 (6 mm) in diameter.
5. Bonding Conductor: No. 4 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

C. Rod Electrodes: Copper-clad steel.

2.04 CONNECTORS AND ACCESSORIES

A. Mechanical Connectors: Bronze.

B. Exothermic Connections:

1. Cadweld or approved equal.

C. Wire: Stranded copper.

D. Grounding Electrode Conductor: Size to meet NFPA 70 requirements.

E. Grounding Well:

1. Well Pipe: 8 inch by 24 inch long clay tile pipe with belled end.
2. Well Cover: Cast iron with legend "GROUND" embossed on cover.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that work likely to damage grounding and bonding system components has been

completed.

B. Verify that field measurements are as shown on the drawings.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

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

B. Install grounding and bonding system components in a neat and workmanlike manner in accordance with NECA 1.

C. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70 or provide ground plates.

D. Make grounding and bonding connections using specified connectors.

1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.

2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.

3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.

4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.

5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

E. Identify grounding and bonding system components in accordance with Section 16075.

F. 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.

G. Common Ground Bonding with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

H. Ground Rods: Drive rods until tops are 2 inches (50 mm) 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.

I. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes shall be at least 12 inches (300 mm) deep, with cover.

1. Test Wells: Install at least one test well for each service, unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

J. 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 so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.

K. 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 within 5' of entrance to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, 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. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

L. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.

M. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each steel column and where indicated on the drawings.

1. Install tinned-copper conductor not less than No. 4/0 AWG for ground ring and for taps to building steel.
2. Bury ground ring (where indicated) not less than 24 inches (600 mm) from building foundation.

N. UFER Ground (Concrete-Encased Grounding Electrode): Fabricate according to CEC, using a minimum of 20 feet (6 meters) of bare copper conductor not smaller than No. 3/0 AWG.

1. If concrete foundation is less than 20 feet (6 m) long, coil excess conductor within base of foundation.

O. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

P. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus on insulated spacers 1 inch (25 mm), minimum, from wall 6 inches (150 mm) above finished floor, unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, down to specified height above floor, and connect to horizontal bus.

Q. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors, except at test wells and as otherwise indicated.

3. Connections to Ground Rods at Test Wells: Bolted connectors.

4. Connections to Structural Steel: Welded connectors.

3.03 FIELD QUALITY CONTROL

A. Perform inspection in accordance with Section 01400.

B. Perform inspections and tests listed in NETA STD ATS, Section 7.13.

C. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.

D. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

*****END OF SECTION*****

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SECTION 16070

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Conditions apply to this Section.

1.02 SECTION INCLUDES

A. Support and attachment components for equipment, conduit, cable, boxes, and other electrical work.

1.03 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2012.

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

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2011.

D. MFMA-4 - Metal Framing Standards Publication; Metal Framing Manufacturers Association; 2004.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.

F. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Comply with applicable building code.

1.05 SUBSTITUTUIONS

Substitutions will be considered per Article 3.3 of the Instruction to Bidders of the Bid Package Section 00003.

1.06 SUBMITTALS

Provide in accordance with Article 3.11 of the General Conditions.

PART 2 - PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:

1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.

2. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) or testing firm acceptable to authority having jurisdiction as suitable for the purpose indicated, where applicable.

3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported with a minimum safety factor of _____. Include consideration for vibration, equipment operation, and shock loads where applicable.
4. Do not use products for applications other than as permitted by NFPA 70 and product listing.
5. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
    a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
    b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.
1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
2. Conduit Clamps: Bolted type unless otherwise indicated.

C. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.

D. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
1. Comply with MFMA-4.

E. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.

F. Anchors and Fasteners:
1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.

2.02 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Allied Tube & Conduit.
    b. Cooper B-Line, Inc.; a division of Cooper Industries.
    c. ERICO International Corporation.
    d. GS Metals Corp.
    e. Thomas & Betts Corporation.
    f. Unistrut; Tyco International, Ltd.
    g. Wesanco, Inc.
3. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
4. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester

coating applied according to MFMA-4.

5. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
6. Channel Dimensions: Selected for applicable load criteria.

B. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch- (14-mm-) diameter holes at a maximum of 8 inches (200 mm) o.c., in at least 1 surface.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Allied Tube & Conduit.
    b. Cooper B-Line, Inc.; a division of Cooper Industries.
    c. Fabco Plastics Wholesale Limited.
    d. Seasafe, Inc.
3. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.
4. Fitting and Accessory Materials: Same as channels and angles, except metal items may be stainless steel.
5. Rated Strength: Selected to suit applicable load criteria.

C. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

D. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored 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 malleable iron.

F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

G. 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. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
        1) Hilti Inc.
        2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
        3) MKT Fastening, LLC.
        4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.

2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated or stainless steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
    a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
        1) Cooper B-Line, Inc.; a division of Cooper Industries.
        2) Empire Tool and Manufacturing Co., Inc.
        3) Hilti Inc.
        4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
        5) MKT Fastening, LLC.
3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

*****END OF SECTION*****

SECTION 16075

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General conditions apply to this Section.

1.02 SECTION INCLUDES

A. Electrical identification requirements.

B. Identification nameplates and labels.

C. Wire and cable markers.

D. Underground warning tape.

E. Warning signs and labels.

1.03 REFERENCE STANDARDS

A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs; 2007.

B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2007.

C. ASTM D 709 - Standard Specification for Laminated Thermosetting Materials; 2001 (Reapproved 2007).

D. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. UL 969 - Marking and Labeling Systems; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.

B. Sequencing:

1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.

2. Do not install identification products until final surface finishes and painting are complete.

1.05 SUBSTITUTIONS

Substitutions will be considered per Article 3.3 of the Instruction to Bidders of the Bid Package Section 00003.

1.06 SUBMITTALS

A. Provide in accordance with Article 3.11 of the General Conditions.

1.07 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.08 FIELD CONDITIONS

A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

PART 2 - PRODUCTS

2.01 IDENTIFICATION REQUIREMENTS

A. Identification for Equipment:

1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.

a. Switchboards:

1) Identify ampere rating.

2) Identify voltage and phase.

3) Identify power source and circuit number. Include location when not within sight of equipment.

4) Use identification nameplate to identify main overcurrent protective device.

5) Use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.

b. Motor Control Centers:

1) Identify ampere rating.

2) Identify voltage and phase.

3) Identify power source and circuit number. Include location when not within sight of equipment.

4) Use identification nameplate to identify main overcurrent protective device.

5) Use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.

c. Panelboards:

1) Identify ampere rating.

2) Identify voltage and phase.

3) Identify power source and circuit number. Include location when not within sight of equipment.

4) Identify main overcurrent protective device. Use identification

label for panelboards with a door. For power distribution panelboards without a door, use identification nameplate.

5) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.

6) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.

d. Transformers:

1) Identify kVA rating.

2) Identify voltage and phase for primary and secondary.

3) Identify power source and circuit number. Include location when not within sight of equipment.

4) Identify load(s) served. Include location when not within sight of equipment.

e. Enclosed switches, circuit breakers, and motor controllers:

1) Identify voltage and phase.

2) Identify power source and circuit number. Include location when not within sight of equipment.

3) Identify load(s) served. Include location when not within sight of equipment.

2. Service Equipment:

a. Use identification nameplate to identify each service disconnecting means.

b. For buildings or structures supplied by more than one service, or any combination of branch circuits, feeders, and services, use identification nameplate or means of identification acceptable to authority having jurisdiction at each service disconnecting means to identify all other services, feeders, and branch circuits supplying that building or structure. Verify format and descriptions with authority having jurisdiction.

c. Use identification nameplate at each piece of service equipment to identify the available fault current and the date calculations were performed.

3. Arc Flash Hazard Warning Labels: Use warning labels to identify arc flash hazards for electrical equipment, such as switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centers that are likely to require examination, adjustment, servicing, or maintenance while energized.

a. Minimum Size: 3.5 by 5 inches.

b. Legend: Include orange header that reads "WARNING", followed by the word message "Arc Flash and Shock Hazard; Appropriate PPE Required; Do not operate controls or open covers without appropriate personal protection

equipment; Failure to comply may result in injury or death; Refer to NFPA 70E for minimum PPE requirements" or approved equivalent.

B. Identification for Conductors and Cables:

1. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.
2. Use wire and cable markers to identify circuit number or other designation indicated for power, control, and instrumentation conductors and cables at the following locations:
    a. At each source and load connection.
    b. Within boxes when more than one circuit is present.
    c. Within equipment enclosures when conductors and cables enter or leave the enclosure.

C. Identification for Raceways:

1. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify circuits enclosed for accessible conduits at wall penetrations, at floor penetrations, at roof penetrations, and at equipment terminations when source is not within sight.
2. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify spare conduits at each end. Identify purpose and termination location.
3. Use underground warning tape to identify underground raceways.

D. Identification for Boxes:

1. Use identification labels or handwritten text using indelible marker to identify circuits enclosed.
    a. For exposed boxes in public areas, use only identification labels.

E. Identification for Devices:

1. Use identification label or engraved wallplate to identify serving branch circuit for all receptacles.
    a. For receptacles in public areas or in areas as directed by Architect, provide identification on inside surface of wallplate.
2. Use identification label or engraved wallplate to identify load controlled for wall-mounted control devices controlling loads that are not visible from the control location and for multiple wall-mounted control devices installed at one location.

F. Buried Electrical Lines: Underground warning tapes.

G. Communication Cabinets: Nameplates.

H. Electrical Distribution and Control Equipment Enclosures: Nameplates.

I. Junction Box Load Connections: Wire markers.

J. Outlet Box Load Connections: Wire markers.

K. Panel Gutter Load Connections: Wire markers.

L. Pull Box Load Connections: Wire markers.

2.02 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:

1. Materials:

   a. Indoor Clean, Dry Locations: Use plastic nameplates.

   b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.

2. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.

   a. Exception: Provide minimum thickness of 1/8 inch when any dimension is greater than 4 inches.

3. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.

4. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.

5. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.

B. Identification Labels:

1. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.

2. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

C. Format for Equipment Identification:

1. Minimum Size: 1 inch by 2.5 inches.

2. Legend:

   a. Equipment designation or other approved description.

3. Text: All capitalized unless otherwise indicated.

4. Minimum Text Height:

   a. Equipment Designation: 1/2 inch.

   b. Other Information: 1/4 inch.

5. Color:

   a. Normal Power System: White text on black background.

D. Format for Caution and Warning Messages:

1. Minimum Size: 2 inches by 4 inches.

2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.

3. Text: All capitalized unless otherwise indicated.

4. Minimum Text Height: 1/2 inch.

5. Color: Black text on yellow background unless otherwise indicated.

E. Format for Receptacle Identification:

1. Minimum Size: 3/8 inch by 1.5 inches.

2. Legend: Power source and circuit number or other designation indicated.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Black text on clear background.

F. Format for Control Device Identification:

1. Minimum Size: 3/8 inch by 1.5 inches.
2. Legend: Load controlled or other designation indicated.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Black text on clear background.

2.03 WIRE AND CABLE MARKERS

A. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.

B. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.

C. Legend: Power source and circuit number or other designation indicated.

D. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.

E. Minimum Text Height: 1/8 inch.

F. Color: Black text on white background unless otherwise indicated.

G. Description: Vinyl cloth type self-adhesive wire markers.

2.04 UNDERGROUND WARNING TAPE

A. Materials: Use non-detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.

1. Exception: Use foil-backed detectable type tape where required by serving utility or where directed by Owner.

B. Non-detectable Type Tape: 6 inches wide, with minimum thickness of 4 mil.

C. Foil-backed Detectable Type Tape: 3 inches wide, with minimum thickness of 5 mil, unless otherwise required for proper detection.

D. Legend: Type of service, continuously repeated over full length of tape.

E. Color:

1. Tape for Buried Power Lines: Black text on red background.
2. Tape for Buried Communication, Alarm, and Signal Lines: Black text on orange background.

2.05 WARNING SIGNS AND LABELS

A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

B. Warning Signs:

1. Materials:

a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic or self-adhesive vinyl signs.

b. Outdoor Locations: Use factory pre-printed rigid aluminum signs.

2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.

3. Minimum Size: 7 by 10 inches unless otherwise indicated.

C. Warning Labels:

1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester, or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.

a. Do not use labels designed to be completed using handwritten text.

2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.

3. Minimum Size: 2 by 4 inches unless otherwise indicated.

PART 3 - EXECUTION

3.01 PREPARATION

A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

3.02 INSTALLATION

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

B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:

1. Surface-Mounted Equipment: Enclosure front.

2. Flush-Mounted Equipment: Inside of equipment door.

3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.

4. Elevated Equipment: Legible from the floor or working platform.

5. Branch Devices: Adjacent to device.

6. Interior Components: Legible from the point of access.

7. Conduits: Legible from the floor.

8. Boxes: Outside face of cover.

9. Conductors and Cables: Legible from the point of access.

10. Devices: Outside face of cover.

C. Install identification products centered, level, and parallel with lines of item being identified.

D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing, or epoxy cement.

E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.

F. Install underground warning tape above buried lines with one tape per trench at 3 inches

below finished grade.

G. Secure rigid signs using stainless steel screws.

H. Mark all handwritten text, where permitted, to be neat and legible.

3.03 FIELD QUALITY CONTROL

A. See Section 01400 - Quality Requirements, for additional requirements.

B. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

*****END OF SECTION*****

SECTION 16123

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Conditions apply to this Section.

1.02 SECTION INCLUDES

A. Single conductor building wire.

B. Wire and cable for 600 volts and less.

C. Wiring connectors.

D. Electrical tape.

E. Heat shrink tubing.

F. Wire pulling lubricant.

1.03 REFERENCE STANDARDS

A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2001 (Reapproved 2007).

B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft; 2011.

C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes; 2010.

D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation; 2004 (Reapproved 2009).

E. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape; 2010.

F. ASTM D4388 - Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes; 2008.

G. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.

H. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy; National Electrical Manufacturers Association; 2009 (ANSI/NEMA WC 70/ICEA S-95-658).

I. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2009.

J. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

K. UL 44 - Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.

L. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.

M. UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.

N. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.

O. UL 486D - Sealed Wire Connector Systems; Current Edition, Including All Revisions.

P. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.

2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.

3. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBSTITUTIONS

Substitutions will be considered per Article 3.3 of the Instruction to Bidders of the Bid Package Section 00003.

1.06 SUBMITTALS

A. Provide in accordance with Article 3.11 of the General Conditions.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.

1.07 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.01 CONDUCTOR AND CABLE APPLICATIONS

A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.

B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.

C. Nonmetallic-sheathed cable is not permitted.

D. Underground feeder and branch-circuit cable is not permitted.

E. Service entrance cable is not permitted.

F. Armored cable is not permitted.

G. Metal-clad cable is not permitted.

2.02 CONDUCTOR AND CABLE MANUFACTURERS

A. Anaconda Power Cables

B. Carol Cable

C. Rome Wire and Cable

D. Pirelli Wire and Cable

E. Okonite Wire

F. Canada Wire

G. Cerro Wire LLC: www.cerrowire.com.

H. Encore Wire Corporation: www.encorewire.com.

I. Southwire Company: www.southwire.com.

2.03 ALL CONDUCTORS AND CABLES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose indicated.

C. Provide new conductors and cables manufactured not more than one year prior to installation.

D. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

E. Comply with NEMA WC 70.

F. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.

G. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.

H. Conductors and Cables Installed Exposed in Spaces Used for Environmental Air (only where specifically permitted): Plenum rated, listed and labeled as suitable for use in return air plenums.

I. Conductor Material:

1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.

2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.

3. Tinned Copper Conductors: Comply with ASTM B33.

J. Minimum Conductor Size:

1. Branch Circuits: 12 AWG.

a. Exceptions:

1) 20 A, 120 V circuits longer than 75 feet: 10 AWG, for voltage drop.
2) 20 A, 120 V circuits longer than 150 feet: 8 AWG, for voltage drop.
3) 20 A, 277 V circuits longer than 150 feet: 10 AWG, for voltage drop.

2. Control Circuits: 14 AWG.

K. Conductor Color Coding:

1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.

2. Color Coding Method: Integrally colored insulation.

a. Conductors size 4 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.

3. Color Code:

a. 480Y/277 V, 3 Phase, 4 Wire System:

1) Phase A: Brown.
2) Phase B: Orange.
3) Phase C: Yellow.
4) Neutral/Grounded: Gray.

b. 208Y/120 V, 3 Phase, 4 Wire System:

1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.
4) Neutral/Grounded: White.

c. Equipment Ground, All Systems: Green.
d. Isolated Ground, All Systems: Green with yellow stripe.
e. Travelers for 3-Way and 4-Way Switching: Pink.

2.04 SINGLE CONDUCTOR BUILDING WIRE

A. Description: Single conductor insulated wire.

B. Conductor Stranding:

1. Feeders and Branch Circuits:
a. Size 10 AWG and Smaller: Solid
b. Size 8 AWG and Larger: Stranded.

C. Insulation Voltage Rating: 600 V.

D. Insulation:

1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.

a. Size 4 AWG and Larger: Type XHHW-2.

b. Installed Underground: Type XHHW-2.

c. Fixture Wiring Within Luminaires: Type TFFN/TFN for luminaires with labeled maximum temperature of 90 degrees C; Approved suitable type for luminaires with labeled maximum temperature greater than 90 degrees C.

E. Type THWN for exterior or wet locations, in raceway.

2.05 WIRING CONNECTORS

A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.

B. Wiring Connectors for Splices and Taps:

1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors or compression connectors.
2. Copper Conductors Size 6 AWG and Larger: Use split bolt mechanical connectors.

C. Wiring Connectors for Terminations:

1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
4. Provide motor pigtail connectors for connecting motor leads in order to facilitate disconnection.
5. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors where connectors are required.
6. Stranded Conductors Size 10 AWG and Smaller: Use crimped terminals for connections to terminal screws.
7. Conductors for Control Circuits: Use crimped terminals for all connections.

D. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.

E. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.

F. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.

G. Mechanical Connectors: Provide bolted type.

H. Compression Connectors: Provide circumferential type or hex type crimp configuration.

I. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.

2.06 WIRING ACCESSORIES

A. Electrical Tape:

1. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F.
2. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.
3. Rubber Splicing Electrical Tape: Ethylene Propylene Rubber (EPR) tape, complying with ASTM D4388; minimum thickness of 30 mil; suitable for continuous temperature environment up to 194 degrees F and short-term 266 degrees F overload service.
4. Electrical Filler Tape: Rubber-based insulating moldable putty, minimum thickness of 125 mil; suitable for continuous temperature environment up to 176 degrees F.

5. Varnished Cambric Electrical Tape: Cotton cambric fabric tape, with or without adhesive, oil-primed and coated with high-grade insulating varnish; minimum thickness of 7 mil; suitable for continuous temperature environment up to 221 degrees F.
6. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, all-weather vinyl backing; minimum thickness of 90 mil.

B. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.

C. Wire Pulling Lubricant: Listed; suitable for use with the conductors or cables to be installed and suitable for use at the installation temperature.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that work likely to damage wire and cable has been completed.

C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.

D. Verify that raceway installation is complete and supported.

E. Verify that field measurements are as shown on the drawings.

F. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.03 INSTALLATION

A. Circuiting Requirements:

1. Unless dimensioned, circuit routing indicated is diagrammatic.
2. When circuit destination is indicated and routing is not shown, determine exact routing required.
3. Arrange circuiting to minimize splices.
4. Include circuit lengths required to install connected devices within 10 ft of location shown.
5. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
6. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
7. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are shown as separate, combining them together in a single raceway is not permitted.
8. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among up to three single phase branch circuits of different phases installed in the same raceway is permitted where not otherwise prohibited, except for the following:
   a. Branch circuits fed from ground fault circuit interrupter (GFCI) circuit breakers.
   b. Branch circuits with dimming controls.

c. Branch circuits with isolated grounding conductor.

d. Branch circuits feeding computer or IT loads.

B. Install products in accordance with manufacturer's instructions.

C. Install conductors and cable in a neat and workmanlike manner in accordance with NECA 1.

D. Installation in Raceway:

1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.

2. Pull all conductors and cables together into raceway at same time.

3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.

4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.

E. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

F. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.

G. Install conductors with a minimum of 12 inches of slack at each outlet.

H. Where conductors are installed in enclosures for future termination by others, provide a minimum of 5 feet of slack.

I. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

J. Make wiring connections using specified wiring connectors.

1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.

2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.

3. Do not remove conductor strands to facilitate insertion into connector.

4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.

5. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.

6. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

K. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.

1. Dry Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.

a. For taped connections, first apply adequate amount of rubber splicing electrical tape or electrical filler tape, followed by outer covering of vinyl insulating electrical tape.

b. For taped connections likely to require re-entering, including motor leads, first apply varnished cambric electrical tape, followed by adequate amount of rubber splicing electrical tape, followed by outer covering of vinyl insulating electrical tape.

2. Damp Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.

   a. For connections with insulating covers, apply outer covering of moisture sealing electrical tape.

   b. For taped connections, follow same procedure as for dry locations but apply outer covering of moisture sealing electrical tape.

3. Wet Locations: Use heat shrink tubing.

L. Insulate ends of spare conductors using vinyl insulating electrical tape.

M. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.

N. Color Code Legend: Provide identification label identifying color code for ungrounded conductors at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.

O. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

P. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise. Keep splices in underground junction boxes, handholes, and manholes to an absolute minimum. Where splices are necessary, use resin pressure splices and resin splicing kits manufactured by the 3M Company to totally encapsulate the splice. Arrange the splicing kit to minimize the effects of moisture.

Q. Install wire and cable securely, in a neat and workmanlike manner, as specified in NECA 1.

3.04 FIELD QUALITY CONTROL

A. Perform inspection, testing, and adjusting in accordance with Section 01400.

B. Inspect and test in accordance with NETA STD ATS, except Section 4.

C. Perform inspections and tests listed in NETA STD ATS, Section 7.3.2. The insulation resistance test is required for all conductors. The resistance test for parallel conductors listed as optional is not required.

D. Correct deficiencies and replace damaged or defective conductors and cables.

E. Perform inspections and tests listed in NETA STD ATS, Section 7.3.2.

*****END OF SECTION*****

SECTION 16131

CONDUIT

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirement and Division 1, General Conditions apply to this Section.

1.02 SECTION INCLUDES

A. Galvanized steel rigid metal conduit (RMC).

B. Aluminum rigid metal conduit (RMC).

C. Intermediate metal conduit (IMC).

D. PVC-coated galvanized steel rigid metal conduit (RMC).

E. Flexible metal conduit (FMC).

F. Liquidtight flexible metal conduit (LFMC).

G. Electrical metallic tubing (EMT).

H. Rigid polyvinyl chloride (PVC) conduit.

I. Conduit fittings.

J. Accessories.

K. Conduit, fittings and conduit bodies.

1.03 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2005.

B. ANSI C80.3 - American National Standard for Steel Electrical Metallic Tubing (EMT); 2005.

C. ANSI C80.5 - American National Standard for Electrical Rigid Aluminum Conduit (ERAC); 2005.

D. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit (EIMC); 2005.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.

F. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); National Electrical Contractors Association; 2006.

G. NECA 102 - Standard for Installing Aluminum Rigid Metal Conduit; National Electrical Contractors Association; 2004.

H. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); National Electrical Contractors Association; 2003.

I. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; National Electrical Manufacturers Association; 2012 (ANSI/NEMA FB 1).

J. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit; National Electrical Manufacturers Association; 2005.

K. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; National Electrical Manufacturers Association; 2003.

L. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; National Electrical Manufacturers Association; 2004.

M. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

N. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.

O. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.

P. UL 6A - Electrical Rigid Metal Conduit-Aluminum, Red Brass, and Stainless Steel; Current Edition, Including All Revisions.

Q. UL 360 - Liquid-Tight Flexible Steel Conduit; Current Edition, Including All Revisions.

R. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.

S. UL 651 - Schedule 40 and 80 Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.

T. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.

U. UL 886 - Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations; Current Edition, Including All Revisions.

V. UL 1242 - Electrical Intermediate Metal Conduit-Steel; Current Edition, Including All Revisions.

1.04 SUBSTITUTIONS

Substitutions will be considered per Article 3.3 of the Instruction to Bidders of the Bid Package Section 00003.

1.05 SUBMITTALS

Provide in accordance with Article 3.11 of the General Conditions.

1.06 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.
4. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not begin installation of conductors and cables until installation of conduit is complete between outlet, junction and splicing points.

1.07 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. ENT: Electrical nonmetallic tubing.

C. EPDM: Ethylene-propylene-diene terpolymer rubber.

D. FMC: Flexible metal conduit.

E. IMC: Intermediate metal conduit.

F. LFMC: Liquidtight flexible metal conduit.

G. LFNC: Liquidtight flexible nonmetallic conduit.

H. NBR: Acrylonitrile-butadiene rubber.

I. RNC: Rigid nonmetallic conduit.

1.08 QUALITY ASSURANCE

Conform to requirements of NFPA 70.

PART 2 - PRODUCTS

2.01 CONDUIT APPLICATIONS

A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.

B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.

C. Underground:

1. Under Slab on Grade: Use PVC-coated galvanized steel rigid metal conduit or rigid PVC conduit.

2. Exterior, Direct-Buried: Use PVC-coated galvanized steel rigid metal conduit or rigid PVC conduit.

3. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit where emerging from underground.

4. Where rigid polyvinyl (PVC) conduit larger than 2 inch (53 mm) trade size is provided, use PVC-coated galvanized steel rigid metal conduit elbows for bends.

D. Concealed Within Masonry Walls: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).

E. Concealed Within Hollow Stud Walls: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).

F. Concealed Above Accessible Ceilings: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).

G. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).

H. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).

I. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).

1. Locations subject to physical damage include, but are not limited to:

a. Where exposed below 8 feet, except within electrical and communication rooms or closets.

b. Where exposed below 20 feet in warehouse areas.

J. Exposed, Exterior: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).

K. Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).

L. Corrosive Locations Above Ground: Use PVC-coated galvanized steel rigid metal conduit or aluminum rigid metal conduit.

1. Corrosive locations include, but are not limited to:

a. Cooling towers.

M. Hazardous (Classified) Locations: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), aluminum rigid metal conduit, or PVC-coated galvanized steel rigid metal conduit.

N. Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit.

1. Maximum Length: 6 feet.

O. Connections to Vibrating Equipment:

1. Dry Locations: Use flexible metal conduit.
2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit.
3. Maximum Length: 6 feet unless otherwise indicated.
4. Vibrating equipment includes, but is not limited to:

a. Transformers.

b. Motors.

2.02 CONDUIT REQUIREMENTS

A. Existing Work: Where existing conduits are indicated to be reused, they may be reused only where they comply with specified requirements, are free from corrosion, and integrity is verified by pulling a mandrel through them.

B. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.

C. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) or testing firm acceptable to authority having jurisdiction as suitable for the purpose indicated.

D. Minimum Conduit Size, Unless Otherwise Indicated:

1. Branch Circuits: 3/4 inch (21 mm) trade size.
2. Branch Circuit Homeruns: 3/4 inch (21 mm) trade size.
3. Control Circuits: 1/2 inch (16 mm) trade size.
4. Flexible Connections to Luminaires: 1/2 inch (16 mm) trade size.
5. Underground, Interior: 1 inch (27 mm) trade size.
6. Underground, Exterior: 1 inch (27 mm) trade size.

E. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI

C80.1 and listed and labeled as complying with UL 6.

B. Fittings:

1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
2. Hazardous (Classified) Locations: Use fittings listed and labeled as complying with UL 1203 for the classification of the installed location.
3. Material: Use steel or malleable iron.
    a. Do not use die cast zinc fittings.
4. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.04 ALUMINUM RIGID METAL CONDUIT (RMC)

A. Description: NFPA 70, Type RMC aluminum rigid metal conduit complying with ANSI C80.5 and listed and labeled as complying with UL 6A.

B. Fittings:

1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
2. Hazardous (Classified) Locations: Use fittings listed and labeled as complying with UL 1203 for the classification of the installed location.
3. Material: Use aluminum.
4. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.05 INTERMEDIATE METAL CONDUIT (IMC)

A. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.

B. Fittings:

1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
2. Hazardous (Classified) Locations: Use fittings listed and labeled as complying with UL 1203 for the classification of the installed location.
3. Material: Use steel or malleable iron.
4. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

C. All exposed conduit runs, fittings and supports in Building exteriors and interiors finished areas shall be painted to match the finish.

D. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.

E. Do not install aluminum conduits in contact with concrete.

2.06 PVC-COATED GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit with external polyvinyl chloride (PVC) coating complying with NEMA RN 1 and listed and labeled as complying with UL 6.

B. Exterior Coating: Polyvinyl chloride (PVC), nominal thickness of 40 mil.

C. PVC-Coated Fittings:

1. Manufacturer: Same as manufacturer of PVC-coated conduit to be installed.
2. Non-Hazardous Locations: Use fittings listed and labeled as complying with UL 514B.
3. Hazardous (Classified) Locations: Use fittings listed and labeled as complying with UL 1203 for the classification of the installed location.
4. Material: Use steel or malleable iron.
5. Exterior Coating: Polyvinyl chloride (PVC), minimum thickness of 40 mil.

D. PVC-Coated Supports: Furnish with exterior coating of polyvinyl chloride (PVC), minimum thickness of 15 mil.

2.07 FLEXIBLE METAL CONDUIT (FMC)

A. Description: NFPA 70, Type FMC standard wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems to be used.

B. Fittings:

1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
2. Material: Use steel or malleable iron.

a. Do not use die cast zinc fittings.

2.08 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.

B. Fittings:

1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
2. Material: Use steel or malleable iron.

a. Do not use die cast zinc fittings.

2.09 ELECTRICAL METALLIC TUBING (EMT)

A. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

B. Fittings:

1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
2. Material: Use steel or malleable iron.
3. Connectors and Couplings: Use compression (gland) type.
   a. Do not use indenter type connectors and couplings.
   b. Do not use set-screw type connectors and couplings.
4. Damp or Wet Locations (where permitted): Use fittings listed for use in wet locations.
5. Embedded Within Concrete (where permitted): Use fittings listed as concrete-tight. Fittings that require taping to be concrete-tight are acceptable.

2.10 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

A. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.

B. Fittings:

1. Manufacturer: Same as manufacturer of conduit to be connected.
2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.11 ACCESSORIES

A. Conduit Joint Compound: Corrosion-resistant, electrically conductive; suitable for use with the conduit to be installed.

B. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.

C. Pull Strings: Use nylon cord with average breaking strength of not less than 200 pound-force.

D. Sealing Compound for Sealing Fittings: Listed for use with the particular fittings to be installed.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on drawings.

B. Verify that mounting surfaces are ready to receive conduits.

C. Verify that conditions are satisfactory for installation prior to starting work.

D. Verify routing and termination locations of conduit prior to rough-in.

3.02 INSTALLATION

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

B. Install conduit in a neat and workmanlike manner in accordance with NECA 1.

C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.

D. Install aluminum rigid metal conduit (RMC) in accordance with NECA 102.

E. Install intermediate metal conduit (IMC) in accordance with NECA 101.

F. Install PVC-coated galvanized steel rigid metal conduit (RMC) using only tools approved by the manufacturer.

G. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.

H. Conduit Routing:

1. Unless dimensioned, conduit routing indicated is diagrammatic.
2. When conduit destination is indicated and routing is not shown, determine exact routing required.
3. Conceal all conduits unless specifically indicated to be exposed.
4. Conduits in the following areas may be exposed, unless otherwise indicated:

a. Electrical rooms.

b. Mechanical equipment rooms.

c. Within joists in areas with no ceiling.

5. Unless otherwise approved, do not route conduits exposed:

   a. Across floors.

   b. Across roofs.

   c. Across top of parapet walls.

   d. Across building exterior surfaces.

6. Conduits installed underground or embedded in concrete may be routed in the shortest possible manner unless otherwise indicated. Route all other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.

7. Arrange conduit to maintain adequate headroom, clearances, and access.

8. Arrange conduit to provide no more than the equivalent of four 90 degree bends between pull points.

9. Route conduits above water and drain piping where possible.

10. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.

11. Maintain minimum clearance of 6 inches between conduits and piping for other systems.

12. Maintain minimum clearance of 12 inches between conduits and hot surfaces. This includes, but is not limited to:

    a. Heaters.

    b. Hot water piping.

    c. Flues.

13. Group parallel conduits in the same area together on a common rack.

I. Conduit Support:

1. Secure and support conduits in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction.

2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.

J. Connections and Terminations:

1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.

2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.

3. Use suitable adapters where required to transition from one type of conduit to another.

4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.

5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
6. Where spare conduits stub up through concrete floors and are not terminated in a box or enclosure, provide threaded couplings equipped with threaded plugs set flush with finished floor.
7. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
8. Secure joints and connections to provide maximum mechanical strength and electrical continuity.

K. Penetrations:

1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
2. Make penetrations perpendicular to surfaces unless otherwise indicated.
3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
4. Conceal bends for conduit risers emerging above ground.
5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
7. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty. Include proposed locations of penetrations and methods for sealing with submittals.
8. Provide metal escutcheon plates for conduit penetrations exposed to public view.
9. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07840.

L. Underground Installation:

1. Provide trenching and backfilling None-N/A.
2. Minimum Cover, Unless Otherwise Indicated or Required:
    a. Underground, Exterior: 24 inches.
    b. Under Slab on Grade: 12 inches to bottom of slab.

M. Concrete Encasement: Where conduits not otherwise embedded within concrete are indicated to be concrete-encased, provide concrete with minimum concrete cover of 3 inches on all sides unless otherwise indicated.

N. Hazardous (Classified) Locations: Where conduits cross boundaries of hazardous (classified) locations, provide sealing fittings located as indicated or in accordance with NFPA 70.

O. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:

1. Where conduits cross structural joints intended for expansion, contraction, or deflection.

2. Where conduits are subject to earth movement by settlement or frost.

P. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:

1. Where conduits pass from outdoors into conditioned interior spaces.
2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
3. Where conduits penetrate coolers or freezers.

Q. Provide pull string in all empty conduits and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end.

R. Provide grounding and bonding.

3.03 FIELD QUALITY CONTROL

A. See Section 01400 - Quality Requirements, for additional requirements.

B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C. Where coating of PVC-coated galvanized steel rigid metal conduit (RMC) contains cuts or abrasions, repair in accordance with manufacturer's instructions.

D. Correct deficiencies and replace damaged or defective conduits.

3.04 CLEANING

A. Clean interior of conduits to remove moisture and foreign matter.

3.05 PROTECTION

A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

B. Only where approved, route exposed conduit parallel and perpendicular to walls.

C. Provide suitable fittings to accommodate expansion and deflection where conduit crosses seismic and expansion joints and between building and walkway covers.

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 INTERFACE WITH OTHER PRODUCTS

A. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods specified in plans and specifications.

B. Route conduit through roof openings for piping and ductwork wherever possible; otherwise, route through roof jack with pitch pocket. Where separate roofing penetration is required, coordinate location and installation method with roofing installation.

*****END OF SECTION*****

SECTION 16138

BOXES

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Conditions apply to this Section.

1.02 SECTION INCLUDES

A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.

B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.

C. Wall and ceiling outlet boxes.

D. Floor boxes.

E. Pull and junction boxes.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; National Electrical Contractors Association; 2010.

C. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; National Electrical Manufacturers Association; 2012 (ANSI/NEMA FB 1).

D. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; National Electrical Manufacturers Association; 2008 (Revised 2010) (ANSI/NEMA OS 1).

E. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports; National Electrical Manufacturers Association; 2008 (Revised 2010) (ANSI/NEMA OS 2).

F. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); National Electrical Manufacturers Association; 2008.

G. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

I. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

J. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.

K. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

1.04 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.05 SUBSTITUTIONS

Substitutions will be considered per Article 3.3 of the Instruction to Bidders of the Bid Package Section 00003.

1.06 SUBMITTALS

Provide in accordance with Article 3.11 of the General Conditions.

PART 2 - PRODUCTS

2.01 BOXES

A. General Requirements:

1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
3. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) or testing firm acceptable to authority having jurisdiction as suitable for the purpose indicated.
4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:

1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
3. Use suitable concrete type boxes where flush-mounted in concrete.
4. Use suitable masonry type boxes where flush-mounted in masonry walls.
5. Use raised covers suitable for the type of wall construction and device configuration where required.
6. Use shallow boxes where required by the type of wall construction.
7. Do not use "through-wall" boxes designed for access from both sides of wall.
8. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
9. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
10. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
11. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes.
12. Wall Plates: Comply with Section 16140.

C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:

1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
2. NEMA 250 Environment Type, Unless Otherwise Indicated:
3. Junction and Pull Boxes Larger Than 100 cubic inches:
    a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.

2.02 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
2. EGS/Appleton Electric.
3. Erickson Electrical Equipment Company.
4. Hoffman.
5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
6. O-Z/Gedney; a unit of General Signal.
7. RACO; a Hubbell Company.
8. Robroy Industries, Inc.; Enclosure Division.
9. Scott Fetzer Co.; Adalet Division.
10. Spring City Electrical Manufacturing Company.
11. Thomas & Betts Corporation.
12. Walker Systems, Inc.; Wiremold Company (The).
13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.

2.03 OUTLET BOXES

A. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.

1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 1/2 inch male fixture studs where required.
2. Concrete Ceiling Boxes: Concrete type.

B. Nonmetallic Outlet Boxes: NEMA OS 2.

C. Cast Boxes: NEMA FB 1, Type FD, aluminum. Provide gasketed cover by box manufacturer. Provide threaded hubs.

2.04 FLOOR BOXES

A. Floor Boxes: NEMA OS 1, fully adjustable, 1-1/2 inches deep.

B. Material: Cast metal.

C. Shape: Round.

2.05 PULL AND JUNCTION BOXES

A. Sheet Metal Boxes: NEMA OS 1, galvanized steel.

2.06 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. Description: Comply with SCTE 77.

1. Color of Frame and Cover: Gray.
2. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
3. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
4. Cover Legend: Molded lettering, as indicated for each service.
5. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
6. Handholes 12 inches wide by 24 inches long (300 mm wide by 600 mm long) and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel or fiberglass or a combination of the two.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
    a. Jensen.
    b. Carson Industries LLC.
    c. CDR Systems Corporation.
    d. Utility Vault.
    e. Brooks.

PART 3 - EXECUTION

3.01 INSTALLATION

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

B. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Box Supports:

1. Secure and support boxes in accordance with NFPA 70 and Section 16070 using suitable supports and methods approved by the authority having jurisdiction.
2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping,

ductwork, or other systems.

E. Install boxes plumb and level.

F. Flush-Mounted Boxes:

1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.

G. Install boxes as required to preserve insulation integrity.

H. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

I. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07840.

J. Close unused box openings.

K. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

L. Provide grounding and bonding in accordance with Section 16060.

M. Install boxes securely, in a neat and workmanlike manner, as specified in NECA 1.

N. Install in locations as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and as required by NFPA 70.

O. Set wall mounted boxes at elevations to accommodate mounting heights specified in section for outlet device.

P. Electrical boxes are shown on Drawings in approximate locations unless dimensioned.

1. Adjust box locations up to 10 feet if required to accommodate intended purpose.

Q. Maintain headroom and present neat mechanical appearance.

R. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

S. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.

T. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.

U. Locate outlet boxes to allow luminaires positioned as shown on reflected ceiling plan.

V. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

W. Use flush mounting outlet box in finished areas.

X. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

Y. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.

Z. Locate outlet boxes so that wall plates do not span different building finishes.

AA. Locate outlet boxes so that wall plates do not cross masonry joints.

AB. Do not install flush mounting box back-to-back in walls; provide minimum 6 inches separation.

1. Provide minimum 24 inches separation in acoustic rated walls.
2. Provide minimum 24 inches separation in fire rated walls.

AC. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

AD. Use stamped steel bridges to fasten flush mounting outlet box between studs.

AE. Install flush mounting box without damaging wall insulation or reducing its effectiveness.

AF. Use adjustable steel channel fasteners for hung ceiling outlet box.

AG. Do not fasten boxes to ceiling support wires.

AH. Support boxes independently of conduit, except cast box that is connected to two rigid metal conduits both supported within 12 inches of box.

AI. Use gang box where more than one device is mounted together. Do not use sectional box.

AJ. Use gang box with plaster ring for single device outlets.

AK. Use cast outlet box in exterior locations exposed to the weather and wet locations.

AL. Use cast floor boxes for installations in slab on grade; formed steel boxes are acceptable for other installations.

AM. Set floor boxes level.

3.02 ADJUSTING

A. Adjust floor boxes flush with finish flooring material.

B. Adjust flush-mounting outlets to make front flush with finished wall material.

C. Install knockout closures in unused box openings.

3.03 CLEANING

A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

*****END OF SECTION*****

SECTION 16140

WIRING DEVICES

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Conditions apply to this Section.

1.02 SECTION INCLUDES

A. Wall switches.

B. Wall dimmers.

C. Receptacles.

D. Wall plates.

E. Floor box service fittings.

F. Poke-through assemblies.

G. Access floor boxes.

1.03 REFERENCE STANDARDS

A. FS W-C-596 - Connector, Electrical, Power, General Specification for; Federal Specification; Revision G, 2001.

B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush-mounted (General Specification); Federal Specification; Revision F, 1999.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.

D. NECA 130 - Standard for Installing and Maintaining Wiring Devices; National Electrical Contractors Association; 2010.

E. NEMA WD 1 - General Color Requirements for Wiring Devices; National Electrical Manufacturers Association; 1999 (R 2005).

F. NEMA WD 6 - Wiring Device -- Dimensional Requirements; National Electrical Manufacturers Association; 2002 (R2008).

G. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. UL 20 - General-Use Snap Switches; Current Edition, Including All Revisions.

I. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.

J. UL 514D - Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.

K. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

L. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.
4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
5. Coordinate the core drilling of holes for poke-through assemblies with the work covered under other sections.
6. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

B. Sequencing:

1. Do not install wiring devices until final surface finishes and painting are complete.

1.05 SUBSTITUTIONS

Substitutions will be considered per Article 3.3 of the Instruction to Bidders of the Bid Package Section 00003.

1.06 SUBMITTALS

Provide in accordance with Article 3.11 of the General Conditions.

1.07 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.08 DELIVERY, STORAGE, AND PROTECTION

A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Hubbell Incorporated: www.hubbell-wiring.com.

B. Leviton Manufacturing Company, Inc.: www.leviton.com.

C. Pass & Seymour, a brand of Legrand North America, Inc.: www.legrand.us

D. Arrow

E. Approved equal.

F. Source Limitations: Where possible, for each type of wiring device furnish products produced by a single manufacturer and obtained from a single supplier.

2.02 APPLICATIONS

A. Provide wiring devices suitable for intended use and with ratings adequate for load served.

B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.

C. Provide weather resistant GFI receptacles with specified weatherproof covers for all receptacles installed outdoors or in damp or wet locations.

D. Provide GFI protection for all receptacles installed within 6 feet of sinks.

E. Provide GFI protection for all receptacles installed in kitchens.

F. Provide GFI protection for all receptacles serving electric drinking fountains.

G. Provide isolated ground receptacles for all receptacles serving computers.

H. Unless noted otherwise, do not use combination switch/receptacle devices.

I. For flush floor service fittings, use tile rings for installations in tile floors.

J. For flush floor service fittings, use carpet flanges for installations in carpeted floors.

2.03 ALL WIRING DEVICES

A. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

B. Coordinate color of finish, style and device face plate color with Architect prior to ordering devices.

2.04 WALL SWITCHES

A. Manufacturers:

1. Hubbell Incorporated: www.hubbell-wiring.com.
2. Leviton Manufacturing Company, Inc.: www.leviton.com.
3. Pass & Seymour, a brand of Legrand North America, Inc.: www.legrand.us

B. All Wall Switches: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.

1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.

C. Standard Wall Switches: Industrial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

2.05 WALL DIMMERS

A. Manufacturers:

1. Leviton Manufacturing Company, Inc.: www.leviton.com.
2. Lutron Electronics Company, Inc.: www.lutron.com.
3. Pass & Seymour, a brand of Legrand North America, Inc.: www.legrand.us

B. All Wall Dimmers: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 1472; types and ratings suitable for load controlled as indicated on the drawings.

C. Incandescent Wall Dimmers: 120 V AC, slide control type with separate on/off switch; single pole or three way as indicated on the drawings.

1. Power Rating: 1000 W unless otherwise indicated or required to control the load indicated on the drawings.

D. Magnetic Low-Voltage Wall Dimmers: 120 V AC, slide control type with separate on/off switch; single pole or three way as indicated on the drawings.

1. Power Rating: 1000 VA unless otherwise indicated or required to control the load indicated on the drawings.

E. Electronic Low-Voltage Wall Dimmers: 120 V AC, slide control type with separate on/off switch; single pole or three way as indicated on the drawings.

1. Power Rating: 400 VA unless otherwise indicated or required to control the load indicated on the drawings.

F. Fluorescent Wall Dimmers: 120 V AC, slide control type with separate on/off switch, compatible with dimming ballast controlled; single pole or three way as indicated on the drawings.

1. Power Rating: 1000 VA unless otherwise indicated or required to control the load indicated on the drawings.

2.06 RECEPTACLES

A. Manufacturers:

1. Hubbell Incorporated: www.hubbell-wiring.com.
2. Leviton Manufacturing Company, Inc.: www.leviton.com.
3. Pass & Seymour, a brand of Legrand North America, Inc.: www.legrand.us

B. All Receptacles: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.

1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
2. NEMA configurations specified are according to NEMA WD 6.

C. Convenience Receptacles:

1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
2. Isolated Ground Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, with ground contacts isolated from mounting strap; single or duplex as indicated on the drawings.
3. Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R,, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.

D. GFI Receptacles:

1. All GFI Receptacles: Provide with feed-through protection, light to indicate ground fault tripped condition and loss of protection, and list as complying with UL 943, class A.
    a. Provide test and reset buttons of same color as device.
2. Standard GFI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
3. Weather Resistant GFI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.

2.07 WALL PLATES

A. All Wall Plates: Comply with UL 514D.

1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
2. Size: Standard.
3. Screws: Metal with slotted heads finished to match wall plate finish.

B. Nylon Wall Plates: Smooth finish, high-impact thermoplastic.

C. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.

D. Galvanized Steel Wall Plates: Rounded corners and edges, with corrosion resistant screws.

2.08 FLOOR BOX SERVICE FITTINGS

A. Manufacturers:

1. Wiremold, a brand of Legrand North America, Inc.: www.legrand.us

B. Description: Service fittings compatible with floor boxes provided under Section 16138 with all components, adapters, and trims required for complete installation.

C. Flush Floor Service Fittings:

1. Dual Service Flush Combination Outlets:

a. Cover: Rectangular.

b. Configuration:

1) Power: One standard convenience duplex receptacle(s) with duplex flap opening(s).

2) Communications:

2. Dual Service Flush Furniture Feed:

a. Cover: Rectangular.

b. Configuration:

1) Power: One 2-1/8 inch by 3/4 inch combination threaded opening(s).

2) Communications: One 2-1/8 inch by 1 inch combination threaded opening(s).

2.09 POKE-THROUGH ASSEMBLIES

A. Manufacturers:

1. Wiremold, a brand of Legrand North America, Inc.: www.legrand.us

B. Description: Assembly comprising floor service fitting, poke-through component, fire stops and smoke barriers, and junction box for conduit termination; fire rating listed to match fire rating of floor and suitable for floor thickness where installed.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that wall openings are neatly cut and will be completely covered by wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that floor boxes are adjusted properly.

F. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

G. Verify that core drilled holes for poke-through assemblies are in proper locations.

H. Verify that openings in access floor are in proper locations.

I. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 16138 as required for installation of wiring devices provided under this section.

1. Mounting Heights: Unless otherwise indicated, as follows:
    a. Wall Switches: 48 inches above finished floor.
    b. Wall Dimmers: 48 inches above finished floor.
    c. Receptacles: 18 inches above finished floor or 6 inches above counter.
2. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
3. Provide minimum of 24 inches horizontal separation between flush mounted outlet boxes installed on opposite sides of fire rated walls.
4. Where multiple receptacles, wall switches, or wall dimmers are installed at the same location and at the same mounting height, gang devices together under a common wall plate.
5. Provide separate outlet boxes for wiring devices connected to emergency power and normal power systems.
6. Unless otherwise indicated, provide separate outlet boxes for line voltage and low voltage devices.
7. Locate wall switches on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.
8. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions.
9. Locate outlet boxes so that wall plate does not span different building finishes.
10. Locate outlet boxes so that wall plate does not cross masonry joints.

C. Install wiring devices in accordance with manufacturer's instructions.

D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

E. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.

F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.

G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

H. For isolated ground receptacles, connect wiring device grounding terminal only to identified branch circuit isolated equipment grounding conductor. Do not connect grounding terminal to outlet box or normal branch circuit equipment grounding conductor.

I. Provide GFI receptacles with integral GFI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.

J. Install wiring devices plumb and level with mounting yoke held rigidly in place.

K. Install wall switches with OFF position down.

L. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.

M. Do not share neutral conductor on branch circuits utilizing wall dimmers.

N. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.

O. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

P. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

Q. Install identification label for wall switches and wall dimmers in accordance with Section 16075 indicating load served when controlling loads that are not visible from the control location or multiple wall switches or wall dimmers are installed at one location.

R. Install poke-through closure plugs in all unused core holes to maintain fire rating of floor.

3.04 FIELD QUALITY CONTROL

A. Inspect each wiring device for damage and defects.

B. Operate each wall switch, wall dimmer, and fan speed controller with circuit energized to verify proper operation.

C. Test each receptacle to verify operation and proper polarity.

D. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.

E. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.05 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

3.06 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

*****END OF SECTION*****

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SECTION 16145

LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Conditions apply to this Section.

1.02 SECTION INCLUDES

A. Occupancy sensors.

1.03 REFERENCE STANDARDS

A. ANSI C136.10 - American National Standard for Roadway and Area Lighting Equipment - Locking-Type Photocontrol Devices and Mating Receptacles - Physical and Electrical Interchangeability and Testing; 2010.

B. ANSI C136.24 - American National Standard for Roadway and Area Lighting Equipment - Nonlocking (Button) Type Photocontrols; 2004 (R2010).

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

D. NECA 130 - Standard for Installing and Maintaining Wiring Devices; National Electrical Contractors Association; 2010.

E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2008.

F. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Fluorescent Ballasts; National Electrical Manufacturers Association; 2011.

G. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. UL 773 - Plug-in Locking Type Photocontrols for Use with Area Lighting; Current Edition, Including All Revisions.

I. UL 773A - Nonindustrial Photoelectric Switches for Lighting Control; Current Edition, Including All Revisions.

J. UL 916 - Energy Management Equipment; Current Edition, Including All Revisions.

K. UL 917 - Clock-Operated Switches; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the placement of lighting control devices with millwork, furniture, equipment, etc. installed under other sections or by others.
2. Coordinate the placement of wall switch occupancy sensors with actual installed door swings.
3. Coordinate the placement of occupancy sensors with millwork, furniture, equipment or other potential obstructions to motion detection coverage installed under other sections or by others.
4. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

B. Sequencing:

1. Do not install lighting control devices until final surface finishes and painting are complete.

1.05 SUBSTITUTIONS

Substitutions will be considered per Article 3.3 of the Instruction to Bidders of the Bid Package Section 00003.

1.06 SUBMITTALS

A. Provide in accordance with Article 3.11 of the General Conditions.

B. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.

C. Field Quality Control Reports.

1.07 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.08 DELIVERY, STORAGE, AND PROTECTION

A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

1.09 FIELD CONDITIONS

1.10 WARRANTY

A. Provide five year manufacturer warranty for all occupancy sensors.

PART 2 - PRODUCTS

2.01 ALL LIGHTING CONTROL DEVICES

A. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

B. Unless specifically indicated to be excluded, provide all required conduit, wiring, connectors, hardware, components, accessories, etc. as required for a complete operating system.

2.02 OCCUPANCY SENSORS

A. All Occupancy Sensors:

1. Description: Factory-assembled commercial specification grade devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such as small desktop level movements, according to published coverage areas, for automatic control of load indicated.

2. Sensor Technology:

a. Passive Infrared/Ultrasonic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and ultrasonic technologies.

3. Provide LED to visually indicate motion detection with separate color LEDs for each sensor type in dual technology units.

4. Operation: Unless otherwise indicated, occupancy sensor to turn load on when occupant presence is detected and to turn load off when no occupant presence is detected during an adjustable turn-off delay time interval.

5. Dual Technology Occupancy Sensors: Field configurable turn-on and hold-on activation with settings for activation by either or both sensing technologies.
6. Passive Infrared Lens Field of View: Field customizable by addition of factory masking material, adjustment of integral blinders, or similar means to block motion detection in selected areas.
7. Turn-Off Delay: Field adjustable, up to a maximum time delay setting of not less than 15 minutes and not more than 30 minutes.
8. Sensitivity: Field adjustable.
9. Adaptive Technology: Field selectable; capable of self-adjusting sensitivity and time delay according to conditions.
10. Integral Photocell: For field selectable and adjustable inhibition of automatic turn-on of load when ambient lighting is above the selected level.
11. Compatibility: Suitable for controlling incandescent lighting, low-voltage lighting with electronic and magnetic transformers, fluorescent lighting with electronic and magnetic ballasts, and fractional motor loads, with no minimum load requirements.
12. Load Rating for Line Voltage Occupancy Sensors: As required to control the load indicated on the drawings.

B. Wall Switch Occupancy Sensors:
   1. All Wall Switch Occupancy Sensors:
      a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated manual control capability, and no leakage current to load in off mode.
      b. Unless otherwise indicated or required to control the load indicated on the drawings, provide line voltage units with self-contained relay.
      c. Where indicated, provide two-circuit units for control of two separate lighting loads, with separate manual controls and separately programmable operation for each load.
      d. Manual-Off Override Control: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during the delayed-off time interval.
   2. Passive Infrared/Ultrasonic Dual Technology Wall Switch Occupancy Sensors: Capable of detecting motion within an area of 900 square feet.

C. Ceiling Mounted Occupancy Sensors:
   1. All Ceiling Mounted Occupancy Sensors:
      a. Description: Low profile occupancy sensors designed for ceiling installation.
      b. Unless otherwise indicated or required to control the load indicated on the drawings, provide low voltage units, for use with separate compatible accessory power packs.
      c. Provide field selectable setting for disabling LED motion detector visual indicator.
      d. Occupancy sensor to be field selectable as either manual-on/automatic-off or automatic on/off.
      e. Finish: White unless otherwise indicated.

2. Passive Infrared/Ultrasonic Dual Technology Ceiling Mounted Occupancy Sensors:
    a. Standard Range Sensors: Capable of detecting motion within an area of 1000 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.

D. Power Packs for Low Voltage Occupancy Sensors:
1. Description: Plenum rated, self-contained low voltage class 2 transformer and relay compatible with specified low voltage occupancy sensors for switching of line voltage loads.
2. Provide quantity and configuration of power and slave packs with all associated wiring and accessories as required to control the load indicated on the drawings.
3. Input Supply Voltage: Dual rated for 120/277 V ac.
4. Load Rating: As required to control the load indicated on the drawings.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that openings for outlet boxes are neatly cut and will be completely covered by devices or wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to lighting control devices.

F. Verify that the service voltage and ratings of lighting control devices are appropriate for the service voltage and load requirements at the location to be installed.

G. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 16138 as required for installation of lighting control devices provided under this section.

C. Install lighting control devices in accordance with manufacturer's instructions.

D. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

E. Install lighting control devices plumb and level, and held securely in place.

F. Where applicable, install lighting control devices and associated wall plates to fit completely flush to mounting surface with no gaps and rough opening completely covered without strain

on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

G. Occupancy Sensor Locations:

1. Location Adjustments: Within the design intent, reasonably minor adjustments to locations may be made in order to optimize coverage and avoid conflicts or problems affecting coverage.

2. Locate ultrasonic and dual technology passive infrared/ultrasonic occupancy sensors a minimum of 4 feet from air supply ducts or other sources of heavy air flow and as per manufacturer's recommendations, in order to minimize false triggers.

3.04 FIELD QUALITY CONTROL

A. See Section 01400 - Quality Requirements, for additional requirements.

B. Inspect each lighting control device for damage and defects.

C. Test occupancy sensors to verify proper operation, including time delays and ambient light thresholds where applicable. Verify optimal coverage for entire room or area. Record test results in written report to be included with submittals.

D. Correct wiring deficiencies and replace damaged or defective lighting control devices.

3.05 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Adjust occupancy sensor settings to minimize undesired activations while optimizing energy savings, and to achieve desired function as indicated or as directed by Architect.

C. Where indicated or as directed by Architect, install factory masking material or adjust integral blinders on passive infrared (PIR) and dual technology occupancy sensor lenses to block undesired motion detection.

3.06 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.07 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate proper operation of lighting control devices to Architect, and correct deficiencies or make adjustments as directed.

*****END OF SECTION*****

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SECTION 16155

EQUIPMENT WIRING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Conditions apply to this Section.

1.02 SECTION INCLUDES

A. Electrical connections to equipment.

1.03 REFERENCE STANDARDS

A. NEMA WD 1 - General Color Requirements for Wiring Devices; National Electrical Manufacturers Association; 1999 (R 2005).

B. NEMA WD 6 - Wiring Devices - Dimensional Requirements; National Electrical Manufacturers Association; 2002 (R2008).

C. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.

2. Determine connection locations and requirements.

B. Sequencing:

1. Install rough-in of electrical connections before installation of equipment is required.

2. Make electrical connections before required start-up of equipment.

1.05 SUBSTITUTIONS

Substitutions will be considered per Article 3.3 of the Instruction to Bidders of the Bid Package Section 00003.

1.06 SUBMITTALS

Provide in accordance with Article 3.11 of the General Conditions.

1.07 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Cords and Caps: NEMA WD 6; match receptacle configuration at outlet provided for equipment.

1. Colors: Conform to NEMA WD 1.

2. Cord Construction: NFPA 70, Type SO, multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
3. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

B. Disconnect Switches: As specified in Section 16412 and in individual equipment sections.

C. Wiring Devices: As specified in Section 16140.

D. Flexible Conduit: As specified in Section 16131.

E. Wire and Cable: As specified in Section 16123.

F. Boxes: As specified in Section 16138.

2.02 EQUIPMENT CONNECTIONS

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.02 ELECTRICAL CONNECTIONS

A. Make electrical connections in accordance with equipment manufacturer's instructions.

B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.

C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.

D. Provide receptacle outlet to accommodate connection with attachment plug.

E. Provide cord and cap where field-supplied attachment plug is required.

F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.

H. Install terminal block jumpers to complete equipment wiring requirements.

I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

*****END OF SECTION*****

SECTION 16231

PACKAGED ENGINE GENERATORS

PART 1 -- GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Conditions apply to this Section.

1.02 DESCRIPTION OF SYSTEM & SITE

A. Provide a 600 kW standby power system to supply electrical power at 120/208 Volts, 60 Hertz, _____ 3 Phase. The generator shall consist of a liquid cooled diesel engine, a synchronous AC alternator, and system controls with all necessary accessories for a complete operating system, including but not limited to the items as specified hereinafter.

B. The site is an NEC ordinary location with no specific harsh environment requirements.

C. The genset shall be applied at the listed ambient and elevation. Bidders to submit the generators rated power output at 110 ambient (˚F) and 1,000 elevation (Ft).

D. Bidders are to submit the genset's sound level in dBA at 23 ft based on the configuration specified.

1.03 REQUIREMENTS OF REGULATORY AGENCIES

A. An electric generating system, consisting of a prime mover, generator, governor, coupling and all controls, must have been tested, as a complete unit, on a representative engineering prototype model of the equipment to be sold.

B. The generator set must conform to applicable NFPA requirements.

C. The generator set must be available with the Underwriters Laboratories listing (UL2200) for a stationary engine generator assembly.

D. The generator set must meet EPA federal emission guidelines for stationary standby power generation.

1.04 MANUFACTURER QUALIFICATIONS

A. This system shall be supplied by an original equipment manufacturer (OEM) who has been regularly engaged in the production of engine-alternator sets, automatic transfer switches, and associated controls for a minimum of 25 years, thereby identifying one source of supply and responsibility. Approved suppliers are Generac Industrial Power or an approved equal.

B. The manufacturer shall have printed literature and brochures describing the standard series specified, not a one of a kind fabrication.

