## SECTION 260010

## GENERAL PROVISIONS FOR ELECTRICAL WORK

### PART 1 – GENERAL

### 1.01 SCOPE OF WORK

A. Provide labor, materials, tools, machinery, equipment, and services necessary to complete the Electrical Work under this Contract. All systems and equipment shall be complete in every aspect and all items of material, equipment and labor shall be provided for a fully operational system and ready for use. Coordinate the work with the work of the other trades in order to resolve all conflicts without impeding the job progress. Contractor shall provide any service, material or equipment not specifically mentioned in these specifications or set forth in the drawings but required to complete this Project without requesting any additional time to complete the Project and without additional cost to the owner.

B. When an item of equipment is indicated on a floor plan and not shown on associated riser diagram or vice-versa, the Contractor shall provide said item and all required conduit and wiring connections for a complete system as part of the Contract.

C. Examine the Structural, Plumbing and Electrical Drawings and other Divisions, and Sections of the Specifications in order to determine the extent of the Work required to be completed under this Division. Failure to examine all the Contract Documents for this Project will not relieve this Section and any other Sections of their responsibilities to perform the Work required for a complete fully operational and satisfactory installation.

D. Contractor shall comply with all laws, regulations, rules, orders, codes, requirements, and the like of federal, state and local governments, courts, governmental authorities, legislative bodies, boards, agencies, commissions and the like ("Laws"). If there is a conflict between or among any Laws and specific requirements of this Contract, then Contractor shall comply with the most stringent Law or requirement in each instance. By noting any specific Law(s) with particularity in this Contract or in any other prior or future communication, Contractor is not relieved of any obligation to comply with all Laws and the Owner does not waive any rights it may have with respect to such compliance.

E. Provide and pay for all materials, labor, services, equipment, licenses, taxes and other items necessary for the execution, installation and completion of Work indicated in Contract Documents.

F. Start-up services shall be included in the bid.

G. All systems, equipment and services specified herein shall be provided complete and ready for use.

H. Provide approved means of firestopping at all rated spaces for all the penetrations made during construction to preserve the fire rating of the spaces.

## 1.02 EXAMINATION OF SITE

A. The Contractor shall be held to have examined the site and to have compared it with the Drawings and Specifications, and deemed to have been satisfied as to the conditions existing at the site, as relating to the actual conditions of the site at the time estimating the Work, the storage and handling of materials, and all other matters as may be incidental to the Work under the Contract, before bidding, and no allowance will subsequently be made to the Contractor by reason of any error due to the Contractor's neglect to comply with the requirements of this clause.

B. Verify final locations for rough work with field measurements and with the requirements of the actual equipment being connected.

## 1.03 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract.

## 1.04 ELECTRICAL EQUIPMENT

A. All electrical equipment shall be the latest of the current year in design, material and workmanship, and shall be the type or model called for in these Specifications.

B. If the type or model specified has been superseded by a later type or model, the latest shall be submitted for approval and shall be provided as part of the Contract.

## 1.05 SUBMITTALS

Provide as outlined in each individual section of these Specifications, including but not limited to:

A. Product Data: Submit manufacturer's product data for equipment including capacity, performance charts, test data, materials, dimensions, weights, and installation instructions.

B. Shop Drawings: Submit manufacture's shop drawings indicating dimensions, weight loading, required clearances, location, and method of assembly of components.

Submittals are mandatory as noted in the respective specifications. Schedules, installation instructions, startup manuals, operation and maintenance manuals, and shop drawings are always required to be submitted.

C. Special Warranty.

D. Quality Assurance Submittals.

E. Operation and Maintenance Manuals.

F. Test Results and Certificates.

G. Manuals and Video Tape of the Personnel Training.

## 1.06 COORDINATION DRAWINGS

A. Provide coordination drawings. Coordination drawings shall be completed so as not to delay the progress of the Project.

## 1.07 CODE COMPLIANCE

A. Drawings and Specifications:

1. It is the intent of these Specifications that all electric work shall be done in strict accordance with the rules of the local Authority Having Jurisdiction (AHJ), local Utility requirements and with the latest applicable version of the NFPA National Electrical Code. Where the requirement of the Drawings or Specifications exceeds the requirements of the Electrical Code, the requirements of the Drawings and Specifications shall be binding upon the Contractor.

2. Should the AHJ inspect the work and issue a violation, the Contractor shall correct the work and eliminate the violation as part of the contract.

B. Interpretation:

1. The electric work detailed in these Specifications and shown on Drawings shall be under the jurisdiction of the Owner, subject to the approval of the AHJ.

2. The Owner shall be the sole source for interpretation of the Contract Documents. Any discrepancies or conflicts shall be brought to the attention of the Owner for clarification.

C. Materials and Appliance: All materials and appliance shall be approved by the Owner's Representative and installed in accordance with the rules and regulations of the local Building Department, AHJ; certificates of approval including the temporary light and power wiring, shall be obtained by the Contractor and delivered to the Owner's Representative before the Work is finally accepted.

## 1.08 ELECTRICAL INSTALLATIONS

A. Coordinate Electrical equipment and materials installation with other building components.

B. Verify all dimensions by field measurements.

C. Arrange for chases, slots, and openings to allow for Electrical installations.

D. Sequence, coordinate, and integrate installations of Electrical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning and entrance prior to the close of the building.

E. Provide a coordinated set of drawings for the project, verifying the integration of the installation clearances between the new components and the existing, and submit for approval prior to initiating construction.

F. Coordinate the cutting and patching of building components to accommodate the installation of Electrical equipment and materials.

G. Where mounting heights are not detailed or dimensioned, install Electrical services and overhead equipment to provide the maximum headroom possible.

H. Install Electrical equipment to facilitate maintenance and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting and minimum of interference with other installations.

I. Coordinate the installation of Electrical materials and equipment above ceilings with suspension system, light fixtures, and all other installations and accessories.

## 1.09 TESTS

A. The Contractor shall demonstrate to the Owner operation of all equipment and systems. All tests shall be completed to the satisfaction of the Owner. Each test shall be performed as indicated in the individual specification section.

## 1.10 GUARANTEES, WARRANTIES, BONDS, AND MAINTENANCE CONTROL

A. Refer to individual equipment specifications for warranty requirements.

1. Compile and assemble the warranties specified for Electrical work into a separated set of documents, tabulated and indexed for easy reference.

2. Provide complete warranty information for each item to include product or equipment including duration of warranty or bond; and names, addresses, and telephone numbers and procedures for filing a claim and obtaining warranty services.

3. Warranties for the equipment, workmanship and materials should be provided for the period of one year.

4. Manufacturers', in addition to Contractors' warranties, shall be provided for all Electrical equipment and accessories.

5. All warranties are to start from the date of Substantial Completion.

## 1.11 OPERATIONS, TRAINING AND MAINTENANCE MANUALS

A. General

1. Provide procedures and requirements for preparation and submittal of operation and maintenance manuals for each item of equipment. Refer to individual equipment specifications for maintenance manual additional requirements.

2. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of all replaceable parts.

3. Manufacturer's printed operating procedures to include start-up, break-in, routine and normal operating instructions; regulation, control, stopping, shut-down, and emergency instructions; and summer and winter operating instructions.

4. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassemble; aligning and adjusting instructions.

5. Servicing instructions and lubrication charts and schedules.

B. Bind all the other Sections maintenance manuals in a single final Operating and Maintenance Manual.

C. Contractor shall videotape all the training sessions for various equipment and systems as specified in individual sections of these Specifications. If a manufacturer's particular equipment item is furnished with a training video, the manufacturer's video shall be provided in addition to the requirements of this Section, not in lieu thereof and at no additional cost to the Owner. Contractor shall be responsible for providing informative videotapes covering all the materials and content outlined in each individual section of these Specifications.

## 1.12 CLEANING AND REPAIR

A. On completion of installation, inspect interior and exterior of installed equipment. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

B. Contractor shall not leave sharp exposed metal edges (bottom of threaded rods, electrical equipment supports, etc.) that could otherwise present safety hazards to the building's occupants/work staff.

**END OF SECTION**

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## SECTION 260526

## GROUNDING AND BONDING

### PART 1 - GENERAL

### 1.01 DESCRIPTION OF WORK

A. The Contractor shall provide a complete grounding of electrical systems and equipment being installed under this project as per NEC 2017. Utilize and extend existing building grounding system to provide grounding of the new system being installed under this project.

### 1.02 SUPPLEMENTAL SUBMITTALS

A. Field Test Reports: Submit written test reports to include the following:

1. Test procedures used.

2. Test results that comply with requirements.

### PART 2 - PRODUCT

### 2.01 GROUNDING CONDUCTORS

A. Copper conductors, bare or insulated with THWN or THHN insulation.

B. Equipment Grounding Conductors: Insulated with green-colored insulation.

C. Isolated Ground Conductors: Insulated with green-colored simulation with yellow stripe. On feeders with isolated ground, use colored tape, alternating bands of green and yellow tape to provide a minimum of three bands of green and two bands of yellow.

D. Grounding Electrode Conductors: Stranded cable.

E. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.

F. Bare Copper Conductors: Comply with the following:

1. Solid Conductors: ASTM B 3.

2. Assembly of Stranded Conductors: ASTM B 8.

3. Tinned Conductors: ASTM B 33.

G. Copper Bonding Conductors: As follows:

1. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG copper conductor, 1/4 inch (6.4 mm) in diameter.

2. Bonding Conductor: No. 4 or No. 6 AWG, stranded copper conductor.

3. Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; 1-5/8 inches (42 mm) wide and 1/16 inch (1.5 mm) thick.

