

**ELECTRICAL SPECIFICATIONS**

**SECTION 16011 TEMPORARY & PERMANENT ELECTRICAL SERVICE**  
**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- This section includes temporary lighting and power with luminaries, panelboards, circuit breakers, and enclosures.
- Related sections include the following:
  - Division 16 Section "Grounding"
  - Division 16 Section "Wiring Devices"
  - Division 16 Section "Circuit Breakers"
  - Division 16 Section "Panelboards"

**1.3 DEFINITIONS**

- GFCI: Ground fault current interrupter.
- RMS: Root Mean Square
- SPDT: Single Pole, Double Throw

**1.4 USE CHARGES**

- General: Cost or use charges for temporary facilities are not chargeable to Owner, Architect, or Engineer and shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, the following:
  - Owner's construction forces.
  - Occupants of Project.
  - Architect.
  - Engineer.
  - Testing agencies.
  - Personnel of authorities having jurisdiction.
- Permanent Service: Coordinate with building owner and utility company to establish permanent service upon completion of the project. Contractor shall pay for all permits, aid-to-construction charges, and related fees associated with the new service.

**1.5 NOTIFICATION**

- Coordinate with owner to provide 72 hour written notification to other tenants of any power interruptions. Notification shall state the estimated time and duration of the electrical outage.

**1.6 QUALITY ASSURANCE**

- Standards: Comply with ANSI A10.6, NECA's "Temporary Electrical Facilities," and NFPA 241.
  - Trade Jurisdictions: Assigned responsibilities for installation and operation of temporary utilities are not intended to interfere with trade regulations and union jurisdictions.
  - Electric Service: Comply with NECA, NEMA and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
  - Comply with OSHA standards and regulations.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- Electrical Outlets: Properly configured, NEMA-polarized outlets to prevent insertion of 110- to 120-V plugs into higher-voltage outlets; equipped with ground-fault circuit interrupters, reset button, and pilot light.
- Power Distribution System Circuits: Where permitted and overhead and exposed for surveillance, wiring circuits, not exceeding 125-V ac, 20-A rating, and lighting circuits may be nonmetallic sheathed cable.
- Main panelboard with disconnect.
- Temporary lighting.
- 120 volt receptacles with overcurrent protection.
- Enclosures: NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.
  - Outdoor Locations: NEMA 250, Type 3R.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, and overload-protected disconnecting means.
  - Install power distribution wiring overhead and rise vertically where least exposed to damage.
- Electric Distribution: Provide receptacle outlets adequate for connection of power tools and equipment.
  - Provide waterproof connectors to connect separate lengths of electrical power cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.
  - Provide metal conduit, tubing, or metallic cable for wiring exposed to possible damage. Provide rigid steel conduits for wiring exposed on grades, floors, decks, or other traffic areas.
  - Provide metal conduit enclosures or boxes for wiring devices.
  - Provide 4-gang outlets, spaced so 1 DO-foot (30-m) extension cord can reach each area for power hand tools and task lighting. Provide a separate 125-V ac, 20-A circuit for each outlet.
- Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations and traffic conditions.
  - Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
  - Provide one 100-W incandescent lamp every 50 feet (15 m) in traffic areas.
  - Install exterior-yard site lighting that will provide adequate illumination for construction operations, parking and traffic conditions, and signage visibility when the Work is being performed.
  - Install lighting for Project identification sign.

**END OF SECTION 16011**

**SECTION 16060 - GROUNDING AND BONDING**  
**PART 1 - GENERAL**

**1.1 SUMMARY**

- This Section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

**1.2 QUALITY ASSURANCE**

- Testing Agency Qualifications: Testing agency as defined by OSHA in 29 CFR 1910.7 or a member company of the International Electrical Testing Association and that is acceptable to authorities having jurisdiction.
  - Testing Agency's Field Supervisor: Person currently certified by the International Electrical Testing Association to supervise on-site testing specified in Part 3.
- Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
  - Comply with UL 467.

**PART 2 - PRODUCTS**

**2.1 GROUNDING CONDUCTORS**

- For insulated conductors, comply with Division 16 Section "Wiring Methods."
- Material: Copper.
- Equipment Grounding Conductors: Insulated with green-colored insulation.
- Grounding Electrode Conductors: Stranded cable.
- Bare Copper Conductors: Comply with the following:
  - Solid Conductors: ASTM B 3.
  - Assembly of Stranded Conductors: ASTM B 8.

**2.2 CONNECTOR PRODUCTS**

- Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.

**PART 3 - EXECUTION**

**3.1 APPLICATION**

- Use only copper conductors.
- In raceways, use insulated equipment grounding conductors.
- Equipment Grounding Conductor Terminations: Use listed pressure clamps.
- Grounding Bus: Install electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
  - Use insulated space race 1 inch from wall and supported from wall 6 inches above finished floor, unless otherwise indicated.
  - At doors, route the bus into the room on top of frame, across the top of the doorway, and down to the specified height above the floor.