C. Manufacturer's authorized service representative shall meet the following criteria:
   1. Certified, factory trained, industrial generator technicians
   2. Service support 24/7

3. Service location within 200 miles
4. Response time of 4 hours
5. Service & repair parts in-stock at performance level of 95%
6. Offer optional remote monitoring and diagnostic capabilities

1.05 SUBSTITUTIONS

Substitutions will be considered per Article 3.3. of the Instruction to Bidders of the Bid Package Section 00003.

1.06 SUBMITTALS

A. Provide in accordance with Article 3.11 of the General Conditions.
B. Engine Generator specification sheet
C. Controls specification sheet(s)
D. Installation / Layout dimensional drawing
E. Wiring schematic
F. Sound data
G. Emission certification

PART 2 -- ENGINE

2.01 Engine Rating and Performance

A. The prime mover shall be a liquid cooled, diesel fueled, turbocharged after-cooled engine of 4-cycle design. It will have adequate horsepower to achieve rated kW output with at an operating speed of 1800 RPM.

B. The engine shall support a 100% load step.

C. The generator system shall support generator start-up and load transfer within 10 seconds.

2.02 Engine Oil System

A. Full pressure lubrication shall be supplied by a positive displacement lube oil pump. The engine shall have a replaceable oil filter(s) with internal bypass and replaceable element(s).

B. The engine shall operate on mineral based oil. Synthetic oils shall not be required.

2.03 Engine Cooling System

A. The engine is to be cooled with a unit mounted radiator, fan, water pump, and closed coolant recovery system. The coolant system shall include a coolant fill box which will provide visual means to determine if the system has adequate coolant level. The radiator shall be designed for operation in 122 degrees F, (50 degrees C) ambient temperature.

B. The engine shall have (a) unit mounted, thermostatically controlled water jacket heater(s) to aid in quick starting. The wattage shall be as recommended by the manufacturer.

C. Engine coolant and oil drain extensions, equipped with pipe plugs and shut-off valves, must

be provided to the outside of the mounting base for cleaner and more convenient engine servicing.

D. A radiator fan guard must be installed for personnel safety that meets UL and OSHA safety requirements.

2.04 Engine Starting System

A. Starting shall be by a solenoid shift, DC starting system.

B. The engine's cranking batteries shall be lead acid. The batteries shall be sized per the manufacturer's recommendations. The batteries supplied shall meet NFPA 110 cranking requirements of 90 seconds of total crank time. Battery specifications (type, amp-hour rating, cold cranking amps) to be provided in the submittal.

C. The genset shall have an engine driven, battery charging alternator with integrated voltage regulation.

2.05 Engine Fuel System

A. The engine fuel system shall be designed for operation on #2 diesel fuel and cold weather diesel blends.

B. The engine shall include a primary fuel filter, water separator, manual fuel priming pump, and engine flexible fuel lines must be installed at the point of manufacture. Element shall be replaceable paper type.

2.06 Engine Controls

A. Engines that are equipped with an electronic engine control module (ECM), shall monitor and control engine functionality and seamlessly integrate with the genset controller through digital communications. ECM monitored parameters shall be integrated into the genset controllers NFPA 110 alarm and warning requirements. All ECM fault codes shall be displayed at the genset controller in standard language – fault code numbers are not acceptable.

B. For engines without ECM functionality or for any additional genset controller monitoring, sensors are to be conditioned to a 4-20ma signal level to enhance noise immunity and all sensor connections shall be sealed to prevent corrosion.

C. Engine speed shall be controlled with an integrated isochronous governor function with no change in alternator frequency from no load to full load. Steady state regulation is to be 0.25%.

2.07 Engine Exhaust & Intake

A. The engine exhaust emissions shall meet the EPA emission requirements for standby power generation.

B. The manufacturer shall supply its recommended stainless steel, flexible connector to couple the engine exhaust manifold to the exhaust system. A rain cap will terminate the exhaust

pipe after the silencer. All components must be properly sized to assure operation without excessive back pressure when installed.

C. The manufacturer shall supply a critical grade exhaust silencer as standard. For applications with site specific sound requirements (reference section 1.1), the silencer shall be selected to achieve site sound levels.

D. For gensets in a weather or sound attenuated enclosure, all exhaust piping from the turbo-charger discharge to the silencer shall be thermally wrapped to minimize heat dissipation inside the enclosure.

E. The engine intake air is to be filtered with engine mounted, replaceable, dry element filters.

PART 3 -- ALTERNATOR

3.01 The alternator shall be the voltage and phase configuration as specified in section 1.1.1.

3.02 The alternator shall be a 4 pole, revolving field, stationary armature, synchronous machine. The excitation system shall utilize a brushless exciter with a three phase full wave rectifier assembly protected against abnormal transient conditions by a surge protector. Photo-sensitive components will not be permitted in the rotating exciter.

3.03 The alternator shall include a permanent magnet generator (PMG) for excitation support. The system shall supply a minimum short circuit support current of 300% of the rating for 10 seconds.

3.04 The alternator shall support 1629 skVA with a maximum voltage dip of 30 %.

3.05 Three phase alternators shall be 12 lead, broad range capable of supporting voltage reconnection. Single phase alternators shall be four lead and dedicated voltage designs (600v) shall be six lead. All leads must be extended into a NEMA 1 connection box for easy termination. A fully rated, isolated neutral connection must be included by the generator set manufacturer.

3.06 The alternator shall use a single, sealed bearing design. The rotor shall be connected to the engine flywheel using flexible drive disks. The stator shall be direct connected to the engine to ensure permanent alignment.

3.07 The alternator shall meet temperature rise standards of UL2200 (120 degrees C). The insulation system material shall be class "H" capable of withstanding 150 degrees C temperature rise.

3.08 The alternator shall be protected against overloads and short circuit conditions by advanced control panel protective functions. The control panel is to provide a time current algorithm that protects the alternator against short circuits. To ensure precision protection and repeatable trip characteristics, these functions must be implemented electronically in the generator control panel -- thermal magnetic breaker implementation are not acceptable.

3.09 An alternator strip heater shall be installed to prevent moisture condensation from forming on the alternator windings. A tropical coating shall also be applied to the alternator windings to provide additional protection against the entrance of moisture.

PART 4 -- CONTROLS

4.01 The generator control system shall be a fully integrated microprocessor based control system for standby emergency engine generators meeting all requirements of NFPA 110 level 1.

4.02 The generator control system shall be a fully integrated control system enabling remote diagnostics and easy building management integration of all generator functions. The generator controller shall provide integrated and digital control over all generator functions including: engine protection, alternator protection, speed governing, voltage regulation and all related generator operations. The generator controller must also provide seamless digital integration with the engine's electronic engine control module (ECM) if so equipped. Generator controller's that utilize separate voltage regulators and speed governors or do not provide seamless integration with the engine management system are considered less desirable.

4.03 Communications shall be supported with building automation via the Modbus protocol without network cards. Optional internet and intranet connectivity shall be available.

4.04 The control system shall provide an environmentally sealed design including encapsulated circuit boards and sealed automotive style plugs for all sensors and circuit board connections. The use of non-encapsulated boards, edge cards, and pc ribbon cable connections are considered unacceptable.

4.05 Circuit boards shall utilize surface mount technology to provide vibration durability. Circuit boards that utilize large capacitors or heat sinks must utilize encapsulation methods to securely support these components.

4.06 A predictive maintenance algorithm that alarms when maintenance is required. The controller shall have the capability to call out to the local servicing dealer when maintenance is required.

4.07 Diagnostic capabilities should include time-stamped event and alarm logs, ability to capture operational parameters during events, simultaneous monitoring of all input or output parameters, callout capabilities, support for multi-channel digital strip chart functionality and .2 msec data logging capabilities.

4.08 In addition to standard NFPA 110 alarms, the application loads should also be protected through instantaneous and steady state protective settings on system voltage, frequency, and power levels.

4.09 The control system shall provide pre-wired customer use I/O: 4 relay outputs (user definable functions), 4 contact inputs, 2 analog inputs, communications support via RS232, RS485, or an optional modem. Additional I/O must be an available option.

4.10 Customer I/O shall be software configurable providing full access to all alarm, event, data logging, and shutdown functionality. In addition, custom ladder logic functionality inside the generator controller shall be supported to provide application support flexibility. The ladder logic function shall have access to all the controller inputs and customer assignable outputs.

4.11 The control panel shall include a digital display for all user pertinent unit parameters including: engine and alternator operating conditions; oil pressure and optional oil temperature; coolant temperature and level alarm; fuel level (where applicable); engine speed; DC battery voltage; run time hours; generator voltages, amps, frequency, kilowatts, and power factor; alarm status and current alarm(s) condition per NFPA 110 level 1.

PART 5 – ENGINE/ALTERNATOR PACKAGING

5.01 The engine/alternator shall be bolted directly to the genset frame and the entire frame shall be mounted on spring isolators. The engine/alternator shall be isolated from the generator frame with rubber isolators. The packaging shall not require the addition of external spring isolators.

5.02 A mainline, thermal magnetic circuit breaker carrying the UL mark shall be factory installed. The breaker shall be rated between 100 to 125% of the rated ampacity of the genset. The line side connections are to be made at the factory. Output lugs shall be provided for load side connections.

5.03 The generator shall include a unit mounted auxiliary power load center. All ancillary AC devices (block heater, battery charger, alternator strip heater, etc) shall have a dedicated breaker within the load center.

5.04 ENCLOSURE

A. The genset shall be packaged with a sound attenuating enclosure with an average sound level not to exceed 75.3 dBA at a distance of 23 feet.

B. The enclosure shall be made of steel with a minimum thickness of 14 gauge. The enclosure is to have hinged, removable doors to allow access to the engine, alternator and control panel. The hinges shall allow for door fit adjustment. Hinges and all exposed fasteners will be stainless steel or JS5000. The use of pop-rivets weakens the paint system and not allowed on external painted surfaces. Each door will have lockable hardware with identical keys.

C. The enclosure shall be coated with electrostatic applied powder paint, baked and finished to manufacturer's specifications. The color will be manufacturer's standard.

D. The sound attenuated enclosure shall utilize an upward discharging radiator hood. The enclosure shall be completely lined with sound deadening material. This material must be of a self extinguishing design.

5.05 SUB-BASE FUEL TANK

A. The packaging shall include a double wall, sub-base mounted, UL142 listed fuel tank. The tank shall be sized to provide 24 hours of run time but not larger than 1050 gallons..

B. The tank shall include fuel suction and return connections, normal and emergency vents, secondary containment emergency vent and rupture basin sensor, mechanical fuel level indication and a stub-up area convenient for electrical conduit entry.

C. The fuel tank shall use an electric fuel sensor to provide an analog indication of fuel level. The controller shall have a warning indication on low fuel level and provide optional shutdown functionality for low, low fuel level.

D. The fuel tank shall have a built-in catch basin to secure genset coolant and oil against an accidental spills.

E. The fuel tank must be supplied by the engine-generator set manufacturer and be installed before shipment.

PART 6 -- LOOSE ITEMS

6.01 LOOSE ITEMS

Supplier to itemize loose parts that require site mounting and installation. Preference will be shown for gensets that factory mount items like mufflers, battery chargers, etc.

PART 7 -- ADDITIONAL PROJECT REQUIREMENTS

7.01 FACTORY TESTING

A. Before shipment of the equipment, the engine-generator set shall be tested under rated load for performance and proper functioning of control and interfacing circuits. Tests shall include:

1. Verify voltage & frequency stability.
2. Verify transient voltage & frequency dip response.
3. Load test the generator for 2 hours at .8 PF.

7.02 OWNER'S MANUAL

A. Three (3) sets of owner's manuals specific to the product supplied must accompany delivery of the equipment. General operating instruction, preventive maintenance, wiring diagrams, schematics and parts exploded views specific to this model must be included.

7.03 INSTALLATION

A. Contractor shall install the complete electrical generating system including all external fuel connections in accordance with requirements of NEC, NFPA, and the manufacturer's recommendations as reviewed by the Engineer.

7.04 SERVICE

A. Supplier of the genset and associated items shall have permanent service facilities in this trade area. These facilities shall comprise a permanent force of EGSA certified and factory trained service personnel on 24 hour call, experienced in servicing this type of equipment, providing warranty and routine maintenance service to afford the owner maximum protection. Delegation of this service responsibility for any of the equipment listed herein will not be considered fulfillment of these specifications. Service contracts shall also be available.

7.05 WARRANTY

A. The standby electric generating system components, complete genset and instrumentation panel shall be warranted by the manufacturer against defective materials and factory workmanship for a period of five (5) years. Such defective parts shall be repaired or replaced at the manufacturer's option, free of charge for parts, labor and travel.

B. The warranty period shall commence when the standby power system is first placed into service. Multiple warranties for individual components (engine, alternator, controls, etc.) will not be acceptable. Satisfactory warranty documents must be provided. Also, in the

judgment of the specifying authority, the manufacturer supplying the warranty for the complete system must have the necessary financial strength and technical expertise with all components supplied to provide adequate warranty support.

7.06 STARTUP AND CHECKOUT

A. The supplier of the electric generating plant and associated items covered herein shall provide factory trained technicians to checkout the completed installation and to perform an initial startup inspection to include:

1. Ensuring the engine starts (both hot and cold) within the specified time.

2. Verification of engine parameters within specification.

3. Verify no load frequency and voltage, adjusting if required.

4. Test all automatic shutdowns of the engine-generator.

5. Perform a load test of the electric plant, ensuring full load frequency and voltage are within specification by using building load.

7.07 TRAINING

A. Training is to be supplied by the start-up technician during commissioning. The training should cover basic generator operation and common generator issues that can be managed by the end-user.

*****END OF SECTION*****

SECTION 16263

STATIC UNINTERRUPTIBLE POWER SUPPLY

PART 1 -- GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Conditions apply to this Section.

1.02 SECTION INCLUDES

A. Charger/rectifier unit.

B. Inverter unit.

C. Batteries.

1.03 REFERENCE STANDARDS

A. IEEE 519 - IEEE Recommended Practices and Requirements for Harmonic Control in Electric Power Systems; Institute of Electrical and Electronic Engineers; 1992 (R 2004).

B. NEMA PE 1 - Uninterruptible Power Systems (UPS) - Specification and Performance Verification; National Electrical Manufacturers Association; 2003.

C. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBSTITUTIONS

Substitutions will be considered per Article 3.3 of the Instruction to Bidders of the Bid Package Section 00003.

1.05 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate electrical characteristics and connection requirements. Provide battery rack dimensions; battery type, size, dimensions, and weight; detailed equipment outlines, weight, and dimensions; location of conduit entry and exit; single-line diagram indicating metering, control, and external wiring requirements; heat rejection and air flow requirements.

C. Product Data: Provide catalog sheets and technical data sheets to indicate physical data and electrical performance, electrical characteristics, and connection requirements.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product. Include equipment installation outline, connection diagram for external cabling, internal wiring diagram, and written instruction for installation.

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

F. Operation Data: Description of operating procedures.

G. Maintenance Data: Description of servicing procedures; list of major components; recommended remedial and preventive maintenance procedures; spare parts list.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience with service facilities within 100 miles of Project.

C. Supplier Qualifications: Authorized distributor of specified manufacturer with minimum three years documented experience.

D. Products: Furnish products listed and classified by Underwriters Laboratories as suitable for purpose specified and indicated.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect equipment from extreme temperature and humidity by storing in a conditioned space.

B. Protect equipment from dust and debris by wrapping unit in dusttight cover and storing away from construction activity.

C. Deliver batteries no sooner than 7 days before charging.

1.08 WARRANTY

A. See Section 01770 - Closeout Submittals, for additional warranty requirements.

PART 2 -- PRODUCTS

2.01 MANUFACTURERS

A. Mitsubishi Electric Automation, Inc;

B. Liebert

C. APC

2.02 UNINTERRUPTIBLE POWER SUPPLY

A. System Configuration: Non-redundant type with reverse transfer.

B. Components:
1. Battery.
2. Rectifier/charger to maintain battery charge and to provide input to inverter when utility power is available.
3. Inverter to provide power to load during normal operation.
4. Static switch to transfer load automatically and without disturbance between inverter and utility power.
5. Manual switch to bypass static switch for maintenance.
6. Input and output isolation transformers and filters to provide appropriate isolation and disturbance attenuation.
7. Monitors, sensors, and control circuits.

C. Design Standards: IEEE 519 and NEMA PE 1.

2.03 SYSTEM RATINGS AND OPERATING CHARACTERISTICS

A. System Continuous Rating: As indicated on Drawings, over entire battery voltage range at specified power factor. Maintain output voltage within specified limits at any load from full load to no-load.

B. Battery Capacity: Capable of operating at full load for .33 hours.

C. Voltage Rating: 120/208 volts, 3 phase.

D. Input Voltage Operating Range: Plus or minus 10 percent.

E. Input Frequency Operating Range: 60 Hz. Plus or minus 3 Hz.

F. Input Current Limit: Adjustable to maximum of 125 percent of that required to operate at full load with battery bank on float charge.

G. Current Walk-in: 25 to 100 percent in fifteen seconds.

H. UPS Power Factor Over Full Range of Loads and Input Voltages: 74 to 100 percent, lagging.

I. Harmonic Distortion of Input Current Wave Form: 5 percent maximum at full load.

J. Output Voltage regulation:

K. Output Free Running Frequency: 60 Hz Plus or minus 0.5 percent.

L. Output Harmonic Distortion: Maximum 5 percent rms total harmonic distortion (THD) and maximum 3 percent any single harmonic, at rated frequency and voltage, from 10 percent load to full load and over battery voltage range, measured into a linear load.

M. Voltage Transient Response for Application of 0 to 50 Percent, 50 to 100 Percent, 100 to 50 Percent, and 50 to 0 Percent Step Loads, and Transfer To and From Bypass Line:
   1. Plus 8, minus 10 percent for maximum of 8.3 milliseconds.
   2. Plus or minus 5 percent for maximum of 25 milliseconds.
   3. Plus or minus 3 percent for maximum of 50 milliseconds.

N. Phase Displacement:
   1. 120 plus or minus 1 degrees for balanced loads.
   2. 120 plus or minus 4 degrees for 50 percent unbalanced loads.

O. Three-phase Overload Ratings:
   1. 1000 percent for 5 cycles; via static switch.
   2. 150 percent for 10 seconds.
   3. 125 percent for 10 minutes.

2.04 DESIGN

A. Inverter Type: Pulse-width modulated.

B. Rectifier/Charger Capacity: Sufficient to supply full load to inverter while recharging fully-discharged battery to 95 percent of full capacity in four hours or less; and within the input current limits specified.

C. Provide means for on-line testing of UPS, including test points to allow adjusting and servicing. Provide means for testing static switch while load is bypassed to utility.

D. Mean Time Between Failures: 60,000 hours, minimum.

E. Cooling: Natural convection.

F. Do not use continuous moving parts or electron tubes. Accomplish power switching using semiconductor devices.

2.05 FABRICATION

A. Electroplate brackets and securing hardware with corrosion resistant material. Secure bolts, studs and nuts with lock washers.

B. Identify internal wiring at each end of conductor. Provide cabinet grounding lug.

2.06 BATTERY

A. Storage Battery: Lead calcium heavy duty industrial battery, designed for auxiliary power service. Provide battery with impact resistant plastic case. Provide cells with explosion proof vents, clear containers, and ample space for plate growth without stressing container and cover.

2.07 CONTROLS AND INDICATORS

A. Controls:
   1. AC input circuit breaker.
   2. Inverter operate switch to initiate inverter operation.
   3. Inverter standby switch to cause inverter to cease operation
   4. Static switch transfer switch to permit manual actuation of static transfer switch.
   5. Battery charge timer.

PART 3 -- EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

3.02 FIELD QUALITY CONTROL

A. Perform field inspection in accordance with Section 01400.
   1. Verify specification performance criteria.
   2. Measure battery discharge and recharge times.
   3. Simulate fault in each system component and utility power.

3.03 CLOSEOUT ACTIVITIES

A. Demonstrate operation uninterruptible power supply by simulating an outage.

3.04 MAINTENANCE

A. Provide service and maintenance of uninterruptible power supply for one year from Date of Substantial Completion.

B. Include all costs, including labor, parts, and travel.

*****END OF SECTION*****

SECTION 16272

DRY TYPE TRANSFORMERS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Conditions apply to this Section.

1.02 SECTION INCLUDES

A. General purpose transformers.

1.03 REFERENCE STANDARDS

A. IEEE C57.94 - Recommended Practice for Installation, Application, Operation, and Maintenance of Dry-Type General Purpose Distribution and Power Transformers; 1982 (R2006).

B. IEEE C57.96 - Guide for Loading Dry-Type Distribution and Power Transformers; 1999 (R2004).

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

D. NECA 409 - Standard for Installing and Maintaining Dry-Type Transformers; 2009.

E. NEMA ST 20 - Dry-Type Transformers for General Applications; National Electrical Manufacturers Association; 1992 (R1997).

F. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2008

G. NEMA TP 1 - Guide for Determining Energy Efficiency for Distribution Transformers; 2002.

H. NEMA TP 2 - Standard Test Method for Measuring the Energy Consumption of Distribution Transformers; 2005.

I. NEMA TP 3 - Standard for the Labeling of Distribution Transformer Efficiency; 2000.

J. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2009.

K. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

L. UL 506 - Standard for Specialty Transformers; Current Edition, Including All Revisions.

M. UL 1561 - Standard for Dry-Type General Purpose and Power Transformers; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the work with placement of support framing and anchors required for mounting of transformers.

1.05 SUBSTITUTIONS

Substitutions will be considered per Article 3.3 of the Instruction to Bidders of the Bid Package Section 00003.

1.06 SUBMITTALS

A. Provide in accordance with Article 3.11 of the General Conditions.

B. Product Data: Include voltage, kVA, impedance, tap configurations, insulation system class and rated temperature rise, efficiency, sound level, enclosure ratings, outline and support point dimensions, weight, required clearances, service condition requirements, and installed features.

1. K-factor Rated Transformers: Include K-factor ratings.

1.07 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to transformer internal components, enclosure, and finish.

1.09 FIELD CONDITIONS

A. Ambient Temperature: Do not exceed 86 degrees F average or 104 degrees F maximum measured during any 24 hour period during and after installation of transformers.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Eaton Corporation; Cutler-Hammer Products: www.eaton.com.

B. General Electric Company: www.geindustrial.com.

C. Schneider Electric; Square D Products: www.schneider-electric.us.

D. Source Limitations: Furnish transformers produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 ALL TRANSFORMERS

A. Description: Factory-assembled, dry type transformers for 60 Hz operation designed and manufactured in accordance with NEMA ST 20 and listed and labeled by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

B. Unless noted otherwise, transformer ratings indicated are for continuous loading according to IEEE C57.96 under the following service conditions:

1. Altitude: Less than 6,600 feet.

2. Ambient Temperature: Not exceeding 86 degrees F average or 104 degrees F maximum measured during any 24 hour period.

C. Core: High grade, non-aging silicon steel with high magnetic permeability and low hysteresis and eddy current losses. Keep magnetic flux densities substantially below saturation point, even at 10 percent primary overvoltage. Tightly clamp core laminations to prevent plate movement and maintain consistent pressure throughout core length.

D. Impregnate core and coil assembly with non-hydroscopic thermo-setting varnish to effectively seal out moisture and other contaminants.

E. Basic Impulse Level: 10 kV.

F. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.

G. Isolate core and coil from enclosure using vibration-absorbing mounts.

H. Nameplate: Include transformer connection data, ratings, wiring diagrams, and overload capacity based on rated winding temperature rise.

2.03 GENERAL PURPOSE TRANSFORMERS

A. Description: Self-cooled, two winding transformers listed and labeled as complying with UL 506 or UL 1561; ratings as indicated on the drawings.

B. Insulation System and Allowable Average Winding Temperature Rise:

1. Less than 15 kVA: Class 185 degrees C insulation system with 115 degrees C average winding temperature rise.

2. 15 kVA and Larger: Class 220 degrees C insulation system with 150 degrees C average winding temperature rise.

C. Coil Conductors: Continuous copper windings with terminations brazed or welded.

D. Winding Taps:

1. Less than 3 kVA: None.

2. 3 kVA through 15 kVA: Two 5 percent full capacity primary taps below rated voltage.

3. 15 kVA through 300 kVA: Two 2.5 percent full capacity primary taps above and four 2.5 percent full capacity primary taps below rated voltage.

4. 500 kVA and Larger: Two 2.5 percent full capacity primary taps above and two 2.5 percent full capacity primary taps below rated voltage.

E. Energy Efficiency: Standard efficiency complying with NEMA TP 1.

F. Energy Efficiency: Standard efficiency complying with NEMA TP 1.

1. Test efficiency according to NEMA TP 2.

2. Label transformer according to NEMA TP 3.

G. Sound Levels: Standard sound levels complying with NEMA ST 20.

H. Mounting Provisions:

1. Less than 15 kVA: Suitable for wall mounting.

2. 15 kVA through 75 kVA: Suitable for wall, floor, or trapeze mounting.

3. Larger than 75 kVA: Suitable for floor mounting.

I. Transformer Enclosure: Comply with NEMA ST 20.

1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:

a. Indoor clean, dry locations: Type 2.

b. Outdoor locations: Type 3R.

2. Construction: Heavy gage steel.

a. Less than 15 kVA: Totally enclosed, non-ventilated.

b. 15 kVA and Larger: Ventilated.

3. Finish: Manufacturer's standard grey, suitable for outdoor installations.

4. Provide lifting eyes or brackets.

J. Accessories:

1. Mounting Brackets: Provide manufacturer's standard brackets.
2. Weathershield Kits: Provide for ventilated transformers installed outdoors to provide a listed NEMA 250, type 3R assembly.
3. Lug Kits: Sized as required for termination of conductors as indicated on the drawings.

2.04 SOURCE QUALITY CONTROL

A. Factory test transformers according to NEMA ST 20.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that suitable support frames and anchors are installed where required and that mounting surfaces are ready to receive transformers.

C. Perform pre-installation tests and inspections on transformers per manufacturer's instructions and as specified in NECA 409. Correct deficiencies prior to installation.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Perform work in a neat and workmanlike manner in accordance with NECA 1.

B. Install transformers in accordance with manufacturer's instructions.

C. Install transformers in accordance with NECA 409 and IEEE C57.94.

D. Use flexible conduit, under the provisions of Section 16131, 2 feet minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.

E. Arrange equipment to provide minimum clearances as specified on transformer nameplate and in accordance with manufacturer's instructions and NFPA 70.

F. Mount wall-mounted transformers using integral flanges or accessory brackets furnished by the manufacturer.

G. Mount floor-mounted transformers using vibration isolators suitable for isolating the transformer noise from the building structure.

H. Mount trapeze-mounted transformers as indicated.

I. Provide seismic restraints.

J. Provide grounding and bonding in accordance with Section 16060.

K. Remove shipping braces and adjust bolts that attach the core and coil mounting bracket to the enclosure according to manufacturer's recommendations in order to reduce audible noise transmission.

L. Where not factory-installed, install lugs sized as required for termination of conductors as shown on the drawings.

M. Where furnished as a separate accessory, install transformer weathershield per manufacturer's instructions.

N. Install transformer identification nameplate in accordance with Section 16075.

3.03 FIELD QUALITY CONTROL

A. Perform field inspection, testing, and adjusting in accordance with Section 01400.

B. Inspect and test in accordance with NETA STD ATS, except Section 4.

3.04 ADJUSTING

A. Measure primary and secondary voltages and make appropriate tap adjustments.

B. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.05 CLEANING

A. Clean dirt and debris from transformer components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

*****END OF SECTION*****

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SECTION 16412

ENCLOSED SWITCHES

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Conditions apply to this Section.

1.02 SECTION INCLUDES

A. Enclosed safety switches.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2008.

C. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum); National Electrical Manufacturers Association; 2001 (R2006).

D. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2009.

E. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

G. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

H. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.

2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.

3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.

4. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBSTITUTIONS

Substitutions will be considered per Article 3.3 of the Instruction to Bidders of the Bid Package Section 00003.

1.06 SUBMITTALS

A. Provide in accordance with Article 3.11 of the General Conditions.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.

1.07 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed switch internal components, enclosure, and finish.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Eaton Corporation; Cutler-Hammer Products; Model _____: www.eaton.com.

B. General Electric Company; Model _____: www.geindustrial.com.

C. Schneider Electric; Square D Products; Model _____: www.schneider-electric.us.

D. Source Limitations: Furnish enclosed switches and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 ENCLOSED SAFETY SWITCHES

A. Description: Quick-make, quick-break, enclosed safety switches complying with NEMA KS 1, type HD (heavy duty), and listed and labeled as complying with UL 98; ratings, configurations, and features as indicated on the drawings.

B. Provide products listed and labeled by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

C. Horsepower Rating: Suitable for connected load.

D. Voltage Rating: Suitable for circuit voltage.

E. Short Circuit Current Rating:

1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.

2. Minimum Ratings:

a. Switches Protected by Class H Fuses: 10,000 rms symmetrical amperes.

b. Heavy Duty Single Throw Switches Protected by Class R, Class J, Class L, or Class T Fuses: 200,000 rms symmetrical amperes.

c. Double Throw Switches Protected by Class R, Class J, or Class T Fuses: 100,000 rms symmetrical amperes.

F. Provide with switch blade contact position that is visible when the cover is open.

G. Fuse Clips for Fusible Switches: As required to accept fuses indicated.

1. Where NEMA Class R fuses are installed, provide rejection feature to prevent installation of fuses other than Class R.

H. Conductor Terminations: Suitable for use with the conductors to be installed.

I. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.

J. Enclosures: Comply with NEMA KS 1 and NEMA 250, and list and label as complying with UL 50 and UL 50E.

1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:

a. Indoor Clean, Dry Locations: Type 1.

b. Outdoor Locations: Type 3R.

c. Kitchen Areas: NEMA 250, Type 4X, stainless steel.

d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

e. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7C.

2. Finish for Painted Steel Enclosures: Manufacturer's standard, factory applied grey unless otherwise indicated.

K. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.

L. Heavy Duty Switches:

1. Conductor Terminations:

a. Provide mechanical lugs unless otherwise indicated.

b. Lug Material: Copper, suitable for terminating copper conductors only.

2. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.

M. Provide the following features and accessories where indicated or where required to complete installation:

1. Hubs: As required for environment type; sized to accept conduits to be installed.

2. Integral fuse pullers.

3. Auxiliary Switch: SPDT switch suitable for connection to system indicated, with auxiliary contact operation before switch blades open and after switch blades close.