4. Tinned Bonding Jumper: Tinned-copper tape, braided copper conductors, terminated with copper ferrules; 1-5/8 inches (42 mm) wide and 1/16 inch (1.5 mm) thick.

## 2.02 CONNECTOR PRODUCTS

A. Comply with IEEE 837 and UL 467. Listed for use for specific types, sizes, and combinations of conductors and connected items.

B. Bolted Connectors: Bolted-pressure-type connectors, or compression type.

C. Welded Connectors: Exothermic-welded type, in kit form, and selected per manufacturer's written instructions.

D. All terminal lugs and bolts shall be 98% silicon bronze copper.

## PART 3 - EXECUTION

## 3.01 APPLICATION

A. In raceways, use insulated equipment grounding conductors.

B. Exothermic-welded Connections: Use for connections to structural steel and for underground connections.

C. Equipment Grounding Conductor Terminations: Use bolted pressure clamps.

E. Underground Grounding Conductors: Use copper conductor, No. 2/0 AWG minimum.

## 3.02 INSTALLATION

A. Nonmetallic Raceways: Install an equipment grounding conductor in non metallic raceways unless they are designated for telephone or data cables.

B. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

C. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then, use a bolted clamp. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.

D. Bond interior metal piping systems and metal air ducts to equipment grounding conductors of associated pumps, fans, blowers, electric heaters, and air cleaners. Use braided-type bonding straps.

## 3.03 CONNECTIONS

A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.

2. Make connections with clean, bare metal at points of contact.

3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.

4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.

5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

B. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.

C. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.

D. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically noncontinuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.

F. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A [and UL 486B].

F. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.

## 3.05 TESTING

A. Testing:

1. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.

2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells. Measure ground resistance not less than two full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests, by the fall-of-potential method according to IEEE 81.

**END OF SECTION**

## SECTION 260529

## FASTENERS, ATTACHMENTS, AND SUPPORTING DEVICES

### PART 1 GENERAL

### 1.01 SUBMITTALS

A. Shop Drawings: Show support details if different from methods specified or shown on the drawings.

B. Product Data: Catalog sheets, specifications and installation instructions.

### PART 2 PRODUCTS

### 2.01 ANCHORING DEVICES

A. Sleeve Anchors Type 3, Class 3: Molly/Emhart's Parasleeve Series, Phillips' Red Head, FS Series, or Ramset's Dynabolt Series.

B. Wedge Anchors Type 4, Class 1 Hilti's Kwik Bolt Series, Molly/Emhart's Parabolt Series, Phillips' Red Head WS, or Ramset's Trubolt Series.

C. Non-Drilling Anchors (FS FF-S-325 Group VIII, Type 1): Hilti's Drop-In Anchor Series, Phillips' Red Head J Series, or Ramset's Dynaset Series.

D. Stud Anchors (FS FF-S-325 Group VIII, Type 2): Phillips' Red Head JS Series.

### 2.02 CAST-IN-PLACE CONCRETE INSERTS

A. Continuous Slotted Type Concrete Insert, Galvanized:

1. Load Rating 1300 lbs./ft.: Kindorf's D-986.

2. Load Rating 2400 lbs./ft.: Kindorf's D-980.

3. Load Rating 3000 lbs./ft.: Hohmann & Barnard Inc.'s Type CS-H.

4. Load Rating 4500 lbs./ft.: Hohmann & Barnard Inc.'s Type CS-HD.

B. Threaded Type Concrete Insert: Galvanized ferrous castings, internally threaded.

C. Wedge Type Concrete Insert: Galvanized box-type ferrous castings, designed to accept bolts having special wedge shaped heads.

## 2.03 MISCELLANEOUS FASTENERS

A. Except where shown otherwise on the Drawings, furnish type, size, and grade required for proper installation of the Work, selected from the following: Furnish galvanized fasteners for exterior use, or for items anchored to exterior walls, except where stainless steel is indicated.

1. Standard Bolts and Nuts: ASTM A 307, Grade A, regular hexagon head.
2. Lag Bolts: FS FF-B-561, square head type.
3. Machine Screws: FS FF-S-92, cadmium plated steel.
4. Machine Bolts: FS FF-B-584 heads; FF-N-836 nuts.
5. Wood Screws: FS FF-S-111 flat head carbon steel.
6. Plain Washers: FS FF-W-92, round, general assembly grade carbon steel.
7. Lock Washers: FS FF-W-84, helical spring type carbon steel.
8. Toggle Bolts: Tumble-wing type; FS FF-B-588, type, class and style as required to sustain load.

B. Stainless Steel Fasteners: Type 302 for interior Work; Type 316 for exterior Work; Phillips head screws and bolts for exposed Work unless otherwise specified.

## 2.04 TPR (THE PEEL RIVET) FASTENERS

A. 1/4 inch diameter, threadless fasteners distributed by Subcon Products, 315 Fairfield Road, Fairfield, NJ 07004 (800) 634-5979.

## 2.05 POWDER DRIVEN FASTENER SYSTEMS

A. Olin Corp.'s Ramset Fastening Systems, or Phillips Drill Company Inc.'s Red Head Powder Actuated Systems.

## 2.06 HANGER RODS

A. Mild low carbon steel, unless otherwise specified; fully threaded or threaded each end, with nuts as required to position and lock rod in place. Unless galvanized or cadmium plated, provide a shop coat of red lead or zinc chromate primer paint.

## 2.07 "C" BEAM CLAMPS

A. With Conduit Hangers:

1. For 1 Inch Conduit Maximum: B-Line Systems Inc.'s BG-8, BP-8 Series, Caddy/Erico Products Inc.'s BC-8P and BC-8PSM Series, or GB Electrical Inc.'s HIT 110-412 Series.

2. For 3 Inch Conduit Maximum: Appleton Electric Co.'s BH-500 Series beam clamp with H50W/B Series hangers, Kindorf's 500 Series beam clamp with 6HO-B Series hanger, or OZ/Gedney Co.'s IS-500 Series beam clamp with H-OWB Series hanger.

3. For 4 Inch Conduit Maximum: Kindorf's E-231 beam clamp and E-234 anchor clip and C-149 series lay-in hanger; Unistrut Corp.'s P2676 beam clamp and P-1659A Series anchor clip with J1205 Series lay in hanger.

B. For Hanger Rods:

1. For 1/4 Inch Hanger Rods: B-Line Systems Inc.'s BC, Caddy/Erico Products Inc.'s BC, GB Electrical Inc.'s HIT 110, Kindorf's 500, 510, or Unistrut Corp.'s P1648S, P2398S, P2675, P2676.

2. For 3/8 Inch Hanger Rods: Caddy/Erico Products Inc.'s BC, Kindorf's 231-3/8, 502, or Unistrut Corp.'s P1649AS, P2401S, P2675, P2676.

3. For 1/2 Inch Rods: Appleton Electric Co. BH-500 Series, Kindorf's 500 Series, 231-1/2, OZ/Gedney Co.'s IS-500 Series, or Unistrut Corp.'s P1650AS, P2403S, P2676.

4. For 5/8 Inch Rods: Unistrut Corp.'s P1651AS beam clamp and P1656A Series anchor clip.

5. For 3/4 Inch Rods: Unistrut Corp.'s P1653S beam clamp and P1656A Series anchor clip.

## 2.08 CHANNEL SUPPORT SYSTEM

A. Channel Material: 12 gage steel.

B. Finishes:

1. Phosphate and baked green enamel/epoxy.

2. Pre-galvanized.

3. Electro-galvanized.

4. Hot dipped galvanized.

5. Polyvinyl chloride (PVC), minimum 15 mils thick.

C. Fittings: Same material and finish as channel.

D. UL Listed Systems:

1. B-Line Systems Inc.'s B-22 (1-5/8 x 1-5/8 inches), B-12 (1-5/8 x 2-7/16 inches), B-11 (1-5/8 x 3-1/4 inches).

2. Grinell Corp.'s Allied Power-Strut PS 200 (1-5/8 x 1-5/8 inches), PS 150 (1-5/8 x 2-

7/16 inches), PS 100 (1-5/8 x 3-1/4 inches).

3. Kindorf's B-900 (1-1/2 x 1-1/2 inches), B-901 (1-1/2 x 1-7/8 inches), B-902 (1-1/2 x 3 inches).

4. Unistrut Corp.'s P-3000 (1-3/8 x 1-5/8 inches), P-5500 (1-5/8 x 2-7/16 inches), P-5000 (1-5/8 x 3-1/4 inches).

5. Versabar Corp.'s VA-1 (1-5/8 x 1-5/8 inches), VA-3 (1-5/8 x 2-1/2 inches).

## 2.09 MISCELLANEOUS FITTINGS

A. Side Beam Brackets: B-Line Systems Inc.'s B102, B103, B371-2, Kindorf's B-915, or Versabar Corp.'s VF-2305, VF-2507.

B. Pipe Straps:

1. Two Hole Steel Conduit Straps: B-Line Systems Inc.'s B-2100 Series, Kindorf's C-144 Series, or Unistrut Corp.'s P-2558 Series.

