SECTION 26.05.00
ELECTRICAL GENERAL PROVISIONS

PART 1 – GENERAL

1.01 WORK INCLUDED

A. Provide all materials, labor, and equipment required to furnish and install a complete electrical system as indicated on the Drawings and as specified herein.

B. Electrical work includes, but is not limited to, the following:
   1. Complete distribution system for lighting and power including the electrical service and necessary feeders, panelboards, branch circuits, conduit, lighting fixtures, control switches, and receptacles.
   2. Excavation, trenching, and backfilling for conduit and/or cable.
   3. Grounding and lightning protection
   4. Data and Telephone system raceways, boxes, and cabling.
   5. Power wiring for equipment furnished under Division 21, 22 and 23.
   6. Fire Alarm System
   7. Field Lighting System

1.02 RELATED WORK

A. The following work shall be furnished under other Divisions of these Specifications, but shall be coordinated with said Divisions by Division 26 tradesman prior to bid.
   1. Flashing of conduits into roofing and outside walls.
   2. Painting.
   3. Cutting and patching.
   4. Heating, ventilating, air conditioning, and plumbing equipment.

1.03 DEFINITIONS

A. Provide: Shall mean "furnish, install, connect, and put in good working order."

B. Wiring: Shall mean "wire and cable, installed in raceway with all required boxes, fittings, connectors, etc. completely installed."

C. Engineer: Shall mean "Engineer of Record" whose seal is affixed to the contract specifications and drawings of Division 26.

1.04 CODES AND STANDARDS

A. Comply with applicable local, state, and federal codes.

B. Electrical work shall be installed in accordance with the Drawings and Specifications, the 2011 NEC, 2012 IBC and applicable accessibility code.

C. In event of conflict between Drawings, Specifications and such codes, Engineer shall be notified in writing prior to bid. A ruling will then be made by the Engineer in writing. All work shall be installed in strict accordance with applicable codes without additional cost to Owner.

D. Contractor shall submit and/or file all necessary specifications and drawings as required by governing authorities.

1.05 SUBMITTALS

A. Provide submittals on materials and equipment identified in the Specifications and Drawings prior to manufacturer, order, or installation in accordance with Shop Drawings, Product Data, and Samples.
B. Submittals shall include but not be limited to the following:

- Lighting fixtures
- Switchgear
- Fire Alarm System
- Lightning protection
- Voice/Data cabling
- Cable Tray
- Field Lighting

PART 2 - PRODUCTS (Not used)

PART 3 - EXECUTION

3.01 SITE VISIT

A. Visit job site prior to bid date to determine actual conditions under which work shall be done, to become familiar with project, and to verify total scope of work required. Failure to do so shall not constitute a reason for an extra charge.

3.02 COMMISSIONING

A. Complete testing of all lighting, wiring, generators, etc. per TBR specifications and complete the associated standard TBR/owner checklists.

END OF SECTION
SECTION 26.05.01
BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 GENERAL

1.01 QUALITY ASSURANCE
   A. Qualifications of Manufacturer: All materials and equipment used in work of Division 26 shall be produced by manufacturers regularly engaged in manufacture of similar items and with history of successful production acceptable to the Engineer. They shall be new and be UL listed and labeled or listed and labeled by other recognized testing laboratory where such label is available.
   B. Qualifications of Installers: Use adequate numbers of skilled workmen who are thoroughly trained and experienced in necessary crafts and who are completely familiar with specified requirements and methods needed for proper performance of work of this Section.

1.02 GUARANTEE-WARRANTY
   A. Guarantee work to be free of material and workmanship defects for a period of one year, from date of final acceptance for the project. Repair and replace defective work and other work damaged thereby which becomes defective during term of Guarantee-Warranty. Furnish Owner with three written copies of Guarantee-Warranty.

PART 2 PRODUCTS

2.01 SUBSTITUTIONS
   A. Reference in Specifications to any article, device, product, material, fixture, form and type of construction, by name, make, or catalog number shall be interpreted as established standard of quality and shall not be construed as limiting competition. Any article, device, product, material, fixture, form and type of construction which in the judgment of Engineer, expressed in writing, is equal to that specified, may be used.
   B. Substitution shall be approved by Engineer before purchase and/or installation. If unapproved materials are installed, work required to remove and replace unapproved items shall be done at the Contractor's expense.

PART 3 EXECUTION

3.01 INSTALLATION
   A. Electrical drawings are diagrammatic and shall not be scaled for exact sizes or locations. They are not intended to disclose absolute or unconditional knowledge of actual field conditions.
   B. Equipment shall be installed according to manufacturer's recommendations.
   C. Protect work and materials from damage by weather, entrance of water, and dirt. Cap conduit during installation. Avoid damage to materials and equipment in place.
   D. Satisfactorily repair or remove and replace damaged work with new materials.
   E. Trenching and backfilling shall comply with Site Work of these Specifications and provide sheathing, shoring, dewatering and cleaning necessary to keep trenches and their grades in proper condition for work to be carried on. Trenches shall be excavated 6" below elevation of bottom of conduit. Backfill shall be per Site Grading and Filling.
   F. Failure to route conduit through building without interfering with other equipment and construction shall not constitute a reason for an extra charge. Equipment, conduit and fixtures shall fit into available space in building and shall not be introduced into building at such times and manner as to cause damage to structure. Equipment requiring services shall be readily accessible.
G. Sequence, coordinate, and integrate the various elements of electrical systems, materials, and equipment. Comply with the following requirements:
1. Coordinate electrical systems, equipment, and materials installation with other building components.
2. Verify all dimensions by field measurements.
3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for electrical installations.
4. Coordinate the installation of required supporting devices and sleeves to be set in poured in-place concrete and other structural components, as they are constructed.
5. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
7. Coordinate connection of electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
8. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Engineer.
9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, whether exposed or concealed.
10. Install electrical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
11. Install access panels or doors where units are concealed behind finished surfaces.
12. Insulate dissimilar metals so they are not installed in direct contact.

H. Conduits which pass through floor slabs (except ground floor) shall be sealed with Fire Stop Sealant. Seal around conduits or other wiring materials passing through partitions, floors, and fire rated walls. Use UL approved Fire Stop Sealant as detailed on the drawings.

I. Coordinate electrical power connection requirements with all equipment suppliers. Where power requirements differ from drawing design requirements, Engineer shall be notified for clarification and installation requirements prior to installing that portion of work. Cost for equipment and labor for improperly installed electrical connections not coordinated and approved by other trades and the Engineer shall be incurred by the Electrical Contractor and shall not constitute a reason for an extra charge because of rework.

3.02 CUTTING AND PATCHING
A. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.

3.03 TESTING AND EQUIPMENT SERVICING
A. Entire installation shall be free from improper grounds and short or open circuits. Conductors shall be tested before energizing circuit. Test to insure that entire system is in proper operating condition, and that adjustments and settings of circuit breakers, fuses, control equipment, and apparatus have been made. Correct defects discovered during tests.

3.04 REMOVAL OF DEBRIS
A. Remove surplus materials and debris caused by, or incidental to electrical work. Remove such debris at frequent intervals. Keep job site clean during construction.
3.05 \textbf{IDENTIFICATION OF EQUIPMENT}  
A. Equipment shall be identified in accordance with Section 26.05.53, “Electrical Identification.”

3.06 \textbf{AS-BUILT DRAWINGS}  
A. Maintain one set of blue line electrical prints on site, marked to show as-built conditions and installations, prints to be turned over to Owner after job is complete.

3.07 \textbf{TEMPORARY LIGHTING AND POWER}  
A. Provide, maintain and remove after construction is completed, temporary lighting adequate for workman safety and temporary power for all trades including any 1 phase power required.

3.08 \textbf{POWER OUTAGES}  
A. Coordinate all power outages with Owner and submit for approval proposed schedule of work indicating extent, number, and length of outages required to perform work. Contractor shall include in bid cost of overtime labor required for power outage to occur after Owner’s normal hours of operation.

3.09 \textbf{OTHER MATERIALS}  
A. Work of this Division shall also include those items not specifically mentioned or described, but which are obviously necessary to conform to the design intent, applicable codes and to produce complete electrical system that functions properly. These materials shall be as selected by Contractor but subject to approval of the Engineer.

3.10 \textbf{OTHER COORDINATION}  
A. Contractor shall obtain and pay for all necessary permits and inspection fees required for the electrical installation.  
B. Contractor shall coordinate electrical service requirements with the local electric utility company, and provide any required fee, conduit, transformer pad, metering equipment, etc. that is required.

\textbf{END OF SECTION}
PART 1 GENERAL

1.01 WORK INCLUDED
   A. Provide a complete conduit system to support all electrical equipment and systems. Conduit system includes conduit, couplers, connectors, fittings, boxes, covers and supports.
   B. No conduit serving branch circuits shall be installed in or below concrete slabs unless required for branch circuits serving loads located in the center of a room.

1.02 QUALITY ASSURANCE
   A. Listing and Labeling: Provide conduit that is listed and labeled.
      1. The term "listed and labeled": As defined in the National Electrical Code, Article 100.
      2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
   B. Conduit and its installation shall comply with requirements of the National Electrical Code.