4. Viewing Window: Positioned over switch blades for visual confirmation of contact position with door closed.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that the ratings of the enclosed switches are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive enclosed safety switches.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install enclosed switches in accordance with manufacturer's instructions.

B. Install enclosed switches securely, in a neat and workmanlike manner in accordance with NECA 1.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required supports in accordance with Section 16070.

E. Install enclosed switches plumb.

F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.

3.03 FIELD QUALITY CONTROL

A. Perform field inspection in accordance with Section 01400.

B. Inspect and test in accordance with NETA STD ATS, except Section 4.

C. Perform inspections and tests listed in NETA STD ATS, Section 7.5.1.1.

D. Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.

3.04 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.05 CLEANING

A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

*****END OF SECTION*****

SECTION 16413

ENCLOSED TRANSFER SWITCHES

PART 1 -- GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Conditions apply to this Section.

1.02 GENERAL

A. The automatic transfer switch shall be furnished by the manufacturer of the engine-generator set so as to maintain system compatibility and local service responsibility for the complete emergency power system. It shall be listed by Underwriter's Laboratory, Standard 1008 with fuse or circuit breaker protection. Representative production samples of the transfer switch supplied shall have demonstrated through tests the ability to withstand at least 10,000 mechanical operation cycles. One operation cycle is the electrically operated transfer from normal to emergency and back to normal. Wiring must comply with NEC table 312.6. The manufacturer shall furnish schematic and wiring diagrams for the particular automatic transfer switch and a typical wiring diagram for the entire system.

1.03 RATINGS & PERFORMANCE

A. The automatic transfer switch shall be 3 poles, 208 volts, 1600 amps. It shall be rated for continuous operation in ambient temperatures of -20 degrees Fahrenheit (-30 degrees Celsius) to +140 degrees Fahrenheit (+60 degrees Celsius). Main power switch contacts shall be rated for 600 V AC minimum. The transfer switch supplied shall have a minimum withstand and closing rating when fuse protected of 200,000 amperes. Where the line side over current protection is provided by circuit breakers, the short circuit withstand and closing ratings shall be 65,000 amperes RMS. These RMS symmetrical fault current ratings shall be the rating listed in the UL listing or component recognition procedures for the transfer switch. All withstand tests shall be performed with the over current protective devices located external to the transfer switch.

1.04 CONSTRUCTION

A. The transfer switch shall be double throw construction, positively electrically and mechanically interlocked to prevent simultaneous closing and mechanically held in both normal and emergency positions. Independent break before make action shall be used to positively prevent dangerous source to source connections. When switching the neutral, this action prevents the objectionable ground currents and nuisance ground fault tripping that can result from overlapping designs. The transfer switch shall be approved for manual operation. The electrical operating means shall be by electric solenoid. Every portion of the contactor is to be positively mechanically connected. No clutch or friction drive mechanism is allowed, and parts are to be kept to a minimum. This transfer switch shall not contain integral over current devices in the main power circuit, including molded case circuit breakers or fuses.

B. The transfer switch electrical actuator shall have an independent disconnect means to disable the electrical operation during manual switching. Maximum electrical transfer time in either direction shall be 160 milliseconds, exclusive of time delays. Main switch contacts shall be high pressure silver alloy with arc chutes to resist burning and pitting for long life operation.

C. The transfer switch electrical actuator shall have an independent disconnect means to disable the electrical operation during manual switching. Maximum electrical transfer time in either direction shall be 160 milliseconds, exclusive of time delays. Main switch contacts shall be high pressure silver alloy with arc chutes and separate arcing contacts to resist burning and pitting for long life operation.

1.05 CONTROLS

A. All control equipment shall be mounted on the inside of the cabinet door in a metal lockable enclosure with transparent safety shield to protect all solid state circuit boards. This will allow for ease of service access when main cabinet lockable door is open, but to prevent access by unauthorized personnel. Control boards shall have installed cover plates to avoid shock hazard while making control adjustments. The solid state voltage sensors and time delay modules shall be plug-in circuit boards with silver or gold contacts for ease of service.

B. A solid state under voltage sensor shall monitor all phases of the normal source and provide adjustable ranges for field adjustments for specific application needs. Pick-up and drop-out settings shall be adjustable from a minimum of 70% to a maximum of 95% of nominal voltage. A utility sensing interface shall be used, stepping down system voltage of 208/120 VAC 3 phase to 24VAC, helping to protect the printed circuit board from voltage spikes and increasing personnel safety when troubleshooting.

C. A solid state under voltage sensor shall monitor all phases of the normal source and provide adjustable ranges for field adjustments for specific application needs. Pick-up and drop-out settings shall be adjustable from a minimum of 70% to a maximum of 95% of nominal voltage. A utility sensing interface shall be used, stepping down system voltage of 208/120 VAC 3 phase to 24VAC, helping to protect the printed circuit board from voltage spikes and increasing personnel safety when troubleshooting.

D. Signal the engine-generator set to start in the event of a power interruption. A set of contacts shall close to start the engine and open for engine shutdown. A solid state time delay start, adjustable, .1 to 10 seconds, shall delay this signal to avoid nuisance start-ups on momentary voltage dips or power outages.

E. Transfer the load to the engine-generator set after it reached proper voltage, adjustable from 70-90% of system voltage, and frequency, adjustable from 80-90% of system frequency. A solid state time delay, adjustable from 5 seconds to 3 minutes, shall delay this transfer to allow the engine-generator to warm-up before application of load. There shall be a switch to bypass this warm-up timer when immediate transfer is required.

F. Retransfer the load to the line after normal power restoration. A return to utility timer, adjustable from 1-30 minutes, shall delay this transfer to avoid short term normal power restoration.

G. The operating power for transfer and retransfer shall be obtained from the source to which the load is being transferred. Controls shall provide an automatic retransfer of the load from emergency to normal if the emergency source fails with the normal source available.

H. Signal the engine-generator to stop after the load retransfers to normal. A solid state engine cool down timer, adjustable from 1-30 minutes, shall permit the engine to run unloaded to cooldown before shutdown. Should the utility power fail during this time, the switch will immediately transfer back to the generator.

I. Provide an engine minimum run timer, adjustable from 5-30 minutes, to ensure an adequate engine run period.

J. The transfer switch shall have a time delay neutral feature to provide a time delay, adjustable from .1-10 seconds, during the transfer in either direction, during which time the load is isolated from both power sources. This allows residual voltage components of motors or other inductive loads (such as transformers) to decay before completing the switching cycle. A switch will be provided to bypass all transition features when immediate transfer is required.

K. The transfer switch shall have an in phase monitor which allows the switch to transfer between live sources if their voltage waveforms become synchronous within 20 electrical degrees within 10 seconds of transfer initiation signal. A switch must be provided to bypass this feature if not required.

L. If the in phase monitor will not allow such a transfer, the control must default to time delay neutral operation. Switches with in phase monitors which do not default to time delay neutral operation are not acceptable.

M. Front mounted controls shall include a selector switch to provide for a NORMAL TEST mode with full use of time delays, FAST TEST mode which bypasses all time delays to allow for testing the entire system in less than one minute, or AUTOMATIC mode to set the system for normal operation.

N. Provide bright lamps to indicate the transfer switch position in either UTILITY (white) or EMERGENCY (red). A third lamp is needed to indicate STANDBY OPERATING (amber). These lights must be energized from utility or the engine-generator set.

O. Provide manual operating handle to allow for manual transfer. This handle must be mounted inside the lockable enclosure so accessible only by authorized personnel.

P. Provide a maintenance disconnect switch to prevent load transfer and automatic engine start while performing maintenance. This switch will also be used for manual transfer switch operation.

Q. Provide LED status lights to give a visual readout of the operating sequence. This shall include utility on, engine warm-up, standby ready, transfer to standby, in phase monitor, time delay neutral, return to utility, engine cool down and engine minimum run. A "signal before transfer" lamp shall be supplied to operate from optional circuitry.

1.06 MISCELLANEOUS TRANSFER SWITCH EQUIPMENT

A. The transfer switch mechanism and controls are to be mounted in a NEMA 3R enclosure.

B. The following options are to be provided by the transfer switch manufacturer.

C. A second set of DPDT(form C), 10 ampere, 250 volt auxiliary contacts, operated by the transfer switch mechanism shall be installed.

1.07 SUBSTITUTIONS

Substitutions will be considered per Article 3.3 of the Instruction to Bidders of the Bid Package Section 00003.

1.08 SUBMITTALS

Provide in accordance with Article 3.11 of the General Conditions.

SECTION 16442

SWITCHBOARDS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division1, General Conditions apply to this Section.

1.02 SECTION INCLUDES

A. Switchboards.

1.03 REFERENCE STANDARDS

A. NECA 400 - Standard for Installing and Maintaining Switchboards (ANSI); National Electrical Contractors Association; 2007.

B. NEMA PB 2 - Deadfront Distribution Switchboards; National Electrical Manufacturers Association; 2011.

C. NEMA PB 2.1 - General Instructions for Proper Handling, Installation, Operation, and Maintenance of Deadfront Distribution Switchboards Rated 600 Volts or Less; National Electrical Manufacturers Association; 2007.

D. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2009.

E. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBSTITUTIONS

Substitutions will be considered per Article 3.3 of the Instruction to Bidders of the Bid Package Section 00003.

1.05 SUBMITTALS

A. Provide in accordance with Article 3.11 of the General Conditions.

B. Product Data: Provide electrical characteristics including voltage, frame size and trip ratings, fault current withstand ratings, and time-current curves of all equipment and components.

C. Shop Drawings: For each switchboard and related equipment.

1. Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings. Include the following:

a. Enclosure types and details for types other than NEMA 250, Type 1.

b. Bus configuration, current, and voltage ratings.

c. Short-circuit current rating of switchboards and overcurrent protective devices.

d. Descriptive documentation of optional barriers specified for electrical insulation and isolation.

e. Utility company's metering provisions with indication of approval by utility company.

f. Mimic-bus diagram.

g. UL listing for series rating of installed devices.

h. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

2. Wiring Diagrams: Power, signal, and control wiring.

D. Manufacturer Seismic Qualification Certification: Submit certification that switchboards, overcurrent protective devices, accessories, and components will withstand seismic forces. Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

E. Test Reports: Indicate results of factory production tests.

F. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

G. Project Record Documents: Record actual locations of switchboards.

H. Maintenance Data: Include spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. Enclosure Keys: Two of each different key.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

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

C. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver in 48 inch maximum width shipping splits, individually wrapped for protection and mounted on shipping skids.

B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle in accordance with NEMA PB 2.1 and manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Eaton Corporation; Cutler-Hammer Products; Model _____: www.eaton.com.

B. General Electric Company; Model _____: www.geindustrial.com.

C. Schneider Electric; Square D Products; Model _____: www.schneider-electric.us.

2.02 SWITCHBOARDS

A. Description: NEMA PB 2 switchboard with electrical ratings and configurations as indicated and specified.

B. Main Section Devices: Panel mounted.

C. Distribution Section Devices: Panel mounted.

D. Bus Material: Copper, Hard-drawn copper of 98 percent conductivity of standard size.

E. Bus Connections: Bolted, accessible from front for maintenance.

F. Fully insulate load side bus bars in rear accessible compartments. Do not reduce spacing of insulated bus. Use flame-retardant, spray-applied insulation. Minimum insulation temperature rating: 105 deg C.

G. Main Phase Buses, Neutral Buses, and Equipment Ground Buses: Uniform capacity for entire length of switchboard's main and distribution sections. Provide for future extensions from both ends.

H. Load Terminals: Insulated, rigidly braced, silver-plated, copper runback bus extensions equipped with pressure connectors for outgoing circuit conductors. Provide load terminals for future circuit-breaker positions at full ampere rating of circuit-breaker position.

I. Ground Bus: 1/4-by-2-inch- (6-by-50-mm-) minimum-size, hard-drawn copper of 98 percent conductivity, equipped with pressure connectors for feeder and branch-circuit ground conductors. For busway feeders, extend insulated equipment grounding cable to busway ground connection and support cable at intervals in vertical run. Extend length of switchboard.

J. Insulated Ground Bus: Extend length of switchboard.

K. Neutral Buses: 100 percent of the ampacity of phase buses, unless otherwise indicated, equipped with pressure connectors for outgoing circuit neutral cables. Bus extensions for busway feeder neutral bus are braced.

L. Molded Case Circuit Breakers: Integral thermal and instantaneous magnetic trip in each pole. NEMA AB 3, with interrupting capacity to meet available fault currents.

1. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.
2. Include shunt trip where indicated.
3. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

M. Molded Case Circuit Breakers with Current Limiters: With replaceable current limiting elements; UL listed.

1. Integral thermal and instantaneous magnetic trip in each pole.
2. Include shunt trip where indicated.

N. Current Limiting Molded Case Circuit Breakers: UL listed.

1. Integral thermal and instantaneous magnetic trip in each pole, coordinated with automatically resetting current limiting elements in each pole.

2. Interrupting rating 100,000 rms amperes symmetrical let-through current and energy level less than permitted for same size Class RK-5 fuse.

3. Include shunt trip where indicated.

O. Solid-State Molded Case Circuit Breakers: With electronic sensing, timing and tripping circuits for adjustable current settings; UL listed.

1. Ground fault trip, ground fault sensing integral with circuit breaker.

2. Instantaneous trip.

3. Adjustable long and short time trip.

4. Stationary mounting.

5. Include shunt trip where indicated.

P. Line and Load Terminations: Accessible from the front only of the switchboard, suitable for the conductor materials and sizes indicated.

Q. Ground Fault Sensor: Zero sequence type.

R. Ground Fault Relay: Adjustable ground fault sensitivity from 200 to 1200 amperes, time delay adjustable from 0 to 15 seconds. Provide monitor panel with lamp to indicate relay operation, TEST and RESET control switches.

S. Metering Transformer Compartment: For utility company's use; compartment size, bus spacing and drilling, door, and locking and sealing requirements in accordance with utility company's requirements.

T. Pull Section:

1. Size as shown on Drawings.

2. Arrange as shown on Drawings.

U. Future Provisions: Fully equip spaces for future devices with bussing and bus connections, suitably insulated and braced for short circuit currents. Provide continuous current rating as indicated.

V. Pull Box: Removable top and sides, same construction as switchboard.

1. Size as shown on Drawings.

2. Set front back sufficient distance to accommodate circuit breaker lifting devices.

3. Provide insulating, fire-resistive bottom with separate openings for each circuit to pass into switchboard.

W. Enclosure: Steel, NEMA 250, Type 1 or NEMA 3R..

1. Align sections at front and rear.

2. Switchboard Height: 90 inches, excluding floor sills, lifting members and pull boxes.

3. Finish: Manufacturer's standard light gray enamel over external surfaces. Coat internal surfaces with minimum one coat corrosion-resisting paint, or plate with cadmium or zinc.

2.03 ACCESSORIES

A. Circuit Breaker Lifting Device: Portable, floor supported, elevating carriage with a roller base, for movement of circuit breakers in and out of switchboard structure.

2.04 SOURCE QUALITY CONTROL

A. Shop inspect and test switchboard according to NEMA PB 2.

PART 3 - EXECUTION

3.01 PREPARATION

A. Verify that field measurements are as indicated on shop drawings.

B. Examine elements and surfaces to receive switchboards for compliance with installation tolerances and other conditions affecting performance.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install switchboard in locations shown on drawings, according to NEMA PB 2.1.

B. Install in a neat and workmanlike manner, as specified in NECA 400.

C. Tighten accessible bus connections and mechanical fasteners after placing switchboard.

D. Install and anchor switchboards level on concrete bases, 4-inch (100-mm) nominal thickness minimum.

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around full perimeter of base.
2. For switchboards, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to switchboards.

E. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from switchboard units and components.

F. Operating Instructions: Frame and mount the printed basic operating instructions for switchboards, including control and key interlocking sequences and emergency procedures. Fabricate frame of finished wood or metal and cover instructions with clear acrylic plastic. Mount on front of switchboards.

3.03 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with Section 01400.

B. Inspect and test in accordance with NETA STD ATS, except Section 4.

C. Perform inspections and tests listed in NETA STD ATS, Section 7.1.

3.04 ADJUSTING

A. Adjust all operating mechanisms for free mechanical movement.

B. Tighten bolted bus connections in accordance with manufacturer's instructions.

C. Adjust circuit breaker trip and time delay settings to values indicated.

D. Adjust circuit breaker trip and time delay settings to values as instructed by Architect.

3.05 CLEANING

A. Touch up scratched or marred surfaces to match original finish.

*****END OF SECTION*****

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SECTION 16443

PANELBOARDS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Conditions apply to this Section.

1.02 SECTION INCLUDES

A. Power distribution panelboards.

B. Lighting and appliance panelboards.

C. Overcurrent protective devices for panelboards.

1.03 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; Federal Specification; Revision D, 2006.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.

C. NECA 407 - Standard for Installing and Maintaining Panelboards; National Electrical Contractors Association; 2009.

D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2008.

E. NEMA PB 1 - Panelboards; National Electrical Manufacturers Association; 2011.

F. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less; National Electrical Manufacturers Association; 2007.

G. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2009.

H. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

J. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

K. UL 67 - Panelboards; Current Edition, Including All Revisions.

L. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.

2. Coordinate arrangement of electrical equipment with the dimensions and clearance

requirements of the actual equipment to be installed.

3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.
4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBSTITUTIONS

Substitutions will be considered per Article 3.3 of the Instruction to Bidders of the Bid Package Section 00003.

1.06 SUBMITTALS

A. Provide in accordance with Article 3.11 of the General Conditions.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.

1. Include characteristic trip curves for each type and rating of overcurrent protective device upon request.

C. Shop Drawings: For each panelboard and related equipment.

1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:
   a. Enclosure types and details for types other than NEMA 250, Type 1.
   b. Bus configuration, current, and voltage ratings.
   c. Short-circuit current rating of panelboards and overcurrent protective devices.
   d. UL listing for series rating of installed devices.
   e. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
2. Wiring Diagrams: Power, signal, and control wiring.

D. Manufacturer Seismic Qualification Certification: Submit certification that panelboards, overcurrent protective devices, accessories, and components will withstand seismic forces. Include the following:

1. Basis of Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

E. Source Quality Control Test Reports: Include reports for tests designated in NEMA PB 1 as routine tests.

F. Field Quality Control Test Reports.

G. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

H. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.

I. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

J. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01600 - Product Requirements, for additional provisions.
2. Panelboard Keys: Two of each different key.

K. QUALITY ASSURANCE

1. Conform to requirements of NFPA 70.
2. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

L. DELIVERY, STORAGE, AND HANDLING

1. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.
2. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
3. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Eaton Corporation; Cutler-Hammer Products: www.eaton.com.

B. General Electric Company: www.geindustrial.com.

C. Schneider Electric; Square D Products: www.schneider-electric.us.

D. Source Limitations: Furnish panelboards and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 ALL PANELBOARDS

A. Provide products listed and labeled by Underwriters Laboratories Inc. as suitable for the purpose indicated.

B. Short Circuit Current Rating:

1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
2. Listed series ratings are acceptable, except where not permitted by motor contribution according to NFPA 70.
3. Label equipment utilizing series ratings as required by NFPA 70.

C. Mains: Configure for top or bottom incoming feed as indicated or as required for the

installation.

D. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.

E. Bussing: Sized in accordance with UL 67 temperature rise requirements.

1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
2. Provide 200 percent rated neutral bus and lugs where indicated, where oversized neutral conductors are provided, or where panelboards are fed from K-rated transformers.
3. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
4. Provide separate isolated/insulated ground bus where indicated or where isolated grounding conductors are provided.

F. Conductor Terminations: Suitable for use with the conductors to be installed.

G. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.

1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
   a. Indoor Clean, Dry Locations: Type 1.
   b. Outdoor Locations: Type 3R.
   c. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
   d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
   e. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7C.
2. Boxes: Galvanized steel unless otherwise indicated.
   a. Provide wiring gutters sized to accommodate the conductors to be installed.
   b. Increase gutter space as required where sub-feed lugs, feed-through lugs, gutter taps, or oversized lugs are provided.
   c. Provide removable end walls for NEMA Type 1 enclosures.
   d. Provide painted steel boxes for surface-mounted panelboards where indicated, finish to match fronts.
3. Fronts:
   a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
   b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
   c. Finish for Painted Steel Fronts: Manufacturer's standard grey unless otherwise indicated.
4. Lockable Doors: All locks keyed alike unless otherwise indicated.

H. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

I. Load centers are not acceptable.

2.03 POWER DISTRIBUTION PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution type,

circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:

1. Main and Neutral Lug Material: Copper, suitable for terminating copper conductors only.
2. Main and Neutral Lug Type: Mechanical.

C. Bussing:

1. Phase and Neutral Bus Material: Copper.
2. Ground Bus Material: Copper.

D. Circuit Breakers:

1. Provide bolt-on type.
2. Provide thermal magnetic circuit breakers unless otherwise indicated.
3. Provide electronic trip circuit breakers where indicated.

E. Enclosures:

1. Provide surface-mounted or flush-mounted enclosures as indicated.
2. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
3. Provide clear plastic circuit directory holder mounted on inside of door.

2.04 LIGHTING AND APPLIANCE PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:

1. Main and Neutral Lug Material: Copper, suitable for terminating copper conductors only.
2. Main and Neutral Lug Type: Mechanical.

C. Bussing:

1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
2. Phase and Neutral Bus Material: Copper.
3. Ground Bus Material: Copper.

D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.

E. Enclosures:

1. Provide surface-mounted or flush-mounted enclosures as indicated.
2. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
3. Provide clear plastic circuit directory holder mounted on inside of door.

2.05 OVERCURRENT PROTECTIVE DEVICES

A. Molded Case Circuit Breakers:

1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
2. Interrupting Capacity:
    a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
        1) 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
        2) 14,000 rms symmetrical amperes at 480 VAC.
    b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
    c. Series Rated Systems: Provide circuit breakers listed in combination with upstream devices to provide interrupting rating not less than the short circuit current rating indicated.
3. Conductor Terminations:
    a. Provide mechanical lugs unless otherwise indicated.
    b. Lug Material: Copper, suitable for terminating copper conductors only.
4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
    a. Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.
    b. Provide interchangeable trip units where indicated.
5. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
    a. Provide the following field-adjustable trip response settings:
        1) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
        2) Long time delay.
        3) Short time pickup and delay.
        4) Instantaneous pickup.
        5) Ground fault pickup and delay where ground fault protection is indicated.
6. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
7. Provide listed switching duty rated circuit breakers with SWD marking for all branch circuits serving fluorescent lighting.
8. Provide listed high intensity discharge lighting rated circuit breakers with HID marking for all branch circuits serving HID lighting.
9. Do not use tandem circuit breakers.
10. Do not use handle ties in lieu of multi-pole circuit breakers.
11. Provide multi-pole circuit breakers for multi-wire branch circuits as required by NFPA

70.

12. Provide the following features and accessories where indicated or where required to complete installation:
    a. Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
    b. Handle Pad-Lock Provision: For locking circuit breaker handle in OFF position.

2.06 SOURCE QUALITY CONTROL

A. Factory test panelboards according to NEMA PB 1.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive panelboards.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

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

B. Install panelboards securely, in a neat and workmanlike manner in accordance with NECA 1 (general workmanship), NECA 407 (panelboards), and NEMA PB 1.1.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required supports in accordance with Section 16070.

E. Install panelboards plumb.

F. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.

G. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor or working platform.

H. Provide minimum of six spare 1 inch trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling and below floor.

I. Provide grounding and bonding in accordance with Section 16060.
    1. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on isolated/insulated ground bus.
    2. Terminate branch circuit isolated grounding conductors on isolated/insulated ground bus only. Do not terminate on solidly bonded equipment ground bus.

J. Install all field-installed branch devices, components, and accessories.

K. Multi-Wire Branch Circuits: Group grounded and ungrounded conductors together in the panelboard as required by NFPA 70.

L. Set field-adjustable circuit breaker tripping function settings as directed.

M. Set field-adjustable ground fault protection pickup and time delay settings as directed.

N. Provide filler plates to cover unused spaces in panelboards.

3.03 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.

B. Create a directory to indicate installed circuit loads (after balancing panelboard loads). The Contractor shall be responsible for updating directories to indicate actual area served which is not necessarily the description indicated on the bid documents. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws or rivets.

3.04 FIELD QUALITY CONTROL

A. Perform inspection, testing, and adjusting in accordance with Section 01400.

B. Inspect and test in accordance with NETA STD ATS, except Section 4.

C. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA STD ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than _____ amperes. Tests listed as optional are not required.

D. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.

1. Perform inspections and tests listed in NETA STD ATS, Section 7.14. The insulation-resistance test on control wiring listed as optional is not required.

E. Test GFCI circuit breakers to verify proper operation.

F. Test shunt trips to verify proper operation.

G. Procure services of a qualified manufacturer's representative to observe installation and assist in inspection, testing, and adjusting. Include manufacturer's reports with field quality control submittals.

H. Correct deficiencies and replace damaged or defective panelboards or associated components.

3.05 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust alignment of panelboard fronts.

C. Load Balancing: For each panelboard, rearrange circuits such that the difference between each measured steady state phase load does not exceed 20 percent and adjust circuit directories accordingly. Maintain proper phasing for multi-wire branch circuits.

3.06 CLEANING

A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

*****END OF SECTION*****

SECTION 16510

INTERIOR LIGHTING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Conditions apply to this Section.

1.02 SECTION INCLUDES

A. Interior luminaires.

B. Emergency lighting units.

C. Exit signs.

D. Ballasts.

E. Fluorescent dimming ballasts and controls.

F. Fluorescent emergency power supply units.

G. Lamps.

H. Luminaire accessories.

1.03 REFERENCE STANDARDS

A. ANSI C78.379 - American National Standard for Electric Lamps -- Reflector Lamps -- Classification of Beam Patterns; 2006.

B. ANSI C82.1 - American National Standard for Lamp Ballast - Line Frequency Fluorescent Lamp Ballast; 2004.

C. ANSI C82.4 - American National Standard for Ballasts for High-Intensity-Discharge and Low Pressure Sodium Lamps (Multiple-Supply Type); 2002.

D. ANSI C82.11 - American National Standard for Lamp Ballasts - High Frequency Fluorescent Lamp Ballasts - Supplements; 2011.

E. IEEE C62.41.2 - Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (R2008).

F. IESNA LM-63 - ANSI Approved Standard File Format for Electronic Transfer of Photometric Data and Related Information; 2002 (Reaffirmed 2008).

G. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.

H. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems; National Electrical Contractors Association; 2006.

I. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; National Electrical Contractors Association; 2006.

J. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Fluorescent Ballasts; National Electrical Manufacturers Association; 2011.

K. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; National Electrical Manufacturers Association; 2006.

L. NEMA WD 6 - Wiring Devices - Dimensional Requirements; National Electrical Manufacturers

Association; 2002 (R2008).

M. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

N. NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures; National Fire Protection Association; 2012.

O. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.

P. UL 935 - Fluorescent-Lamp Ballasts; Current Edition, Including All Revisions.

Q. UL 1029 - High-Intensity-Discharge Lamp Ballasts; Current Edition, Including All Revisions.

R. UL 1598 - Luminaires; Current Edition, Including All Revisions.

S. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.

2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.

3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.

4. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

B. ANSI/CEC - National Electrical Code.

C. ANSI/NFPA 101 - Life Safety Code.

D. Title-24 C.C.R.

1.05 SUBSTITUTIONS

Substitutions will be considered per Article 3.3 of the Instruction to Bidders of the Bid Package Section 00003.

1.06 SUBMITTALS

A. Provide in accordance with Article 3.11 of the General Conditions.

B. Shop Drawings: Indicate dimensions and components for each fixture that is not a standard product of the manufacturer.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.

1. Provide electronic files of photometric data certified by a National Voluntary Laboratory Accreditation Program (NVLAP) lab or independent testing agency in IESNA LM-63 standard format upon request.

2. Ballasts: Include wiring diagrams and list of compatible lamp configurations.

3. Lamps: Include rated life, color temperature, color rendering index (CRI), and initial and mean lumen output.

4. Fluorescent Emergency Power Supply Unit: Include list of compatible lamp configurations and associated lumen output.

D. Samples:

1. Provide one sample(s) of each luminaire proposed for substitution upon request.

E. Certificates for Dimming Ballasts: Manufacturer's documentation of compatibility with dimming controls to be installed.

F. Field Quality Control Reports.

G. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

H. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01600 - Product Requirements, for additional provisions.

2. Extra Lenses and Louvers: Two percent of total quantity installed for each type, but not less than one of each type.

3. Extra Lamps: Ten percent of total quantity installed for each type, but not less than two of each type.

4. Extra Ballasts: Two percent of total quantity installed for each type, but not less than one of each type.

J. Project Record Documents: Record actual connections and locations of luminaires and any associated remote components.

1.07 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

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

1.08 DELIVERY, STORAGE, AND PROTECTION

A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting), and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.09 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.10 WARRANTY

A. See Section 01780 - Closeout Submittals, for additional warranty requirements.

B. Provide two year manufacturer warranty for all linear fluorescent ballasts.

C. Provide five year pro-rata warranty for batteries for emergency lighting units.

D. Provide ten year pro-rata warranty for batteries for self-powered exit signs.

E. Provide three year full warranty for fluorescent emergency power supply units.

PART 2 - PRODUCTS

2.01 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

2.02 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products that comply with requirements of NFPA 70 and NFPA 101.

D. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

E. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

F. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.

G. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

H. Recessed Luminaires:

1. Ceiling Compatibility: Comply with NEMA LE 4.
2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
3. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.
4. Air-Handling Recessed Fluorescent Luminaires: Suitable for air supply/return, heat removal, or combination as indicated.

I. Fluorescent Luminaires:

1. Provide ballast disconnecting means complying with NFPA 70 where required.
2. Fluorescent Luminaires Controlled by Occupancy Sensors: Provide programmed start ballasts.
3. Fluorescent Luminaires Controlled by Dual-Level Switching: Provide with stepped-dimming ballast.

2.03 EMERGENCY LIGHTING UNITS

A. Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.

B. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.

C. Battery:

1. Sealed maintenance-free lead calcium unless otherwise indicated.
2. Size battery to supply all connected lamps, including emergency remote heads where indicated.

D. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.