2. One Hole Malleable Iron Clamps: Kindorf's HS-400 Series, or OZ/ Gedney Co.'s 14-G Series, 15-G Series (EMT).

C. Deck Clamps: Caddy/Erico Products Inc.'s DH-4-T1 Series.

D. Fixture Stud and Strap: OZ/Gedney Co.'s SL-134, or Steel City's FE-431.

E. Supporting Fittings for Pendent Mounted Industrial Type Fluorescent Fixtures on Exposed Conduit System:

1. Ball Hanger: Appleton Electric Co.'s AL Series, or Crouse-Hinds Co.'s AL Series.

2. Flexible Fixture Hanger: Appleton Electric Co.'s UNJ-50, UNJ-75, or Crouse-Hinds Co.'s UNJ115.

3. Flexible (Hook Type) Fixture Hanger: Appleton Electric Co.'s FHHF, or Crouse-Hinds Co.'s UNH-1.

4. Eyelet: Unistrut Corp.'s M2250.

5. Eyelet with Stud: Kindorf's H262, or Unistrut Corp.'s M2350.

6. Conduit Hook: Appleton Electric Co.'s FHSN, or Crouse-Hinds Co.'s UNH-13.

F. Supporting Fasteners (Metal Stud Construction): Metal stud supports, clips and accessories as produced by Caddy/Erico Products Inc.

# PART 3 EXECUTION

## 3.01 INSTALLATION

A. Where specific fasteners are not specified or indicated for securing items to in-place construction, provide appropriate type, size, and number of fasteners for a secure, rigid installation.

B. Install anchoring devices and other fasteners in accordance with manufacturer's printed instructions.

C. Make attachments to structural steel wherever possible.

## 3.02 FASTENER SCHEDULE

A. Material:

1. Use cadmium or zinc coated anchors and fasteners in dry locations.

2. Use hot dipped galvanized or stainless-steel anchors and fasteners in damp and wet locations.

3. For corrosive atmospheres or other extreme environmental conditions, use fasteners made of materials suitable for the conditions.

B. Types and Use: Unless otherwise specified or indicated use:

1. Anchoring devices to fasten items to solid masonry and concrete when the anchor is not subjected to pull out loads, or vibration in shear loads.

2. Toggle bolts to fasten items to hollow masonry and stud partitions.

3. TPR fasteners to fasten items to plywood backed gypsum board ceilings.

4. Metallic fasteners installed with electrically operated or powder driven tools for approved applications, except:

a. Do not use powder driven drive pins or expansion nails.

b. Do not attach powder driven or welded studs to structural steel less than 3/16 inch thick.

c. Do not support a load, in excess of 250 lbs. from any single welded or powder driven stud.

d. Do not use powder driven fasteners in precast concrete.

## 3.03 ATTACHMENT SCHEDULE

A. General: Make attachments to structural steel or steel bar joists wherever possible. Provide intermediate structural steel members where required by support spacing. Select steel members for use as intermediate supports based on a minimum safety factor of 5.

1. Make attachments to steel bar joists at panel points of joists.

2. Do not drill holes in main structural steel members.

3. Use "C" beam clamps for attachment to steel beams.

B. Where it is not possible to make attachments to structural steel or steel bar joists, use the following methods of attachment to suit type of construction unless otherwise specified or indicated on the drawings:

1. Attachment to Steel Roof Decking (No Concrete Fill):

a. Decking With Hanger Tabs: Use deck clamps.

b. Decking Without Hanger Tabs:

1) Before Roofing Has Been Applied: Use 3/8 inch threaded steel rod welded to a 4 x 4 x 1/4 inch steel plate and installed through 1/2 inch hole in roof deck.

2) After Roofing Has Been Applied: Use welding studs, or self-drilling/tapping fasteners. Exercise extreme care when installing fasteners to avoid damage to roofing.

2. Attachment to Concrete Filled Steel Decks (Total thickness, 2-1/2 inches or more):

a. Before Fill Has Been Placed:

1) Use thru-bolts and fish plates.

2) Use welded studs. Do not support a load in excess of 250 pounds from a single welded stud.

b. After Fill Has Been Placed: Use welded studs. Do not support a load in excess of 250 lbs. from a single welded stud.

3. Attachment to Cast-In-Place Concrete:

a. Fresh Concrete: Use cast-in-place concrete inserts.

b. Existing Concrete: Use anchoring devices.

4. Attachment to Cored Precast Concrete Decks:

a. New Construction: Use thru-bolts and fish plates before Construction Work Contractor has placed concrete fill over decks.

1) Existing Construction: Toggle bolts may be installed in cells for a maximum load of 15 lbs.

5. Attachment to Hollow Block or Tile Filled Concrete Deck:

a) New Construction: Use cast-in-place concrete inserts by having Construction Work Contractor omitting blocks and pouring solid blocks with insert where required.

6. Attachment to Waffle Type Concrete Decks:

(a) New Construction:

1) Use cast-in-place concrete inserts in fresh concrete.

2) If concrete fill has been applied over deck, thru-bolts and fish plates may be used where additional concrete or roofing is to be placed over the deck.

7. Attachment to Precast Concrete Planks: Use anchoring devices, except do not make attachments to precast concrete planks less than 2-3/4 inches thick.

8. Attachment to Precast Concrete Tee Construction:

a. New Construction:

1) Use tee hanger inserts between adjacent flanges.

2) Use thru-bolts and fish plates, except at roof deck without concrete fill.

b) Existing Construction:

1) Use anchoring devices installed in webs of tees. Install anchoring devices as high as possible in the webs.

2) Do not use powder driven fasteners.

3) Exercise extreme care in drilling holes to avoid damage to reinforcement.

9. Attachment to Wood Construction: Use side beam brackets fastened to the sides of wood members to make attachments for hangers.

a) Under 15 lbs Load: Attach side beam brackets to wood members with 2 No. 18 x 1-1/2 inch long wood screws, or 2 No. 16 x 1-1/2 inch long drive screws.

b) Over 15 lbs Load: Attach side beam brackets to wood members with bolts and nuts or lag bolts. Do not use lag bolts in wooden members having a nominal thickness (beam face) under 2 inches in size. Install bolts and nuts or lag bolts in the side of wood members at the mid-point or slightly above. Install plain washers under all nuts.

| LOAD | LAG BOLT SIZE | BOLT DIA. |
|---|---|---|

| | | |
|---|---|---|
| 15 lbs to 30 lbs | 3/8 x 1-3/4 inches | 3/8 inch |
| 31 lbs to 50 lbs | 1/2 x 2 inches | 1/2 inch |
| Over 50 lbs to load limit of structure. | Use bolt & nut | 5/8 inch |

10. Attachment to Metal Stud Construction: Use supporting fasteners manufactured specifically for the attachment of raceways and boxes to metal stud construction.

## 3.04 CONDUIT SUPPORT SCHEDULE

A. Provide number of supports as required by National Electrical Code. Exception: Maximum support spacing allowed is 4'-0" for conduit sizes 3 inches and larger supported from wood trusses.

B. Use pipe straps and specified method of attachment where conduit is installed proximate to surface of wood or masonry construction.

1. Use hangers secured to surface with specified method of attachment where conduit is suspended from the surface.

C. Use "C" beam clamps and hangers where conduit is supported from steel beams.

D. Use deck clamps and hangers where conduit is supported from steel decking having hanger tabs.

1. Where conduit is supported from steel decking which does not have hanger tabs, use clamps and hangers secured to decking, utilizing specified method of attachment.

E. Use channel support system supported from structural steel for multiple parallel conduit runs.

F. Where conduits are installed above ceiling, do not rest conduit directly on runner bars, T-Bars, etc.

1. Conduit Sizes 2-1/2 Inches and Smaller: Support conduit from ceiling supports or from construction above ceiling.

2. Conduit Sizes Over 2-1/2 Inches: Support conduit from beams, joists, or trusses above ceiling.

## 3.05 LIGHTING FIXTURE SUPPORT SCHEDULE

A. General: Do not support fixtures from ceilings or ceiling supports unless it is specified or indicated on the drawings to do so.

1. Support fixtures with hanger rods attached to beams, joists, or trusses. Hanger rod diameter, largest standard size that will fit in mounting holes of fixture.

a. Where approved, channel supports may span and rest upon the lower chord of trusses and be utilized for the support of lighting fixtures.

b. Where approved, channel supports may span and be attached to the underside of beams, joists, or trusses and be utilized for the support of lighting fixtures.

2. Use 2 nuts and 2 washers on lower end of each hanger rod to hold and adjust fixture (one nut and washer above top of fixture housing, one nut and washer below top of fixture housing).

a. Where specified that an adequately supported outlet box is to support a fixture or be utilized as one point of support, support the box so that it may be adjusted to bring the face of the outlet box even with surface of ceiling.

B. Specific Installations Where Fixtures May Be Supported From New Ceilings Being Installed By Construction Work Contractor:

1. Support surface mounted fluorescent fixtures and incandescent fixtures directly from plywood backed gypsum board ceilings.

2. Support surface mounted fluorescent fixtures and incandescent fixtures directly from framing or furring members of fire rated suspended ceilings (double gypsum board).

3. Support recessed mounted fluorescent fixtures and incandescent fixtures directly from furring members of furred gypsum board ceilings.

4. Support recessed mounted fluorescent fixtures and incandescent fixtures directly from the suspension system of suspended acoustical ceilings. Exception: Support each fixture weighing more than 50 pounds (including lamps) independent of the suspended ceiling grid.

5. Deliver documents which state actual fixture weights and indicate fixture locations to the Construction Work Contractor (thru the Director's Representative).

C. Number of Supports for Ceiling Mounted Lighting Fixtures: Provide at least the following number of supports. Provide additional supports when recommended by fixture manufacturer, or shown on the drawings.