PART 2 PRODUCTS

2.01 CONDUIT
   A. Electric Metallic Tubing (EMT): Allied, Wheatland, LTV Copperweld, or approved equal.
   B. Rigid Metal Conduit (RMC): Allied, Wheatland, Republic, or approved equal.
   C. Flexible Steel Conduit (Greenfield): Alflex, Electroflex, or approved equal.
   D. Rigid Non-Metallic Conduit (PVC): Carlon Schedule 40, Cantex, Southern Pipe, Schedule 80 or approved equal.
   E. Liquidtight Flexible Nonmetallic Conduit (LFNC): Alflex, Electroflex, or approved equal.

2.02 CONDUIT FITTINGS
   B. Bushings: Appleton, T&B, O.Z., or Gedney
   C. Straps and Hangers: Appleton, T&B, Steel City, or Minerallac.
   D. Group Pipe supports: Unistrut, Kindorf, B-Line, or approved equal.
   E. Expansion Fittings: O.Z. Gedney Type AX, or equal by Appleton, or approved equal.

PART 3 EXECUTION

3.01 CONDUIT
   A. In general, conduit installation shall follow layout shown on drawings. However, this layout is diagrammatic only and where changes are necessary due to structural conditions, other apparatus or other causes, such changes shall be made without cost to Owner. Offsets in conduits are not indicated and must be furnished as required.
   B. Conduit shall be installed in accordance with the National Electrical Code.
   C. Provide bushings on the open ends of conduit containing conductors. Insulated bushings shall be provided for conduits containing conductors #4 AWG or larger with an insulating ring an integral part of the bushing.
D. Use EMT where Drawings call for conduit to be concealed in walls or above ceilings or when cast in concrete slabs not on grade. Do not use EMT exposed lower than 4’ above floor, in wet locations, or in exterior applications.

E. Use Schedule 40 PVC encased in concrete or when installed underground. Use Schedule 80 PVC when exposed.

F. When PVC conduit is used, turn up perpendicular to slab.

G. Support conduit and secure to forms when cast in concrete so that conduit will not be displaced during pouring of concrete. Stuff boxes and cork fittings to prevent entrance of water during concrete pouring and at other times during construction, prior to completion of conduit installation.

H. Route all conduit at right angles or parallel to walls of building.

I. Use proper sized tools for bending. Do not heat metal conduit. Dents and flat spots will be rejected. Cut and thread conduit so ends will butt in couplings. Make threads no longer than necessary and ream pipe free of burrs.

J. Minimum conduit size 1/2” unless otherwise required.

K. Leave one #10 AWG or equivalent nylon pull wire in empty conduits.

L. Use short pieces, approximately five (5’) feet of flexible conduit to connect motors and other devices subject to motion and vibration. Use liquid tight flexible conduit where outside or subject to water spray.

3.02 CONDUIT FITTINGS

A. When EMT is installed concealed in walls or above ceilings use steel double set screw connectors. All connectors shall have throated insulating bushing.

B. Support conduit vertically and horizontally by straps or hangers. Do not exceed intervals as described in the National Electrical Code.

C. Use expansion fittings, properly bonded to assure ground continuity, across expansion joints in floors and ceilings. Use double lock nuts and bushings on panel feeders at panel cans.

D. When connections are made to motors or other equipment, not near walls or columns, provide a vertical conduit, minimum 3/4”, attached to floor with a floor flange, bring wiring out of this conduit by means of a condulet and flexible conduit extending to equipment junction box.

END OF SECTION
SECTION 26.05.19
WIRE AND CABLE

PART 1 GENERAL

1.01 WORK INCLUDED
A. Wire and cable for all service, feeders, branch circuits, and instrument and control wiring rated 600 volts and below.

1.02 QUALITY ASSURANCE
A. Listing and Labeling: Provide wire and cable that is listed and labeled.
   1. The term "listed and labeled": As defined in the National Electrical Code, Article 100.
   2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
B. Wire and cable and its installation shall comply with requirements of the National Electrical Code.

PART 2 PRODUCTS

2.01 MATERIALS
A. Wires and cables shall meet applicable requirements of the National Electrical Code and UL for the type of insulation, jacket, and conductor specified or indicated.
B. All conductors shall be copper with 600 volt insulation unless otherwise indicated.
C. Wire and cable shall be manufactured by Belden, General Cable, Essex, Encore, Rome Cable, Southwire, or approved equal.
D. Use solid copper type THHN/THWN for branch circuit wiring #10 AWG and smaller. No conductor for branch circuit wiring shall be smaller than #12 AWG.
E. Use stranded copper, type THHN/THWN for feeder and power circuits #8 AWG and larger.
F. Provide color coded wire and with a different color for each phase and neutral and ground as follows: 208/120 volt circuits - phases A, B, and C: black, red, and blue respectively; neutral: white; ground: green, 480/277 volt circuits – phases A, B, and C: brown, orange, and yellow, respectively, neutral: gray; ground: green. Approved color tape is acceptable for feeders. Also provide color coded wire for control circuits.

PART 3 EXECUTION

3.01 INSTALLATION
A. Complete conduit system before pulling any wire or cable. Use cable lubricants recommended by cable manufacturer as necessary.
B. Conductors shall be continuous from outlet to outlet or to branch circuit over-current devices. Make splices only in junction boxes. Splices shall not be made in panelboards. Control wiring shall be continuous between components and/or terminal boards.
C. A minimum of eight (8") inches of slack conductor shall be left in every outlet or junction box. There should also be enough slack so three (3") inches extends outside the outlet or junction box.
D. Make splices in conductors #10 AWG and smaller diameter with insulated, pressure-type connector. Use Scotchlok, Ideal, or equal wire connectors.
E. Make splices in conductors #8 AWG and larger diameter with solderless connectors and cover with insulation material equivalent to conductor insulation. Use Burndy compression connectors with crimpit cover, type CC, or equal.
3.02 TESTING

A. After completion of the installation and splicing and prior to energizing the conductors, wire and cable shall be given continuity and insulation tests as herein specified.

B. Test wiring to verify that no short circuits, open circuits, or accidental grounds exist. Continuity tests shall be conducted using a dc device with bell or buzzer.

C. Perform Megger tests on wiring #4 AWG and larger.

END OF SECTION
SECTION 26.05.26
GROUNDING AND BONDING

PART 1 – GENERAL

1.01 WORK INCLUDED
A. Grounding electrodes and conductors.
B. Equipment grounding conductors.
C. Bonding.

1.02 PERFORMANCE REQUIREMENTS
A. The grounding system to earth resistance shall be less than 5 ohms.

1.03 QUALITY ASSURANCE
A. Listing and Labeling: Provide grounding and bonding materials that are listed and labeled.
   1. The term "listed and labeled": As defined in the National Electrical Code, Article 100.
   2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
B. Components and installation shall comply with the requirements of the National Electrical Code (NEC).
C. Materials shall comply with UL 467, “Grounding and Bonding Equipment.”

PART 2 – PRODUCTS

2.01 MANUFACTURERS
A. Manufacturers shall be Burndy, T&B, or approved equal.

2.02 GROUNDING ELECTRODES
A. Ground rods shall be copper clad steel with minimum dimensions of ¾ inch diameter by 10 feet long.

2.03 CONNECTORS
A. Exothermic welded connections shall be provided in kit form and selected for the specific types, sizes, and combinations of conductors and other items to be connected.
B. Pressure connectors shall be high-conductivity-plated units.
C. Bolted clamps shall be heavy-duty units listed for the application.

2.04 WIRE AND CABLE
A. All grounding conductors shall be copper.
B. The grounding electrode conductor shall be stranded.
C. Equipment grounding conductors shall have green insulation.
D. Bare copper conductors shall conform to the following:
   1. Solid conductors: ASTM B-3
   2. Assembly of stranded conductors: ASTM B-8
   3. Tinned Conductors: ASTM B-33

2.05 MISCELLANEOUS CONDUCTORS
A. Ground bus shall be bare annealed copper bars.
B. Braided bonding jumpers shall be copper tape, braided number 30 gauge bare copper wire, and terminated with copper ferrules.

C. Bonding strap conductor/connectors shall be soft copper, 0.05 inch thick and two (2") inches wide, unless otherwise noted.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Grounding system shall be in accordance with Article 250 of the NEC except where the Drawings or Specifications exceed NEC requirements.

B. Install code size green grounding conductors in all feeder and branch circuits. Bond conductors to chassis or fixed equipment.

C. All grounding conductors shall be bonded to multi-terminal ground bus at panelboard or other distribution equipment. Grouping of grounding conductors under a single lug is not acceptable.

D. Bond interior metal piping systems and metal air ducts to equipment ground conductors of pumps, fans, electric heaters, and air cleaners serving individual systems.

E. Bond structural steel and reinforcing steel in foundation footing to grounding electrode conductor. Bond steel together. Every corner column and every other column in between shall be connected to the ground ring.

F. Install a triad of ground rods, 15’ apart at the concessions stands, pressbox, fieldhouse and hospitality building. Provide a single ground rod at all ancillary buildings (ticket booths, etc). All grounding electrode connections shall be made by minimum #2/0, or larger where required by NEC 250.

G. Locate all grounding attachments away from areas subject to physical damage. Provide protective covering as required.

H. All separate grounding electrodes shall be bonded together to limit potential differences between them and between their associated wiring systems. This includes the power system, TVSS, telephone system, and system grounding electrodes.

3.02 CONNECTIONS

A. Make connections in such a manner as to minimize possibility of galvanic action or electrolysis. 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 assure high conductivity and make contact points closer in order of galvanic series.