E. Provide low-voltage disconnect to prevent battery damage from deep discharge.

F. Accessories:

1. Provide compatible accessory mounting brackets where indicated or required to complete installation.

2.04 FIXTURE TYPES

A. Furnish products as indicated in Schedule included on the Drawings.

2.05 EXIT SIGNS

A. All Exit Signs: Internally illuminated with LEDs unless otherwise indicated; complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.

1. Number of Faces: Single or double as indicated or as required for the installed location.
2. Directional Arrows: As indicated or as required for the installed location.

B. Exit Signs: Exit sign fixture suitable for use as emergency lighting unit.

1. Provide fixtures complying with NFPA 101.
2. Lamps: LED.
3. Mounting: As indicated.

2.06 BALLASTS

A. All Ballasts:

1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.

B. Fluorescent Ballasts:

1. All Fluorescent Ballasts: Unless otherwise indicated, provide high frequency electronic ballasts complying with ANSI C82.11 and listed and labeled as complying with UL 935.

a. Input Voltage: Suitable for operation at voltage of connected source, with variation tolerance of plus or minus 10 percent.

b. Total Harmonic Distortion: Not greater than 10 percent.

c. Power Factor: Not less than 0.95.

d. Ballast Factor: Normal ballast factor between 0.85 and 1.15, unless otherwise indicated.

e. Thermal Protection: Listed and labeled as UL Class P, with automatic reset for integral thermal protectors.

f. Sound Rating: Class A, suitable for average ambient noise level of 20 to 24

decibels.

g. Lamp Compatibility: Specifically designed for use with the specified lamp, with no visible flicker.

h. Lamp Operating Frequency: Greater than 20 kHz, except as specified below.

1) Do not operate lamp(s) within the frequencies from 30 kHz through 40 kHz in order to avoid interference with infrared devices.

i. Lamp Current Crest Factor: Not greater than 1.7.

j. Lamp Wiring Method:

1) Instant Start Ballasts: Parallel wired.

2) Rapid Start Ballasts: Series wired.

3) Programmed Start Ballasts: Provide parallel or series/parallel wired where available; otherwise series wired is acceptable.

k. Provide automatic restart capability to restart replaced lamp(s) without requiring resetting of power.

l. Provide end of lamp life automatic shut down circuitry for T5 and smaller diameter lamp ballasts.

m. Surge Tolerance: Capable of withstanding characteristic surges according to IEEE C62.41.2, location category A.

n. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of CFR, Title 47, Part 18, for Class A, non-consumer application.

o. Ballast Marking: Include wiring diagrams with lamp connections.

2. Non-Dimming Fluorescent Ballasts:

a. Lamp Starting Method:

1) T8 Lamp Ballasts: Instant start unless otherwise indicated.

2) T5 Lamp Ballasts: Programmed start unless otherwise indicated.

3) Compact Fluorescent Lamp Ballasts: Programmed start unless otherwise indicated.

b. Lamp Starting Temperature: Capable of starting standard lamp(s) at a minimum of 0 degrees F, and energy saving lamp(s) at a minimum of 60 degrees F unless otherwise indicated.

3. Dimming Fluorescent Ballasts:

a. Dimming Range: Continuous dimming from 100 percent to one percent relative light output unless dimming capability to lower level is indicated, without flicker and with even tracking across multiple lamps.

b. Control Compatibility: Fully compatible with the dimming controls to be installed.

c. Lamp Starting Method: Programmed start unless otherwise indicated.

d. Lamp Starting Temperature: Capable of starting lamp(s) at a minimum of 50 degrees F.

e. Dimmed Lamp Starting: Capable of starting lamp(s) at any dimmed preset

without transitioning first to full light output.

4. Bi-Level Stepped Dimming Linear Fluorescent Ballasts:
    a. Bi-Level Operation: Capable of being switched between full light output on all lamps, 50 percent of full light output on all lamps, and all lamps off.
    b. Control Compatibility: Capable of being controlled by standard manual light switches or occupancy sensors unless otherwise indicated.
    c. Lamp Starting Method: Programmed start unless otherwise indicated.
    d. Lamp Starting Temperature: Capable of starting lamp(s) at a minimum of 50 degrees F.

C. High Intensity Discharge (HID) Ballasts: Complying with ANSI C82.4 and listed and labeled as complying with UL 1029.
    1. Electronic Metal Halide Ballasts:
        a. All Electronic Metal Halide Ballasts:
            1) Input Voltage: Suitable for operation at voltage of connected source, with variation tolerance of plus or minus 10 percent.
            2) Total Harmonic Distortion: Not greater than 15 percent.
            3) Power Factor: Not less than 0.90.
            4) Provide thermal protection with automatic reset.
            5) Sound Rating: Class A, suitable for average ambient noise level of 20 to 24 decibels.
            6) Lamp Operating Frequency: Less than 200 Hz or as required to avoid acoustic resonance in lamp arc tube.
            7) Lamp Current Crest Factor: Not greater than 1.5.
            8) Lamp Starting Temperature: Capable of starting standard lamp(s) at a minimum of -22 degrees F.
            9) Provide end of lamp life automatic shut down circuitry.
            10) Surge Tolerance: Capable of withstanding characteristic surges according to IEEE C62.41.2, location category A.
            11) Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of CFR, Title 47, Part 18, for Class A, non-consumer application.

2.07 FLUORESCENT EMERGENCY POWER SUPPLY UNITS

A. Description: Self-contained fluorescent emergency power supply units suitable for use with indicated luminaires, complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.

B. Compatibility:
    1. Ballasts: Compatible with electronic, standard magnetic, energy saving, and dimming AC ballasts, including those with end of lamp life shutdown circuits.
    2. Lamps: Compatible with low-mercury lamps.

C. Operation: Upon interruption of normal power source, solid-state control automatically switches connected lamp(s) to the fluorescent emergency power supply for minimum of 90

minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.

D. Battery: Sealed maintenance-free high-temperature nickel cadmium unless otherwise indicated.

E. Emergency Illumination Output:

1. Luminaires with F32T8 Lamps: Operate two lamp(s) at a minimum of 1350 lumens unless otherwise indicated with indicated illumination evenly divided between the lamps.
2. Luminaires with F28T5 Lamps: Operate one lamp(s) at a minimum of 1325 lumens unless otherwise indicated.
3. Luminaires with F54T5HO Lamps: Operate one lamp(s) at a minimum of 1250 lumens unless otherwise indicated.

F. Diagnostics: Provide accessible and visible multi-chromatic combination test switch/indicator light to display charge, test, and diagnostic status and to manually activate emergency operation.

G. Operating Temperature: From 32 degrees F to 122 degrees F unless otherwise indicated or required for the installed location.

H. Accessories:

1. Include TEST switch and AC ON indicator light, installed to be operable and visible integral to fixture.

2.08 LAMPS

A. Manufacturers:

1. General Electric Company/GE Lighting: www.gelighting.com.
2. Osram Sylvania: www.sylvania.com.
3. Philips Lighting Company: www.lighting.philips.com.
4. Manufacturer Limitations: Where possible, provide lamps produced by a single manufacturer.
5. Where a specific manufacturer or model is indicated elsewhere in the luminaire schedule or on the drawings, substitutions are not permitted unless explicitly indicated.

B. All Lamps:

1. Unless explicitly excluded, provide new, compatible, operable lamps in each luminaire.
2. Verify compatibility of specified lamps with luminaires to be installed. Where lamps are not specified, provide lamps per luminaire manufacturer's recommendations.
3. Minimum Efficiency: Provide lamps complying with all current applicable federal and state lamp efficiency standards.
4. Color Temperature Consistency: Unless otherwise indicated, for each type of lamp furnish products which are consistent in perceived color temperature. Replace lamps that are determined by the Architect to be inconsistent in perceived color temperature.

C. Compact Fluorescent Lamps: Wattage and bulb type as indicated, with base type as required for luminaire.

1. Low Mercury Content: Provide lamps that pass the EPA Toxicity Characteristic Leaching Procedure (TCLP) test for characteristic hazardous waste.
2. Correlated Color Temperature (CCT): 4,100 K unless otherwise indicated.
3. Color Rendering Index (CRI): Not less than 80.
4. Average Rated Life: Not less than 10,000 hours for an operating cycle of three hours per start.

D. Linear Fluorescent Lamps: Wattage and bulb type as indicated, with base type as required for luminaire.

1. Low Mercury Content: Provide lamps that pass the EPA Toxicity Characteristic Leaching Procedure (TCLP) test for characteristic hazardous waste.
2. T8 Linear Fluorescent Lamps:
    a. Correlated Color Temperature (CCT): 4,100 K unless otherwise indicated.
    b. Color Rendering Index (CRI): Not less than 80.
    c. Average Rated Life: Not less than 20,000 hours for an operating cycle of three hours per start.
3. T5 Linear Fluorescent Lamps:
    a. Correlated Color Temperature (CCT): 4,100 K unless otherwise indicated.
    b. Color Rendering Index (CRI): Not less than 80.
    c. Average Rated Life: Not less than 20,000 hours for an operating cycle of three hours per start.

E. High Intensity Discharge (HID) Lamps: Wattage as indicated, with bulb type, burning position, and base type as required for luminaire.

1. Metal Halide Lamps:
    a. Non-Reflector Type Metal Halide Lamps: Phosphor coated lamp finish unless otherwise indicated.
    b. Provide ANSI type O-rated protected metal halide lamps where required for open luminaires provided with compatible exclusionary sockets.
    c. Ceramic Metal Halide Lamps:
        1) Correlated Color Temperature (CCT): 4,000 K unless otherwise indicated.
        2) Color Rendering Index (CRI): Not less than 80.

F. Lamp Types: As specified for each fixture.

2.09 ACCESSORIES

A. Stems for Suspended Luminaires: Steel tubing, minimum 1/2" size, factory finished to match luminaire or field-painted as directed.

B. Threaded Rods for Suspended Luminaires: Zinc-plated steel, minimum 1/4" size, field-painted as directed.

C. Provide accessory plaster frames for luminaires recessed in plaster ceilings.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 16138 as required for installation of luminaires provided under this section.

B. Install products according to manufacturer's instructions.

C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 1 (general workmanship), NECA 500 (commercial lighting), and NECA 502 (industrial lighting).

D. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

E. Suspended Ceiling Mounted Luminaires:

1. Do not use ceiling tiles to bear weight of luminaires.
2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.
3. Secure pendant-mounted luminaires to building structure.
4. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
5. In addition to ceiling support wires, provide two galvanized steel safety wire(s), minimum 12 gage, connected from opposing corners of each recessed luminaire to building structure.
6. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.

F. Recessed Luminaires:

1. Install trims tight to mounting surface with no visible light leakage.
2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.

G. Suspended Luminaires:

1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.

3. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet in length, with no more than 4 feet between supports.
4. Install canopies tight to mounting surface.
5. Unless otherwise indicated, support pendants from swivel hangers.

H. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

I. Install fixtures securely, in a neat and workmanlike manner, as specified in NECA 500 and 502.

J. Surface Mounted Fixtures: Install plumb and square and aligned with building lines and with each other; secure to prevent movement.

K. Wall Mounted Fixtures: Install at height as indicated on the drawings.

L. Install accessories furnished with each luminaire.

M. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within fixture.

N. Bond products and metal accessories to branch circuit equipment grounding conductor.

O. Air Handling Luminaires: Interface with air handling accessories furnished and installed under Section 15840.

P. Fluorescent Luminaires Controlled by Dual-Level Switching: Connect such that each switch controls the same corresponding lamps in each luminaire.

Q. Emergency Lighting Units:

1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.

R. Exit Signs:

1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.

S. Fluorescent Emergency Power Supply Units:

1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal ballast(s) in luminaire. Bypass local switches, contactors, or other lighting controls.

T. Remote Ballasts: Install in accessible location as indicated or as required to complete installation, using conductors per manufacturer's recommendations not exceeding manufacturer's recommended maximum conductor length to luminaire.

U. Install lamps in each luminaire.

V. Lamp Burn-In: Operate lamps at full output for prescribed period per manufacturer's recommendations prior to use with any dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.

W. Install in accordance with manufacturer's instructions.

X. Install specified lamps in each luminaire, emergency lighting unit and exit sign.

Y. Verify all ceiling types and provide lighting fixtures with suitable mounting hardware for mounting in or on subject ceiling.

Z. Surface Mounted Fluorescent Fixtures: Where fixtures are indicated for installation on

low-density cellulose fiberboard (see room finish schedule on drawings), provide 1-1/2" insulation, unless UL approved for mounting directly to the ceiling material.

AA. Properly support and align fixtures and provide all necessary steel shapes for support of the fixtures. Coordinate complete fixture installation with the building construction.

AB. Where special fixtures to be used in special ceiling are scheduled, verify all ceiling systems and coordinate fixture type and accessories prior to ordering fixtures. Coordinate and cooperate with ceiling supplier in the preparation of ceiling system Shop Drawings.

AC. Install fluorescent fixtures as recommended by the manufacturer or as necessary to provide exact horizontal alignment, preventing horizontal or vertical deflection on angular jointing of fixtures suspended in continuous rows.

AD. Two-lamp ballasts shall be allowed to feed single lamps in tandem fixtures and shall be properly identified to show which lamps are fed from this ballast by markers on the fixture and the ballast. Provide the quantity and type of ballasts required to achieve switching configuration indicated on the drawings.

3.04 FIELD QUALITY CONTROL

A. See Section 01400 - Quality Requirements, for additional requirements.

B. Inspect each product for damage and defects.

C. Operate each luminaire after installation and connection to verify proper operation.

D. Test self-powered exit signs, emergency lighting units, and fluorescent emergency power supply units to verify proper operation upon loss of normal power supply.

E. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

F. Each fluorescent fixture when initially energized shall be left on continuously for 100 consecutive hours to properly burn in fluorescent lamps.

3.05 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.

B. Aim and position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as required or as directed by Architect or authority having jurisdiction.

C. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Architect or authority having jurisdiction.

D. Aim and adjust fixtures as indicated.

E. Position exit sign directional arrows as indicated.

3.06 CLEANING

A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

B. Clean electrical parts to remove conductive and deleterious materials.

C. Remove dirt and debris from enclosures.

D. Clean photometric control surfaces as recommended by manufacturer.

E. Clean finishes and touch up damage.

3.07 CLOSEOUT ACTIVITIES

A. See Section 01780 - Closeout Submittals, for closeout submittals.

B. Demonstration: Demonstrate proper operation of luminaires to Architect, and correct deficiencies or make adjustments as directed.

C. Just prior to Substantial Completion, replace all lamps that have failed.

3.08 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

3.09 SCHEDULE - SEE DRAWINGS

*****END OF SECTION*****

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SECTION 16520

EXTERIOR LIGHTING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Conditions apply to this Section.

1.02 SECTION INCLUDES

A. Exterior luminaires.

B. Ballasts.

C. Lamps.

D. Poles and accessories.

1.03 REFERENCE STANDARDS

A. ANSI C78.379 - American National Standard for Electric Lamps -- Reflector Lamps -- Classification of Beam Patterns; 2006.

B. ANSI C82.1 - American National Standard for Lamp Ballast - Line Frequency Fluorescent Lamp Ballast; 2004.

C. ANSI C82.4 - American National Standard for Ballasts for High-Intensity-Discharge and Low Pressure Sodium Lamps (Multiple-Supply Type); 2002.

D. ANSI C82.11 - American National Standard for Lamp Ballasts - High Frequency Fluorescent Lamp Ballasts - Supplements; 2011.

E. ANSI O5.1 - American National Standard for Wood Poles -- Specifications and Dimensions; 2008.

F. IEEE C2 - National Electrical Safety Code; 2012.

G. IEEE C62.41.2 - Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (R2008).

H. IESNA LM-63 - ANSI Approved Standard File Format for Electronic Transfer of Photometric Data and Related Information; 2002 (Reaffirmed 2008).

I. IESNA RP-8 - American National Standard Practice for Roadway Lighting; Illuminating Engineering Society of North America; 2000(R2005) (ANSI/IES RP8).

J. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.

K. NECA/IESNA 501 - Recommended Practice for Installing Exterior Lighting Systems; 2006.

L. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

M. UL 935 - Fluorescent-Lamp Ballasts; Current Edition, Including All Revisions.

N. UL 1029 - High-Intensity-Discharge Lamp Ballasts; Current Edition, Including All Revisions.

O. UL 1598 - Luminaires; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate placement of poles and associated foundations with utilities, curbs, sidewalks, trees, walls, fences, striping, etc. installed under other sections or by others. Coordinate elevation to obtain specified foundation height.

2. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

B. Coordination: Furnish bolt templates and pole mounting accessories to installer of pole foundations.

1.05 SUBSTITUTIONS

Substitutions will be considered per Article 3.3 of the Instruction to Bidders of the Bid Package Section 00003.

1.06 SUBMITTALS

A. Provide in accordance with Article 3.11 of the General Conditions.

B. Shop Drawings:

1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.

2. Provide photometric calculations where luminaires are proposed for substitution upon request.

3. Provide structural calculations for each pole proposed for substitution.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, weight, effective projected area (EPA), and installed accessories; include model number nomenclature clearly marked with all proposed features.

1. Provide electronic files of photometric data certified by a National Voluntary Laboratory Accreditation Program (NVLAP) lab or independent testing agency in IESNA LM-63 standard format upon request.

2. Lamps: Include rated life and initial and mean lumen output.

3. Poles: Include information on maximum supported effective projected area (EPA) and weight for the design wind speed.

D. Samples:

1. Provide one sample(s) of each luminaire proposed for substitution upon request.

E. Certificates for Poles and Accessories: Manufacturer's documentation that products are suitable for the luminaires to be installed and comply with designated structural design criteria.

F. Field Quality Control Reports.

1. Include test report indicating measured illumination levels.

G. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

H. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01600 - Product Requirements, for additional provisions.
2. Extra Lamps: Ten percent of total quantity installed for each type, but not less than two of each type.
3. Extra Ballasts: Two percent of total quantity installed for each type, but not less than one of each type.
4. Extra Fuses: Five percent of total quantity installed for each type, but not less than two of each type.
5. Touch-Up Paint: 2 gallons, to match color of pole finish.

J. Project Record Documents: Record actual connections and locations of pole foundations, luminaires, and any pull or junction boxes.

1.07 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

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

D. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Receive, handle, and store products according to NECA/IESNA 501 and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

C. Receive, handle, and store wood poles in accordance with ANSI O5.1.

PART 2 - PRODUCTS

2.01 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the Drawings.

2.02 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, poles, foundations, supports, trims, accessories, etc. as necessary for a complete operating system.

F. Provide products suitable to withstand normal handling, installation, and service without any

damage, distortion, corrosion, fading, discoloring, etc.

G. Provide luminaires listed and labeled as suitable for wet locations unless otherwise indicated.

2.03 BALLASTS

A. All Ballasts:

1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.

B. Fluorescent Ballasts: Unless otherwise indicated, provide high frequency electronic ballasts complying with ANSI C82.11 and listed and labeled as complying with UL 935.

1. Input Voltage: Suitable for operation at voltage of connected source, with variation tolerance of plus or minus 10 percent.
2. Total Harmonic Distortion: Not greater than 20 percent.
3. Power Factor: Not less than 0.95.
4. Thermal Protection: Listed and labeled as UL Class P, with automatic reset for integral thermal protectors.
5. Sound Rating: Class A, suitable for average ambient noise level of 20 to 24 decibels.
6. Lamp Compatibility: Specifically designed for use with the specified lamp, with no visible flicker.
7. Lamp Operating Frequency: Greater than 20 kHz, except as specified below.
    a. Do not operate lamp(s) within the frequencies from 30 kHz through 40 kHz in order to avoid interference with infrared devices.
8. Lamp Current Crest Factor: Not greater than 1.7.
9. Lamp Wiring Method:
    a. Instant Start Ballasts: Parallel wired.
    b. Rapid Start Ballasts: Series wired.
    c. Programmed Start Ballasts: Provide parallel or series/parallel wired where available; otherwise series wired is acceptable.
10. Lamp Starting Method:
    a. T8 Lamp Ballasts: Instant start unless otherwise indicated.
    b. T5 Lamp Ballasts: Programmed start unless otherwise indicated.
    c. Compact Fluorescent Lamp Ballasts: Programmed start unless otherwise indicated.
11. Provide automatic restart capability to restart replaced lamp(s) without requiring resetting of power.
12. Provide end of lamp life automatic shut down circuitry for T5 and smaller diameter lamp ballasts.
13. Surge Tolerance: Capable of withstanding characteristic surges according to IEEE C62.41.2, location category A.
14. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of CFR, Title 47, Part 18, for Class A, non-consumer

application.

15. Ballast Marking: Include wiring diagrams with lamp connections.

C. High Intensity Discharge (HID) Ballasts: Unless otherwise indicated, provide electromagnetic ballasts complying with ANSI C82.4 and listed and labeled as complying with UL 1029.

1. Input Voltage: Suitable for operation at voltage of connected source, with variation tolerance of plus or minus 5 percent.
2. Power Factor: Not less than 0.90 unless otherwise indicated.

2.04 LAMPS

A. Manufacturers:

1. General Electric Company/GE Lighting: www.gelighting.com.
2. Osram Sylvania: www.sylvania.com.
3. Philips Lighting Company: www.lighting.philips.com.
4. Substitutions: See Section 01600 - Product Requirements.
5. Manufacturer Limitations: Where possible, provide lamps produced by a single manufacturer.
6. Where a specific manufacturer or model is indicated elsewhere in the luminaire schedule or on the drawings, substitutions are not permitted unless explicitly indicated.

B. All Lamps:

1. Unless explicitly excluded, provide new, compatible, operable lamps in each luminaire.
2. Verify compatibility of specified lamps with luminaires to be installed. Where lamps are not specified, provide lamps per luminaire manufacturer's recommendations.
3. Minimum Efficiency: Provide lamps complying with all current applicable federal and state lamp efficiency standards.
4. Color Temperature Consistency: Unless otherwise indicated, for each type of lamp furnish products which are consistent in perceived color temperature. Replace lamps that are determined by the Architect to be inconsistent in perceived color temperature.

C. Lamp Types: As specified for each luminaire.

2.05 POLES

A. All Poles:

1. Provide poles and associated support components suitable for the luminaire(s) and associated supports and accessories to be installed.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 16138 as required for installation of luminaires provided under this section.

B. Install products according to manufacturer's instructions.

C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 1 (general workmanship) and NECA/IESNA 501 (exterior lighting).

D. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

E. Pole-Mounted Luminaires:

1. Foundation-Mounted Poles:

a. Provide cast-in-place concrete foundations for poles as indicated, in accordance with Section 03300.

1) Install anchor bolts plumb per template furnished by pole manufacturer.

2) Position conduits to enter pole shaft.

b. Install foundations plumb.

c. Install poles plumb, using leveling nuts or shims as required to adjust to plumb.

d. Tighten anchor bolt nuts to manufacturer's recommended torque.

e. Install non-shrink grout between pole anchor base and concrete foundation, leaving small channel for condensation drainage.

f. Install anchor base covers or anchor bolt covers as indicated.

2. Grounding:

a. Bond luminaires, metal accessories, metal poles, and foundation reinforcement to branch circuit equipment grounding conductor.

3. Install separate service conductors, 12 AWG copper, from each luminaire down to handhole for connection to branch circuit conductors.

F. Install accessories furnished with each luminaire.

G. Bond products and metal accessories to branch circuit equipment grounding conductor.

H. Provide concrete bases for lighting poles at locations indicated.

I. Install lamps in each luminaire.

J. Bond luminaires, metal accessories, and metal poles to branch circuit equipment grounding conductor.

3.04 FIELD QUALITY CONTROL

A. See Section 01400 - Quality Requirements, for additional requirements.

B. Inspect each product for damage and defects.

C. Operate each luminaire after installation and connection to verify proper operation.

D. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

E. Measure illumination levels to verify conformance with performance requirements. Take measurements during night sky, without moon or with heavy overcast clouds effectively obscuring moon.

3.05 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.

B. Luminaires with Field-Rotatable Optics: Position optics according to manufacturer's instructions to achieve lighting distribution as indicated or as directed by Architect.

C. Aim and adjust luminaires to provide illumination levels and distribution indicated on Drawings.

3.06 CLEANING

A. Clean surfaces according to NECA/IESNA 501 and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

B. Clean electrical parts to remove conductive and deleterious materials.

C. Remove dirt and debris from enclosure.

D. Clean photometric control surfaces as recommended by manufacturer.

E. Clean finishes and touch up damage.

3.07 CLOSEOUT ACTIVITIES

A. See Section 01780 - Closeout Submittals, for closeout submittals.

B. See Section 01820 - Demonstration and Training, for additional requirements.

C. Demonstration: Demonstrate proper operation of luminaires to Architect, and correct deficiencies or make adjustments as directed.

D. Just prior to Substantial Completion, replace all lamps that have failed.

3.08 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

3.09 SCHEDULE - SEE DRAWINGS

*****END OF SECTION*****

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SECTION 16570

AUTOMATIC LIGHTING CONTROL SYSTEM

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Conditions apply to this Section.

1.02 SCOPE OF WORK

A. Provide and design an automatic lighting control system as described in this specification and as called for on the drawings.

1.03 QUALITY ASSURANCE

A. Manufacturer shall have a minimum of 10 years experience in manufacturing and installing this type of system.

B. All components and assemblies are to be pre-tested and assembled at the factory prior to installation.

C. Provide a factory-trained technician on site. The technician shall functionally test each component in the system after installation to verify proper operation and confirm that the panel wiring and addressing conform to the wiring documentation.

1.04 SUBSTITUTIONS

Substitutions will be considered per Article 3.3 of the Instruction to Bidders of the Bid Package Section 00003.

1.05 SUBMITTALS

A. Provide in accordance with Article 3.11 of the General Conditions.

B. The following list includes the required shop drawings and product data information that shall be submitted.

1. Underwriters Laboratories, Inc. (UL) listing and factory test reports.
2. Internal and system wiring diagrams.
3. Single line diagram of the system configuration. Typical riser diagrams are not acceptable.
4. Dimensions of the equipment layout.
5. Control wiring and conduits layout and connections.
6. Floor plans to scale showing the location of each device and equipment.
7. Product data of all the components including but not limited to programmable central controllers, transceivers panels, input relays, switches and other ancillary equipment.

1.06 REFERENCES

A. UL 916 Energy Management Equipment.

B. FCC Emissions Standards specified in Part 15, subpart J for Class A, Applications.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Provide and microprocessor controlled relay panels for the Lighting Control System. The system shall include programmable standalone master panel, switch inputs, wiring, power supplies, relays and ancillary relays.

B. Panels shall be capable of standing alone or operating as part of a network.

1. The system shall provide intelligence to operate as follows:

a. Store all user operating data.

b. Initiate all relay output commands based on:

1) Operator inputs

2) Automatic operating schedule

3) Binary type field sensors

4) Universal override switch inputs

5) Internal 56K Baud modem

c. Provide automatic system diagnostics and alarming based on detected faults in the controller, transceiver panels, relays, and data line.

2. System shall include a memory back up to be able to survive an indefinite length of power failure.

C. Lighting Control Panel (LCP): Microprocessor based, complete prewired assemblies consisting of the following:

1. Stand alone panel controller capable of receiving and acting upon programs downloaded from the central computer. Programs downloaded from the network shall be capable of continuing to operate even if the network should fail. Battery Back up provides 8 days of memory retention. Panel shall be part of a system that can control up to 750 relays and receive up to 500 switch inputs. Panel shall have an USB input for local programming and trouble shooting from a laptop computer.

2. Internal digital clock with self control power.

3. Output modules: Plug in type to receive coded digital commands from the panel controller and pulse output relays to the appropriate state. Actual status feedback of the relays are to be fed back to the panel controller and from there to the central computer. Actual status of each relay is to be indicated by a pilot LED on the control board. Each Module controls 8 or 16 relays.

4. Switch input modules: Plug-in type, actuated by remote external contact closures. These contact closures may be either momentary or maintained. The action of the contact is noted by the panel controller and acted upon as programmed by software. The action of the contact can command any group of output relays to the desired state. Either 8 or 24-input channels as shown on the plans.

5. Output Relays

a. Type: Momentary pulsed, mechanically latched with pilot light contact.

b. Rating: 20 Ampere, 277VAC

c. Number per panel: 16,32 or 48 as required to satisfy this project scope.

6. The low voltage and high voltage sections of the lighting control cabinet shall be separated by a 14 gage steel barrier in which the relays are mounted. In areas where both 120 volt and 277 volt loads are present the high voltage compartment shall have a 14 gage steel barrier between the relays that carry 120 VAC and the

relays that carry 277VAC. Each section shall be clearly labeled as to the voltage in that compartment.

7. Panel power supply shall be dual primary 115/277 volts AC, 60 Hz. ± 10%. Low voltage side shall be protected from power line surges and spikes on the input power. The low voltage section shall be protected against short circuit faults and relay failures.
8. Panels shall be UL approved and shall have a short circuit withstand current rating at 14,000 AIC.
9. Manufacturer: Lighting Control and Design, or G.E. or equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. The Lighting Control System shall be installed and wired completely as required by the equipment manufacturer by the contractor, who shall make all necessary wiring connections to the lighting fixtures, override switches, photo cells and equipment.

B. The Contractor shall provide on-site programming time with factory-trained personnel for the system set-up. The Contractor shall set up the software program and program the entire system in accordance with the Owner's instructions.

C. Documentation

1. Accurate "as-built" drawings shall be provided by the Contractor. These shall indicate the load controlled by each relay and the identification number for that switch connected to an input and the identification number of that input. Three sets of space plans or reflected ceiling plans shall be provided by the contractor indicating which fixtures are controlled by each relay.
2. A separate data grade private line with RJ45 jack shall be furnished for each modem.

3.02 SERVICE AND SUPPORT

A. Startup: After the system has been installed, the Contractor shall provide the services of a factory trained representative of the manufacturer to verify correct operation of all system components. The contractor shall guarantee all material and workmanship involving the system for three years after startup.

B. Training: After system startup and after all the programming is completed, the Contractor shall arrange for a factory trained representative to train the Owner's personnel. The trainer shall instruct the Owner's personnel in how to program the system and demonstrate a typical operating program for an area. The Contractor shall allow for 24 hours' instruction time for the Owner's training.

C. Factory Support: Factory support shall be available free of charge during the three-year warranty period to answer programming and application questions. The manufacturer, or his representative, shall have a remote terminal capable of programming the system to support the Owner's personnel during this period. The Contractor shall include a modem, necessary cabling and telephone extension to support this telecommunications operation. The Contractor shall provide a three-year maintenance service contract as part of the cost.