1. Commercial and Industrial Fluorescent Fixtures:

a. Support individual fluorescent fixtures less than 2 feet wide at 2 points.

b. Support continuous row fluorescent fixtures less than 2 feet wide at points equal to the number of fixtures plus one. Uniformly distribute the points of support over the row of fixtures.

c. Support individual fluorescent fixtures 2 feet or wider at 4 corners.

d. Support continuous row fluorescent fixtures 2 feet or wider at points equal to twice the number of fixtures plus 2. Uniformly distribute the points of

support over the row of fixtures.

e. An adequately supported outlet box may be utilized as one point of support for fixtures weighing less than 50 pounds.

2. Commercial and Industrial Incandescent Fixtures: Support fixture from adequately supported outlet box, to suit fixture design (fixture weight less than 50 pounds).

## 3.06 CHANNEL SUPPORT SYSTEM SCHEDULE

A. Use channel support system where specified or indicated on the drawings.

B. Channel supports may be used, as approved, to accommodate mounting of equipment.

C. Material and Finish:

1. Dry Locations: Use 12 gage steel channel support system having any one of the specified finishes.

2. Damp Locations: Use 12 gage steel channel support system having any one of the specified finishes except green epoxy/enamel.

3. Wet Locations: Use 12 gage steel channel support system having hot dipped galvanized, or PVC finish.

**END OF SECTION**

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# SECTION 260533

# RACEWAYS

## PART 1 – GENERAL

### 1.01 RELATED DOCUMENTS

A. The requirements and general provisions of Section 260010 shall apply to the work of this Section.

### 1.02 SCOPE

A. Provide raceways, fittings, boxes and accessories indicated on the Drawings, herein specified or required for the complete and proper operation of the systems specified or indicated on the Drawings.

C. Where the Contractor selects and installs an item of equipment which requires either additional conduit, boxes, fittings, etc., or a modification of the conduit system indicated on the Drawings, such additional conduit, boxes, fittings, etc., shall be provided and such modifications shall be performed by the Contractor as part of this Contract and without extra compensation from the Owner.

D. The Contractor shall coordinate the work with all trades so that the completed installation, particularly partitions and walls, will present a finished appearance. There shall be no structural malformation caused by improper installation of electrical equipment and no observable spaces between electrical equipment and the structure.

### 1.03 SUBMITTALS

A. Product data.

## PART 2 – PRODUCTS

### 2.01 RACEWAYS

A. Rigid Galvanized Conduit (RGC)

1. Rigid conduit shall be in standard lengths with manufacturers' name, nominal diameter and Underwriters label (U.L.) stamped on each length.
Material shall be galvanized steel. RGC shall meet the requirements of Article 344 of the National Electrical Code.

B. Steel Electrical Metal Tubing (EMT-S) and Elbows:

1. Manufacturers: Subject to compliance with requirements, undefined:
   a. Allied Tube & Conduit; Atkore International.
   b. Calconduit; Atkore International.

c. Emerson Electric Co.

2. Applicable Standards:
   a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
   b. General Characteristics:
      1) Reference Standards: UL 797 and UL Category Control Number FJMX.
      2) Material: Steel.
      3) Exterior Coating: Alternate corrosion-resistant coating.
      4) Interior Coating: Zinc .
   c. Options:
      1) Minimum Trade Size: 3/4 inch .
      2) Colors: As indicated on Drawings

C. Flexible Metal Conduit:

Galvanized steel strip shaped into interlocking convolutions, UL categorized as Flexible Metal Conduit (identified on UL Listing Mark as Flexible Steel Conduit or Flexible Steel Conduit Type RW), as manufactured by American Flexible Conduit Co., Cerro Conduit Co., Ettco Wire and Cable Corp., or International Metal Hose Co.

D. Liquid tight Flexible Metal Conduit:

Anaconda Metal Hose Anamet Inc.'s Sealtite Type UA, Electri-Flex Co.'s Type LA Liquatite, Flexible Technology Corp.'s Type UA, or Universal Metal Hose Co.'s Universal Sealflex U.

E. Rigid Nonmetallic Conduit, Fittings, and Accessories:

UL categorized as Rigid Nonmetallic, Schedule 40 and Schedule 80 PVC conduit (identified on UL Listing Mark as Rigid Nonmetallic Conduit Aboveground and Underground Schedule 40; Rigid Nonmetallic Conduit Aboveground and Underground Extra Heavy Wall Schedule 80), by Beck Mfg./Picoma Industries, Cantex Inc., Carlon/Div. Of Lamson and Sessions, Ipex Inc., J-M Mfg. Co. Inc., National Pipe & Plastics Inc., or Queen City Plastics Inc.

## 2.02 FITTINGS AND ACCESSORIES

All fittings and accessories must be U.L. approved and compatible with selected raceways.

A. Insulated Bushings

B. Plastic Bushings for 3/4" Conduit

C. Insulated Grounding Bushings

D. Connectors, Couplings and Locknuts

E. Conduit Bodies (Threaded)
Malleable Iron/Zinc Electroplate: Zinc electroplate malleable iron or cast iron alloy bodies with zinc electroplate steel covers.

F. Expansion Fittings
Zinc Electroplate Finish with external bonding jumper.

G. Connectors and Couplings
Waterproof Hub connectors shall be used on all exterior installations. T&B # 370.

H. Deflection Fittings

I. Sealing Fittings

J. Expanding Silicone Foam

K. Vertical Conductor Supports

L. Drag Line
1/8" polypropylene monofilament utility rope.

## 2.03 CONDUIT SIZES

A. The sizes of conduits and raceways indicated on the Drawings are the minimum acceptable by the Owner's Representative for the number of conductors to be installed. Where neither Drawings nor the Specifications indicate a size, conduits shall be not less than 3/4 inch size (nominal diameter) or of such larger size as required by the New York State Electric Code for the number of conductors specified or indicated on the Drawings. Where the Drawings or the Specifications indicate existing conduit is to be extended, the new conduit extension shall be the same size as the conduit extended, unless otherwise specified in the Drawings or the Specification.

## 2.04 INSULATED BUSHINGS

A. All conduits having a nominal diameter of 1-inch or larger shall be equipped with insulated bushings meeting either of the following requirements:

1. Metal bushings, cadmium plated and insulated with Bakelite.

2. Bushings of heat treated aluminum alloy with phenolic treated fiber insulation.

## 2.05 HANGERS AND STRAPS

A. Hangers:

Separate hangers shall be installed for supporting conduits. Wherever possible hangers shall be supported from concrete slab by inserts. Prefabricated adjustable metal channel framing and associated fittings the equal of Kindorf, Unistrut, Power-Strut or Binkley will be acceptable in lieu of hangers if of equal mechanical strength.

Hangers and fittings shall be rust resistant treated and where installed concealed in hung ceilings need not be painted. Where installed exposed, apply finish coat of aluminum paint or color to match, as approved. Conduits on hangers shall be firmly attached to each hanger by using approved "U" bolts or straps.
Hangers and piping installed by other trades shall not be used for supporting electric conduits.

B. Straps and backs:

Straps shall be properly formed to rigidly support conduits, and to properly space conduits from each other and from the ceiling or wall; minimum acceptable thickness shall be 1/16". Straps shall be galvanized or cadmium plated after they have been formed and drilled.

Maximum spacing of straps shall be five (5) feet for conduits not mounted on hangers.
Straps for use on the exterior of the building or in pipe tunnels shall be hot dipped galvanized.

C. Vertical Supports:

At each floor provide rust resistant iron conduit clamps or other approved support at floor slabs on all vertical feeder conduits. Supports shall be as manufactured by Kindorf, Steel City, OZ/Gedney and Kellem.

## 2.06 SLEEVES FOR CONDUIT

A. Provide sleeves for all electrical conduits passing through foundation, floors, roofs, beams, and at other areas where indicated on Drawings. Provide as detailed on Drawings and as specified herein.

1. Interior floors' roofs: Provide galvanized sheet steel sleeve, 20 gauge. Provide 1" flange at bottom end for securing purposes. Sleeve ends flush with ceiling surfaces, and top of finished floors or roof.

2. Sleeves passing through fire-rated walls, floors, roofs, ceilings, and other areas where indicated: the space between sleeve and pipe/conduit shall be fire stopped to comply with fire rating of assembly through which it passes.

# PART 3 – EXECUTION

## 3.01 RACEWAY INSTALLATION - GENERAL

A. General Requirements for Raceway

1. Make all cuts square.

2. Ream out all burrs from ends.

3. Couple sections together utilizing fittings specifically designed for use with the raceway.

4. Make up raceway to cabinets and boxes utilizing steel or malleable iron fittings with insulated throats, and specifically designed for the purpose.

5. Equip all conduit runs, which cross building expansion or control joints with expansion fittings having flexible grounding bonds by passing sliding parts. Arrange expansion fittings so that sliding action is not impeded.

6. During installation, cap all runs left unfinished or unattended. Also cap terminations of finished runs until wires and cables are to be pulled in. For capping, utilize fittings manufactured specifically for the purpose. Exclude paper or wood plugs.

7. Where embedded in concrete, utilize concrete compression type couplings, connectors and fittings of a type, which assures ground continuity.

8. Coat all threads with conductive, oxide inhibiting compound.

B. Not Used.

C. Number of Raceways:

Do not change number of raceways to less than the number indicated on the Drawings unless prior approval is received. Existing raceways may be reused if the Contractor meets the following conditions:

1. The existing raceway must be of adequate size for the new conductors to be installed therein. More circuits may be enclosed by existing raceways than the circuiting shown on the Drawings provided conductor sizes are increased to compensate for derating.