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

   3. Aluminum to steel connections shall be with stainless steel separators and mechanical clamps.

   4. Aluminum to galvanized steel connections shall be with tin-plated copper jumpers and mechanical clamps.

   5. Coat and seal connections involving dissimilar metals with inert material such as red lead paint to prevent future penetration of moisture to contact surfaces.

B. Use exothermic welded connections for connections to structural steel and for underground connections. Comply with manufacturer's written recommendations. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.

C. For compression-type connections, use hydraulic compression tools to provide the correct circumferential pressure for compression connectors. Use tools and dies recommended by the manufacturer of the connectors. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on the ground conductor.
D. Terminate insulated equipment grounding conductors for feeders and branch circuits with pressure-type grounding lugs. Where metallic raceways terminate at metallic housings without mechanical and electrical connection to the housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to the ground bus in the housing. Bond electrically noncontinuous conduits at both entrances and exits with grounding bushings and bare grounding conductors.

E. Tighten grounding and bonding connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values for connectors and bolts. Where manufacturer's torquing requirements are not indicated, tighten connections to comply with torque tightening values specified in UL 486A and UL 486B.

F. Where insulated ground conductors are connected to ground rods or ground buses, insulate the entire area of the connection and seal against moisture penetration of the insulation and cable.

G. Do not use flexible metal conduit and fittings as a grounding means. Pull a green wire in each piece of flexible conduit, and screw to conduit system with lugs at both ends.

3.03 FIELD QUALITY CONTROL

A. Use the fall-of-potential method as described in IEEE Standard 81 to measure the resistance of the following. Record the measurements and provide to the Engineer.
   - The resistance between earth and each ground rod prior to interconnection with other ground rods.
   - The resistance between earth and the counterpoise.
   - The resistance of the grounding system at the grounding electrode connection to earth.
     Measure the ground resistance when there has been no precipitation for 5 days, without the soil being moistened by any means other than natural precipitation or natural drainage or seepage, and without chemical treatment or other artificial means of reducing natural ground resistance. Resistance shall be less than 5 ohms.

B. Perform continuity tests at all power receptacles to ensure the ground terminals are properly grounded to the facility ground network.
SECTION 26.05.29
SUPPORTING DEVICES

PART 1 – GENERAL

1.01 WORK INCLUDED
A. This Section includes secure support from the building structure for electrical items by means of hangers, supports, anchors, sleeves, inserts, seals, and associated fasteners.

1.02 QUALITY ASSURANCE
A. Electrical Component Standard: Components and installation shall comply with the National Electrical Code.

PART 2 – PRODUCTS

2.01 MANUFACTURERS
A. Subject to compliance with requirements, Slotted Metal Angle and U-Channel Systems shall be provided by Allied Tube & Conduit, American Electric, B-Line Systems, Inc., Unistrut Diversified Products, or approved equal.
B. Subject to compliance with requirements, Conduit Sealing Bushings shall be provided by Bridgeport Fittings, Inc., Cooper Industries, Inc., Killark Electric Mfg. Co., O-Z/Gedney, Raco, Inc., Spring City Electrical Mfg. Co., Thomas & Betts Corp., or approved equal.

2.02 COATINGS
A. Coating: Supports, support hardware, and fasteners shall be protected with zinc coating or with treatment of equivalent corrosion resistance using approved alternative treatment, finish, or inherent material characteristic. Products for use outdoors shall be aluminum or hot-dip galvanized.

2.03 MANUFACTURED SUPPORTING DEVICES
A. Raceway Supports: Raceways shall be supported with clevis hangers, riser clamps, conduit straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring steel clamps.
B. Fasteners: Types, materials, and construction features as follows:
   1. Expansion Anchors: Carbon steel wedge or sleeve type.
   2. Toggle Bolts: All steel springhead type.
C. Conduit Sealing Bushings: Factory-fabricated watertight conduit sealing bushing assemblies suitable for sealing around conduit, or tubing passing through concrete floors and walls. Construct seals with steel sleeve, malleable iron body, neoprene sealing grommets or rings, metal pressure rings, pressure clamps, and cap screws.
D. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for nonarmored electrical cables in riser conduits. Provide plugs with number and size of conductor gripping holes as required to suit individual risers. Construct body of malleable-iron casting with hot-dip galvanized finish.
E. U-Channel Systems: 16-gauge steel channels, with 9/16-inch-diameter holes, at a minimum of 8 inches on center, in top surface. Provide fittings and accessories that mate and match with U-channel and are of the same manufacturer.

2.04 FABRICATED SUPPORTING DEVICES
A. General: Shop- or field-fabricated supports or manufactured supports assembled from U-channel components.
B. Steel Brackets: Fabricated of angles, channels, and other standard structural shapes. Connect with welds and machine bolts to form rigid supports.

C. Pipe Sleeves: Provide pipe sleeves of one of the following:
1. Sheet Metal: Fabricate from galvanized sheet metal; round tube closed with snaplock joint, welded spiral seams, or welded longitudinal joint. Fabricate sleeves from the following gage metal for sleeve diameter noted:
   a. 3-inch and smaller: 20-gauge.
   b. 4-inch to 6-inch: 16-gauge.
   c. over 6-inch: 14-gauge.
2. Steel Pipe: Fabricate from Schedule 40 galvanized steel pipe.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install supporting devices to fasten electrical components securely and permanently in accordance with NEC requirements.

B. Coordinate with the building structural system and with other electrical installation.

C. Raceway Supports: Comply with the NEC and the following requirements:
   1. Conform to manufacturer's recommendations for selection and installation of supports.
   2. Strength of each support shall be adequate to carry present and future load multiplied by a safety factor of at least four. Where this determination results in a safety allowance of less than 200 lbs., provide additional strength until there is a minimum of 200 lbs. safety allowance in the strength of each support.
   3. Install individual and multiple (trapeze) raceway hangers and riser clamps as necessary to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assembly and for securing hanger rods and conduits.
   4. Support parallel runs of horizontal raceways together on trapeze-type hangers.
   5. Support individual horizontal raceways by separate pipe hangers. Spring steel fasteners may be used in lieu of hangers only for 1-1/2-inch and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings only. For hanger rods with spring steel fasteners, use 1/4-inch-diameter or larger threaded steel. Use spring steel fasteners that are specifically designed for supporting single conduits or tubing.
   6. Space supports for raceway types not covered by the above in accordance with NEC.
   7. Support exposed and concealed raceway within 1 foot of an unsupported box and access fittings. In horizontal runs, support at the box and access fittings may be omitted where box or access fittings are independently supported and raceway terminals are not made with chase nipples or threadless box connectors.
   8. In vertical runs, arrange support so the load produced by the weight of the raceway and the enclosed conductors is carried entirely by the conduit supports with no weight load on raceway terminals.

D. Vertical Conductor Supports: Install simultaneously with installation of conductors.

E. Miscellaneous Supports: Support miscellaneous electrical components as required to produce the same structural safety factors as specified for raceway supports. Install metal channel racks for mounting cabinets, panelboards, disconnects, control enclosures, pull boxes, junction boxes, transformers, and other devices.

F. In open overhead spaces, cast boxes threaded to raceways need not be supported separately except where used for fixture support; support sheet metal boxes directly from the building structure or by bar hangers. Where bar hangers are used, attach the bar to raceways on opposite sides of the box and support the raceway with an approved type of fastener not more than 24 inches from the box.
G. Sleeves: Install in concrete slabs and walls and all other fire rated floors and walls for raceways and cable installations. For sleeves through fire rated wall or floor construction, apply UL listed firestopping sealant in gaps between sleeves and enclosed conduits and cables in accordance with manufacturer’s recommendations.

H. Conduit Seals: Install seals for conduit penetrations of slabs on grade and exterior walls below grade and where indicated. Tighten sleeve seal screws until sealing grommets have expanded to form watertight seal.

I. Fastening: Unless otherwise indicated, fasten electrical items and their supporting hardware securely to the building structure, including but not limited to conduits, raceways, cables, cable trays, busways, cabinets, panelboards, transformers, boxes, disconnect switches, and control components in accordance with the following:

1. Fasten by means of wood screws or screw-type nails on wood; toggle bolts on hollow masonry units; concrete inserts or expansion bolts on concrete or solid masonry; and machine screws, welded threaded studs, or spring-tension clamps on steel. Threaded studs driven by a powder charge and provided with lock washers and nuts may be used instead of expansion bolts and machine or wood screws. Do not weld conduit, pipe straps, or items other than threaded studs to steel structures. In partitions of light steel construction, use sheet metal screws.

2. Holes cut to depth of more than 1-1/2 inches in reinforced concrete beams or to depth of more than 3/4 inch in concrete shall not cut the main reinforcing bars. Fill holes that are not used.

3. Ensure that the load applied to any fastener does not exceed 25 percent of the proof test load. Use vibration- and shock- resistant fasteners for attachments to concrete slabs.

END OF SECTION
PART 1 – GENERAL

1.01 WORK INCLUDED
A. Wall and ceiling outlet boxes.
B. Pull and junction boxes.

1.02 QUALITY ASSURANCE
A. Listing and Labeling: Provide outlet and junction boxes that are listed and labeled.
   1. The term "listed and labeled": As defined in the National Electrical Code, Article 100.
   2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
B. Outlet and junction boxes and their installation shall comply with the requirements of the National Electrical Code.