D. The Contractor shall also provide a software site licensing so that the Owner will be able to transfer the software program from the main computer to the other computers. This transfer shall not be an extra cost to the Owner.

*****END OF SECTION*****

SECTION 270000

COMMON COMMUNICATIONS REQUIREMENTS

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Conditions apply to this Section.

1.02 SUMMARY

This Section includes the general administrative and procedural requirements for Division 27; it supplements, but does not replace, administrative requirements specified in Divisions 01.

A. The requirements described herein include the following:

1. Inclusion of Division 27 sections in the general contract
2. References
3. Definitions
4. Resolution to conflicts between divisions, specifications sections and drawings
5. Submittals
6. Quality Assurance
7. Delivery, storage, and handling
8. Construction site management, coordination and administration
9. Warranty
10. Product Substitutions
11. Permits, licenses, inspections, and fees
12. Field Quality Control

B. Related Documents

1. Division 00 Procurement and Contracting Requirements
2. Division 01 General Requirements
3. Division 02 Site Work
4. Division 03 Concrete as pertained to material requirements in the construction of communications underground pathway and spaces construction
5. Division 05 Metals as pertained to supports and braces for communications cable trays, sleeves, conduits, cabling, access panels, et cetera
6. Division 06 Wood, Plastics, and Composites as pertained to backing, fasteners, anchorage, fabrications, et cetera for structural support of communications equipment
7. Division 07 Thermal and Moisture Protection as pertained to membrane clamps, sheet metal flashing, caulking, sealant, et cetera as required for damp-proofing, waterproofing and fireproofing of conduit penetrations or openings for communications pathway systems
8. Division 08 Openings as pertained to accesses to communications pull and junction boxes, cable trays, et cetera for installation and maintenance of communications

cabling systems

9. Division 09 Finishes as pertained to priming and finish coating of backboards in telecommunications spaces, exposed conduit, pull and junction boxes, et cetera
10. Division 10 as pertained to provisions of adequate and appropriate telecommunications pathway system per Riverside County Information Technology (RCIT) Telecommunications Standards for communications cabling to service fire protection equipment, et cetera
11. Division 11 Equipment as pertained to provisions of adequate and appropriate telecommunications pathway system per Riverside County Information Technology (RCIT) Telecommunications Standards for communications cabling to service equipment
12. Division 12 Furnishings as pertained to provisions of adequate and appropriate telecommunications pathway system per Riverside County Information Technology (RCIT) Telecommunications Standards for communications cabling to service equipment
13. Division 13 Special Construction as pertained to provisions of adequate and appropriate telecommunications pathway system per Riverside County Information Technology (RCIT) Telecommunications Standards for communications cabling to service fabricated engineered structures; and to use and construction of fabricated seismic control components and manufactured seismic control assemblies for communications pathway systems and equipment, such as conduits cable trays, relay racks, cabinets, et cetera
14. Division 14 Conveying Equipment as pertained to provisions of adequate and appropriate telecommunications pathway system per Riverside County Information Technology (RCIT) Telecommunications Standards for communications cabling to service elevators, dumbwaiters, et cetera
15. Division 21 Fire Suppression as pertained to provisions of fire suppression systems in telecommunications spaces
16. Division 22 Plumbing as pertained to no piping shall enter or pass through any telecommunications spaces
17. Division 23 Heating, Ventilating, and Air Conditioning (HVAC) as pertained to environmental control systems in telecommunications spaces
18. Division 25 Integrated Automation as pertained to provisions of adequate and appropriate telecommunications pathway system per Riverside County Information Technology (RCIT) Telecommunications Standards for communications cabling to automation equipment
19. Division 26 Electrical as pertained to provisions of adequate and appropriate electrical systems in telecommunications rooms and spaces per Riverside County Information Technology (RCIT) Telecommunications Standards for proper operation of communications equipment
20. Division 28 Electronic Safety and Security as pertained to provisions of adequate and appropriate telecommunications pathway system per Riverside County Information Technology (RCIT) Telecommunications Standards for communications cabling to electronic safety and security equipment
21. All other Divisions as pertained to inter-trade coordination to produce a complete and operable installation in compliance of communications standards specified herein; for example, plumbing piping shall not pass through any telecommunications rooms, adequate accessibility to communications cable tray per Riverside County Information Technology (RCIT) Telecommunications Standards, et cetera

22. Riverside County Information Technology *Telecommunications Infrastructure Specifications,* latest revision prior to bid award

1.03 INCLUSION OF DIVISION 27 SECTIONS IN GENERAL CONTRACT

Section Number	Section Description	Inclusion
27 05 26.01	Telecommunications Grounding and Bonding Backbone System	Yes
27 05 28.01	In-Building Telecommunications Pathways for Voice, Data and Video Communications Cabling	Yes
27 05 29	Hangers and Support for Voice and Data Communications Systems	No
27 05 33	NOT USED	
27 05 36	NOT USED	
27 05 39	Surface Raceways for Communications Systems	Yes
27 05 43	Underground Ducts and Raceways for Communications Systems	Yes
27 05 46	Utility Poles for Communications Systems	Yes
27 05 48	Vibration and Seismic Controls for Communications Systems	Yes
27 11 00	Telecommunications Spaces Fittings	No
27 11 13	Communications Entrance Protection	No
27 11 16	Communications Cabinets, Racks, Frames, and Enclosures	No
27 11 19	Communications Termination Blocks and Patch Panels	No
27 11 23	Communications Cable Management and Ladder Racks	No
27 11 26	Communications Rack Mounted Power Protection and Power Strips	No
27 13 13	Communications Voice Copper Backbone Cabling	No
27 13 23	Communications Data Optical Fiber Backbone Cabling	No
27 13 33	Communications Coaxial Backbone Cabling	No
27 13 43	Communications Services Cabling (Except cabling for use by the General Contractor and its subs during construction)	No
27 15 00.16	Voice Communications Horizontal Cabling	No

27 15 00.19	Data Communications Horizontal Cabling	No
27 15 00.23	Audio-Video Communications Horizontal Cabling	No
27 15 23.04	CATV Optical Fiber Horizontal Cabling	No
27 15 33.02	CATV Television Coaxial Horizontal Cabling	No
27 15 43.01	Voice, Data, and CATV Communications Faceplates and Connectors	No
27 15 43.02	All Other Communications Faceplates and Connectors	Yes
27 41 16.28	Integrated Audio-Video Systems and Equipment for Conference Rooms	No
27 41 16.29	Integrated Audio-Video Systems and Equipment for Board Rooms	No
27 41 16.62	Integrated Audio-Video Systems and Equipment for Auditoriums	No

1.04 REFERENCES

A. General

1. Referenced publications, including their respective amendments, addenda, revisions, supplements, or errata, or all, form a part of the specifications to the extent as deemed applicable by Riverside County Department of Information Technology (RCIT) and by a reasonable person who is experienced in the construction trade in general and in telecommunications infrastructure design, installation and inspection in particular.
2. Unless otherwise noted, codes and standards documents adopted and published prior to submittal of the bid shall form a part of this specification section and be considered fully and entirely repeated herein.

B. Codes

Perform Work and furnish materials and equipment in compliance with applicable federal and California State regulatory and statutory requirements, Riverside County and other municipal ordinances, including but not limited to the following:

1. The Office of the Federal Register Code of Regulations, Title 29, Part 1910 *Occupational Safety and Health Standards*
2. California Code of Regulations
3. Title 8, *General Industrial Safety Orders*
4. Title 24, *California Building Standards Code*
5. Riverside County Ordinance No. 787, An Ordinance of the County of Riverside Adopting the 2010 California Fire Code as Amended
6. Ordinances and municipal codes issued by all other authority/authorities having jurisdiction(s) over the Work.

C. Standards

Perform Work and furnish materials and equipment in conformance with the following:

1. National Fire Protection Agency (NFPA) 75, Standard for the Protection of Information Technology Equipment
2. NFPA 780, Standard for the Installation of Lightning Protection Systems
3. National Electrical Manufacturers Association (NEMA) VE 2-2006, Cable Tray Installation Guidelines
4. American National Standards Institute (ANSI)/J-STD-607-A, Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
5. Motorola R56, Standards and Guidelines for Communications Sites
6. Institute of Electrical and Electronics Engineers, Inc. (IEEE)
    a. Std. 81, IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System
    b. Std. 142, IEEE Recommended Practice for Grounding of Industrial and Commercial Power System
    c. Std.1100, IEEE Recommended Practice for Powering and Grounding Electronic Equipment
    d. C2-2007 National Electrical Safety Code
7. American National Standards Institute/Telecommunications Industry Association/Electronic Industries Alliance (ANSI/TIA/EIA)-568-C, Generic Telecommunications Cabling Standard
8. ANSI/TIA/EIA-569-B, Commercial Building Standards for Telecommunications Pathways and Spaces
9. ANSI/TIA/EIA-758, Customer-Owned Outside Plant Telecommunications Cabling Standard
10. ANSI/TIA/EIA-942, Telecommunications Infrastructure Standards for Data Centers
11. ANSI/TIA-1005, Telecommunications Infrastructure for Industrial Premises
12. TIA-1179 Healthcare Infrastructure Standard
13. Underwriters Laboratories (UL) listings and ratings, including:
    a. UL 96A, Installation Requirements for Lightning Protection Systems
    b. UL 444, Communications Cables
    c. UL 1651, Optical Fiber Cable
    d. UL 1655, Community Antenna Television Cable
    e. UL 1963, Communications Circuit Accessories
14. Building Industry Consulting Services International (BICSI)
    a. Telecommunications Distribution Methods Manual
    b. Outside Plant Design Reference Manual
    c. Electronic Safety and Security Design Reference Manual
    d. Information Technology Systems Installation Methods Manual
15. ANSI/NECA/BICSI 568 Standard for Installing Commercial Building Telecommunications Cabling
16. ANSI/BICSI 002-2011, Data Center Design and Implementation Best Practices

1.05 DEFINITIONS

A. The Definitions of Division 01 shall apply to all Division 27 sections.

B. Unless otherwise set forth in meaning in Division 01 or Division 27, all terms shall be defined using the documents referenced in 1.3 of this section as the sources for terms pertaining to matters each document governs respective that are part of, accidental to, or associated with, the Work delineated and specified in Division 27.

C. For standard American English words that are not defined in Division 01, Division 27 or cited references, http://www.merriam-webster.com and the Merriam-Webster's Collegiate Dictionary, 11th Edition shall be used as the source for definition of terms in their ordinarily accepted meanings within the context in which they are used. Where there are conflicts of definitions in the above cited sources, Riverside County Information Technology shall determine the one that is most appropriately applicable to the Work.

D. List of specific terms as used in Division 27 sections:

1. The Work: Complete and fully functional telecommunications pathway system(s), telecommunications spaces, and telecommunications grounding and bonding system, lightning protection system, et cetera, as specified within Division 27, including the associated acceptance testing, certifications and As-Built documentation.

2. The Contractor: The General Contractor who has been awarded with a contract for the building construction; the General Contractor's subcontractor responsible for the Work under Division 27.

3. Provide: Supply, furnish, deliver, install, pull, fix, dress, terminate, label, test, ground and document the components as such to conform to the requirements specified in this Specifications Section.

4. Products: Components installed for delivery of the Work defined in the Scope of Work prepared for each specific project.

5. Shop Drawings: Detailed construction and fabrication drawings that show the proposed material, shape, size, and assembly of the parts and how the entire unit will be installed.

6. Telecommunications Space: Any room or space dedicated to house equipment for system operations of voice, data, video, access controls, CATV, or CCTV, to include main point of entry room, server room, radio room, control room, and switch room, et cetera

1.06 RESOULTION TO CONFLICTS BETWEEN SPECIFICATIONS SECTIONS AND DRAWINGS

A. General administrative and procedural requirements in Division 01 take precedence over those in Division 27.

B.

C. Unless otherwise specifically noted, codes and standards documents specified in Division 27 shall form a part of specified requirements for work that pertain to communications systems under all other Divisions; the codes and standards documents specified in Division 27 shall be considered fully and entirely repeated therein.

D.

E. Division 27 and communications drawings takes precedence over all other divisions in specifications for communications systems as well as utilities intended to support communications cabling (i.e. conduits, cable trays, sleeves, et cetera) and telecommunications spaces (i.e. air conditioning units, floor loading, electrical requirements, et cetera). In circumstances where discrepancies of quantity exist, the highest count in any

division governs with no exceptions.

F.

G. Division 27 also governs the materials and installation practices for communications wiring systems required to support equipment specified in Divisions 10, 11, 14, 21, 23, 25, 26, 28; and all requirements in Division 27 shall be considered fully and entirely repeated therein.

1.07 SUBSTITUTIONS

Substitutions will be considered per Article 3.3 of the Instruction to Bidders of the Bid Package Section 00003.

1.08 SUBMITTALS

A. Provide in accordance with Article 3.11 of the General Conditions.

B. In addition to submittal procedures, requirements, format, and quantity specified in Divisions 01 and 26, comply with the requirements specified herein with no exceptions.

C. Product Data and Fabrications

1. For review and approval of RCIT and the electrical engineer on record, submit the product information of every component or system installed to support communications cabling system; for example: cable trays, conduits, raceways, back boxes, pull boxes, firestopping materials, manholes, handholes, et cetera.

2. For review and approval of RCIT and the mechanical and electrical engineer on record, submit the product information of every piece of electrical and mechanical equipment to be installed in the telecommunication spaces; for example: air conditioning unit, uninterruptable power supplies, et cetera).

3. Submit manufacturer's technical specifications including physical and dimensional information, performance data, test data, et cetera. Use arrows to indicate items being submitted; identify optional accessories that are included and excluded.

4. Submit associated and incidental products needed to comprise a complete system installation.

D. Seismic Calculations

1. For review and approval of the architect on record and structural engineer on record, submit seismic calculations prepared by a structural engineer licensed in the State of California; for example: anchorage calculations for floor-mounted and wall-mounted racks and equipment cabinets, support mechanisms for cable trays, et cetera.

2. Submit anchorage calculations for fully loaded equipment racks, frames and cabinets conforming with California Code of Regulation, Title 24, and all requirements as deemed necessary by the structural engineer on record.

3. All seismic calculations shall be prepared by a structural engineer licensed to practice in California, with wet stamp and we signature.

E. Shop Drawings

1. Submit shop drawings for proposed installation if it differs from the Contract Document or the design intent. Clearly identify and justify the deviations for review and consideration by RCIT and the engineers on record.

2. Shop drawing shall consist of floor plans, reflected ceiling plans where applicable, enlarged room plans, elevations, isometric projection taking into account components of all trades affected, and any other additional drawings as deemed necessary by the engineers on record or by RCIT upon review of the submitted shop drawings.

F. Resubmitted Shop Drawings

1. Cloud all revisions made to each drawing in response to engineers' review comment; provide narratives

G. As-Built Record Drawings

1. Notwithstanding requirements specified in Division 01, submit one full set of record drawings in PDF, and another set in AutoCAD drawings, both on CD-ROM. All CAD files shall be submitted in either AutoCAD 2000, or newer, ".dwg" format; the file naming convention shall be consistent with that of the construction bid documents.
2. The as-built record drawings shall clearly identify all components installed inside and outside the buildings to support communications cabling system, including, but not limited to, manholes, handholes, vaults, underground conduits, cable trays, sleeves, conduits, junction-boxes, outlet boxes, pull boxes, access panels, raceways, poke-thru devices, floor boxes, slots, wall openings, firestopping locations, et cetera.
3. The as-built record drawings for service areas shall include plan view layout drawings depicting junction boxes provisioned for communications outlets.
4. The as-built record drawings for telecommunications spaces (that is, telecom rooms, server rooms, main point of entry (MPOE) rooms, data centers, et cetera) shall include enlarged floor plans, depicting all supporting utilities installed in the room; for example, air conditioning units, electrical panels, et cetera.
5. The as-built drawings for vertical pathway system shall include a single line diagram depicting how telecommunications spaces are connected using cable trays, sleeves and conduits.
6. The as-built record drawings for telecommunications grounding and bonding record drawings shall include a single line diagram and a plan view drawings, depicting routing and locations of m, and where and how it is connected to the main building ground system.
7. The as-built record drawings for outside plant pathway system shall include plan view, sections, profile, and isometric drawings to depict pertinent information, including, but not limited to, depth of all installed conduits and spaces, slope, other utilities in proximity within five feet.
8. Use the same project title block, text fonts and sizes, symbols, et cetera as those provided in the Contract Documents.

1.09 QUALITY ASSURANCE

A. Materials

1. All materials shall be new, unused, without defects, and in conformance with the requirements and regulations by the State Fire Marshal, Riverside County Fire Department, and all other authorities having jurisdiction over the project.
2. Notwithstanding code requirements, materials and workmanship shall meet or exceed
those specified in
3. Use only specified products, unless otherwise submitted and approved through submittal process according to Division 01 requirements; under no circumstance shall the quality be any lesser than those required by code and by requirements specified in Division 27.

B. Workmanship

4. All work shall be performed in compliance with the most stringent, applicable statutory and regulatory requirements, industry best installation practices, including but not limited to those cited in the references under this and other Divisions.

C. Interpreting Construction Drawings

5. The drawings for the Work within Division 27 are a diagrammatic representation of the design intent and depict only the general pathway routing and location of outlets.

6. The drawings are not dimensioned and do not show every sleeve, conduit, access panel, pull box, accessory, et cetera required to comprise a complete and functional pathway system.

7. Notwithstanding the diagrammatic nature of the contract drawings, Contractor shall furnish and install a completely functional pathway system to cohere with the design intent. For example, if a section of cable tray goes through a hard lid ceiling area, Contractor shall furnish and install an access panel whether or not it is depicted, because without it cables cannot be placed in the cable tray and the pathway is not functional; or if a segment of conduits has more than two 90-degree turns, an appropriately sized pull box shall be provisioned whether or not it is depicted, because without it the pathway does not meet the requirements of the ANSI/TIA/EIA 569 standards document as specified.

1.010 DELIVERY, STORAGE AND HANDLING

A. Refer to Divisions 01 and 26 for all specified requirements as though fully and entirely repeated herein.

B. Notwithstanding provisions in Divisions 01 and 26, Contractor shall not store any materials, equipment, construction tools, et cetera in any telecommunications rooms and spaces.

1.011 CONSTRUCTION MANAGEMENT, COORDINATION AND ADMINISTRATION

A. Designate a construction engineer to coordinate with other trades whose work may have impacts on the completeness, functionality and operability of a telecommunications pathway system as defined and specified in this Division. The responsibilities include, but are not limited to, the following:

1. Perform a thorough review(s) on the shop drawings prepared by all other trades (electrical, mechanical, plumbing, et cetera); redline, document, resolve, and remove any potential conflicts and deficiencies that might impact construction of a complete telecommunications pathway system and telecommunications spaces to meet all requirements as specified in this Division. Examples of discrepancies and deficiencies: plumbing pipes going through a telecommunications space; air duct(s) in excess of 8 feet in length or in width directly above any cable tray section, effectively blocking access for placement of communications cables in the cable tray; missing penetration sleeves through firewalls, prohibiting placement of communications cabling through the shortest path from a workstation to the designated telecommunications room.

2. Coordinate with other contractors hired the County to perform work not in the scope of general scope contract; for example, voice and data communications cabling, et cetera.

3. Coordinate job site access with all telecommunications services providers from whom the County has ordered services.

4. Coordinate

1.012 WARRANTY

A. Refer to Divisions 01 and 26 for all specified requirements as though fully and entirely repeated herein.

PART 2 – PRODUCTS

2.01 GENERAL

A. Contractor shall use materials, tools, equipment, et cetera that meet the requirements established or adopted by regulatory agencies; and safety standards set by testing and certification organizations, including but not limited to, the following:

1. United States Environmental Protection Agency; California State Environmental Protection Agency; Riverside County Environmental Protection Agency
2. United States Occupational Safety and Health Administration; California State Occupational Safety and Health Administration
3. California Building Standards Commission
4. United States Occupational Safety and Health Administration; California Occupational Safety and Health Administration
5. Riverside County ordinances
6. Ordinances of any municipal governments having jurisdiction over any portion of the Work defined in this Division
7. Underwriters Laboratories

B. Manufacturer names, models and part numbers used in this Division are intended to demonstrate the acceptable level of performance and quality of the products to be used for the Work. Contractor may propose to use products by other manufacturers through the submittal process as defined in Division 01, provided that the proposed products are of equal or more superior in quality, technical characteristics and performance criteria.

C. Notwithstanding provisions in Division 01, to establish product equivalency or superiority, Contractor shall provide all technical data and other supporting documents, including a copy of test results issued by the same certification organization of the originally specified products, et cetera, in the Contractor's first, and only one, submittal.

D. Any proposed products rejected by the County shall be final, unless the Contractor submits, within the timeline as defined in Division 01, an original certification letter(s) from the same certification organization of the originally specified products, certifying that it has performed the necessary certification test(s) and determined that the proposed product(s) and the specified product(s) are of equivalent quality; or that the proposed product(s) is of superiority quality than the specified product(s).

PART 3 - EXECUTION

3.01 PERMITS, LICENSES, INSPECTIONS, AND FEES

A. Refer to Division 01 for specified requirements for permits, licenses, inspections, and fees.

3.02 WORKMANSHIP

A. The Work shall be performed in a neat and workmanlike manner.

B. Conform to applicable code requirements as interpreted by the County and any other governing bodies having jurisdiction over the Work.

C. Execute work in accordance with all referenced standards documents.

D. Install all products in compliance with the respective manufacturer's installation guidelines.

3.03 EXAMINATION

A. Review areas of potential interference and resolve conflicts before proceeding with the work.

B. Examine areas and conditions under which the system is to be installed. Do not proceed with the Work until satisfactory conditions have been achieved.

3.04 FIELD QUALITY CONTROL

A. Refer to Division 01 for field quality control.

3.05 INSTALLATION

A. Comply with manufacturer's installation instructions.

B. Coordinate with all other trades to ensure that their work does not create deficient conditions for any of the work in Division 27, whether or not such work within the Contractor's scope.

C. Perform work according to applicable installation standards published by BICSI, NECA and NEMA as appropriate.

3.06 PUNCH ITEMS

A. All punch items shall be corrected within ten working days.

*****END OF SECTION *****

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SECTION 270110

IN-BUILDING TELECOMMUNICATIONS PATHWAY SYSTEM FOR VOICE, DATA AND VIDEO COMMUNICATIONS CABLING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Conditions apply to this Section.

1.02 SUMMARY

A. This section includes the technical requirements for materials and installation of an interior telecommunications pathway system, which comprises cable trays, conduits, utility poles, raceways, poke-thru devices, pull boxes, junction boxes, et cetera; specifically excluded are cable hangers.

B. Refer to administrative requirements in Section 27 00 00 as though fully and entirely repeated herein.

C. The requirements described herein include the following:

1. References
2. Definitions
3. System description

D. Related documents:

1. Comply with the Related Documents requirements of Section 27 00 00.
2. Section 27 05 26.01 – Grounding and Bonding for Communications Systems
3. Section 27 11 00 – Telecommunications Room Fittings

1.03 REFERENCES

A. Refer to cited references in Section 27 00 00 as though fully and entirely repeated herein.

B. Publications listed below, including their respective amendments, addenda, revisions, supplements, and errata, form a part of the specifications to the extent as deemed applicable to the Work by RCIT and by a reasonable person who is experienced in the construction trade in general and in pathway system installation and inspection in particular.

1. California Building Code
2. ANSI/NEMA FB-1-2012 *Fittings, Cast Metal Boxes and Conduit Bodies for Conduit, Electrical Metallic Tubing (EMT) and Cable*
3. ANSI/TIA/EIA-569-B *Commercial Building Standard for Telecommunications Pathways and Spaces*
4. American Society for Testing and Materials (ASTM) International:
    a. ASTM A1011 / A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
    b. ASTM A123 / A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
    c. ASTM A510 - Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel

d. ASTM A513 - Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing

e. ASTM A580 – Standard Specification for Stainless Steel Wire

f. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel

g. ASTM A641 / A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire

h. ASTM A653 / A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Gal annealed) by the Hot-Dip Process.

i. ASTM D769 - Standard Specification for Black Synthetic Iron Oxide

j. ASTM B 633 Specifications for Electrodeposited Coatings of Zinc on Iron and Steel

k. ASTM A653 Specifications for Steel Sheet, Zinc-Coated (Galvanized) by Hot Dip Process

l. ASTM A591 Specifications for Electrodepositing Coatings of Zinc on steel wire or sheets.

m. ASTM A123 Specifications for Zinc (Hot Galvanized) Coatings on Iron and Steel.

5. BICSI Telecommunications Distribution Methods Manual

6. National Electrical Manufacturers Association:

   a. NEMA VE 1 - Metal Cable Tray Systems.

   b. NEMA VE 2-2006 – Cable Tray Installation Guidelines

   c. NEMA FB2.10 Selection and Installation Guidelines for Fittings for Use with Non-Flexible Electrical Metal Conduit or Tubing (Rigid Metal Conduit, Intermediate Metal Conduit and Electrical Metallic Tubing)

   d. NEMA FB2.20 Selection and Installation Guidelines for Fittings for Use with Flexible Electrical Metal Conduit and Cable

1.04 DEFINITIONS

A. Definitions as described in Section 27 00 00 shall apply to this section.

B. Unless otherwise set forth in meaning, all terms shall be defined using the respective documents referenced as the sources for terms pertaining to matters each document governs that are part of, accidental to, or associated with, the Work delineated and specified in Division 27.

C. List of specific terms as used in this section:

1. Cable tray: A cable support and management system made of continuous, rigid, welded steel wire mesh; available in different sizes.

2. Cable hangers: A curved piece of metal used to hold and suspend communications cables; commonly known as J-hooks and U-hooks in the construction industry.

3. Conduit: Rigid and electrical metallic tubing, minimum 1-inch trade size.

4. Conduit system: Any combination of ducts, conduits, junction boxes, pull boxes, and penetration sleeves joined to form an integrated whole.

5. Junction box: A location in the pathway system that allows transition of pathways and

access to cables.

6. Pathway: A facility for the placement of telecommunications cabling from the workstation area to the cross-connection point in a designated telecommunications room.
7. Outlet box: Housing used to hold telecommunications outlet/connectors.
8. Poke-thru device: An assembly that allows through-penetration of floor decking with telecommunication cables, or power, or both, while maintaining the fire-rating integrity of the floor.
9. Pull box: A housing located in a pathway run used to facilitate the placing of wire or cables.
10. Sleeved conduit: A conduit going through purpose-cored opening of wall the wall, ceiling or floor to allow passage of cables.
11. Through penetration: A continuous opening that passes through both surfaces of a fire-rated barrier.
12. Work area: A building space where the occupants perform business functions; or a designated space to locate voice, data or video communications equipment.

1.05 SYSTEM DESCRIPTION

A. The Work under this section includes materials and labor to install and document a complete functional telecommunications pathway system to facilitate placement of voice, data and video cabling from workstation area to the designated telecommunications spaces.

B. The Telecommunications Pathways consists of overhead cable tray system; electrical metallic tubing and associated fittings and fastening accessories; poke-thru devices and floor boxes; pull boxes and junction boxes; under-floor cable tray system; in-slab raceway system; connecting point with outside plant pathway system; underground conduit or ducting system in building; sleeves and conduit system on rooftops; outlet boxes in slab, on wall, in ceiling void, at every building space designated as work area, and at any location occupants will interact with non-wireless voice, data or video equipment. In other words, any and all pathways required to facilitate placement of telecommunications systems in the building as required by regulatory code, by municipal ordinance, or as deemed required by codes and ordinances the interpretation of jurisdiction having authority over this project

C. Construction of telecommunications pathway system shall comply with ANSI/TIA/EIA-569-B *Commercial Building Standard for Telecommunications Pathways and Spaces* and BICSI *Telecommunications Distribution Methods Manual*, of the most current edition, respectively.

D. Where conduit runs contain the equivalent of two 90-degree bends, or are longer than 100 feet in length, appropriately-sized pull boxes shall be provisioned in conveniently accessible locations, that is, in ceiling void of hallways and corridors. Conduits shall enter and exit a pull from opposite sides; and no conduit fittings shall be used in lieu of a pull box. Follow the guideline below to select proper size of pull box:

Conduit Trade Size	Pull Box Size			Width Increase for Additional Conduit (in)
	Min Width (in)	Min Length (in)	Min Depth (in)	
1	4	16	3	2
1¼	6	20	3	3
1½	8	27	4	4
2	8	36	4	5
2½	10	42	5	6
3	12	48	5	6
4	15	60	8	8

E. Pull boxes shall not be used in lieu of bends.

F. Each wall-mounted or ceiling-mounted telecommunications outlet for a typical work area of general business operations requiring voice and data applications shall be provisioned with one (1) 4-11/16 " x 4-11/16" x 2-1/8"D, 42 cubic inch back box and one (1) 1-inch trade size EMT conduit.

G. Each floor-mounted telecommunications outlet for typical work area of general business operations requiring voice and data applications shall be provisioned with the following:

1. An adequately-sized floor box, or a compartment of a joint-use floor box, with 3-inch minimum depth behind the device plate and with a volume of 42-cubic-inch or more, fitted with one (1) 1-1/4-inch continuous conduit that is routed from the said floor box to the closest ceiling void of the same floor (in other words, the conduits cannot be routed to the floor below); or

2. A purpose-made, specialty poke-thru device that will accommodate up to four (4) Category 6 connectors; fitted with one (1) 1-1/4-inch continuous conduit that is routed from the said floor box to the closest ceiling void of the same floor without any (in other words, the conduits cannot be routed to the floor below) this device can be one for joint use with electrical receptacles.

H. Unless a certain floor box or poke-thru device is specified, or it is specifically noted on the architectural drawing that no floor box or poke-thru device is required, any space designated as conference room shall be provisioned with one floor-mounted telecommunication floor box or a poke-thru device every one hundred square feet; the conduit requirements shall be the same as for a floor box or a poke-through device at a general work area.

I. Furnish and provide access panels for access

1.06 SUBSTITUTIONS

Substitutions will be considered per Article 3.3 of the Instruction to Bidders of the Bid Package Section 00003.

1.07 SUBMITTALS

A. Provide in accordance with Article 3.11 of the General Conditions. Refer to Division 01 and Section 27 00 00 and comply with requirements specified therein.