2. Remove existing conductors.

3. Demonstrate to the Owner that the existing raceway is clear of obstructions and in good condition.

4. Check ground continuity. When ground continuity of existing raceway is inadequate, install insulated grounding bushings, grounding wedges, bonding straps, grounding jumpers or equipment grounding conductors to establish effective path to ground.

5. Install insulated bushings to replace damaged or missing bushings. Replace non-insulated bushings with insulated bushings on raceway sizes 1" and larger.

6. Install vertical conductor supports to replace existing or missing vertical conductor supports.

7. Install extension collars on existing boxes when the number of new conductors installed therein exceeds code.

D. Raceways for Future Use (Spare and Empty Raceways):

Draw fish tape through raceways in the presence of the Owner's Representative to show that the raceway is clear of obstructions.

1. Install a dragline in each raceway.

E. Conduit Installed Concealed in Existing Construction

In existing buildings new conduit systems shall be installed, in the following manner:

1. Where new partition walls and new hung or furred ceilings are being erected the conduits and related equipment shall be installed concealed in walls and in hung or furred ceilings.

2. Rigid Conduits must be used for conductors of the fire alarm system stairway lights, and exposed feeders.

F.Conduit Installed Concealed in New Construction:

1. Ceilings, Walls, and Partitions: Install conduit concealed in the ceilings, walls, and partitions of the building unless otherwise indicated on the Drawings.

   a. Run conduits in partitions vertically.

2. The Contractor shall not cut any hole larger than six (6) inches except where otherwise directed in the Contract, and where the opening if larger than six inches it shall be reinforced by other trades.

G. Conduit Installed Exposed

1. Work shall be done in neat and workmanlike manner at right angles and parallel to building walls and structure.

2. Install vertical runs perpendicular to floor.

3. Install runs on the ceiling perpendicular or parallel to the walls.

4. Install horizontal runs parallel to the floor.

5. Do not run conduits near heating pipes.

6. Installation of conduit directly on the floor will not be permitted.

H. Conduit Size: Not smaller than 3/4" electrical trade size.

I. Conduit Bends:

For 3/4" conduits, bends may be made with manual benders. For all conduit sizes larger than 3/4" manufactured or field fabricated offsets or bends may be used. Make field fabricated offsets or bends with an approved mechanical/hydraulic bender.

## 3.02 RACEWAY SCHEDULE

A. Rigid Galvanized Steel Conduit (RGC):

1. Install in all locations, unless otherwise specified or indicated on the Drawings, including but not limited to the following:

a. Conduits installed exposed up to 10'-0" AFF. Exposed risers shall be RGC for the entire vertical run.

b. Rigid conduit shall be used for exposed work in Mechanical Spaces and in unfinished sections of the building.

B. Electrical Metallic Tubing (EMT)

Provide EMT for feeders and branch circuits for power, lighting and low voltage systems installed indoors.

C. Flexible Metal Conduit:

Install for all connections to vibrating equipment, or as otherwise specified and as detailed as follows:

1. Use for final conduit connection to recessed lighting fixtures in suspended ceilings. Use 4 to 6 ft. of flexible metal conduit (minimum size 3/4") between junction box and fixture. Locate junction box at least 1 ft. from fixture and accessible if the fixture is removed.

2. Use 1 to 3 ft. of flexible metal conduit for final conduit connection to:

a. Motors with open, drip-proof or splash-proof housings.

b. Equipment subject to vibration (dry locations).
c. Equipment requiring flexible connection for adjustment or alignment (dry locations).

3. Use for concealed branch circuit conduits above existing non-removable suspended ceilings where conduit cannot be installed due to inaccessibility of space above ceiling.

4. May be installed concealed as branch circuit conduits in drywall construction with sheet metal studs, except where studs are less than 3-1/2" deep.

5. Flexible steel conduit shall be attached to boxes or to rigid conduits by means of connectors having twin screw fastenings, or other approved type, each of which will separately and securely hold the flexible conduit in place.

6. In all cases install equipment-grounding conductor in the flexible raceway and bond at each box or equipment to which flex is connected. The Contractor is advised that grounding conductors are not shown on the Drawings.

D. Liquidtight Flexible Metal Conduit:

1. Use 1 to 3 ft. of liquidtight flexible metal conduit for final conduit connection to:

a. Motors with weather-protected or totally enclosed housings.

b. Equipment requiring flexible connection for adjustment or alignment (damp and wet locations).

E. Rigid Nonmetallic PVC Conduit:

1. Schedule 80:
2.

a. Use for protection of feeders installed underground.

F. General Requirements for Raceway

1. Make all cuts square.

2. Ream out all burrs from ends.

3. Couple sections together utilizing fittings specifically designed for use with the raceway.

4. Make up raceway to cabinets and boxes utilizing steel or malleable iron fittings with insulated throats, and specifically designed for the purpose.

5. Equip all conduit runs, which cross building expansion or control joints with expansion fittings having flexible grounding bonds by passing sliding parts. Arrange expansion fittings so that sliding action is not impeded.

6. During installation, cap all runs left unfinished or unattended. Also cap terminations of finished runs until wires and cables are to be pulled in. For

capping, utilize fittings manufactured specifically for the purpose. Exclude paper or wood plugs.

7. Where embedded in concrete, utilize concrete compression type couplings, connectors and fittings of a type, which assures ground continuity.

8. Coat all threads with conductive, oxide inhibiting compound.

## 3.03 FITTINGS AND ACCESSORIES SCHEDULE

A. General

1. Use zinc electroplate or hot dipped galvanized steel/malleable iron or cast iron alloy fittings and accessories in conjunction with ferrous raceways in dry and damp locations unless otherwise specified or indicated on the Drawings.
2. Use insulated grounding bushings or grounding wedges on ends of conduit for terminating and bonding equipment grounding conductors (when required) if cabinet or boxes are not equipped with grounding/bonding screws or lugs.
3. Use caps or plugs to seal ends of conduits until wiring is installed (to exclude foreign material).
4. Use insulated grounding bushings on the ends of conduits, which are not directly connected to the enclosure (such as stub-ups under equipment, etc.) and bond between bushings and enclosure with equipment grounding conductor.
5. Use expansion fittings where raceways cross expansion joints.
6. Use deflection fittings where raceways cross expansion joints, which move in more than one plane.
7. Use two (2) locknuts and an insulated bushing on end of each conduit entering sheet metal cabinet or box. Terminate conduit ends within cabinet/box at the same level. Plastic bushings may be used for 1/2" & 3/4" conduits.

B. For Rigid Metal Conduit:

Use threaded fittings and accessories. Use 3-piece conduit coupling where neither piece of conduit can be rotated.

C. For Electrical Metallic Tubing: Use compression type connectors and couplings.

D. For Flexible Metal Conduit: Use flexible metal conduit connectors.

E. For Liquidtight Flexible Metal Conduit: Use liquidtight connectors.

F. For Rigid Nonmetallic PVC Conduit: Use conduit manufacturer's standard fittings and accessories.

G. Short Radius Elbows

Short radius elbows shall be installed where indicated on the Drawings and/or as required. A short radius elbow shall consist of a T & B No. 470 series bushed elbow and

floor coupling, Appleton, R & S., 1901 or other approved equal. The end of the coupling shall be flush with floor.

## 3.04 FLOOR AND WALL PENETRATIONS

A. Plug all penetrations through fire rated floors and walls with a three hour rated, fire stop penetration kit as manufactured by Hevi-Duty/Nelson or approved equal, consisting of:

1. Type CMP Firestop Compound or an approved equal.
2. 7" x 7" panel (large penetrations).
3. Type CLK Firestop Caulk.
4. Panel support material and ceramic fiber as required, to be utilized for large penetrations.

## 3.05 EXISTING RACEWAYS

A. Remove all existing unused exposed conduits and other related equipment in the areas to be refurbished. All existing concealed conduits not indicated to be reused shall be abandoned. Any existing conduits to be reused shall be cleaned to remove scale and burrs.

## 3.06 ROUTING OF CONDUITS

A. The routing of conduits, as shown on the Drawings, is approximate, only unless dimensions are indicated. Conduit runs as shown on risers and Drawings are generally diagrammatic. The Contractor shall follow the general routing shown on the risers or Drawings (e.g. whether overhead or underneath) and furnish and install all necessary offsets, fittings, wiring and miscellaneous hardware, to run from one point to another. The actual routing shall be subject to the approval of the Owner's Representative.

B. Conduits shall not be run above or in close proximity to boilers or hot pipes; nor shall conduits be run directly beneath water pipes.

C. Exposed conduits shall be rigidly fastened to structure, or to rigid hangers or angle irons connected to structure at intervals not exceeding eight ft. Exposed conduits crossing expansion joints, conduits shall have approved expansion fittings in line or at the pull box.

D. Where the conduits or surface metal raceways are installed exposed they shall follow the architectural lines of the enclosure and shall be run as to be as inconspicuous as possible. Conduits or surface metal raceways shall not be installed diagonally on ceilings, walls or columns.

## 3.07 CONCEALED CONDUITS

A. Conduits from distribution points such as panelboards, fire signal control board, sound control cabinet, inter-connecting boxes, and the like, to outlets for switches, receptacles, lighting fixtures, fire signal stations, bells, buzzers, horns, telephones, clocks, loudspeakers, etc., and between these outlets shall be installed concealed where possible and installed in accordance with approved Shop Drawings.