PART 2 – PRODUCTS

2.01 OUTLET AND JUNCTION BOXES
A. Outlet and junction boxes shall be galvanized steel, 1-1/2” deep minimum by Raco, T&B/Steel City, Crouse Hinds or approved equal.
B. Boxes for interior areas with exposed conduit shall be pressed steel and in exterior areas with exposed conduit shall be cast metal with threaded hubs, "FS" type. Use galvanized steel for concealed boxes.

PART 3 – EXECUTION

3.01 GENERAL
A. Outlet and junction boxes in inaccessible ceiling areas shall be located no more than 6 inches from ceiling access panel or from removable recessed luminaire.
B. Install boxes to preserve fire resistance rating of partitions and other elements, using UL listed fire stop materials and methods.
C. Do not install flush mounted boxes back-to-back in walls; provide minimum six (6”) inches separation. Provide minimum twenty-four (24”) inches separation in fire rated walls.
D. Do not fasten boxes to ceiling support wires.
E. Support boxes independently of conduit.
F. Bonding jumpers shall be used around knockouts.

3.02 OUTLET BOXES
A. Outlet boxes shall be securely anchored, set true, and plumb and no part of box shall extend beyond finished wall or ceiling. Flush mounted boxes shall be set to within 1/8” of finished wall and a plaster ring used to make cover flush with wall.
B. Select boxes according to intended use and type of outlet. Ceiling outlet boxes shall be four (4”) inches octagon and 2-1/2” deep. Use four (4”) inches square boxes where required. All ceiling outlet boxes shall have a fixture stud of the no bolt, self-locking type if required to hang the fixture specified at the outlet.
C. Receptacle and switch boxes installed in concrete block walls not plastered shall be Steel City, Appleton, Raco Series No. 690 through No. 699, or approved equal masonry boxes of proper depth and gang required and specifically designed for this purpose. If more than two conduits enter box from one direction, 4" square boxes with square-cut device covers not less than one (1") inch deep specifically designed for this purpose, shall be used. Round edge plaster rings will not be acceptable for block walls. Sectional or gangable type outlet boxes will not be acceptable except in drywall construction.

D. Mount outlet boxes worked to nearest block course. Confirm ADA compliance.

E. Install blank device plates on outlet boxes left for future use.

F. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices. Confirm accessibility code compliance.

3.03 JUNCTION BOXES

A. Pull and junction boxes shall be sized in accordance with the National Electrical Code according to number of conductors in box or type of service to be provided. Minimum size is 4-11/16” square and 2-1/2” deep.

B. Pull boxes shall be provided where necessary in the conduit system to facilitate conductor installation. Conduit runs longer than 100 feet or with bends exceeding 270 degrees shall have a pull box installed at a convenient intermediate location.

C. Install in locations as shown on Drawings and as required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements.

D. Install pull and junction boxes above accessible ceilings and in unfinished areas only.

3.04 ADJUSTING

A. Adjust flush-mounting outlets to make front flush with finished wall material.

B. Install knockout closures in unused box openings.

3.05 CLEANING

A. Clean interior of boxes to remove dust, debris, and other material.

B. Clean exposed surfaces and restore finish.

END OF SECTION
SECTION 26.05.53
ELECTRICAL IDENTIFICATION

PART 1 – GENERAL

1.01 WORK INCLUDED
A. Extent and types of electrical identification are indicated herein and as follows:
   1. Operational instructions and warnings.
   2. Danger signs.
   3. Equipment/system identification signs.
   5. Power and control wiring identification.
   6. Terminal marking.
   7. Arc-flash warning.
   8. Panelboard Legends.

PART 2 – PRODUCTS

2.01 MANUFACTURERS
A. Subject to compliance with requirements, identification products shall be provided by W.H. Brady Co., Ideal Industries, Inc., Panduit, T&B, or approved equal.

2.02 MATERIALS
A. General: Except as otherwise indicated, provide manufacturer's standard products of categories and types required for each application. Where more than single type is specified for an application, selection is Installer's option, but provide single selection for each application.
B. Cable/Conductor Identification Bands: Provide manufacturer's standard wrap-around type, vinyl-cloth, self-adhesive cable/conductor markers with either pre-numbered plastic coated type or write-on type with clear plastic self-adhesive cover flap, numbered to show circuit identification. Provide markers for all field control wiring.
C. Self-Adhesive Plastic Signs: Provide manufacturer's standard, self-adhesive or pressure-sensitive, pre-printed, flexible vinyl signs for operational instructions or warnings. Signs shall be of sizes suitable for application areas and adequate for visibility, with proper wording for each application (as examples: 208V, EXHAUST FAN or DANGER – HIGH VOLTAGE).
   1. Colors: Unless otherwise indicated or required by governing regulations, provide orange signs with black lettering.
D. Engraved Plastic-Laminate Signs: Provide three-layer engraving stock in sizes and thickness indicated, engraved with engraver's standard letter style of sizes and wording indicated, black and white core (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.
   1. Thickness: 1/16", for units up to 20 sq. in. or eight (8") length; 1/8" for larger units.
   2. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate substrate.
E. Underground Warning Tape: Provide four (4") inch wide detectable type, plastic, yellow warning tape with suitable warning describing type of cable/circuit over buried electrical lines.
2.03 LETTERING AND GRAPHICS

A. General: Coordinate names, abbreviations, and other designations used in electrical identification work, with corresponding designations shown, specified, or scheduled. Provide numbers, lettering, and working as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of electrical systems and equipment.

PART 3 – EXECUTION

3.01 APPLICATION AND INSTALLATION

A. General Installation Requirements:

1. Coordination: Where identification is to be applied to surfaces, which require finish, install identification after completion of painting.

2. Regulations: Comply with governing regulations and requests of governing authorities for identification of electrical work.

3. Conduit Identification: Where electrical conduit is exposed in spaces with exposed mechanical piping which is identified by a color-coded method, apply color-coded identification on electrical conduit in a manner similar to piping identification. Except as otherwise indicated, use orange as coded color for conduit.

4. Equipment/System Identifications: Install engraved plastic-laminate sign on each disconnect and control cabinets. Except as otherwise indicated, provide single line of text, 1/2" high lettering on 1-1/2" high sign (2" high where 2 lines are required), white lettering in black field. Provide text matching terminology and numbering of the contract documents and shop drawings. Provide identification and warning signs for each unit of the following categories of electrical work.

   a. Electrical cabinets and enclosures.
   b. Panelboards
   c. Access panel/doors to electrical cabinets.
   d. Control stations.
   e. Disconnect switches.

B. Install signs at locations indicated or, where not otherwise indicated, at locations for best convenience of viewing without interference with operation and maintenance of equipment. Secure to substrate with stainless steel tamperproof fasteners.

C. Install danger signs on all disconnect and control cabinet exteriors.

D. Install danger and notice to disconnect power before removing or opening on all inner panels.

E. Install underground warning tape in accordance with the National Electrical Code.

END OF SECTION
SECTION 26.05.73
OVERCURRENT PROTECTIVE DEVICES

PART 1 – GENERAL

1.01 WORK INCLUDED
A. This section includes circuit breakers and fuses.

1.02 SUBMITTALS
A. Provide manufacturer's product data for the following:
   1. Circuit breakers
   2. Enclosures
   3. Fuses (Provide complete list of all fuses and the equipment where they are used.)
   4. Shunt trips
B. Provide maintenance data for products for inclusion in the Operating and Maintenance Manual.
   1. Include a load current and overload relay heater list compiled by Contractor after motors have been installed. Arrange list to demonstrate selection of heaters to suit actual motor nameplate full load currents.

1.03 QUALITY ASSURANCE
A. Listing and Labeling: Provide overcurrent protective devices that are listed and labeled.
   1. The term "listed and labeled": As defined in the National Electrical Code, Article 100.
   2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
B. Overcurrent protective devices and their installation shall comply with the requirements of the National Electrical Code.
C. Circuit breakers shall comply with UL 489, NEMA AB 1, and NEMA AB 3.
D. Fuses shall conform to NEMA FU 1.

PART 2 – PRODUCTS

2.01 MANUFACTURERS
A. Circuit Breakers: Subject to compliance with requirements, provide products by Cutler-Hammer; General Electric Co.; Siemens Energy & Automation, Inc.; Square D Co.; or approved equal.
B. Fuses: Subject to compliance with requirements, provide products by Bussmann Mfg. Co., Littlefuse Co, Ferraz Shawmut, or approved equal.

2.02 MOLDED-CASE CIRCUIT BREAKERS
A. Circuit breakers shall be bolt-on only. Plug-in type circuit breakers are not permitted.
B. Circuit breakers shall be molded case, manually operated, trip-free, with inverse-time, thermal-overload protection, and instantaneous magnetic, short-circuit protection, as required. Circuit breakers shall be completely enclosed in a molded case, with the calibrated sensing element factory-sealed to prevent tampering.
C. Thermal-magnetic tripping elements shall be located in each pole of the circuit breaker and shall provide inverse-time-delay thermal overload protection and instantaneous magnetic short-circuit protection. On frame sizes larger than 100 amperes, the instantaneous magnetic tripping element shall be adjustable and accessible from the front of the breaker.
D. Breaker size shall be as required for the continuous current rating of the circuit. Breaker class shall be as required.