B. Submit computer-generated test records of measured soil resistance values for inclusion into the Operation and Maintenance Manual.

1.08 QUALITY ASSURANCE

A. Refer to Division 01 and Section 27 00 00; comply with requirements specified therein.

B. Refer to Division 01 for personnel training requirements.

C. Comply with CEC, NEMA and NFPA installation requirements.

1.09 DELIVERY, STORAGE AND HANDLING

A. Refer to Section 27 00 00 and comply with requirements specified therein.

1.010 WARRANTY

A. Provide warranty for a period of 5 years; correct deficiencies within 24 hours of notification.

PART 2 - PRODUCTS

2.01 GENERAL

A. All materials used in the installation shall be new and shall comply in weight, size and

composition as required by manufacturer; be labeled and listed by Underwriters for use in electrical grounding; and be compliant with all applicable referenced standards.

2.1 CABLE TRAY

A. Acceptable manufacturers

1. Cablofil "EZ-Tray" series
2. 8319 Route 4
   Mascoutah, IL62258
3. Tel: (618) 566-3244
4. Fax: (618) 566-3250
5. Chatsworth Products "OnTrac" series
6. 31425 Agoura Road
   Westlake Village, CA 91361
7. Tel: (818) 735-6100
   Fax: (818) 735-6199
8. Cooper B-Line "WB" series
9. 509 West Monroe Street
   Highland, IL 62249
   Tel: (800) 851-7415
   Fax: (800) 356-1438

B. Cable trays shall be of basket type, UL-listed, made of steel wires and formed into a standard 2-inch by 4-inch or 2-inch by 2-inch wire mesh pattern. Wire intersections shall be welded and wire ends along sides (flanges) shall be rounded to prevent damage to cables.

C. Field fabrication may not be used in lieu of manufactured fittings.

D. Cable trays shall be supported at 5-ft intervals.

E. Unless specifically noted otherwise, cable tray size shall be 24" in width.

F. Grounding of cable trays shall be continuous; use #6 AWG ground straps to bond joining cable tray sections.

G. sections of pre-galvanized steel accessories grounded in their entire lengths Grounding straps Terminal support and cable support for attachment on tray of continuous ground

2.02 ELECTRICAL METALLIC TUBING (EMT) AND FITTINGS

A. Acceptable manufacturers:

1. Allied Tube and Conduit Co.
2. Triangle PWC, Inc.
3. Western Tube and Conduit Corp.
4. Spring City Electrical Manufacturing Co.
5. Appleton Electric Co.
6. OZ/Gedney
7. Thomas & Betts Corp.
8. Spring City Electrical Manufacturing Co.
9. Crouse Hinds.

B. Conduits shall be formed of cold rolled strip steel, electrical resistance welded continuously

along the longitudinal seam and hot dip galvanized after fabrication. Connectors and couplers shall be shall be of compression, electroplate steel.

2.03 GALVANIZED RIGID STEEL CONDUIT (GRS)

A. Conduits shall be full weight, threaded, hot-dip galvanized steel. Standard threaded couplings, locknuts, bushings and elbows shall be made of steel. Locknuts shall be bonding type with sharp edges for digging into the metal wall of an enclosure.

B. All fittings and connectors shall be threaded.

2.04 LIQUIDTIGHT FLEXIBLE METALLIC CONDUIT (LFMC)

A. Conduits shall be fabricated in continuous lengths from galvanized steel strips, interlocking spirally wound, covered with extruded liquid tight jacket of polyvinyl chloride (PVC) and conforming to UL 360. Provide conduit with a continuous copper-bonding conductor wound spirally between the convolutions.

B. Connector body and gland nut shall be of cadmium plated steel or cast malleable iron, with tapered, male, threaded hub; insulated throat and neoprene "O" ring gasket recessed into the face of the stop nut. The clamping gland shall be of molded nylon with an integral brass push-in ferrule.

2.05 OUTLET BOXES

A. Wall-mounted telecommunications outlet box shall be one-piece die formed or drawn steel, minimum size 4-11/16" x 4-11/16" x 2-1/8"D, furnished with and a single-gang mud ring one (1) 1-inch conduit from outlet to ceiling void.

B. Floor-mounted telecommunications outlet box shall be inset in slab and of stamped steel, minimum size 4"W x 5½" L x 3-5/8"D and furnished with one (1) 1¼" conduit from outlet to ceiling void of the same floor and a single-gang mud ring.

2.06 COMMUNICATION POKE-THRU DEVICES

A. Poke-thru devices shall be manufactured by Wiremold/Legrand (no known equivalent products).

B. Unless otherwise specified, furnish and install a model that accommodates up to eight (8) telecommunications Category 6 cables per device.

PART 3 - EXECUTION

3.01 GENERAL

A. Comply with the Execution requirements of Section 27 00 00.

B. Work shall conform to California Building Code and referenced standards specified; the most stringent requirement shall prevail should there be any discrepancies, unless otherwise ruled by RCIT Engineering.

C. Identify and label firestopping and components according to local codes, Division 26 requirements, and RCIT Engineering standards.

D. Install components to manufacturer's instructions and recommendations and as required per UL listing.

E. Terminations must be easily accessible for inspection and maintenance of the system.

1.1 EXAMINATION AND PREPARATION

A. Prior to commencing work specified in this section, examine and coordinate with all trades to ensure readiness and that all inter-trade conflicts are resolved.

1.2 INSTALLATION PRACTICES

A. Cable tray

1. Install cable tray system in accordance with manufacturer's instructions; comply with California Building Code, NEMA, and NECA requirements.
2. Use only splice connectors, support components, and other accessories by the same manufacturer. Bends shall have a minimum of a 12" bend radius. Install radius shields at each bend/corner of "T" type intersections and cross intersections, and blind ends where cable tray termination is exposed.
3. Supports cable tray sections with dual support hangers, trapeze hangers or wall brackets at every 48-inch interval. Ensure supporting mechanism is reviewed and approved by the architect and the structural engineer on record.
4. Ground cable tray system per California Electrical Code 70 Article 250. Provide approved connection bolt to join system. Provide external grounding strap at expansion joints, sleeves, crossovers, and at other locations where system continuity is interrupted.
5. Test cable tray system according to NFPA 70B, Chapter 18, for testing and test methods.

B. Metallic Tubing and Fittings

1. Install metallic conduits in stud walls, furred spaces, crawl spaces and hardwood ceiling to facilitate placement of communications cables.
2. Coordinate with ductwork, plumbing, ceiling and wall construction in the same areas to ensure conduits do no cross other piping or block access to any equipment.
3. Install conduits in groups in parallel vertical or horizontal runs and at elevations to avoid offsets.
4. Conduits shall be run parallel or at right angles to the centerlines of columns and beams.
5. Do not place conduits closer than 12 inches to a flue, parallel hot water, steam line or any other heat producing sources; maintain three inches clearance from such lines when crossing perpendicularly
6. Exposed conduit installation shall not encroach into the ceiling height headroom of walkways, or doorways.
7. Install horizontal runs above water and below steam piping.
8. Support every pull box from structure independent of conduit supports (Pull boxes are not indicated on the Drawings).
9. Provide every reasonably inferred standard conduit fitting and accessory required to meet the intended application whether or not noted, indicated or specified in the Contract Documents.
10. Minimum conduit size for wall-mounted outlet is 1" and for floor-mounted outlet is 1¼".
11. Fire-stop, water-stop and moisture-stop all conduits according to Division 26 requirements.

*****END OF SECTION*****

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SECTION 270526

TELECOMMUNICATIONS GROUNDING AND BONDING BACKBONE SYSTEMS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Conditions apply to this Section

1.02 SUMMARY

A. This section includes the technical requirements for materials and installation of a telecommunications grounding and bonding system, comprising the telecommunications backbone (TBB) system which is interconnected to the grounding electrode system by means of bonding the telecommunications main busbar (TMGB) to the electrical main grounding busbar.

B. Refer to administrative requirements in Section 27 00 00 as though fully and entirely repeated herein.

C. The requirements described herein include the following:

1. References
2. Definitions
3. System description
4. Related documents:

D. Comply with the Related Sections requirements of Section 27 00 00.

1.03 REFERENCES

A. Refer to cited references in Section 27 00 00 as though fully and entirely repeated herein.

B. Publications listed below, including their respective amendments, addenda, revisions, supplements, and errata, form a part of the specifications to the extent as deemed applicable to the Work by RCIT and by a reasonable person who is experienced in the construction trade in general and in grounding and lightning protection system design, installation and inspection in particular.

1. California Code of Regulation
    a. Title 24, California Building Code
2. Telecommunications Industry Association, (TIA)
    b. ANSI-TIA-607-B *Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises*
    c. ANSI/TIA/EIA-606-B *Administration Standard for Telecommunications Infrastructure*
3. Bellcore (Telcordia)
    a. GR-1089-CORE, Electromagnetic Compatibility and Electrical Safety
    b. GR-63-CORE, Physical Protection
4. Institute of Electrical and Electronics Engineers, Inc. (IEEE)
    a. Std. 81, IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System

b. Std. 142, IEEE Recommended Practice for Grounding of Industrial and Commercial Power System

c. IEEE 467, IEEE Recommended Practice for Grounding of Industrial and Commercial Power Systems

d. Std.1100, IEEE Recommended Practice for Powering and Grounding Electronic Equipment

e. C2-2007 National Electrical Safety Code

5. Motorola

   a. R56 Standard and Guidelines for Communications Sites, current edition

6. National Electrical Contractors Association

   a. ANSI/NECA/BICSI 568-2006 Standard for Installing Commercial Building Telecommunications Cabling, current edition

7. National Fire Protection Association (NFPA)

   a. NFPA 780, Standard for the Installation of Lightning Protection Systems, 2008

   b. NFPA 70, National Electric Code, current edition

8. Underwriters Laboratories, Inc. (UL)

   a. UL 96A, Installation Requirements for Lightning Protection Systems

   b. 44-2005, Thermoset-Insulated Wires and Cables

   c. 83-2003, Thermoplastic-Insulated Wires and Cables

   d. 467-2004, Grounding and Bonding Equipment

   e. 486A-486B-2003, Wire Connectors

1.04 DEFINITIONS

A. Definitions as described in Section 27 00 00 shall apply to this section.

B. Unless otherwise set forth in meaning, all terms shall be defined using the respective documents referenced as the sources for terms pertaining to matters each document governs that are part of, accidental to, or associated with, the Work delineated and specified in Division 27.

C. List of specific terms as used in this section:

1. Bond: To join metallic parts to form an electrically conductive path.

2. Bonding: The joining of metallic parts to form an electrically conductive path.

3. Bonding conductor: A conductor that joins metallic parts to form an electrically conductive path.

4. Bonding conductor for telecommunications: An appropriately sized conductor that interconnects the telecommunication bonding infrastructure to the building's main electrical busbar.

5. Bonding network (telecommunications): A set of interconnected conductive structures that provides a low impedance path for the associated telecommunications infrastructure.

6. Common bonding network: The set of metallic components which are interconnected to form principle means for effectively bonding equipment inside a building to the grounding electrode system.

7. Connect: To join metallic parts to form an electrically conductive path.
8. Customer premises: Building(s), communications towers, grounds and appurtenances (belongings) under the control of the County of Riverside.
9. Ground: A conducting connection, whether intentional or accidental, between an electrical circuit (e.g., telecommunications) or equipment and the earth, or to some conducting body that serves in place of earth.
10. Grounding: The act of creating a ground.
11. Grounding conductor: A conductor used to connect the grounding electrode to the building's main grounding busbar (MGB).
12. Telecommunications grounding and bonding system: A system which connects various pieces of conductive telecommunications equipment together to keep them at the same potential, by means of establishing an electrical connection to the earth. The design and implementation of this system shall conform to applicable regulatory codes, ordinances, and industry standards, including UL 96A, NFPA 780, Motorola R56, Bellcore (Telcordia), and ANSI-J-STD-607-B. This infrastructure interconnects telecommunications systems and electrical systems.
13. Grounding electrode: A conductor, usually a rod, pipe or plate (or group of conductors) in direct contact with the earth for the purpose of providing a low-impedance connection to the earth.
14. Grounding electrode system: One or more grounding electrodes that are connected together.
15. Grounding equalizer: The conductor that interconnects elements of the telecommunications grounding system.
16. Lighting Protection System (LPS): A system designed and installed by the Contractor. It is part of the grounding system to protect the radio tower, the building, and other structures from damage due to lightning strikes by intercepting and passing safely their voltage current to grounding. It includes all components designed and installed to mitigate fire hazards by means of providing a low resistance path to ground for potential strikes. The design and implementation of this system conforms to applicable regulatory codes, ordinances, and industry standards, including UL 96A, NFPA 780, Motorola R56, Bellcore (Telcordia), and ANSI/TIA-607-B standards.
17. Telecommunications: Any transmission, emission, and reception of signs, signals, writings, images, and sounds, that is, information of any nature by cable, radio, optical, or other electromagnetic systems.
18. Telecommunications bonding backbone (TBB): A conductor that interconnects all the telecommunications grounding busbars (TGBs) with the telecommunications main grounding busbar (TMGB).
19. Telecommunications grounding busbar (TGB): The grounding connection point for telecommunications systems and equipment served by a telecommunications room, equipment room, server room, data center, and wall mounted cabinet not installed in a telecommunications room.
20. Telecommunications main grounding busbar (TMGB): A busbar placed at a location determined by Riverside County Information Technology Department (RCIT); it is bonded to the building service equipment (power) ground by means of the bonding conductor for telecommunications.
21. Telecommunications spaces: A space within the building, that is, a dedicated room, a portion of a room, a wall space, a wall-mounted cabinet, or a free-standing rack, et

cetera, where telecommunications equipment is installed. Some common names used for telecommunications spaces include Entrance Facilities (also known as Main Point of Entry or MPOE), Telecommunications Rooms or TR (also known as Main Distribution Frame or MDF, Intermediate Distribution Frame or IDF, data room), Equipment Room (also known as Server Room, Data Center, et cetera).

1.05 SYSTEM DESCRIPTION

A. The Work under this section includes materials and labor to install, test and document a complete functional Telecommunications Grounding and Bonding Backbone System, to which telecommunications equipment, apparatus, and associated pathways for telecommunications, within and outside the scope of the general contract, will be bonded.

B. The Telecommunications Grounding and Bonding Backbone System consists of the telecommunications bonding backbone (TBB), bonding conductor for telecommunications that bonds the telecommunications main grounding busbar (TMGB) to the electrical main grounding busbar, a telecommunications grounding busbar in every telecommunications space, bonding conductors from busbars to building steel and electrical panelboards, a grounding equalizer every three floors, and connecting devices (for example, lugs, clamps, exothermic welds, et cetera). Every conductor segments shall be contiguous and not to exceed 500 feet in length.

C. Conduits for telecommunications backbone cabling and all cable trays shall be bonded to the telecommunications grounding busbar in the closest Telecommunications Grounding and Bonding Backbone System.

D. Figure 270526-1 illustrates an example of a Grounding and Bonding Backbone System for a new, multi-story building with multiple telecommunications rooms on each floor used as public safety communications site, and a lightning protection system attached to and becomes part of the grounding system for the building (Refer to Section 27 05 27 for lightning protection system specifications and requirements).

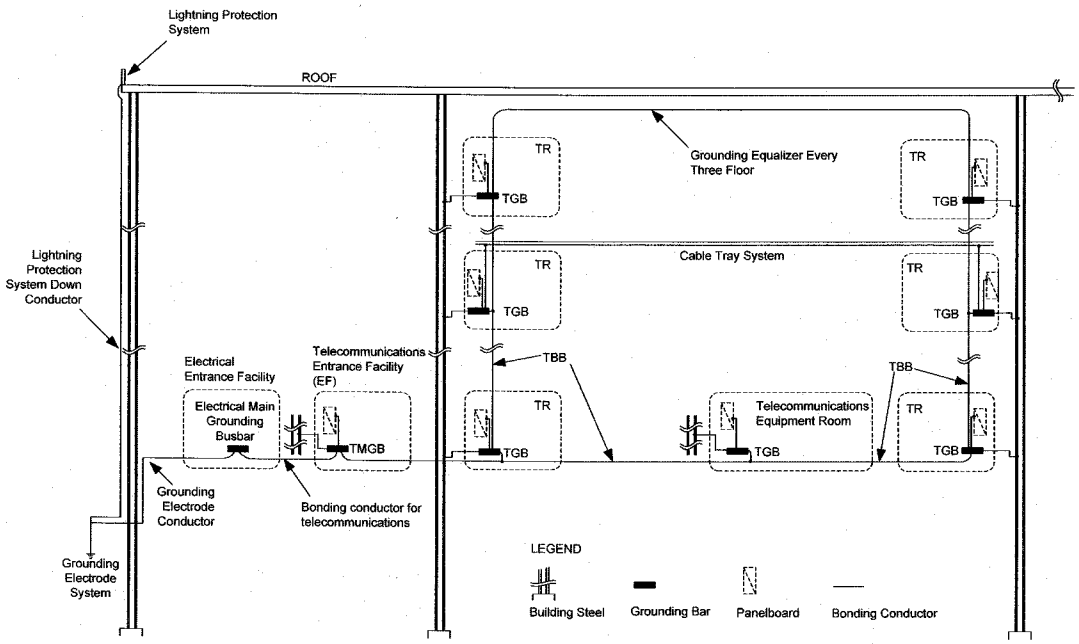

Figure 270526-1

E. Figure 270526-2 illustrates an example of a Grounding and Bonding Backbone System for a

typical existing small office building not used as public safety communications site.

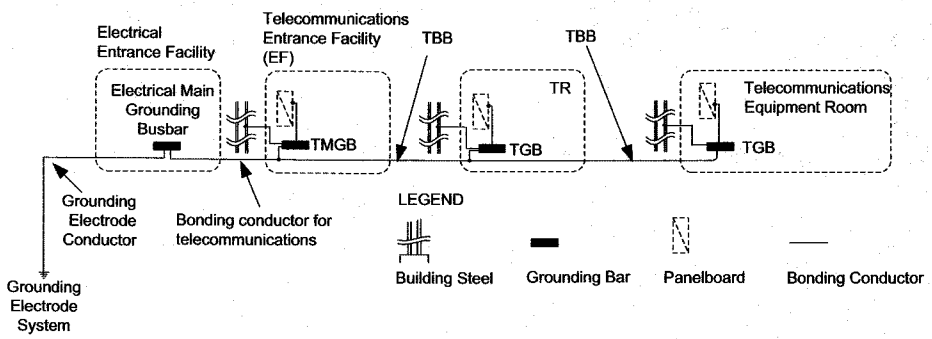

Figure 270526-2

F. Conductor Sizing: Conductor sizing shall correspond to the linear length of individual segment; the bonding conductor for telecommunications (from TMGB to main electrical grounding busbar) and grounding equalizers shall be the same conductor size as the largest telecommunication bonding backbone segment. Grounding conductors shall not decrease in size as the grounding path moves closer to earth.

Conductor linear length	**Minimum Size (AWG)**
Less than 13	6
14 – 26	3
27 – 85	3/0
85 – 105	4/0
106 – 125	250 kcmil
126 – 150	300 kcmil
151 – 175	350 kcmil
176 – 250	500 kcmil
251 – 300	600 kcmil
Greater than 301	750 kcmil

G. Resistance from any point of the communication grounding backbone system to the ground electrode and to earth shall not exceed 5 Ohms.

1.06 SUBSTITUTIONS

Substitutions will be considered per Article 3.3 of the Instruction to Bidders of the Bid Package Section 00003.

1.07 SUBMITTALS

A. Provide in accordance with Article 3.11 of the General Conditions. Refer to Division 01 and Section 27 00 00 and comply with requirements specified therein.

B. Submit computer-generated test records of measured soil resistance values for inclusion into the Operation and Maintenance Manual.

1.08 QUALITY ASSURANCE

A. Refer to Division 01 and Section 27 00 00; comply with requirements specified therein.

B. Refer to Division 01 for personnel training requirements.

1.09 DELIVERY, STORAGE AND HANDLING

A. Refer to Section 27 00 00 and comply with requirements specified therein.

1.010 WARRANTY

A. Provide warranty for a period of 5 years; correct deficiencies within 24 hours of notification.

PART 2 - PRODUCTS

2.01 GENERAL

A. All materials used in the installation shall be new and shall comply in weight, size and composition as required by manufacturer; be labeled and listed by Underwriters for use in electrical grounding; and be compliant with all applicable referenced standards.

2.02 ACCEPTABLE MANUFACTURERS

A. ERICO United States
34600 Solon Road
Solon, Ohio 44139
United States

B. BURNDY LLC - USA
47 E Industrial Park Drive
Manchester NH 03109

C. CHATSWORTH PRODUCTS, INC.
31425 Agoura Road
Westlake Village, CA 91361

D. HARGER LIGHTNING & GROUNDING
301 Ziegler Drive
Grayslake, IL 60030

2.03 TELECOMMUNICATIONS BUSBARS

A. The Telecommunications Main Grounding Busbar (TMGB) and Telecommunications Grounding Busbars (TGB) shall be made of bare copper, 4"W x ¼"H x 20"L in size, and predrilled with holes for use with standard sized lugs.

B. Standard: UL 467 and in compliance with ANSI-J-STD-607-standards requirements.

2.04 CONDUCTORS

A. Conductors shall be ASTM B8 bare stranded copper, THHN (Thermoplastic High Heat-resistant Nylon-coated) or THWN (Thermoplastic Heat and Water-resistant Nylon-coated), rated for the environment where it is installed, and contained in conduits.

B. Every conductors segment shall be continuous without splicing, contained in a metallic conduit, and bonded to the conduit at both ends.

C. Standard: UL83, UL1063, UL758, UL VW-1, IEEE 383.

D. Color: Green

2.05 EXORTHERMIC WELDED CONNECTIONS

A. Use exothermic welded connections at both ends of conductors when bonding to ground electrodes and building steel frames.

B. Harger weld type BE, or approved equivalent, shall be made to the ground bars using

appropriate size molds.

C. Harger weld types VA, VD, or VU, or approved equivalent, shall be made to structural steel framework using appropriate size molds.

D. Harger weld types GS or approved equivalent shall be made to structural steel framework using appropriate size molds.

2.06 CONNECTOR LUGS

A. To bond the panelboard without a built-in neutral bar to the Telecommunications Grounding Busbar (TGB), use UL-Listed two-hole, long barrel, electro tin-plated compression lugs with inspection port.

B. Antioxidant joint compound shall be applied to the contact areas.

C. Lugs shall be secured to the frame of panelboard with stainless steel hex head cap screws with stainless steel washers, lock washers and nuts.

2.07 GROUNDING ELECTROD

A. Refer to Division 26 for grounding electrode requirements.

PART 3 - EXECUTION

3.01 GENERAL

A. Comply with the Execution requirements of Section 27 00 00.

B. Work shall conform to California Building Code and referenced standards specified; the most stringent requirement shall prevail should there be any discrepancies, unless otherwise ruled by RCIT Engineering.

C. Identify and label grounding and bonding conductors and components according to local codes and RCIT Engineering standards.

D. Install components to manufacturer's instructions and recommendations and as required per UL listing.

E. Terminations must be easily accessible for inspection and maintenance of the system.

3.02 EXAMINATION AND PREPARATION

A. Prior to commencing work specified in this section, examine and coordinate with all trades to ensure readiness and that all inter-trade conflicts are resolved.

3.03 INSTALLATION PRACTICES

A. Install all grounding and bonding conductors in continuous segments, that is, without any splices.

B. Install BCT, TBB, and GE conductors in conduit to protect them from physical damage. Bond the conductor to the conduit at both ends using a #6 AWG bonding conductor as a pigtail, an irreversible connection for the conductor-to-pigtail connection, and insulated ground bushings at the conduit ends.

C. Bond both ends of pathway system for telecommunications backbone cabling system, including conduits, cable trays, et cetera. Cable tray sections shall be bonded with #6 AWG jumpers.

D. Install every busbar using insulating standoffs.

E. Location of telecommunication busbar in every telecommunications space is subject to final field coordination with RCIT.

F. Ensure 12-inch bend radius.

3.04 LABELING

A. Label colors and identification assignments shall conform to TIA/EIA-606-B standards document. Contact RCIT for specific requirements.

B. Affix a permanent label onto every busbar; and onto both every conductor at connecting point in telecommunications spaces, and every thirty feet of its entire length.

C. Labels on conductors shall fully wrap around conductors with a self-laminating feature to provide permanent marking.

D. Provide permanent labels with machine-generated text; hand written labels will not be accepted.

3.05 RESISTIVITY MEASUREMENT

A. Ground system resistance shall not exceed 5 ohms. Contractor shall submit certified measurements taken by a geotechnical soil testing lab.

B. Contractor shall provide a performance measurement of the earth grounding electrode system. Testing shall utilize an earth resistance meter and be conducted in accordance with the requirements specified in Division 26.

C. The manufacturer or an independent testing firm shall be employed for the final testing and report. The Contractor shall submit a copy of the test report to the designated RCIT engineer within ten (10) County workdays after testing and before the ground system becomes inaccessible.

3.06 PUNCH ITEMS

A. Punch Items shall be corrected within ten working days.

*****END OF SECTION*****

SECTION 280513

CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY & SECURITY

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Conditions apply to this Section.

1.2 RELATED DOCUMENTS

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

1.3 SUMMARY

A. Section Includes:

1. Low-voltage control cabling.
2. Control-circuit conductors.
3. Fire alarm wire and cable.
4. Identification products.

1.4 SUBSTITUTIONS

Substitutions will be considered per Article 3.3 of the Instruction to Bidders of the Bid Package Section 00003.

1.5 ACTION SUBMITTALS

A. Provide in accordance with Article 3.11 of the General Conditions.

B. Product Data: For each type of product.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.

B. Source quality-control reports.

C. Field quality-control reports.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: An NRTL.

1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site. Test each pair of UTP cable for open and short circuits.

1.9 FIELD CONDITIONS

A. Do not install conductors and cables that are wet, moisture damaged, or mold damaged.

1. Indications that wire and cables are wet or moisture damaged include, but are not limited to, discoloration and sagging of factory packing materials.

B. Environmental Limitations: Do not deliver or install UTP cable and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and

maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

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.

2.2 BACKBOARDS

A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches. Comply with requirements for plywood backing panels in Section 061000 "Rough Carpentry."

2.3 LOW-VOLTAGE CONTROL CABLE

A. Paired Cable: NFPA 70, Type CMG.

1. One pair, twisted, No. 16 AWG, stranded (19x29) and No. 18 AWG, stranded (19x30) tinned copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1581.

B. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.

1. One pair, twisted, No. 16 AWG, stranded (19x29) and No. 18 AWG, stranded (19x30) tinned copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with NFPA 262.

2.4 CONTROL-CIRCUIT CONDUCTORS

A. Class 1 Control Circuits: Stranded copper, Type THHN-THWN, complying with UL 83, in raceway or Type XHHN, complying with UL 44, in raceway.

B. Class 2 Control Circuits: Stranded copper, Type THHN-THWN, complying with UL 83, in raceway Type XHHN, complying with UL 44, in raceway.

C. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type TW or TF, complying with UL 83.

2.5 FIRE ALARM WIRE AND CABLE

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Comtran Corporation.
2. Draka Cableteq USA.

3. Genesis Cable Products; Honeywell International, Inc.
4. Rockbestos-Suprenant Cable Corp.
5. West Penn Wire.

B. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.

C. Signaling Line Circuits: Twisted, shielded pair, not less than No. 18 AWG size as recommended by system manufacturer.

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 2-hour rating.

D. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation.

1. Low-Voltage Circuits: No. 16 AWG, minimum.
2. Line-Voltage Circuits: No. 12 AWG, minimum.
3. Multiconductor Armored Cable: NFPA 70, Type MC, copper conductors, Type TFN/THHN conductor insulation, copper drain wire, copper armor with outer jacket with red identifier stripe, NTRL listed for fire alarm and cable tray installation, plenum rated, and complying with requirements in UL 2196 for a 2-hour rating.

2.6 IDENTIFICATION PRODUCTS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Brady Worldwide, Inc.
2. HellermannTyton North America.
3. Kroy LLC.
4. Panduit Corp.

B. Comply with UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

C. Comply with requirements in Section 260553 "Identification for Electrical Systems."

2.7 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate cables.

B. Factory test UTP cables on reels according to TIA/EIA-568-B.1.

C. Factory test UTP cables according to TIA/EIA-568-B.2.

D. Cable will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for installation of supports for cables.

3.2 WIRING METHOD

A. Install wiring in metal pathways and wireways.

1. Minimum conduit size shall be 3/4 inch. Control and data transmission wiring shall not share conduit with other building wiring systems.
2. Comply with requirements in Section 280528 "Pathways for Electronic Safety and Security."
3. Comply with requirements in Section 260536 "Cable Trays for Electrical Systems."

B. Install cable, concealed in accessible ceilings, walls, and floors when possible.

C. Wiring within Enclosures:

1. Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.
2. Install lacing bars and distribution spools.
3. Separate power-limited and non-power-limited conductors as recommended in writing by manufacturer.
4. Install conductors parallel with or at right angles to sides and back of enclosure.
5. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with intrusion system to terminal blocks.
6. Mark each terminal according to system's wiring diagrams.
7. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Comply with NECA 1.

B. Conductors: Size according to system manufacturer's written instructions unless otherwise indicated.

C. General Requirements for Cabling:

1. Comply with TIA/EIA-568-B.1.
2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
3. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
4. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
5. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
6. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
7. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
8. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

D. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA-569-B recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
    a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.
3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
    a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.
4. Separation between cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
    a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.
5. Separation between Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
6. Separation between Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.4 FIRE ALARM WIRING INSTALLATION

A. Comply with NECA 1 and NFPA 72.

B. Wiring Method: Install wiring in metal raceway according to Section 260533 "Raceways and Boxes for Electrical Systems."
    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 raceway system. This system shall not be used for any other wire or cable.

C. Wiring Method:
    1. Cables and raceways 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: Use of 2-hour, fire-rated fire alarm cables, NFPA 70, Types MI and CI, is permitted.
    3. Signaling Line Circuits: Power-limited fire alarm cables shall not be installed in the same cable or raceway 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 where 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 circuits differently from alarm-initiating circuits. Use different colors for visible 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.

3.5 POWER AND CONTROL-CIRCUIT CONDUCTORS

A. 120-V Power Wiring: Install according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables" unless otherwise indicated.