1. Conduits in Hung and Furred Ceiling:

a. In hung ceilings the conduits must be run so as not to interfere with pipes or ducts. Groups of conduits shall be suspended above the hung ceiling upon separate hangers installed by the Contractor. Hangers will not be required for conduits to and between outlets of lighting fixtures located on or in hung ceilings or to wall switch.

b. Single conduits may be laid on and fastened to angle supports of the hung and furred ceilings.

## 3.09 PAINTING

A. All exposed conduits and raceways in unfinished portions of the building, such as the cellar, etc., including boxes of all kinds, except those of motor control equipment, (manufacturers motor control housings) shall not be painted. All exposed conduits and raceways including boxes in finished parts of the building shall be painted. Painting shall consist of a prime coat and a finished coat, color as selected. Factory painting will be accepted as a prime coat.

**END OF SECTION**

# SECTION 260534

# OUTLET, JUNCTION, AND PULL BOXES

## PART 1 GENERAL

### 1.01 REFERENCES

A. NEMA, and UL.

### 1.02 SUBMITTALS

A. Product Data: Catalog sheets, specifications and installation instructions.

1. For fire rated construction, prove that materials and installation methods proposed for use are in accordance with the listing requirements of the classified construction.

## PART 2 PRODUCTS

### 2.01 GALVANIZED STEEL OUTLET BOXES

A. Standard galvanized steel boxes and device covers by Appleton Electric Co., Beck Mfg./Picoma Industries, Cooper/Crouse-Hinds, Raco/Div. of Hubbell, or Steel City/T & B Corp.

### 2.02 GALVANIZED STEEL JUNCTION AND PULL BOXES

A. Code gage, galvanized steel screw cover boxes by Delta Metal Products Inc., Hoffman Enclosures Inc., Hubbell Wiegmann, Lee Products Co., or Rittal/Electromate.

### 2.03 THREADED TYPE BOXES:

A. Outlet Boxes:

1. For Dry, Damp Locations: Zinc electroplate malleable iron or cast iron alloy boxes by Appleton Electric Co., Cooper/Crouse-Hinds Co., or OZ/ Gedney Co., with zinc electroplate steel covers to suit application.

2. For Wet Locations: Malleable iron or cast iron alloy boxes with hot dipped galvanized or other specified corrosion resistant finish as produced by Cooper/Crouse-Hinds (hot dipped galvanized or Corro-free epoxy powder coat), or OZ/Gedney Co. (hot dipped galvanized), with stainless steel cover screws, and malleable iron covers gasketed to suit application.

B. Junction and Pull Boxes:

1. For Dry, Damp Locations: Zinc electroplate cast iron boxes by Appleton Electric Co., Cooper/Crouse-Hinds, or OZ/Gedney Co., with zinc electroplate steel or cast iron cover.

2. For Wet Locations: Cast iron boxes by Cooper/Crouse-Hinds' (hot dipped galvanized or Corro-free epoxy powder coat), or OZ/Gedney Co. (hot dipped galvanized), with stainless steel cover screws and cast iron cover gasketed to suit application.

C. Conduit Bodies, Threaded (Provided with a Volume Marking):

1. For Dry, Damp Location: Zinc electroplate malleable iron or cast iron alloy bodies with zinc electroplate steel covers; Appleton Electric Co.'s Unilets, Cooper/Crouse-Hinds' Condulets, or OZ/Gedney Co.'s Conduit Bodies.

2. For Wet Locations: Malleable iron or cast iron alloy bodies with hot dipped galvanized or other specified corrosion resistant finish; Cooper/Crouse-Hinds' Condulets (hot dipped galvanized or Corro-free epoxy power coat), or OZ/Gedney Co.'s Conduit Bodies (hot dipped galvanized) with stainless steel cover screws and malleable iron covers gasketed to suit application.

## 2.04 CORROSION RESISTANT BOXES

A. Plastic Coated Outlet and Junction Boxes: Threaded type malleable iron boxes coated with 40 mils thick polyvinylchloride coating; Ocal/T&B Corp.'s Ocal-Blue System, PCD Inc.'s KorKap, KorKap XL, or Robroy Industries' Plastibond or Perma-Cote System.

B. Non-Metallic Junction and Pullboxes: Glass fiber reinforced polyester; Carlon/Div. of Lamon and Sessions' Himeline Series, Cooper/Crouse-Hinds' Krydon Products, or Robroy Industries' Stahlin Enclosures.

## 2.05 SPECIFIC PURPOSE OUTLET BOXES

A. As fabricated by manufacturers for mounting their equipment.

## 2.06 FINISHING COLLAR OR COMBINATION FINISHING COLLAR/OUTLET BOX (SURFACE MOUNTED EQUIPMENT USED WITH EXPOSED RACEWAY):

A. Finishing Collar: Same finish and peripheral dimensions as the equipment base, including provisions for mounting, slots to fit over raceway and of depth to cover outlet box and extend back to ceiling or wall.

B. Combination Finishing Collar/Outlet Box: Same finish and peripheral dimensions as the equipment base, gage or thickness of metal as required by National Electrical Code, including provisions for mounting, and knockouts or threaded bosses for entrance of raceway.

## 2.07 OUTLET BOXES AND RELATED PRODUCTS FOR FIRE RATED CONSTRUCTION

A. Parameters for Use of Listed Metallic Outlet or Switch Boxes: UL Electrical Construction Equipment Directory - Metallic Outlet Boxes (QCIT).

B. Wall Opening Protective Materials: As listed in UL Fire Resistance Directory - Wall Opening Protective Materials (CLIV), or UL Electrical Construction Equipment Directory - Wall Opening Protective Materials (QCSN).

C. Floor Outlet Boxes:

1. Poke-Through System: As listed in UL Fire Resistance Directory - Outlet Boxes and Fittings Classified for Fire Resistance (CEYY), or UL Electrical Construction Equipment Directory - Outlet Boxes and Fittings Classified for Fire Resistance (QBWY).

2. Service Fittings:

a. Above Floor: Aluminum, dog house style, to suit power, signal and telecommunication service.

b. Flush Floor: Metallic flush round cover with hinged lid (and carpet flanges for carpeted areas) to suit power, signal and telecommunication service, finish to match hardware in area where more installed.

3. Wiring devices of the type and ratings indicated on the drawings.

# PART 3 EXECUTION

## 3.01 PREPARATION

A. Before proceeding with the installation of junction and pull boxes, check the locations with the Director's Representative and have same approved.

## 3.02 INSTALLATION

A. Mounting Position of Wall Outlets for Wiring Devices: Unless otherwise indicated, install boxes so that the long axis of each wiring device will be vertical.

B. For ceiling mounted fixtures and or electrical junction boxes that act as receptors for the ceiling fixtures, provide and install a reinforced fixture bracket. Provide and install heavy ceiling fan fixture boxes and bars as required to accommodate the weight of the fixture.

C. Supplementary Junction and Pull Boxes: In addition to junction and pull boxes indicated on the drawings and required by NFPA 70, provide supplementary junction and pull boxes as follows:

1. When required to facilitate installation of wiring.

2. At every third 90 degree turn in conjunction with raceway sizes over 1 inch.

3. At intervals not exceeding 100 feet in conjunction with raceway sizes over 1 inch.

## 3.03 OUTLET, JUNCTION, AND PULL BOX SCHEDULE

A. Boxes for Concealed Conduit System:

1. Non-Fire Rated Construction:

a. Depth: To suit job conditions and comply with NFPA 70 Article 370.

b. For Lighting Fixtures: Use galvanized steel outlet boxes designed for the purpose.

1) For Fixtures Weighing 50 lbs. or less: Box marked "FOR FIXTURE SUPPORT".

2) For Fixtures More Than 50 lbs.: Box listed and marked with the weight of the fixture to be supported (or support fixture independent of the box).

c. For Junction and Pull Boxes: Use galvanized steel boxes with flush covers.

d. For Switches, Receptacles, Etc.:
1) Plaster or Cast-In-Place Concrete Walls: Use 4 inch or 4-11/16 inch galvanized steel boxes with device covers.

2) Walls Other Than Plaster or Cast-In-Place Concrete: Use type of galvanized steel box which will allow wall plate to cover the opening made for the installation of the box.

2. Recessed Boxes in Fire Rated (2 hour maximum) Bearing and Nonbearing Wood or Steel Stud Walls (Gypsum Wallboard Facings):

a. Use listed single and double gang metallic outlet and switch boxes. The surface area of individual outlet or switch boxes shall not exceed 16 square inches.

b. The aggregate surface area of the boxes shall not exceed 100 square inches per 100 square feet of wall surface.

c. Securely fasten boxes to the studs. Verify that the opening in the wallboard facing is cut so that the clearance between the box and the wallboard does not exceed 1/8 inch.

d. Separate boxes located on opposite sides of walls or partitions by a minimum horizontal distance of 24 inches. This minimum separation distance may be reduced when wall opening protective materials are installed according to the requirements of their classification.

e. Use wall opening protective material in conjunction with boxes installed on opposite sides of walls or partitions of staggered stud construction in accordance with the classification requirements for the protective material.

3. Other Fire Rated Construction: Use materials and methods to comply with the listing requirements for the classified construction.

B. Boxes For Exposed Conduit System:

1. Dry and Damp Locations: Use zinc electroplate or hot dipped galvanized threaded type malleable iron or cast iron alloy outlet, junction, and pullboxes or conduit bodies provided with a volume marking in conjunction with ferrous raceways unless otherwise specified or indicated on the drawings.

a. Galvanized steel boxes may be used in conjunction with conduit sizes over 1 inch in non-hazardous dry and damp locations.

b. Galvanized steel boxes may be used in conjunction with electrical metallic tubing where it is allowed (specified) to be installed exposed as branch circuit conduits at elevations over 10'-0" above finished floor.