E. Interrupting capacity of the branch circuit breakers shall be sufficient to successfully interrupt the maximum short-circuit current imposed on the circuit at the breaker terminals. Circuit breaker minimum interrupting capacities shall be as shown on drawings and shall conform to NEMA AB 3.

F. Multipole circuit breakers shall be of the common-trip type having a single operating handle and shall have a two-position on/off indication. Circuit breakers shall have temperature compensation for operation in an ambient temperature of 104 degrees F. Circuit breakers shall have root mean square (rms) symmetrical interrupting rating sufficient to protect the circuit being supplied. Interrupting ratings may have selective type tripping (time delay, magnetic, thermal, or ground fault).

G. Breaker body shall be of phenolic composition. Breakers shall be capable of having such accessories as handle-extension, handle-locking, and padlocking devices attached where required.

H. Provide UL listed service entrance equipment when used for service disconnect.

I. Circuit breakers used for switching high intensity discharge lights or fluorescent lights shall be rated for that type of service.

2.03 ENCLOSED MOLDED-CASE CIRCUIT BREAKERS
A. Enclosed circuit breakers shall be thermal-magnetic, molded-case circuit breakers in surface-mounted, nonventilated enclosures, conforming to the appropriate articles of NEMA 250 and NEMA AB 1.

2.04 FUSES
A. A complete set of fuses for all switches shall be provided. Fuses shall have a voltage rating not less than the circuit voltage.

B. Provide Class RK5 fuses for motor branch circuits.

C. Fuses shall be labeled showing UL class, interrupting rating, and time-delay characteristics, when applicable.

D. Fuse holders field-mounted in a cabinet or box shall be porcelain. Field installation of fuse holders made of such materials as ebony asbestos, Bakelite, or pressed fiber shall not be used.

E. Provide a minimum of three (3) spare fuses of each size and type fuse installed.

F. Provide a complete list of all fuses and the equipment where they are used.

2.05 EQUIPMENT ENCLOSURES
A. Enclosures for equipment shall be in accordance with NEMA 250.

B. Equipment installed inside, clean, dry locations shall be contained in NEMA Type 1, general-purpose sheet-steel enclosures.

C. Equipment installed in wet locations shall be contained in NEMA Type 3R, rainproof, sheet-steel enclosures, constructed for outdoor use to protect against falling rain, sleet, and ice.

D. Ferrous-metal surfaces of electrical enclosures shall be cleaned, phosphatized, and painted with the manufacturer’s standard finish.

PART 3 – EXECUTION

3.01 INSTALLATION
A. Install overcurrent protective devices as indicated or required, in accordance with the manufacturer's written instructions and with recognized industry practices to ensure that protective devices comply with requirements.
B. Coordinate with other work, including electrical wiring work, as necessary to interface installation of overcurrent protective devices.

C. Fasten circuit breakers without mechanical stresses, twisting or misalignment being exerted by clamps, supports, or cables.

D. Install enclosed circuit breakers plumb with operating handle at five (5') feet above finished elevation.

E. Set field-adjustable circuit breakers for trip settings as indicated, subsequent to installation of devices.

F. Provide engraved plastic-laminate identification under the provisions of Section 26.05.53, "Electrical Identification" for enclosed circuit breakers and motor controllers.

3.02 FIELD QUALITY CONTROL

A. Prior to energization of overcurrent protective devices, test devices for continuity of circuitry and for short-circuits. Correct malfunctioning units, and then demonstrate compliance with requirements.

B. In the presence of the Owner or Owner’s Representative, test each device and demonstrate its working as specified.

END OF SECTION
SECTION 26 08 00
ELECTRICAL & LIGHTING SYSTEMS COMMISSIONING

PART 1 – GENERAL

1.01 The Functional Performance Testing of the Lighting and Electrical Systems is essential to the operation and performance of the equipment and the completion of the project. Complete all inspections and tests prior to substantial completion of the Work.

PART 2 – PRODUCTS

2.01 The following are suggested testing instruments that could be used but similar types of instruments are acceptable. If the Designer determines that additional instruments are required, provide at no additional charge.

   A. Recommended Instruments for Testing Purposes

         1. Fluke 43B Single Phase Power Quality Analyzer: With Current Clamp and Voltage Probes
         2. EXTECH Instruments: Foot Candle/Lux Light Meter 401025
         3. Ideal 61-165 ARCFAULT 165
         4. Fluke 1AC-II / 1LAC-II VoltAlert
         5. Power Line Disturbance Monitor
         6. Load Profiler

PART 3 – EXECUTION

3.01 The Functional Performance Testing Procedures approved by the Designer will be used to document the inspection and testing of the equipment and systems. Provide all necessary manpower and have the appropriate subcontractor and/or manufacturer’s representative present during the testing and demonstrate, to the Designers satisfaction, the full operation of all electrical and lighting systems. Coordinate the schedule of the testing so that the Designer and Owner can be present.

   A. Prior to starting the final testing of the systems, ensure that all equipment and systems were initially started-up and initialized as prescribed by the manufacturer’s instructions or by the manufacturer’s representative and that the Contractor has performed a complete inspection and test of all electrical and lighting equipment and systems.

   B. Review the Designer’s inspection reports and correct all deficiencies.

   C. Open and inspect all panels for cleanness and neatness.

   D. Check and record voltage and current readings on the Panel board Check Sheet (see Division 26 08).
E. Voltage and Amperage readings off by 5% between phases needs to be investigated and a variance of 10% indicated there is a problem.

F. Check the Ground for leakage current. Ground current of less than 1 amp is OK, 1 to 3 amps needs to be checked and more than 3 amps is a problem.

G. Main breaker settings, Long Term, Short Term, Instantaneous and Ground Fault, need to be checked, recorded and have the Electrical Designer verify they are correct. 
   NOTE: VFD’s will cause noise on neutral and ground and fluctuations on voltage as SCR’s fire. They also induce motor bearing currents and shaft voltages that will cause pitting of the shaft and motor failure. If none of the following shaft voltage/current eliminators are utilized on the motors, the motors should be checked for excessive voltage/current to determine if a retrofit is required.

H. Test receptacle circuits for voltage drop, impedance on hot leg and GFI/ARC, at the last receptacle on the branch line. Circuits used for computers or voltage sensitive equipment, at design amperage, must not be less than 6% and for all other circuits less than 10% of design. At all times the load voltage should not drop below 111 volts. Record findings on the Power Circuit Check Sheet (see Division 26 08).

I. Demonstrate the Lighting Control System utilizing the Performance Testing Identification Form and Performance Testing Procedures Form (see Division 01 91) approved by the Designer.

J. Demonstrate lighting levels at desk level after dark to ensure that they are not affected by outside light and record readings on the Lighting Check Sheet (see Division 26 08).

K. Perform power outage test and/or emergency generator test, under load, and utilize the procedure and record findings on the Emergency Generator Testing Procedures (see Division 26 08).

L. Check fuses and overloads in all motor starters.

M. Upon completion of the performance testing procedures, the Installer, General Contractor and Designers representatives who observed the testing will sign the Functional Performance Test Certification form (see Division 01 91) and attach deficiency list.

   1. Emergency Power/Generator System
   2. Electrical Switchgear/Panel boards
   3. Electrical Power Circuits
   4. Electrical Lighting

N. Provide testing instruments, at no charge or the Designer may elect to provide their own instruments.

END OF SECTION
## Panelboard Check Sheet

**Owner's Project Number:** 166/  
**Institution or Campus:**  
**Building:**  
**Installer:**

**System/Unit Identifier:**

**Location:**

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<td>Spare breakers off</td>
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## Power Circuit Check Sheet

### Section 26 08 13

**Owner's Project Number:** 166/

**System/Unit Identifier:**

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**Tests run by:**

**Page** of **Page** of

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Posted in XLS format

June 2011

OFD s260813

Page 1 of 1
SECTIONS 26 08 50
LIGHTING CHECK SHEET

Owner's Project Number: 166/
Institution or Campus:
Building:
Installer:

System/Unit Identifier:
Location:

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SECTION 26.22.00
DRY-TYPE TRANSFORMERS

PART 1 - GENERAL

1.01 SCOPE

A. The Contractor shall furnish and install single-phase and three-phase general purpose individually mounted dry-type transformers of the two-windings type, self-cooled as specified herein, and as shown on the contract drawings.

1.02 REFERENCES

A. The transformers and all components shall be designed, manufactured and tested in accordance with the latest applicable standards of ANSI, NEMA and UL.

B. Transformers shall meet the requirements of federal law 10 CFR Part 431 "Energy Efficiency Program for Certain Commercial and Industrial Equipment"

1.03 SUBMITTALS – FOR REVIEW/APPROVAL

A. The following information shall be submitted to the Engineer:
   1. Outline dimensions and weights
   2. Technical certification sheet
   3. Transformer ratings including:
      a. kVA
      b. Primary and secondary voltage
      c. Taps
      d. Basic impulse level (BIL) for equipment over 600 volts
      e. Design impedance
      f. Insulation class and temperature rise
      g. Sound level.
   4. Product data sheets

1.04 SUBMITTALS – FOR CONSTRUCTION

A. The following information shall be submitted for record purposes.
   1. Final as-built drawings and information for items listed in Paragraph 1.04, and shall incorporate all changes made during the manufacturing process
   2. Connection diagrams
   3. Installation information
   4. Seismic certification and equipment anchorage details as specified

1.05 QUALIFICATIONS

A. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.

B. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.

C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.
1.06 REGULATORY REQUIREMENTS

A. All transformers shall be UL listed and bear the UL label.

1.07 DELIVERY, STORAGE AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer’s instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

1.08 OPERATION AND MAINTENANCE MANUALS

A. Equipment operation and maintenance manuals shall be provided with each assembly shipped, and shall include instruction leaflets and instruction bulletins for the complete assembly and each major component.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Eaton products

The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety. Other manufacturers will be considered, provided their products meet the requirements of the documents.

2.02 RATINGS

A. The kVA and voltage ratings shall be as indicated on the drawings.

B. Transformers shall be designed for continuous operation at rated kVA, for 24 hours a day, 365 days a year operation, with normal life expectancy as defined in ANSI C57.96.

C. Transformer sound levels shall not exceed the following ANSI and NEMA levels for self-cooled ratings:

<table>
<thead>
<tr>
<th>Range</th>
<th>Sound Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 9 kVA</td>
<td>40 dB</td>
</tr>
<tr>
<td>10 to 50 kVA</td>
<td>45 dB</td>
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<tr>
<td>51 to 150 kVA</td>
<td>50 dB</td>
</tr>
<tr>
<td>151 to 300 kVA</td>
<td>55 dB</td>
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<tr>
<td>301 to 500 kVA</td>
<td>60 dB</td>
</tr>
<tr>
<td>501 to 700 kVA</td>
<td>62 dB</td>
</tr>
<tr>
<td>701 to 1000 kVA</td>
<td>64 dB</td>
</tr>
<tr>
<td>1001 to 1500 kVA</td>
<td>65 dB</td>
</tr>
</tbody>
</table>

2.03 CONSTRUCTION – GENERAL PURPOSE TRANSFORMERS

A. Insulation Systems

1. Transformer insulation system shall be as follows:
   a. Less than 15 kVA: 185 degrees C insulation system with 115 degree C rise, encapsulated design; 15 kVA and above: 220 degree C insulation system with 115 degree C rise, ventilated design.

2. Required performance shall be obtained without exceeding the above indicated temperature rise in a 40 degrees C maximum ambient, and a 24-hour average ambient of 30 degrees C.

3. All insulation materials shall be flame-retardant and shall not support combustion as defined in ASTM Standard Test Method D635.
B. Core and Coil Assemblies
   1. Transformer core shall be constructed with high-grade, nonaging, silicon steel with high magnetic
      permeability, and low hysteresis and eddy current losses. Maximum magnetic flux densities shall be
      substantially below the saturation point. The transformer core volume shall allow efficient
      transformer operation at 10% above the nominal tap voltage. The core laminations shall be tightly
      clamped and compressed. Coils shall be wound of electrical grade aluminum with continuous
      wound construction
   2. On three-phase units rated 15 kVA and below the core and coil assembly shall be completely
      encapsulated in a proportioned mixture of resin and aggregate to provide a moisture proof, shock-
      resistant seal. The core and coil encapsulation system shall minimize the sound level
   3. On three-phase units rated 15 kVA and above the core and coil assembly shall be impregnated with
      non-hydroscopic, thermosetting varnish and cured to reduce hot spots and seal out moisture. The
      assembly shall be installed on vibration-absorbing pads

C. Taps
   1. Three-phase transformers rated 15 through 500 kVA shall be provided with six 2-1/2% taps, two
      above and four below rated primary voltage
   2. All single-phase transformers, and three-phase transformers rated below 15 kVA and above 500
      kVA, shall be provided with the manufacturer’s standard tap configuration.

D. Electrostatic Shielding
   1. Where shown on the drawings, provide shielded isolation transformers with an electrostatic shield
      consisting of a single turn of aluminum placed between the primary and secondary winding and
      grounded to the housing of the transformer.

2.04 ENCLOSURE – GENERAL PURPOSE TRANSFORMERS

A. The enclosure shall be made of heavy-gauge steel. All transformers shall be equipped with a wiring
   compartment suitable for conduit entry and large enough to allow convenient wiring. The maximum
   temperature of the enclosure shall not exceed 90 degrees C. The core of the transformer shall be
   grounded to the enclosure.

B. On three-phase units rated 15 kVA and below the enclosure construction shall be encapsulated, totally
   enclosed, non-ventilated, NEMA 3R, with lifting eyes.

C. On three-phase units rated 15 kVA and above the enclosure construction shall be ventilated, NEMA 2,
   drip-proof, with lifting holes. All ventilation openings shall be protected against falling dirt.

2.05 FINISH
   a. Enclosures shall be finished with ANSI 61 color, weather-resistant enamel.

PART 3 - EXECUTION

3.01 FACTORY TESTING

A. The following standard factory tests shall be performed on the equipment provided under this section. All
   tests shall be in accordance with the latest version of ANSI and NEMA standards.
   1. Ratio tests at the rated voltage connection and at all tap connections
   2. Polarity and phase relation tests on the rated voltage connection
   3. Applied potential tests
   4. Induced potential test
   5. No-load and excitation current at rated voltage on the rated voltage connection
3.02 INSTALLATION
   A. The Contractors shall install all equipment per the manufacturer’s recommendations and the contract drawings.

3.03 FIELD ADJUSTMENTS
   A. Adjust taps to deliver appropriate secondary voltage.

3.04 FIELD TESTING
   A. Measure primary and secondary voltages for proper tap settings.

END OF SECTION
SECTION 26.24.00
MECHANICAL EQUIPMENT AND CONTROLS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. General provisions of contract, including general and supplementary conditions and general requirements apply to work specified in this section.

PART 2 – PRODUCTS

2.01 STARTERS

A. All starters for Division 22 and 23 package mechanical equipment will be furnished by Division 22 and 23, but installed and connected by Division 26.

2.02 CONTROL WIRING

A. All control wiring for mechanical equipment shall be provided in conduit under each respective division. Control components for mechanical equipment will be furnished and installed by Division 22 and 23.

2.03 POWER WIRING

A. All power wiring at 120, 208, 277 and 480 volts shall be provided by Division 26.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Coordinate electrical power connection requirements with Mechanical Contractor. Where power requirements differ from drawing design requirements, Engineer shall be notified in writing. Contractor shall be given clarification and installation requirements prior to installation of the portion of work. Cost of equipment and labor for improperly installed electrical connections not coordinated and approved by Engineer and Mechanical Contractor shall be incurred by the Electrical Contractor and shall not constitute a reason for an extra charge because of any rework.

END OF SECTION
PART 1 GENERAL

1.01 SCOPE
   A. The Contractor shall furnish and install the panelboards as specified and as shown on the contract drawings.

1.02 REFERENCES
   A. The panelboards and all components shall be designed, manufactured and tested in accordance with the latest applicable standards of NEMA and UL as follows:
      1. UL 67 – Panelboards
      2. UL 50 – Cabinets and boxes
      3. NEMA PB1
      5. Circuit breaker – Type I class I
      6. Fusible switch – Type II class I

1.03 SUBMITTALS – FOR REVIEW/APPROVAL
   A. The following information shall be submitted to the Engineer:
      1. Breaker layout drawing with dimensions indicated and nameplate designation
      2. Component list
      3. Conduit entry/exit locations
      4. Assembly ratings including:
         a. Short-circuit rating
         b. Voltage
         c. Continuous current
      5. Cable terminal sizes
      6. Product data sheets
   B. Where applicable, the following additional information shall be submitted to the Engineer:
      1. Key interlock scheme drawing and sequence of operations

1.04 SUBMITTALS – FOR CONSTRUCTION
   A. The following information shall be submitted for record purposes:
      1. Final as-built drawings and information for items listed in Paragraph 1.04, and shall incorporate all changes made during the manufacturing process
      2. Installation information
      3. Seismic certification and equipment anchorage details as specified

1.05 QUALIFICATIONS
   A. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.
   B. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.
   C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.
D. Provide Seismic tested equipment as follows:
   1. The following minimum mounting and installation guidelines shall be met, unless specifically
      modified by the above referenced standards.
      a. The Contractor shall provide equipment anchorage details, coordinated with the equipment
         mounting provision, prepared and stamped by a licensed civil engineer in the state. Mounting
         recommendations shall be provided by the manufacturer based upon the above criteria to
         verify the seismic design of the equipment.
      b. The equipment manufacturer shall certify that the equipment can withstand, that is, function
         following the seismic event, including both vertical and lateral required response spectra as
         specified in above codes.
      c. The equipment manufacturer shall document the requirements necessary for proper seismic
         mounting of the equipment. Seismic qualification shall be considered achieved when the
         capability of the equipment, meets or exceeds the specified response spectra.

1.06 REGULATORY REQUIREMENTS
   A. The panelboards shall be UL labeled.

1.07 DELIVERY, STORAGE AND HANDLING
   A. Equipment shall be handled and stored in accordance with manufacturer’s instructions. One (1) copy of
      these instructions shall be included with the equipment at time of shipment.

1.08 OPERATION AND MAINTENANCE MANUALS
   A. Equipment operation and maintenance manuals shall be provided with each assembly shipped and shall
      include instruction leaflets, instruction bulletins and renewal parts lists where applicable, for the complete
      assembly and each major component.

PART 2 PRODUCTS

2.01 MANUFACTURERS
   A. Eaton

   The listing of specific manufacturers above does not imply acceptance of their products that do not meet
   the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting
   these specifications in their entirety. Other manufacturers will be considered, provided their products
   meet the requirements of the documents.