**3.2 EQUIPMENT GROUNDING CONDUCTORS**

- Comply with NFPA 70, Article 250 for types, sizes, and quantities of equipment grounding conductors, unless specified otherwise. Large diameter conductors shall be insulated in accordance with NFPA 70.

**3.3 INSTALLATION**

- Equipment 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.

**3.4 CONNECTION**

- 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.
- Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 6 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors. 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.
- 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.

**END OF SECTION 16060**

**SECTION 16100 - WIRING METHODS**  
**PART 1 - GENERAL**

**1.1 SECTION REQUIREMENTS**

- Summary: Building wire and cable and associated splices, connectors, and terminations for wiring systems rated 600 V and less, and twisted-pair cable, and raceways and boxes.

**PART 2 - PRODUCTS**

**2.1 WIRES AND CABLES**

- Connectors and Splices: Wiring connectors of size, ampacity rating, material, and type and class for application and for service indicated.

**2.2 RACEWAYS**

- Wireways: Screwed cover type, with manufacturer's standard finish.
- Outlet and Device Boxes: Sheet metal boxes, except use cast-metal boxes at exterior, interior exposed, and interior damp locations.
- Pull and Junction Boxes: Sheet metal boxes, except use nonmetallic boxes with gasketed covers at exterior and interior damp locations.

**2.3 ENCLOSURES**

- Hinged-Cover Enclosures: NEMA 250, steel enclosure with continuous hinge cover and flush latch. Finish inside and out with manufacturer's standard enamel.
- Cabinets: NEMA 250, Type 1, unless otherwise indicated.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- Install wires and cables according to the NECA's "Standard of Installation."
- Wiring at Outlets: Install with at least 12 inches of slack conductor at each outlet.
- Conceal wiring, unless otherwise indicated, within finished walls, ceilings, and floors.
- Boxes and Enclosures: In damp or wet locations use NEMA 250, Type 4, stainless steel.
- Use raceway fittings compatible with raceway and suitable for use and location. For intermediate steel conduit, use threaded rigid steel conduit fittings, unless otherwise indicated.
- Raceways Embedded in Slabs: Install in middle third of the slab thickness where practical, and leave at least 1 inch concrete cover.
- Install exposed raceways parallel to or at right angles to nearby surfaces or structural members, and follow the surface contours as much as practical.
- Join raceways with fittings designed and approved for the purpose and make joints tight. Use bonding bushings or wedges at connections subject to vibration. Use bonding jumpers where joints cannot be made tight. Use insulating bushings to protect conductors.
- Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel or monofilament plastic line having not less than 200-lb tensile strength. Leave not less than 18 inches of slack at each end of the pull wire.
- Install raceway sealing fittings where required by the NEC and at wiring entrances to refrigerated spaces. Locate at suitable, approved, accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces.
- Stub-up Connections for Equipment: Extend conductors to equipment with intermediate metal conduit; flexible metal conduit may be used 6 inches above the floor.
- Install a separate green ground conductor in surface metal raceway from the junction box supplying the raceway to receptacle and fixture ground terminals.

**3.2 IDENTIFICATION MATERIALS AND DEVICES**

- Install at locations for most convenient viewing without interference with operation and maintenance of equipment.
- Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations indicated in the Contract Documents or required by codes and standards. Use consistent designations throughout Project.
- Identify raceways and cables with color banding as follows:
  - Bands: Pre-tensioned, snap-around, colored plastic sleeves or colored encircling conduit, and place adjacent bands of two-color markings in contact, side by side.
  - Band Locations: At changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
  - Colors: As follows:
    - Telecommunication System: Green and yellow.
- Color-code System secondary service, feeder, and branch-circuit conductors throughout the secondary electrical system as follows:
 

	120/208V		277/480V
1. Phase A:	Black	Brown	
2. Phase B:	Red	Orange	
3. Phase C:	Blue	Yellow	
4. Neutral:	White	Gray	
5. Ground:	Green	Green	

**END OF SECTION 16100**

**SECTION 16442 - PANELBOARDS**  
**PART 1 - GENERAL**

**1.1 SECTION REQUIREMENTS**

- Submittals: None.
- Comply with NFPA 70.
- Comply with NEMA PB 1.