2. Wet Locations: Use threaded type malleable iron or cast iron alloy outlet junction, and pullboxes or conduit bodies (provided with a volume marking) with hot dipped galvanized or other specified corrosion resistant coating in conjunction with ferrous raceways unless otherwise specified or indicated on the drawings.

a. Use corrosion resistant boxes in conjunction with plastic coated rigid ferrous metal conduit.

3. Finishing Collar or Combination Finishing Collar/Outlet Box (Surface Mounted Equipment Used With Exposed Raceway):

a. Use finishing collar where surface mounted equipment is installed on an exposed raceway outlet box and the equipment base is larger than the outlet box.

b. Use combination finishing collar/outlet box where surface mounted equipment is not indicated to be installed on an exposed raceway outlet box, but raceway cannot be run directly into equipment body due to equipment design.

C. Specific Purpose Outlet Boxes: Use to mount equipment when available and suitable for job conditions. Unless otherwise specified, use threaded type boxes with finish as specified for exposed conduit system, steel (painted) for surface metal raceway system and galvanized steel for recessed installations.

**END OF SECTION**

# SECTION 262726

# WIRING DEVICES

## PART 1 GENERAL

### 1.01 SUBMITTALS

A. Product Data: Catalog sheets, specifications and installation instructions.

## PART 2 PRODUCTS

### 2.01 SWITCHES

A. Local Switches, Single Pole:

1. 20A, 120/277 V ac; Bryant's 4901, Crouse-Hinds/AH's 1991, Hubbell's 1121/1221, Leviton's 1121/1221, Pass & Seymour's 20AC1, or Woodhead's 1991.

B. For line voltage wall-mounted occupant sensors (Vacancy Mode/Manual ON) in small offices, Watt Stopper DW100.

### 2.02 RECEPTACLES

A. Straight-blade-type; Commercial Specification Grade minimum; compliance with NEMA WD 1; DSCC WC 596, AND UL 498 and UL 943 2006 Codes.

1. Duplex receptacle, NEMA 5-20R (20A, 125V, 2P, 3W); Hubbell Inc. HBL5362, Leviton BR20, Pass & Seymour/Legrand PS5362

2. Ground-Fault Circuit Interrupter GFCI; duplex (20A, 125V, 2P, 3W) Hubbell Inc GF5352SL, Leviton 6899, Pass & Seymour/Legrand PS2095

### 2.03 WEATHERPROOF RECEPTACLE ENCLOSURE

A. For use in wet location equal to Pass & Seymour/Legrand WIUC10-G.

### 2.03 WALL PLATES

A. Provide wall plate for wiring devices. Material shall be 0.035-inch thick, satin-finished stainless steel. Metal screw heads to match plate finish.

## PART 3 EXECUTION

## 3.01 INSTALLATION

A. Install wiring devices in outlet boxes.

B. Local Switches:

1. Install local switches rated 15A, 120/277 V ac for switches unless otherwise shown on the drawings or specified.

2. Install switches indicated Sa, Sb, Sc, etc, for control of outlets, with corresponding letters on the same circuit.

3. Where more than one switch occurs at same location in a 120 volt system, arrange switches in gangs and cover with one face plate.

4. Install switches in a 277 volt system in separate single boxes if voltage between exposed live metal parts of adjacent switches exceeds 300 volts.

5. Install single and double pole switches so that switch handle is up when switch is in the "On" position.

6. Install key operated switches where shown on the drawings.

C. Wall Plates:

1. Install wall plates on all wiring devices in dry locations, with finish to match hardware in each area.

2. Install hospital wall plates on Type HG receptacles.

3. Install blank wall plates on outlet boxes which are for future equipment except telephone outlets.

4. Install 5/8 inch bushed wall plates on telephone outlets.

5. Fasten wall plates with vandal resistant screws in patients' area. Deliver 10 screw keys to the facility.

6. Fasten wall plates with vandal resistant screws (torx-center-pin type) in offices, public access areas, and areas accessible to inmates. Deliver 10 screw keys to the facility.

D. Weatherproof Covers: Install weatherproof covers on wiring devices in damp locations.

E. Weatherproof While In Use Covers: Install weatherproof while in use covers on wiring devices in wet locations.

F. Nameplates: Provide phenolic or embossed aluminum nameplate for each special purpose receptacle indicating phase, ampere and voltage rating of the

circuit. Attach nameplate with rivets or tamperproof fasteners to wall plate or to wall above receptacle. Wall plates may be engraved with required data in lieu of separate nameplates.

**END OF SECTION**

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# SECTION 262812

# SAFETY SWITCHES

## PART 1 – GENERAL

### 1.01 RELATED DOCUMENTS

A. The following shall apply to work in this section:

1. Section 260010: "General Provisions for Electrical Work".

### 1.02 DESCRIPTION OF THE WORK

A. Provide Safety switches as and where shown on the Drawings for service use. Switches shall be fusible type where noted with Service Entrance Label as required.

### 1.03 SUBMITTALS

A. Product Data
Catalog sheets, Specifications and Installation Instructions.

### 1.04 SPARE PARTS

A. Three spare fuses for each type and size installed.

## PART 2 – PRODUCTS

### 2.01 SAFETY SWITCHES (SINGLE THROW)

A. NEMA 1 & 3R.

Challenger, Cutler-Hammer, General Electric, Siemens, Square D or Westinghouse Electric, heavy duty type, having:

1. Fused, or unfused as indicated on Drawings and shall be of applicable H. P. rating.

2. Fused switches equipped with fuse holders to accept only the fuses specified in Section 262815.

3. NEMA 1 enclosure unless otherwise indicated on Drawing.

4. Voltage Ratings:

   a. 250V rating for 120V, 208V, or 240V, circuits.

5. Solid neutral bar when neutral conductor is included with circuit.

6. Ground bar when equipment grounding conductor is included with circuit.

7. Current rating and number of poles as indicated on Drawings.

## 2.02 MANUAL ENCLOSED STARTERS

A. Description: NEMA ICS 2, general purpose, Class A, with toggle action and overload element.

## 2.02 NAMEPLATES

A. General:

Precision engrave letters and numbers with uniforms margins, character size minimum 3/16" high.

1. Phenolic: Two color laminated engravers stock, 1/16" minimum thickness, machine engraved to expose inner core color (white).

2. Aluminum: Standard aluminum alloy plate stock, minimum .032" thick, engraved areas enamel filled or background enameled with natural aluminum engraved characters.

3. Materials for Outdoor Applications: As recommended by nameplate manufacturer to suit environmental conditions.

## PART 3 – EXECUTION

## 3.01 INSTALLATION

A. Install switches so that the maximum height above the floor to the center of the operating handle does not exceed 6'-6". When shown as wall mounted switches shall be mounted to horizontal strut supports. Free standing units shall be mounted on a free-standing strut system anchored to the floor, ceiling, and walls.

B. Identify each safety switch, indicating purpose or load served:

1. NEMA 1 Enclosures: Rivet or bolt nameplate to the cover.

2. NEMA 3R Enclosures: Attach nameplate to the cover using adhesive specifically designed for the purpose, or mount nameplate on wall or other conspicuous location adjacent to switch. Do not penetrate enclosure with fasteners.

C. Provide fusing as indicated on the Drawings.

**END OF SECTION**

# SECTION 262815

# OVERCURRENT PROTECTIVE DEVICES, CIRCUIT BREAKERS AND FUSES

## PART 1 – GENERAL

### 1.01 DESCRIPTION OF WORK

A. Provide circuit breakers for use in existing panelboards.

### 1.02 SUPPLEMENTAL SUBMITTALS

A. Product Data: Include the following for each fuse type indicated:

1. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.

2. Let-through current curves for fuses with current-limiting characteristics.

3. Time-current curves, coordination charts and tables, and related data.

4. Spare parts.

## PART 2 – PRODUCTS

### 1.01 CIRCUIT BREAKERS

A. General

Circuit breakers shall be thermal-magnetic type, conforming to the following Specifications:

1. Connection to bus shall be by "bolt-on". Plug-in type circuit breakers are not acceptable.

2. Multi-pole breakers shall have barriers between poles

3. Multi-pole breakers shall have separate tripping element for each pole. Each tripping element shall open all poles. Multi-pole breakers shall have one handle controlling all poles.

4. Breakers of 225-ampere trip rating or less shall have non-tamperable, permanently set trip elements enclosed and sealed in molded composition housing.

5. Single pole breakers shall be rated for not less than 277 volts, A.C., multi-pole breakers shall be rated for not less than 277 volts A.C.

6. Where spaces for future breakers are required, copper connections for mounting of future breakers shall be provided.

7. Circuit breakers shall be mounted in standard panel boards as indicated on the drawings. Frame and sizes of circuit breakers shall conform to the following:

   a. Use standard molded-case type.

## PART 3 – EXECUTION

### 3.01 INSTALLATION

A. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

**END OF SECTION**

# SECTION 265610

# LED INTERIOR/EXTERIOR LIGHTING

## PART 1 - GENERAL

### 1.01 DESCRIPTION OF WORK

A. The Contractor shall provide all lighting luminaires, mounting brackets, photo controls, time clock, conduit, wire, etc. The interior and exterior lighting shall be installed in accordance with the Contract Drawings and Specifications. The lighting system shall be completely operational, aimed, tested, and free from fault.