2.02 RATINGS
   A. Panelboards rated 240 Vac or less shall have short-circuit ratings as shown on the drawings or as herein
      scheduled, but not less than 10,000 amperes RMS symmetrical.
   B. Panelboards rated 480 Vac shall have short-circuit ratings as shown on the drawings or as herein
      scheduled, but not less than 14,000 amperes RMS symmetrical.
   C. Panelboards shall be labeled with a UL short-circuit rating. When series ratings are applied with integral
      or remote upstream devices, a label or manual shall be provided. It shall state the conditions of the UL
      series ratings including:
      1. Size and type of upstream device
      2. Branch devices that can be used
      3. UL series short-circuit rating
2.03 CONSTRUCTION
A. Interiors shall be completely factory assembled. They shall be designed such that switching and protective devices can be replaced without disturbing adjacent units and without removing the main bus connectors.
B. Trims for branch circuit panelboards shall be supplied with a hinged door over all circuit breaker handles. Doors in panelboard trims shall not uncover any live parts. Doors shall have a semi flush cylinder lock and catch assembly. Door-in-door trim shall be provided. Both hinged trim and trim door shall utilize three point latching. No tools shall be required to install or remove trim. Trim shall be equipped with a door-actuated trim locking tab. Equip locking tab with provision for a screw such that removal of trim requires a tool, at the owner’s option. Installation shall be tamper resistant with no exposed hardware on the panelboard trim.
C. Distribution panelboard trims shall cover all live parts. Switching device handles shall be accessible.
D. Surface trims shall be same height and width as box. Flush trims shall overlap the box by 3/4 of an inch on all sides.
E. A directory card with a clear plastic cover shall be supplied and mounted on the inside of each door.
F. All locks shall be keyed alike.

2.04 BUS
A. Main bus bars shall be copper sized in accordance with UL standards to limit temperature rise on any current carrying part to a maximum of 65 degrees C above an ambient of 40 degrees C maximum.
B. A system ground bus shall be included in all panels.
C. Full-size (100%-rated) insulated neutral bars shall be included for panelboards shown with neutral. Bus bar taps for panels with single-pole branches shall be arranged for sequence phasing of the branch circuit devices. Neutral busing shall have a suitable lug for each outgoing feeder requiring a neutral connection.

2.05 BRANCH CIRCUIT PANELBOARDS
A. The minimum short-circuit rating for branch circuit panelboards shall be as specified herein or as indicated on the drawings. Panelboards shall be series rated. Panelboards shall be Eaton type Pow-R-Line 1a, Pow-R-Line 2a or Pow-R-Line 3a.
B. Bolt-on type, heavy-duty, quick-make, quick-break, single- and multi-pole circuit breakers of the types specified herein, shall be provided for each circuit with toggle handles that indicate when unit has tripped.
C. Circuit breakers shall be thermal-magnetic type with common type handle for all multiple pole circuit breakers. Circuit breakers shall be minimum 100-ampere frame and through 100-ampere trip sizes shall take up the same pole spacing. Circuit breakers shall be UL listed as type SWD for lighting circuits.
D. Circuit breakers shall have a minimum interrupting rating of 10,000 amperes symmetrical at 240 volts, and 14,000 amperes symmetrical at 480 volts, unless otherwise noted on the drawings.

2.06 DISTRIBUTION PANELBOARDS – CIRCUIT BREAKER TYPE
A. Distribution panelboards with bolt-on devices contained therein shall have interrupting ratings as specified herein or indicated on the drawings. Panelboards shall be series rated. Panelboards shall be Eaton type Pow-R-Line 3a or Pow-R-Line 4B. Panelboards shall have molded case circuit breakers as indicated below.
B. Where indicated, provide circuit breakers UL listed for application at 100% of their continuous ampere rating in their intended enclosure.

C. Provide shunt trips, bell alarms, and auxiliary switches as shown on the contract drawings.

2.07 ENCLOSURE

A. Enclosures shall be at least 20 inches wide made from galvanized steel. Provide minimum gutter space in accordance with the National Electrical Code. Where feeder cables supplying the mains of a panel are carried through its box to supply other electrical equipment, the box shall be sized to include the additional required wiring space. At least four interior mounting studs with adjustable nuts shall be provided.

B. Enclosures shall be provided with blank ends.

C. Where indicated on the drawings, branch circuit panelboards shall be column width type.

2.08 NAMEPLATES

A. Provide an engraved nameplate for each panel section.

2.09 FINISH

A. Surfaces of the trim assembly shall be properly cleaned, primed, and a finish coat of gray ANSI 61 paint applied.

PART 3 EXECUTION

3.1 FACTORY TESTING

A. The following standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of NEMA and UL standards.

3.2 INSTALLATION

A. The Contractors shall install all equipment per the manufacturer’s recommendations and the contract drawings.

END OF SECTION
SECTION 26.27.26
WIRING DEVICES AND PLATES

PART 1 – GENERAL

1.01 WORK INCLUDED
A. Switches
B. Receptacles
C. Plates

1.02 QUALITY ASSURANCE
A. Listing and Labeling: Provide wiring devices and plates that are listed and labeled.
   1. The term "listed and labeled": As defined in the National Electrical Code, Article 100.
   2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
B. Wiring devices and plates and their installation shall comply with the requirements of the National Electrical Code.

PART 2 – PRODUCTS

2.01 SWITCHES
A. Switches shall be toggle, quiet-type with totally enclosed bodies of thermoplastic and mounting strap.
B. Switches shall be rated for 20 amps, 277 volts AC. Switches shall be specification grade Hubbell, P&S, Leviton, Cooper Wiring Devices, or approved equal.

2.02 RECEPTACLES
A. Receptacles shall be general purpose, heavy duty, duplex receptacles made of thermoplastic supported on a metal mounting strap in accordance with NEMA WD 1. Receptacles shall be 20 amp, 125 volt, specification grade Cooper Wiring Devices, Hubbell, Leviton, P&S.
B. Ground fault circuit interrupter receptacles shall be the “feed-through” type rated to protect 20 amps. Receptacles shall be specification grade duplex receptacles with almond impact-resistant nylon face with test and reset buttons.
   1. 20 Amp, 125 Volt: Cooper Wiring Devices, Hubbell, Leviton, P&S, or approved equal.
C. Special Receptacles: As indicated on Drawings.

2.03 PLATES
A. Provide UL listed, one-piece device plates to suit the devices installed.
B. For metal outlet boxes, plates on unfinished walls shall be of zinc-coated sheet steel or cast-metal having round or beveled edges.
C. Plates on finished walls shall be nylon or thermoplastic, mid-size, unless noted otherwise. Plates in the kitchens/food service areas shall be stainless steel.
D. Plates shall be same color as receptacle or toggle switch with which they are mounted. Screws shall be machine-type with countersunk heads in color to match finish of plate.
E. Plates installed in wet locations shall be gasketed and UL listed for “wet locations” as per NEC 406.8 (B).
PART 3 – EXECUTION

3.01 INSTALLATION

A. Provide proper size outlet boxes for all wiring devices in accordance with Section 26.05.33, “Outlet and Junction Boxes.”

B. Install switches forty-eight (48”) inches above finished floor on lock side and clear of door frame a minimum of three (3”) inches unless otherwise noted. Prior to rough-in, coordinate with architectural drawings to determine lockside of door.

C. All switches shall be made by the same manufacturer.

D. Where two or more snap switches are to be installed at the same location, they shall be mounted in one-piece ganged switch boxes, with at gang cover plate.

E. Combination snap switch and single or duplex receptacles shall be mounted in two-gang switch box with one-piece device plate.

F. Receptacles shall be mounted 18” above finished floor unless otherwise noted.

G. All wiring devices shall be mounted in accordance with accessibility code requirements.

H. The color of all devices and plates shall be selected by the architect.

END OF SECTION
SECTION 26.28.13
DISCONNECT SWITCHES

PART 1 – GENERAL

1.01 WORK INCLUDED
   A. Fused Disconnect Switches

1.02 SUBMITTALS
   A. Provide product data showing switch’s ratings and enclosure type.

1.03 QUALITY ASSURANCE
   A. Listing and Labeling: Provide disconnect switches that are listed and labeled.
      1. The term "listed and labeled": As defined in the National Electrical Code, Article 100.
      2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
   B. Disconnect switches and their installation shall comply with the requirements of the National Electrical Code.

PART 2 – PRODUCTS

2.01 MANUFACTURERS
   A. Switches shall be Eaton, or approved equal. Examples are Square D, General Electric, Siemens Energy & Automation.

2.02 MATERIALS
   A. Use heavy-duty type for 600 volt switches. Switches shall have quick make, quick break, load interrupter, enclosed knife switch manufactured to the requirements of NEMA KS 1.
   B. All switches shall have externally operable handles with interlocking covers to prevent opening front cover with switch in the ON position and have provisions for multiple padlocks in the OFF position.
   C. Provide equipment ground lug in each switch.
   D. Provide NEMA 1 enclosures for interior installations, unless otherwise noted.
   E. Provide NEMA 3R enclosures for exterior installations or in wet locations, unless otherwise noted.
   F. Provide fuses as per equipment manufacturer recommendation.

