

SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Methods and materials for grounding systems and equipment.
2. **KROGER DIRECT BUY PROGRAM:** Owner supplied/Contractor installed.
 - a. The Kroger Company will supply the following items:
 - 1) Insulated and bare conductors.
 - b. Comply with requirements in Division 00 Section "General Conditions."
3. Contractor supplied items:
 - a. Connectors and grounding electrodes.
 - b. Other items as required for a complete installation.
4. Contractor installed items
 - a. Insulated and bare copper conductors.
 - b. Connectors and grounding electrodes.

B. Direct Buy Wiring Quantity Determination:

1. Complete the Electrical Wire (Cuts) Order Form (in Division 26 Section "Low Voltage Electrical Power Conductors and Cables"). Order may be broken down into a maximum of two deliveries, additional deliveries are at contractor's expense. Submit via email to the Direct Buy Wire Supplier:

Graybar Electric
CIOHKroger@gbe.com
Attention Renee Miller
2. Include with wiring in Division 26 Section "Low Voltage Electrical Power Conductors and Cables."
3. Report any discrepancies between the Electrical Wire (Cuts) Order Form and actual product received to the Direct Buy Wire Supplier and copy Kroger within the allotted time frame as established by the Direct Buy Wire Supplier. Coordinate delivery schedule, cut lengths, colors, location and date with the Direct Buy Wire Supplier. Upon receipt, the electrical wire becomes the property of the Contractor.
4. Notify Direct Buy Wire Supplier of any delivery date change with copies to Kroger's Procurement Department and Kroger's Project Manager. Notification must take place a

minimum of two weeks prior to requested delivery date and change must be a minimum of plus or minus two weeks.

5. Adjustments may be made between the Electrical Wire Bid Takeoff Form and the Electrical Wire (Cuts) Order Form as long as the adjustments do not exceed the value of the total wire price originally calculated on the Electrical Wire Bid Takeoff Form. Provide at no additional cost to the Owner, any additional electrical wire; equal in quality to Kroger supplied wiring, required to complete the project. Kroger will pay for pricing increases in wire due to inflation.
6. Manage any warranty claims directly with the Direct Buy Wire Supplier and copy Kroger.

1.2 SUBMITTALS

- A. The Owner will provide the following submittals for the Contractor's review. The Contractor shall review and return submittals as specified in Division 00 Section "General Conditions."
 1. Product Data: For each type of Owner furnished product.
- B. Provide the following submittals for Owner's and Architect's review:
 1. Product Data: For each type of Contractor furnished product.
 2. Field quality-control test reports.
 3. Electrical Wire Order Form: Submit as defined above.

1.3 QUALITY ASSURANCE

- A. 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.
- B. Comply with UL 467 for grounding and bonding materials and equipment.
- C. Coordination Meeting: Between electronic equipment installers, electrical installers and Contractor before start of Work.

PART 2 - PRODUCTS

2.1 CONDUCTORS (OWNER SUPPLIED)

- A. Refer to Division 01 Section "Vendor Contact List."
 1. Products will comply with NEC, and established industry standards.
 2. Insulated Conductors: Owner will supply wire or cable insulated for 600 V unless otherwise required by applicable code or authorities having jurisdiction. Unless otherwise specified, service entrance conductors, feeder and subfeeders rated 100 ampere and larger will be compact stranded AA-8000 aluminum alloy.
 3. Bare Copper Conductors: Owner will supply bare copper conductors complying with the following:

- a. Solid Conductors: ASTM B 3.
- b. Stranded Conductors: ASTM B 8.
- c. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
- d. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
- e. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
- f. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

2.2 CONNECTORS (CONTRACTOR SUPPLIED)

- A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Bolted pressure-type, with at least two bolts.
 1. Bolted Connectors for Copper Conductors: Copper or copper alloy
 2. Bolted Connectors for Aluminum Conductors: Aluminum alloy AA-8000 compact stranded conductors.
 3. Pipe Connectors: Clamp type, sized for pipe.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 GROUNDING ELECTRODES (CONTRACTOR SUPPLIED)

- A. Ground Rods: Copper-clad steel; 3/4 inch (19 mm) in diameter by 10 feet (3 m) long.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare copper conductor, No. 2/0 AWG minimum. Bury at least 24 inches (600 mm) below grade.
- C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.
- D. Conductor Terminations and Connections:
 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.

2. Underground Connections: Welded connectors, except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.2 EQUIPMENT GROUNDING

- A. Provide a separate grounding conductor for branch circuits and feeders from the load side terminals of the device or equipment to the source grounding bar (i.e. at the panelboard or switchboard). Mechanical grounding (i.e. grounding connecting the device or equipment to the junction box or conduit) will not be permissible. Other applications in addition to that required by NFPA 70 are listed below:
 1. Flexible raceway runs.
 2. Metal-clad cable runs.
 3. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
 4. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.
- B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- C. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- D. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
- E. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
- F. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide No. 6 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring cabinet, and central equipment location.

1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch (6-by-50-by-300-mm) grounding bus. Coordinate with equipment installers for locations requiring grounding.
 2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.
- G. Metal Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.3 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
1. Fasten cables directly to the structural steel using factory clamps/clips specifically designed for the respective cable. Do not attach cables to metal deck.
- B. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade, unless otherwise indicated.
1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.
 2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
- C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.
1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
 3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.
- D. Grounding and Bonding for Piping:
1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
 2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.

3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve. Retain and edit paragraph below to exceed NFPA 70 requirements, and comply with NFPA 70 recommendations for a higher standard of safety or electromagnetic interference suppression if needed.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells.
 - a. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
 - b. Perform tests by fall-of-potential method according to IEEE 81.

B. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm(s).

C. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

1. Cost to reduce ground resistance shall be at Contractor's expense.

END OF SECTION 26 05 26