### 1.02 SUPPLEMENTAL SUBMITTALS

A. Submittal Package

Submit the Shop Drawings, Product Data, samples, candlepower distribution curves, Isofootcandle distribution curves for the indicated mounting heights and quality control submittals specified below at the same time as a package.

B. Shop Drawings

For mounting brackets that have welded assembly, show details of luminaires and welded assembly and manufacturer's certification of galvanizing after completed assembly.

C. Product Data

Catalog sheets, description of Luminaires, specifications and installation instructions.

1. For each luminaire, include data indicating the effective projected area, details of attaching luminaries, accessories, and other equipment.

D. Samples: One of each product if different from Company or catalog number specified - when requested by owner.

E. Manufacturer's specification sheets showing IESNA cutoff data and classification, shielding accessories, Candlepower and Isofootcandle Distribution Curves for each luminaire type if different from the Manufacturer/catalog number specified.

F. Certificate of compliance with the Quality Assurance requirements.

G. Warranty

H. Spare parts

## 1.03 QUALITY ASSURANCE

A. Company Field Advisor

Secure the services of a Company Field Advisor for a minimum of eight- (8) working hours for the following:

1. Determine and recommend final luminaire aiming points.

2. Render advice and witness completion of luminaire aiming at night.

## 1.04 SPARE PARTS

A. Screwdrivers

Provide one (1) screwdriver suitable for each type of vandal resistant screw installed on a luminaires.

B. Spare parts lenses, vandal shields, Drivers, LED luminaire and photocontrols

1. The Contractor shall provide extra parts as follows:

a. For Canopy Lights: The contractor shall provide (1) one spare polycarbonate exact replacement lens (including any screws or hardware required to replace the lens) for each 10 luminaries installed. A minimum of one lens for each type of Canopy Light is required.

C. The Contractor shall provide one (1) canopy luminaire pack for each 20 wall pack luminaires (same type and wattage).

## 1.05 WARRANTY

A. Manufacturer's standard form in which manufacturer agrees to repair or replace luminaires or components of luminaires and lamps that fail in materials or workmanship; corrode; or fade, stain, or chalk due to effects of weather or solar radiation within one year of Substantial completion.

# PART 2 - PRODUCTS

## 2.01 GENERAL

A. The following requirements shall apply to all luminaires that are provided by the Contractor. Wherever luminaires are specified by Catalog Numbers or Catalog Numbers are noted on the Drawings or in the Specifications for a specific type of luminaire, that luminaire shall be modified to meet the requirements listed below for all luminaires.

B. Manufacturers

The following luminaire manufacturers, listed, will be approved provided all applicable paragraphs of the Specifications including required modifications are conformed with.

Cooper Lighting
Holophane
Hubble Lighting
Rab Lighting

Philips Lighting

## 2.02 LED ENGINE

A. The Correlated Color Temperature (CCT) of LED modules shall be 4000K and shall be consistent through the entire outdoor project. Color Rendering Index (CRI) shall be minimum 70 for all outdoor lighting.

B. The performance of LED luminaires shall be tested according to the IESNA standards LM-79 "Electrical and Photometric Measurements of Solid-State Lighting Products" and LM-80 "Measuring Lumen Maintenance of LED Light Sources." Reports shall be available upon request.

C. LED luminaires shall have a minimum 50,000 life with the minimum 70% lumen maintenance.

D. Electrical circuitry for weather exposed luminaires shall have integral surge protector rated for a minimum of 20KA and 10KV.

E. Drivers shall be suitable for 0-10V dimming control and have greater than .9 power factor and less than 20% Total Harmonic Distortion.

F. Optics

1. Unless otherwise noted on The Contract Drawings, optics shall be Dark Sky Compliant with NEMA Type II, Type III, Type IV or Type V (VS).

2. Weather exposed optical elements shall be shatter resistant, UV resistant and field replaceable.

## 2.03 DIRECT LED LUMINAIRES FOR INTERIOR INSTALLATION

A. Direct LED luminaire housing and end-caps shall be constructed of no less than 22-gage die-formed steel, or extruded aluminum in white finish. Refer to Article 2.05 for technical requirements of the luminaire construction.

B. Luminaires shall be provided with fully adjustable aircraft cable support for pendant mounting. Cable and cable adjuster shall be independently rated to support an 800# load. Cable suspension adjustment for mounting height shall be located on luminaires and not at ceiling.

C. Distribution shall be 100% down with (Minimum of 130 Lumens/Watts).

## 2.04 UNDER CANOPY LUMINAIRS

A. Recessed LED downlights shall be lensed and gasketed and shall have access to all internal electrical connections through the ceiling aperture. Luminaire components shall be field replaceable through the ceiling aperture. Construction shall be of cast aluminum components having a minimum thickness 3/16 inch. Brittle die cast aluminum housings are not acceptable. Finish shall be thermoset acrylic enamel or powder coat of color approved by the Architect.

B. Recessed luminaires installed at 4 ft from the canopy edge could be UL listed for Damp Location.

C. Surface mounted luminaires shall be mounted to recessed junction boxes and have a weather seal covering the outline of the box.

D. Exposed lenses shall be of tempered glass, polycarbonate or shatter resistant UV stabilized acrylic.

## 2.05 LIGHTING CONTROLS

A. Time Switch

1. Provide Time switches where indicated on Drawings. Generally, time switches shall be three pole, single throw or single pole, double throw. Provide alternative configurations as required by specific loads.

2. When two circuits are to be controlled, the switch shall be a two pole, single throw. Switch contacts shall be rated 40 amperes per pole at 277 volts. The time switch shall be 24-hour type.

3. The clock motor shall be a self-starting synchronous motor rated for 120 volts, 60 Hz. AC

4. Spring driven reserve shall be provided with sufficient capacity to operate time switch contacts at least 16 hours after power failure. On restoration of power, spring driven reserve shall be automatically rewound.

5. Switch shall be Tork 7120L for the lighting contactor's coil control, Tork 7300L for three pole or 7200L for two pole, or the equal by Sangamo, Intermatic Register Company, LD&C, or the Paragon Electric Co.

B. Photocontrols

1. Provide photoelectric controls wired in parallel with the time switches and lighting contactor coil.

   a. Photocells shall be standard EEI-NEMA twistlock type solid state, poly-voltage type to operate on line voltages from 110 volts to 277 volts, 60Hz. Photocell shall be provided with silicon diode sensor. Cadmium sulfide type is not acceptable.

   b. Photocells shall be as manufactured by Fisher Pierce or equal.

2. Provide EEI-NEMA - twistlock receptacle mounted in heavy duty 4"x4"x3" deep cast aluminum [with ¾"pipe knockouts and external mounting ears] box for mounting of photocontrol.

3. A master photocontrol wired in parallel with the approved time clock to the starter coil of a magnetic contactor is required. Photocontrols shall not be used on individual luminaires unless absolutely necessary.

C. Refer to section 262726-wiring devices for additional lighting control.

## PART 3 - EXECUTION

### 3.01 GENERAL

A. The Contractor shall be responsible for the safe and proper support of each luminaire. The Contractor shall provide all items of equipment (hangers, rods, inserts, boxes, brackets, yokes, channels, frames, etc.) required to adequately and safely support each luminaire in a manner acceptable to the owner.

B. Contractor shall provide underground pull boxes, concrete reinforced flush to top of grade. Cover shall be cast iron, gasketed, with the word "Electrical" embossed on the top cover plate. Cable and conduit openings entering and leaving this pull box shall be sealed.

C. The Contractor shall examine the Drawings and familiarize himself with location and conditions under which each type of luminaire is to be installed, so that details of construction will best suit mounting conditions and/or obstructions at the job.

D. The Contractor is required to protect luminaires from damage during installation of same and up to time of acceptance by the owner and any broken luminaires, glassware, plastics, lamps, etc., shall be replaced by the Contractor.

### 3.02 LUMINAIRE INSTALLATION

A. The Contractor shall be responsible for the proper mounting and support of all luminaires.

B. A suitable cast metal roughing box shall be provided by the Contractor for each luminaire provided. The box shall receive all branch circuit conduit and wiring. Each luminaire shall

connect to the roughing box in an approved manner using sealtile conduit, maximum length 12".

C. Recessed luminaires weighing 50 pounds or less

Recessed luminaires weighting 50 pounds or less may be directly supported by suspended ceiling grid (Z bars, T grid, cross beams) providing that the maximum allowable deflection (1/360$^{th}$ of the span) is not exceeded. Recessed luminaires so supported shall be additionally secured with safety chains or aircraft cable that can fully support the weight of the luminaire in the event of a failure of the suspended ceiling. Safety chains or aircraft cable shall support each luminaire at two diagonal corners and shall be attached to the building structural steel or concrete.

## 3.03 MOUNTING HEIGHT OF LUMINAIRES

A. Luminaires shall be hung in accordance with the mounting heights indicated on Drawings and meeting the Electrical Code Requirements. Mounting heights (distance above finished floor) are detailed on the Drawings.

## 3.04 WIRING AND CONNECTIONS

A. Each luminaire shall be completely wired in an approved manner in accordance with requirements of the Electrical Code.

B. Install branch circuit grounding conductor from the grounding terminal bar in the panelboard to each exterior luminaire.

## 3.05 AIMING

A. After installation and prior to final acceptance, exterior lighting shall be adjusted under the supervision of the Owner's Representative and the Engineer to provide the intent of the Contract Drawings.

## 3.06 CLEANING

A. All luminaires shall be cleaned prior to final acceptance to remove construction dirt, dust, finger prints, etc. inside and out.

**END OF SECTION**

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