PART 3 – EXECUTION

3.01 INSTALLATION
   A. Provide safety switches sized as indicated on the Drawings.
   B. Mount individually enclosed switches plumb and level with top four (4') feet above floor or grade, unless otherwise noted.
   C. Provide a set of fuses in fusible disconnect switches, as per equipment manufacturer recommendations.

3.02 IDENTIFICATION
   A. Identify disconnect switches in accordance with Section 26.05.53, "Electrical Identification."
END OF SECTION
SECTION 26.51.00
INTERIOR LIGHTING

PART 1 – GENERAL

1.01 WORK INCLUDED
A. This Section includes interior lighting fixtures, lamps, ballasts, and accessories.

1.02 DEFINITIONS
A. Fixture: A complete lighting unit. Fixtures include lamps and parts required to distribute the light, position and protect lamps, and connect lamps to the power supply.
B. Luminaire: Fixture.
C. Average Life: The published time when 50 percent have failed and 50 percent have survived under normal conditions.

1.03 SUBMITTALS
Provide the following submittals:
A. Product data describing fixtures, lamps, and ballasts. Arrange product data for fixtures in order of fixture designation.
B. Shop drawings from manufacturers detailing nonstandard fixtures and indicating dimensions, weights, methods of field assembly, components, features, and accessories.
C. Maintenance data for products for inclusion in Operating and Maintenance Manual.
D. Provide complete set of fixture information and include in O&M Manuals.

1.04 QUALITY ASSURANCE
A. Listing and Labeling: Provide fixtures, ballasts, lamps, and emergency lighting units that are listed and labeled for their indicated use on the Project.
   1. Special Listing and Labeling: Provide fixtures for use in damp or wet locations and recessed in combustible construction specifically listed and labeled for such use.
   2. The term "Listed and Labeled": As defined in the 2008 National Electrical Code, Article 100.
   3. Listing and Labeling Agency Qualification: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
B. Interior lighting fixtures, lamps, ballasts, and accessories and their installation shall comply with the requirements of the 2008 National Electrical Code.
C. Manufacturers Qualifications: Firms experienced in manufacturing fixtures that are similar to those indicated for this Project and that have a record of successful inservice performance.
D. Coordination of Fixtures With Ceiling: Coordinate fixture mounting hardware and trim with the ceiling system.

1.05 EXTRA MATERIALS
A. Furnish extra materials matching products installed, as described below, packaged with protective covering for storage, and identified with labels describing contents. Deliver extra materials to the Owner.
   1. Lamps: 10 lamps for each 100 of each type and rating installed. Furnish at least 1 of each type.
   2. Ballasts: 1 for each 100 of each type and rating installed. Furnish at least 1 of each type.
   3. Globes and Guards: 1 for each 20 of each type and rating installed. Furnish at least 1 of each type.
PART 2 – PRODUCTS

2.01 FIXTURE COMPONENTS, GENERAL

A. Metal Parts: Free from burrs and sharp corners and edges.
B. Sheet Metal Components: Steel, except as indicated. Components are formed and supported to prevent warping and sagging.
C. Doors, Frames, and Other Internal Access: Smooth operating and free from light leakage under operating conditions. Arrange to permit relamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during relamping and when secured in the operating position.
D. Reflecting Surfaces: Minimum reflectances as follows, except as otherwise indicated:
   1. White Surfaces: 85 percent.
   2. Specular Surfaces: 83 percent.
   3. Diffusing Specular Surfaces: 75 percent.
   4. Laminated Silver Metallized Film: 90 percent.
E. Lenses, Diffusers, Covers, and Globes: 100 percent virgin acrylic plastic or water white, annealed crystal glass except as indicated.
   1. Plastic: Highly resistance to yellowing and other changes due to aging, exposure to heat and UV radiation.
   2. Lens Thickness: 0.125 inches, minimum.

2.02 FLUORESCENT FIXTURES

A. Fixtures: Conform to UL 1570, "Fluorescent Lighting Fixtures."
B. Ballasts: Conform to UL 935, "Fluorescent-Lamp Ballasts."
   1. Certification: By Electrical Testing Laboratory (ETL).
   2. Type: Class P, high-power-factory type except as indicated otherwise.
   4. Voltage: Match connected circuits.
   1. Minimum Power Factor: 90 percent.
   2. Minimum Operating Frequency: 20,000 Hz.
   3. Harmonic Content of Ballast Current: Less than 10 percent.
D. Electromagnetic Interference Filters: Integral to the fixture assembly. Provide one filter for each ballast. Suppress electromagnetic interference as required by MIL-STD-461, "Electromagnetic Emission and Susceptibility Requirements for the Control of Electromagnetic Interference."

2.03 LAMPS

A. Conform to ANSI Standards, C78 series applicable to each type of lamp.

2.4 FINISH

A. Steel Parts: Manufacturer's standard finish applied over corrosion-resistant primer, free of streaks, runs, holidays, stains, blisters, and defects. Remove fixtures showing evidence of corrosion during project warranty period and replace with new fixtures.
B. Other Parts: Manufacturer's standard finish.
PART 3 – EXECUTION

3.01 INSTALLATION

A. Setting and Securing: Set units plumb, square, and level with ceiling and walls, and secure according to manufacturer’s printed instructions and approved shop drawings.

B. Support For Recessed and Semirecessed Fixtures: Install fixtures so they are supported independently from the suspended ceiling support system. Install fixture support rods or wires at a minimum of four rods or wires per fixture located not more than 6 inches from fixture corners.

1. Fixtures Smaller Than Ceiling Grid: Install a minimum of four (4) rods or wires for each fixture and locate at corner of the ceiling grid where the fixture is located. Do not support fixtures by ceiling acoustical panels.

2. Fixtures of Sizes Less Than Ceiling Grid: Center in the acoustical panel. Support fixtures independently with at least two (2) 3/4-inch metal channels spanning and secured to the ceiling tees.

3. Install support clips for recessed fixtures, securely fastened to ceiling grid members, at or near each fixture corners.

C. Lamping: Lamp units according to manufacturer’s instructions. Fluorescent lamps shall have minimum CRI of 82.

3.02 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Give advance notice of dates and times for field tests.

C. Provide instruments to make and record test results.

D. Tests: Verify normal operation of each fixture after fixtures have been installed and circuits have been energized with normal power source. Interrupt electrical energy to demonstrate proper operation of emergency lighting installation. Include the following in tests of emergency lighting equipment:

1. 1 ½ hour burn.

E. Replace or repair malfunctioning fixtures and components, then retest. Repeat procedure until all units operate properly.

3.03 ADJUSTING AND CLEANING

A. Clean fixtures upon completion of installation. Use methods and materials recommended by manufacturer.

B. Adjust aimable fixtures to provide required light intensities.

END OF SECTION
SECTION 26.61.00
GENERAL LIGHTING PROVISIONS

PART 1 – GENERAL

1.01 WORK INCLUDED
A. Fixtures
B. Controls
C. Lamps
D. Ballasts
E. Exterior Fixtures
F. Emergency Lighting

1.02 SUBMITTALS
A. Submit shop drawings and product data in accordance with Section 26.05.00.
B. Submit shop drawings for luminaries showing pertinent physical characteristics and performance data.
C. Submit samples of luminaries prior to final production at Engineer's request on any proposed fixture substitution.
D. Provide a complete set of fixture information and include in O&M Manuals.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS
A. Provide fixtures as shown in the fixture schedule or approved equal.

2.02 FIXTURES
A. Provide electronic instant start ballasts in all fluorescent lighting fixtures with less than 10% total harmonic distortion suitable for roof/floor or roof/ceiling fire rating indicated on architectural plans. Ballasts shall be Universal, Advance, or General Electric. Recessed fluorescent lighting fixtures ballasts shall be provided with integral thermal protection.
B. Provide instant start lamps for all fluorescent fixtures. Lamps shall be General Electric and 3,500 °K, CRI of 80 or better, unless specified otherwise.

2.03 CONTROLS
A. Time switches shall be Tork, Intermatic, or Paragon of types and quantity shown on Drawings.

2.04 EMERGENCY EGRESS LIGHTING UNITS AND EXIT SIGNS
A. Provide fully automatic operation on power failure. Units shall have integral battery back-up for 1½ hours per NFPA. Units shall be connected unswitched to lighting circuits.

PART 3 – EXECUTION

3.01 GENERAL
A. Furnish, locate, and install fixtures as indicated on Drawings.
3.02 INSTALLATION

A. Mount fixtures as called for in schedule on Drawings. Determine type of ceiling to be installed in each space and furnish fixtures suitable for exact type, including roof/floor or ceiling/floor fire rated design. Recessed fixtures shall be supported from building structure.

B. Lighting fixtures shall be structurally supported. Fluorescent fixtures mounted in the ceiling shall be attached to ceiling system as required by NEC 410-16(b). Surface mounted fixtures shall be supported from building structural system by rods or rods and clamps, or by fixture outlet box which in turn shall be supported by rods.

C. Receive, store, uncrate, and install light fixtures shown in schedule on drawings to be specified by others.

D. Adjust lighting fixtures to illuminate the intended area.

E. Wire recessed fluorescent luminaries with Type THHN wire not smaller than No. 12.

F. Wire surface mounted fluorescent luminaries with Type THHN wire not smaller than No. 12 from outlet boxes.

G. Locate no splice or tap within an arm or stem. Wire shall be continuous from splice in outlet box of building wiring system to lamp socket or ballast terminals.

END OF SECTION