B. Minimum Conductor Sizes:

1. Class 1 remote-control and signal circuits, No. 14 AWG.
2. Class 2 low-energy, remote-control and signal circuits, No. 16 AWG.
3. Class 3 low-energy, remote-control, alarm and signal circuits, No. 12 AWG.

3.6 CONNECTIONS

A. Comply with requirements in Section 283111 "Digital, Addressable Fire-Alarm System for connecting, terminating, and identifying wires and cables.

3.7 FIRESTOPPING

A. Comply with requirements in Section 078413 "Penetration Firestopping."

B. Comply with TIA-569-B, "Firestopping" Annex A.

C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.8 GROUNDING

A. For communications wiring, comply with J-STD-607-A and with BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. For low-voltage wiring and cabling, comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

3.9 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.10 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Visually inspect UTP cable jacket materials for NRTL certification markings. Inspect cabling terminations to confirm color-coding for pin assignments, and inspect cabling connections to confirm compliance with TIA/EIA-568-B.1.

2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
3. Test UTP cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross connection.
    a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

B. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide, or transfer the data from the instrument to the computer, save as text files, print, and submit.

C. End-to-end cabling will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

*****END OF SECTION*****

SECTION 283111

DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Conditions apply to this Section

1.2 RELATED DOCUMENTS

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

1.3 SUMMARY

A. Section Includes:

1. Fire-alarm control unit.
2. Manual fire-alarm boxes.
3. System smoke detectors.
4. Heat detectors.
5. Notification appliances.
6. Device guards.
7. Firefighters' two-way telephone communication service.
8. Firefighters' smoke-control station.
9. Magnetic door holders.
10. Remote annunciator.
11. Graphic annunciator.
12. Addressable interface device.
13. Digital alarm communicator transmitter.
14. Network communications.

B. Related Requirements:

1. Section 280513 "Conductors and Cables for Electronic Safety and Security" for cables and conductors for fire-alarm systems.

1.4 DEFINITIONS

A. EMT: Electrical Metallic Tubing.

B. FACP: Fire Alarm Control Panel.

C. HLI: High Level Interface.

D. NICET: National Institute for Certification in Engineering Technologies.

E. PC: Personal computer.

F. VESDA: Very Early Smoke-Detection Apparatus.

1.5 SUBSTITUTIONS

Substitutions will be considered per Article 3.3 of the Instruction to Bidders of the Bid Package Section 00003.

1.6 ACTION SUBMITTALS

A. Provide in accordance with Article 3.11 of the General Conditions.

B. Product Data: For each type of product, including furnished options and accessories.

1. Include construction details, material descriptions, dimensions, profiles, and finishes.
2. Include rated capacities, operating characteristics, and electrical characteristics.

C. Shop Drawings: For fire-alarm system.

1. Comply with recommendations and requirements in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
2. Include plans, elevations, sections, details, and attachments to other work.
3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations. Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
4. Detail assembly and support requirements.
5. Include voltage drop calculations for notification-appliance circuits.
6. Include battery-size calculations.
7. Include input/output matrix.
8. Include statement from manufacturer that all equipment and components have been tested as a system and meet all requirements in this Specification and in NFPA 72.
9. Include performance parameters and installation details for each detector.
10. Verify that each duct detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
11. Provide program report showing that air-sampling detector pipe layout balances pneumatically within the airflow range of the air-sampling detector.
12. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale; coordinate location of duct smoke detectors and access to them.

    a. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators.
    b. Show field wiring required for HVAC unit shutdown on alarm.
    c. Show field wiring and equipment required for HVAC unit shutdown on alarm and override by firefighters' control system.
    d. Show field wiring and equipment required for HVAC unit shutdown on alarm and override by firefighters' smoke-evacuation system.
    e. Locate detectors according to manufacturer's written recommendations.
    f. Show air-sampling detector pipe routing.

13. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
14. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits and point-to-point wiring diagrams.

D. 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.

E. Delegated-Design Submittal: For notification appliances and smoke and heat detectors, in addition to submittals listed above, indicate compliance 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 each notification appliance and smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the device.
2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72. Calculate spacing and intensities for strobe signals and sound-pressure levels for audible appliances.
3. Indicate audible appliances required to produce square wave signal per NFPA 72.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Seismic Qualification Certificates: For fire-alarm control unit, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field quality-control reports.

1.8 SAMPLE WARRANTY: For special warranty.

1.9 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following and deliver copies to authorities having jurisdiction:

a. Comply with the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
b. Provide "Fire Alarm and Emergency Communications System Record of Completion Documents" according to the "Completion Documents" Article in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
c. Complete wiring diagrams showing connections between all devices and equipment. Each conductor shall be numbered at every junction point with indication of origination and termination points.
d. Riser diagram.
e. Device addresses.
f. Air-sampling system sample port locations and modeling program report showing layout meets performance criteria.
g. Record copy of site-specific software.
h. Provide "Inspection and Testing Form" according to the "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:

1) Equipment tested.
2) Frequency of testing of installed components.
3) Frequency of inspection of installed components.
4) Requirements and recommendations related to results of maintenance.
5) Manufacturer's user training manuals.

i. Manufacturer's required maintenance related to system warranty requirements.
j. Abbreviated operating instructions for mounting at fire-alarm control unit and each annunciator unit.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.10 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps for Remote Indicating Lamp Units: Quantity equal to 10 percent of amount installed, but no fewer than one unit.

2. Lamps for Strobe Units: Quantity equal to 10 percent of amount installed, but no fewer than one unit.
3. Smoke Detectors, Fire Detectors: Quantity equal to 10 percent of amount of each type installed, but no fewer than one unit of each type.
4. Detector Bases: Quantity equal to two percent of amount of each type installed, but no fewer than one unit of each type.
5. Keys and Tools: One extra set for access to locked or tamperproofed components.
6. Audible and Visual Notification Appliances: One of each type installed.
7. Fuses: Two of each type installed in the system. Provide in a box or cabinet with compartments marked with fuse types and sizes.

1.11 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level II or Level III technician.

C. NFPA Certification: Obtain certification according to NFPA 72 by an NRTL (nationally recognized testing laboratory).

D. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.

E. NFPA Certification: Obtain certification according to NFPA 72 in the form of a placard by an FM Global-approved alarm company.

1.12 PROJECT CONDITIONS

A. Perform a full test of the existing system prior to starting work. Document any equipment or components not functioning as designed.

B. Interruption of Existing Fire-Alarm Service: Do not interrupt fire-alarm service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary guard service according to requirements indicated:

1. Notify Owner and Architect or Construction Manager no fewer than seven days in advance of proposed interruption of fire-alarm service.
2. Do not proceed with interruption of fire-alarm service without Architect's or Construction Manager's written permission.

C. Use of Devices during Construction: Protect devices during construction unless devices are placed in service to protect the facility during construction.

1.13 SEQUENCING AND SCHEDULING

A. Existing Fire-Alarm Equipment: Maintain existing equipment fully operational until new equipment has been tested and accepted. As new equipment is installed, label it "NOT IN SERVICE" until it is accepted. Remove labels from new equipment when put into service, and label existing fire-alarm equipment "NOT IN SERVICE" until removed from the building.

B. Equipment Removal: After acceptance of new fire-alarm system, remove existing disconnected fire-alarm equipment and wiring.

1.14 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace fire-alarm system equipment and components that fail in materials or workmanship within specified warranty period.

1. Warranty Extent: All equipment and components not covered in the Maintenance Service Agreement.
2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Source Limitations for Fire-Alarm System and Components: Components shall be compatible with, and operate as an extension of, existing system. Provide system manufacturer's certification that all components provided have been tested as, and will operate as, a system.

B. Noncoded, UL-certified addressable system, with multiplexed signal transmission and voice/strobe evacuation.

C. Automatic sensitivity control of certain smoke detectors.

D. All components provided shall be listed for use with the selected system.

E. 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.

2.2 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices and systems:

1. Manual stations.
2. Heat detectors.
3. Smoke detectors.
4. Duct smoke detectors.
5. Automatic sprinkler system water flow.
6. Fire standpipe system.
7. Fire pump running.

B. Fire-alarm signal shall initiate the following actions:

1. Continuously operate alarm notification appliances, including voice evacuation notices.
2. Identify alarm and specific initiating device at fire-alarm control unit and remote annunciators.
3. Transmit an alarm signal to the remote alarm receiving station.
4. Unlock electric door locks in designated egress paths.
5. Release fire and smoke doors held open by magnetic door holders.
6. Activate voice/alarm communication system.
7. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
8. Activate smoke-control system (smoke management) at firefighters' smoke-control system panel.
9. Activate stairwell and elevator-shaft pressurization systems.
10. Close smoke dampers in air ducts of designated air-conditioning duct systems.
11. Recall elevators to primary or alternate recall floors.
12. Activate elevator power shunt trip.
13. Activate emergency lighting control.
14. Record events in the system memory.
15. Indicate device in alarm on the graphic annunciator.

C. Supervisory signal initiation shall be by one or more of the following devices and actions:

1. Valve supervisory switch.
2. Elevator shunt-trip supervision.
3. Fire pump running.
4. Fire-pump loss of power.
5. Fire-pump power phase reversal.
6. Independent fire-detection and -suppression systems.
7. User disabling of zones or individual devices.
8. Loss of communication with any panel on the network.
9. Emergency generator trouble.

10. Emergency generator running.
11. Emergency generator not in auto.
12. Emergency generator low fuel.

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 communication with any addressable sensor, input module, relay, control module, remote annunciator, printer interface, or Ethernet module.
4. Loss of primary power at fire-alarm control unit.
5. Ground or a single break in internal circuits of fire-alarm control unit.
6. Abnormal ac voltage at fire-alarm control unit.
7. Break in standby battery circuitry.
8. Failure of battery charging.
9. Abnormal position of any switch at fire-alarm control unit or annunciator.
10. Voice signal amplifier failure.
11. Hose cabinet door open.

E. System Supervisory Signal Actions:

1. Initiate notification appliances.
2. Identify specific device initiating the event at fire-alarm control unit and remote annunciators.
3. Record the event on system printer.
4. After a time delay of 200 seconds, transmit a trouble or supervisory signal to the remote alarm receiving station.
5. Transmit system status to building management system.
6. Display system status on graphic annunciator.

2.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Fire-alarm control unit and raceways shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2.4 FIRE-ALARM CONTROL UNIT

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. GAMEWELL.
2. GE UTC Fire & Security; A United Technologies Company.
3. Notifier.
4. Siemens Industry, Inc.; Fire Safety Division.
5. SimplexGrinnell LP.

B. General Requirements for Fire-Alarm Control Unit:

1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864 and UUKL for smoke control.

   a. System software and programs shall be held in nonvolatile flash, electrically erasable, programmable, read-only memory, 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 and printer.
   c. Provide communication between the FACP and remote circuit interface panels, annunciators, and displays.

d. The FACP shall be listed for connection to a central-station signaling system service.
e. Provide nonvolatile memory for system database, logic, and operating system and event history. The system shall require no manual input to initialize in the event of a complete power down condition. The FACP shall provide a minimum 500-event history log.

2. Addressable Initiation Device Circuits: The FACP shall indicate which communication zones have been silenced and shall provide selective silencing of alarm notification appliance by building communication zone.
3. Addressable Control Circuits for Operation of Notification Appliances and Mechanical Equipment: The FACP shall be listed for releasing service.

C. 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, 80 characters, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.

D. 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, three 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.

E. Initiating-Device, Notification-Appliance, and Signaling-Line Circuits:

1. Pathway Class Designations: NFPA 72, Class A.
2. Pathway Survivability: Level 3.
3. Install no more than 100 addressable devices on each signaling-line circuit.
4. Serial Interfaces:

a. One dedicated RS 485 port for central-station operation using point ID DACT.
b. One RS 485 port for remote annunciators, Ethernet module, or multi-interface module (printer port).
c. One USB or RS 232 port for PC configuration.
d. One RS 232 port for VESDA HLI connection.
e. One RS 232 port for voice evacuation interface.

F. Stairwell Pressurization: Provide an output signal using an addressable relay to start the stairwell pressurization system. Signal shall remain on until alarm conditions are cleared and fire-alarm system is reset. Signal shall not stop in response to alarm acknowledge or signal silence commands.

1. Pressurization starts when any alarm is received at fire-alarm control unit.
2. Alarm signals from smoke detectors at pressurization air supplies have a higher priority than other alarm signals that start the system.

G. Smoke-Alarm Verification:

1. Initiate audible and visible indication of an "alarm-verification" signal at fire-alarm control unit.
2. Activate an approved "alarm-verification" sequence at fire-alarm control unit and detector.
3. Record events by the system printer.
4. Sound general alarm if the alarm is verified.
5. Cancel fire-alarm control unit indication and system reset if the alarm is not verified.

H. 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.

I. Elevator Recall:

1. Elevator recall shall be initiated only by one of the following alarm-initiating devices:

   a. Elevator lobby detectors except the lobby detector on the designated floor.
   b. Smoke detector in elevator machine room.
   c. Smoke detectors in elevator hoistway.

2. Elevator controller shall be programmed to move the cars to the alternate recall floor if lobby detectors located on the designated recall floors are activated.
3. Water-flow alarm connected to sprinkler in an elevator shaft and elevator machine room shall shut down elevators associated with the location without time delay.

   a. Water-flow switch associated with the sprinkler in the elevator pit may have a delay to allow elevators to move to the designated floor.

J. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke-barrier walls shall be connected to fire-alarm system.

K. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory, and print out the final adjusted values on system printer.

L. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.

M. Voice/Alarm Signaling Service: Central emergency communication system with redundant microphones, preamplifiers, amplifiers, and tone generators provided in a separate cabinet located in the fire command center or as a special module that is part of fire-alarm control unit.

1. Indicate number of alarm channels for automatic, simultaneous transmission of different announcements to different zones or for manual transmission of announcements by use of the central-control microphone. Amplifiers shall comply with UL 1711.

   a. Allow the application of, and evacuation signal to, indicated number of zones and, at the same time, allow voice paging to the other zones selectively or in any combination.
   b. Programmable tone and message sequence selection.
   c. Standard digitally recorded messages for "Evacuation" and "All Clear."
   d. Generate tones to be sequenced with audio messages of type recommended by NFPA 72 and that are compatible with tone patterns of notification-appliance circuits of fire-alarm control unit.

2. Status Annunciator: Indicate the status of various voice/alarm speaker zones and the status of firefighters' two-way telephone communication zones.
3. Preamplifiers, amplifiers, and tone generators shall automatically transfer to backup units, on primary equipment failure.

N. Printout of Events: On receipt of signal, print alarm, supervisory, and trouble events. Identify zone, device, and function. Include type of signal (alarm, supervisory, or trouble) and date and time of occurrence. Differentiate alarm signals from all other printed indications. Also print system reset event, including same information for device, location, date, and time. Commands initiate the printing of a list of existing alarm, supervisory, and trouble conditions in the system and a historical log of events.

O. 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 signals, supervisory and digital alarm communicator 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.

P. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.

1. Batteries: Sealed lead calcium.

Q. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

2.5 MANUAL FIRE-ALARM BOXES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. GAMEWELL.
2. GE UTC Fire & Security; A United Technologies Company.
3. Notifier.
4. Siemens Industry, Inc.; Fire Safety Division.
5. SimplexGrinnell LP.
6. System Sensor.

B. 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. Double-action mechanism requiring two actions 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. Station Reset: Key- or wrench-operated switch.
3. Indoor Protective Shield: Factory-fabricated, clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.
4. Weatherproof Protective Shield: Factory-fabricated, clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm.

2.6 SYSTEM SMOKE DETECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Bosch Security Systems.
2. Faraday.
3. Fenwal Protection Systems; A UTC Fire & Security Company.
4. Fire-Lite Alarms.
5. GAMEWELL.
6. GE UTC Fire & Security; A United Technologies Company.
7. Gentex Corporation.
8. Harrington Signal, Inc.
9. Keltron Corporation.
10. Mircom Technologies, Ltd.
11. Notifier.
12. Siemens Industry, Inc.; Fire Safety Division.

13. Silent Knight.
14. SimplexGrinnell LP.
15. System Sensor.

B. General Requirements for System Smoke Detectors:

1. Comply with UL 268; operating at 24-V dc, nominal.
2. Detectors shall be two-wire type.
3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
6. Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.
7. Remote Control: Unless otherwise indicated, detectors shall be digital-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.

    a. Rate-of-rise temperature characteristic of combination smoke- and heat-detection units shall be selectable at fire-alarm control unit for 15 or 20 deg F per minute.
    b. Fixed-temperature sensing characteristic of combination smoke- and heat-detection units shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155 deg F.
    c. Multiple levels of detection sensitivity for each sensor.
    d. Sensitivity levels based on time of day.

C. 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.).

D. Ionization Smoke Detector:

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.).

E. Duct Smoke Detectors: Photoelectric type complying with UL 268A.

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.).

3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector for smoke detection in HVAC system ducts.
4. Each sensor shall have multiple levels of detection sensitivity.
5. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
6. Relay Fan Shutdown: Fully programmable relay rated to interrupt fan motor-control circuit.

2.7 MULTICRITERIA DETECTORS

A. Mounting: Twist-lock base interchangeable with smoke-detector bases.

B. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

C. Automatically adjusts its sensitivity by means of drift compensation and smoothing algorithms. The detector shall send trouble alarm if it is incapable of compensating for existing conditions.

D. Test button tests all sensors in the detector.

E. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

1. Primary status.
2. Device type.
3. Present sensitivity selected.
4. Sensor range (normal, dirty, etc.).

F. Sensors: The detector shall be comprised of four sensing elements including a smoke sensor, a carbon monoxide sensor, an infrared sensor, and a heat sensor.

1. Smoke sensor shall be photoelectric type as described in "System Smoke Detectors" Article.
2. Carbon monoxide sensor shall be as described in "Carbon Monoxide Detectors" Article.
3. Heat sensor shall be as described in "Heat Detectors" Article.
4. Each sensor shall be separately listed according to requirements for its detector type.

2.8 HEAT DETECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Bosch Security Systems.
2. Faraday.
3. Fire-Lite Alarms.
4. GAMEWELL.
5. GE UTC Fire & Security; A United Technologies Company.
6. Gentex Corporation.
7. Harrington Signal, Inc.
8. Keltron Corporation.
9. Mircom Technologies, Ltd.
10. Notifier.
11. Siemens Industry, Inc.; Fire Safety Division.
12. Silent Knight.
13. SimplexGrinnell LP.
14. System Sensor.

B. General Requirements for Heat Detectors: Comply with UL 521.

1. Temperature sensors shall test for and communicate the sensitivity range of the device.

C. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F or a rate of rise that exceeds 15 deg F per minute unless otherwise indicated.

1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

D. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature of 190 deg F.

1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

2.9 NOTIFICATION APPLIANCES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Wheelock.
2. Federal Signal Corporation.
3. GE UTC Fire & Security; A United Technologies Company.
4. Gentex Corporation.
5. Harrington Signal, Inc.
6. Keltron Corporation.
7. Mircom Technologies, Ltd.
8. Siemens Industry, Inc.; Fire Safety Division.
9. SimplexGrinnell LP.
10. System Sensor.

B. General Requirements for Notification Appliances: Individually addressed, connected to a signaling-line circuit, equipped for mounting as indicated, and with screw terminals for system connections.

C. General Requirements for Notification Appliances: Connected to notification-appliance signal circuits, zoned as indicated, equipped for mounting as indicated, and with screw terminals for system connections.

1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.

D. Chimes, Low-Level Output: Vibrating type, 75-dBA minimum rated output.

E. Chimes, High-Level Output: Vibrating type, 81-dBA minimum rated output.

F. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet from the horn, using the coded signal prescribed in UL 464 test protocol.

G. Visible Notification Appliances: Xenon strobe lights complying 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, white.

H. Voice/Tone Notification Appliances:

1. Comply with UL 1480.
2. Speakers for Voice Notification: Locate speakers for voice notification to provide the intelligibility requirements of the "Notification Appliances" and "Emergency Communications Systems" chapters in NFPA 72.
3. High-Range Units: Rated 2 to 15 W.
4. Low-Range Units: Rated 1 to 2 W.
5. Mounting: Surface mounted and bidirectional.
6. Matching Transformers: Tap range matched to acoustical environment of speaker location.

I. Exit Marking Audible Notification Appliance:

1. Exit marking audible notification appliances shall meet the audibility requirements in NFPA 72.
2. Provide exit marking audible notification appliances at the entrance to all building exits.
3. Provide exit marking audible notification appliances at the entrance to areas of refuge with audible signals distinct from those used for building exit marking.

2.10 FIREFIGHTERS' TWO-WAY TELEPHONE COMMUNICATION SERVICE

A. Dedicated, two-way, supervised, telephone voice communication links between fire-alarm control unit and remote firefighters' telephone stations. Supervised telephone lines shall be connected to talk circuits by controls in a control module. Provide the following:

1. Common-talk type for firefighter use only.
2. Selective-talk type for use by firefighters and fire wardens.
3. Controls to disconnect phones from talk circuits if too many phones are in use simultaneously. An indicator lamp shall flash if a phone is disconnected from the talk circuits.
4. Addressable firefighters' phone modules to monitor and control a loop of firefighter phones. Module shall be capable of differentiating between normal, off-hook, and trouble conditions.
5. Audible Pulse and Tone Generator, and High-Intensity Lamp: When a remote telephone is taken off the hook, it causes an audible signal to sound and a high-intensity lamp to flash at the fire-alarm control unit.
6. Selector panel controls to provide for simultaneous operation of up to six telephones in selected zones. Indicate ground faults and open or shorted telephone lines on the panel front by individual LEDs.
7. Display: Digital to indicate location of caller.
8. Remote Telephone Jack Stations: Single-gang, stainless-steel-plate mounted plug, engraved "Fire Emergency Phone."
9. Handsets: Push-to-talk-type sets with noise-canceling microphone stored in a cabinet adjacent to fire-alarm control unit.

2.11 FIREFIGHTERS' SMOKE-CONTROL SYSTEM

A. Initiate Smoke-Management Sequence of Operation:

1. Comply with sequence of operation as described in Section 230993 "Sequence of Operations for HVAC Controls."
2. Fire-alarm system shall provide all interfaces and control points required to properly activate smoke-management systems.
3. First fire-alarm system initiating device to go into alarm condition shall activate the smoke-control functions.
4. Subsequent devices going into alarm condition shall have no effect on the smoke-control mode.

B. Addressable Relay Modules:

1. Provide address-setting means on the module. Store an internal identifying code for control panel use to identify the module type.
2. Allow the control panel to switch the relay contacts on command.
3. Have a minimum of two normally open and two normally closed contacts available for field wiring.
4. Listed for controlling HVAC fan motor controllers.

2.12 MAGNETIC DOOR HOLDERS

A. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching doorplate.

1. Electromagnets: Require no more than 3 W to develop 25-lbf holding force.
2. Wall-Mounted Units: Flush mounted unless otherwise indicated.
3. Rating: 24-V ac or dc.
4. Rating: 120-V ac.

B. Material and Finish: Match door hardware.

2.13 GRAPHIC ANNUNCIATOR

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. GE UTC Fire & Security; A United Technologies Company.
2. Harrington Signal, Inc.
3. Keltron Corporation.
4. Mircom Technologies, Ltd.
5. Siemens Industry, Inc.; Fire Safety Division.
6. SimplexGrinnell LP.

B. Graphic Annunciator Panel: Mounted in an aluminum frame with nonglare, minimum 3/16-inch- thick, clear acrylic cover over graphic representation of the facility. Detector locations shall be represented by red LED lamps. Normal system operation shall be indicated by a lighted, green LED. Trouble and supervisory alarms shall be represented by an amber LED.

1. Comply with UL 864 and UUKL.
2. Operating voltage shall be 24-V dc provided by a local 24-V power supply provided with the annunciator.
3. Include built-in voltage regulation, reverse polarity protection, RS 232/422 serial communications, and a lamp test switch.
4. Surface mounted in a NEMA 250, Type 1 cabinet, with key lock and no exposed screws or hinges.
5. Graphic representation of the facility shall be a CAD drawing and each detector shall be represented by an LED in its actual location. CAD drawing shall be at 1/8-inch per foot scale or larger.
6. The LED representing a detector shall flash two times per second while detector is an alarm.

2.14 REMOTE ANNUNCIATOR

A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.

1. Mounting: Flush cabinet, NEMA 250, Type 1.

B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.15 ADDRESSABLE INTERFACE DEVICE

A. General:

1. Include address-setting means on the module.
2. Store an internal identifying code for control panel use to identify the module type.
3. Listed for controlling HVAC fan motor controllers.

B. Monitor Module: Microelectronic module providing a system address for alarm-initiating devices for wired applications with normally open contacts.

C. Integral Relay: Capable of providing a direct signal to elevator controller to initiate elevator recall and to circuit-breaker shunt trip for power shutdown.

1. Allow the control panel to switch the relay contacts on command.
2. Have a minimum of two normally open and two normally closed contacts available for field wiring.

D. Control Module:

1. Operate notification devices.
2. Operate solenoids for use in sprinkler service.

2.16 DIGITAL ALARM COMMUNICATOR TRANSMITTER

A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632.

B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture two telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.

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.
5. Loss of power.
6. Low battery.
7. Abnormal test signal.
8. Communication bus failure.

E. Secondary Power: Integral rechargeable battery and automatic charger.

F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

2.17 NETWORK COMMUNICATIONS

A. Provide network communications for fire-alarm system according to fire-alarm manufacturer's written requirements.

B. Provide network communications pathway per manufacturer's written requirements and requirements in NFPA 72 and NFPA 70.

C. Provide integration gateway using BACnet or Modbus for connection to building automation system.

2.18 DEVICE GUARDS

A. Description: Welded wire mesh of size and shape for the manual station, smoke detector, gong, or other device requiring protection.

1. Factory fabricated and furnished by device manufacturer.
2. Finish: Paint of color to match the protected device.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance of the Work.

1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed, before installation begins.

B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EQUIPMENT INSTALLATION

A. Comply with NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install all electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."

1. Devices placed in service before all other trades have completed cleanup shall be replaced.
2. Devices installed but not yet placed in service shall be protected from construction dust, debris, dirt, moisture, and damage according to manufacturer's written storage instructions.

B. Install wall-mounted equipment, with tops of cabinets not more than 78 inches above the finished floor.

1. Comply with requirements for seismic-restraint devices specified in Section 260548 "Vibration and Seismic Controls for Electrical Systems."

C. Manual Fire-Alarm Boxes:

1. Install manual fire-alarm box in the normal path of egress within 60 inches of the exit doorway.

2. Mount manual fire-alarm box on a background of a contrasting color.
3. The operable part of manual fire-alarm box shall be between 42 inches and 48 inches above floor level. All devices shall be mounted at the same height unless otherwise indicated.

D. Smoke- or Heat-Detector Spacing:

1. Comply with the "Smoke-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for smoke-detector spacing.
2. Comply with the "Heat-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, 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 Annex A or Annex B in NFPA 72.
5. HVAC: Locate detectors not closer than 36 inches 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 and not directly above pendant mounted or indirect lighting.

E. Install a cover on each smoke detector that is not placed in service during construction. Cover shall remain in place except during system testing. Remove cover prior to system turnover.

F. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct. Tubes more than 36 inches long shall be supported at both ends.

1. Do not install smoke detector in duct smoke-detector housing during construction. Install detector only during system testing and prior to system turnover.

G. Air-Sampling Smoke Detectors: If using multiple pipe runs, the runs shall be pneumatically balanced.

H. Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location. Do not install smoke detectors in sprinklered elevator shafts.

I. Single-Station Smoke Detectors: Where more than one smoke alarm is installed within a dwelling or suite, they shall be connected so that the operation of any smoke alarm causes the alarm in all smoke alarms to sound.

J. Remote Status and Alarm Indicators: Install in a visible location near each smoke detector, sprinkler water-flow switch, and valve-tamper switch that is not readily visible from normal viewing position.

K. 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. Install all devices at the same height unless otherwise indicated.

L. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches below the ceiling. Install all devices at the same height unless otherwise indicated.

M. Device Location-Indicating Lights: Locate in public space near the device they monitor.

3.3 PATHWAYS

A. Pathways above recessed ceilings and in nonaccessible locations may be routed exposed.

1. Exposed pathways located less than 96 inches above the floor shall be installed in EMT.

B. Pathways shall be installed in EMT.

C. Exposed EMT shall be painted red enamel.

3.4 CONNECTIONS

A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Section 087100 "Door Hardware." Connect hardware and devices to fire-alarm system.

1. Verify that hardware and devices are listed for use with installed fire-alarm system before making connections.

B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 36 inches from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.

1. Alarm-initiating connection to smoke-control system (smoke management) at firefighters' smoke-control system panel.
2. Alarm-initiating connection to stairwell and elevator-shaft pressurization systems.
3. Smoke dampers in air ducts of designated HVAC duct systems.
4. Magnetically held-open doors.
5. Electronically locked doors and access gates.
6. Alarm-initiating connection to elevator recall system and components.
7. Alarm-initiating connection to activate emergency lighting control.
8. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
9. Supervisory connections at valve supervisory switches.
10. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
11. Supervisory connections at elevator shunt-trip breaker.
12. Data communication circuits for connection to building management system.
13. Data communication circuits for connection to mass notification system.
14. Supervisory connections at fire-extinguisher locations.
15. Supervisory connections at fire-pump power failure including a dead-phase or phase-reversal condition.
16. Supervisory connections at fire-pump engine control panel.

3.5 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

B. Install framed instructions in a location visible from fire-alarm control unit.

3.6 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.

B. Ground shielded cables at the control panel location only. Insulate shield at device location.

3.7 FIELD QUALITY CONTROL

A. Field tests shall be witnessed by authorities having jurisdiction.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

D. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

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 the "Completion Documents, Preparation" table in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
    b. Comply with the "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 the "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" chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

E. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

F. Fire-alarm system will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

H. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

I. 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.

3.8 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of manufacturer's designated service organization. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

1. Include visual inspections according to the "Visual Inspection Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
2. Perform tests in the "Test Methods" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
3. Perform tests per the "Testing Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

3.9 SOFTWARE SERVICE AGREEMENT

A. Comply with UL 864.

B. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.

C. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.

1. Upgrade Notice: At least 30 days to allow Owner to schedule access to system and to upgrade computer equipment if necessary.

3.10 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

END OF SECTION