**PART 2 - PRODUCTS**

**2.1 PANELBOARDS AND LOAD CENTERS**

- Manufacturers: Subject to compliance with requirement, provide products by one of the following:
  - Panelboards, Overcurrent Protective Devices, Controllers, Contactors, and Accessories:
    - Square D Co.
    - Eaton Corp., Cutler-Hammer Products.
    - General Electric Co., Electrical Distribution & Control Div.
    - Siemens Energy & Automation.
  - Recessed, NEMA PB 1, Type 1.
    - Load Center Capacity: as shown on drawings.
    - Front: Secured to box with concealed trim clamps.
    - Doors: With concealed hinges, flush catches, and tumblers locks, all keyed alike.
    - Bus: Hard drawn copper of 98 percent conductivity.
  - Molded-Case Circuit Breakers: NEMA AB 1, plug-in type, Single-handle for multiple circuit breakers. Appropriate for application, including Type SWD for repetitive switching lighting loads and Type HACR for heating, air-conditioning, and refrigerating equipment.
  - Contactors: NEMA ICS 2, Class A combination contactors.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- Install panelboards and accessory items according to NEMA PB 1.1. Indicate installed circuit loads in English and Spanish on a typed circuit directory after balancing panelboard loads.
- Mounting Heights: Top of trim 74 inches above finished floor, unless otherwise indicated.
- Future Circuit Provisions at Flush Panelboards: Stub four empty 3/4-inch conduits from panelboard into accessible or designated clear space.
- Wiring in Panelboard Gutters: Arrange conductors into groups, bundle and wrap with wire ties according to NEC guidelines.
- Tighten electrical connectors and terminals, including grounding connections, according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in NFPA 70.
- Perform visual and mechanical inspections and electrical tests stated in NETA ATS.

**END OF SECTION 16442**

**SECTION 16500 - LIGHTING**  
**PART 1 - GENERAL**

**1.1 SECTION REQUIREMENTS**

- Submittals: Product Data for each luminaire, including types.
- Fixtures, Emergency Lighting Units, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
- Coordinate ceiling-mounted luminaires with ceiling construction, mechanical work, and acoustical and fire-prevention features mounted in ceiling space and on ceiling.

**PART 2 - PRODUCTS**

**2.1 FIXTURES AND FIXTURE COMPONENTS, GENERAL**

- Metal Parts: Free from burrs, sharp corners, and edges. Steel surfaces otherwise indicated. Form and support to prevent warping and sagging.
- Doors, Frames, and Internal Access: Smooth operating, free from light leakage under operating conditions, and arranged to permit repositioning without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling, mis-latching and when latched in operating position.
- Lenses: Diffusers, Covers and Shades: 100 percent virgin acrylic plastic or annealed crystal glass, unless otherwise indicated.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- Support units level, plumb, and square with ceiling and walls, and secure.
- Support for Recessed and Nonrecessed Grid-Type Fluorescent Fixtures: Install ceiling support system rods or wires at minimum of 4 rods or wires for each fixture, located not more than 6 inches from fixture corners. Support for Suspended Fixtures: Support according to manufacturer's recommendations. Labeling: Where specific lamp designations are not indicated, lamp units according to manufacturer's written instructions.

**END OF SECTION 16500**

**SECTION 16140 - WIRING DEVICES**  
**PART 1 - GENERAL**

**1.1 SECTION REQUIREMENTS**

- Submittals: None.
- Comply with NEMA WD 1.
- Comply with NFPA 70.

**PART 2 - PRODUCTS**

**2.1 DEVICES**

- General: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
- Color: Per Material Schedule of sheet E10.
- Receptacles: Heavy-Duty grade, NEMA WD6, Configuration 5-20R, unless otherwise indicated.
- Ground-Fault Circuit Interrupter Receptacles: Integrated duplex receptacle; for installation in box without an adapter. Feed-through type, with a 2-3/4-inch-deep outlet.
- Isolated-Ground Receptacles: Provide ground-fault protection from mounting strap. Equipment grounding contacts connected only terminate at the device with inherent electrical isolation.
- Snap Switches: Heavy-duty, quarter-turn type.
- Wall Plates: Material Schedule of sheet E10.
- Floor Service Fittings: Modular, above-floor, dual-service units suitable for wiring method used.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- Install devices and assemblies plumb and secure.
- Mount devices flush with long dimension vertical, of receptacles on top unless otherwise indicated, under single mounting with exceptions.
- Protect devices and assemblies during painting. Install plates when painting is complete.

**END OF SECTION 16140**

**SECTION 16410 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS**  
**PART 1 - GENERAL (Not Applicable)**  
**PART 2 - PRODUCTS**

**2.1 SWITCHES**

- Enclosed, Nonfusable Switch: NEMA KS 1, Type HD, with lockable handle.

**2.2 CIRCUIT BREAKERS**

- Enclosed, Molded-Case Circuit Breaker: NEMA AB 1, with thermal-magnetic trip unless otherwise indicated.
  - Characteristics: Frame size, trip rating, number of poles, and auxiliary devices as indicated.
  - Interrupting Rating: PER DRAWINGS
  - Thermal-Magnetic Circuit Breakers, 225 A and Larger: Trip units fixed.
  - Current-Limiting Trips: Let-through ratings less than NEMA FU 1, Class RK-5.
  - Enclosure: NEMA AB 1, Type 1, unless otherwise specified or required to meet environmental conditions of installed location.

**PART 3 - EXECUTION**

**3.1 TESTING**

- Perform visual and mechanical inspections and electrical tests stated in NETA ATS.

**END OF SECTION 16410**

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