

## **SECTION 26 05 26**

### **GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS**

#### **PART 1 - GENERAL**

##### 1.1 RELATED DOCUMENTS:

- A. The Conditions of the Contract and applicable requirements of Divisions 0 and 1 and Section 26 00 01, "Electrical General Provisions", govern this Section.

##### 1.2 DESCRIPTION OF WORK:

- A. Work Included: Provide electrical service, distribution, and equipment grounding as shown, scheduled, indicated, and as specified.
- B. Types: The types of electrical service and equipment grounding specified in this Section include, but are not necessarily limited to, grounding all equipment and devices shown and as required by the National Electrical Code (NEC), the local electrical inspection department, and The Power Company.

##### 1.3 STANDARDS:

- A. Products shall be designed, manufactured, tested, and installed in compliance with the following Standards:
  - 1. ANSI/IEEE Standard 142 - Recommended Practice for Grounding of Industrial and Commercial Power Systems.
  - 2. ANSI/UL 467 - Safety Standard for Grounding and Bonding Equipment.
  - 3. NFPA 70 - National Electrical Code (NEC).

##### 1.4 QUALITY ASSURANCE:

- A. NEC Compliance: Comply with Article 250 of the NEC for grounding.
- B. Approval: All grounding shall be in accordance with the requirements of, and shall be subject to the approval of the Engineer and the local electrical inspection department.
- C. UL Label: All grounding products shall be UL-labeled.
- D. Manufacturers: Provide grounding products complying with these specifications and as manufactured by Copperweld and Cadweld.

##### 1.5 SUBMITTALS:

- A. Shop Drawing submittals shall include, but not be limited to, the following:
  - 1. A complete grounding system diagram for special grounding systems.
  - 2. Cut sheets of grounding products.
  - 3. Additional information as required in Section 26 00 01, "Electrical General Provisions"..

##### 1.6 STORAGE AND HANDLING:

- A. Store grounding products in a clean, dry space.

#### **PART 2 - PRODUCTS**

## 2.1 MATERIALS AND COMPONENTS:

- A. General: For each electrical grounding connection, provide a complete assembly of materials to construct a completely grounded electrical system.
- B. Raceways: Raceways for grounding conductors shall be as specified in Section 26 05 33 "Electrical Raceways", and Section 26 05 34, "Electrical Boxes".
- C. Cable, Wire, and Connectors: Grounding cable, wire and connectors shall be as specified in Section 26 05 19, "Low Voltage Conductors and Cables".
- D. Ground Clamps: Ground clamps for connecting grounding conductors to copper, brass, or lead pipes shall be made of copper and if pipes are of steel or iron, the ground clamps should be made of galvanized iron. These clamps shall be designed to provide permanent and positive pressure and to avoid mechanical injury to the pipe. Use exothermic welds for connecting ground wires to ground rods, for all below grade counterpoise ground grids, and elsewhere where noted on the Drawings.
- E. Ground Conductors and Jumpers: Grounding conductors and jumpers shall be connected to each other and to items to be grounded by means of approved type pressure connectors, clamps and other suitable methods approved by the Engineer. No solder connections shall be made.
- F. Grounding Electrode Rods: Grounding electrode rods used shall be a minimum of 3/4" diameter by 10' long, steel core and thick copper jacket. All concrete encased or direct buried underground grounding electrode conductors shall be of lead alloy-coated copper, Class B, stranded, conforming to ASTM A189.
- G. Exothermic Welds: Use cadweld or an approved equal system of exothermic welding for welded grounding connections where shown on the Drawings or specified.

## PART 3 - EXECUTION

### 3.1 INSTALLATION OF ELECTRICAL GROUNDING:

- A. General: Install grounding connections as shown and specified, in accordance with applicable portions of the NECA's "Standard of Installation", and recognized industry practices to ensure that products serve the intended functions.
- B. Grounding Electrode System: Each **[main switchboard]** **[substation]** **[service]** neutral and ground bus shall be connected to the incoming cold water piping system to the building on the street side of the building water meter. Provide a bonding jumper around the water meter. The main grounding conductor shall be sized as shown and shall be run in conduit. The cold water pipe ground shall be supplemented as required by NEC, Article 250 H, and as required by the local inspection department. In addition, the lightning protection system ground rods specified in Section 26 41 13, "Lightning Protection for Structures", shall be interconnected with a bonding loop below the basement slab. This loop shall be bonded to the electric service ground and to the Power Company transformer ground rods.
- C. Bonding: All metallic piping systems and building steel shall be effectively bonded to the electrical grounding system in accordance with Article 250 of the NEC. Install bonding jumpers to all piping systems and building steel.
- D. Building Equipment Grounding System: The building equipment grounding system shall consist of the ground wire and electrically continuous metallic conduit system as shown.

Every item of equipment served by the electrical system shall be bonded to the building equipment ground. Portions of metallic piping and duct systems which are electrically isolated shall be bonded to the equipment grounding system with a flexible bonding jumper.

- E. System Neutral: The system neutral shall be grounded to the grounding electrode system at the service entrance only, and shall be kept isolated from the building grounding system throughout the building. The neutral of separately derived systems shall be grounded at one point as specified hereinbelow.
- F. Miscellaneous: Provide bonding and grounding wires run in conduit and sized per the NEC in accordance with the local electrical inspection department and the NEC. Metallic piping and duct systems which enter the building shall be grounded at the point of entry to the building, in accordance with the NEC.
- G. Continuity: Continuity of the building equipment grounding system shall be maintained throughout the project. Grounding jumpers shall be installed across conduit expansion fittings, all liquidtight flexible metal and flexible metal conduit, light fixture pigtails in excess of 6', and all other non-electrically continuous raceway fittings.
- H. Main Conductors: All main grounding conductors shall be stranded copper conductors, sized as shown or per the NEC, and run in a suitable raceway. All main grounding conductors shall be continuous without joints or splices over their entire length.
- I. Special Grounding: Provide special grounding systems where shown on the Drawings.
- J. Separately Derived System Grounding: Bond the case and neutral of each transformer directly to the nearest available effectively grounded structural metal member of the structure, the nearest available effectively grounded metal water pipe, or in accordance with the local electrical inspection department. Flexible conduit shall not be used as a ground path to a transformer.
- K. Standby Electric Power System: This is a **[non]**separately derived system and shall **[NOT]** have its neutral grounded to the generator frame.
- L. Voice/Data Equipment Grounding: Provide a ground conductor from voice/data terminal provisions to the building grounding system as required by the local Telephone Company and as specified in Section **[27 10 25, "Voice/Data System Provisions/Cabling"] [26 27 21, "Voice/Data System Provisions"]**.
- M. Fluorescent Fixtures: Carefully and securely ground all fluorescent fixture bodies to the conduit grounding system S12E in accordance to Table 250-122.
- N. Receptacles: Ground all grounding type receptacles with a separate ground wire in each branch circuit. Further, ground each outlet by the use of an approved grounding screw to attach to pigtail to junction box on removal of the coverplate; or by the use of an approved grounding yoke type receptacle. An equipment bonding jumper shall be used to connect the grounding terminal of a grounding type receptacle to grounded box.
- O. Isolated Ground Receptacles: Where isolated ground receptacles are shown on the Drawings, ground each isolated ground receptacle with a separate insulated ground wire; this ground wire shall not be connected to the outlet box. Ground each isolated ground receptacle outlet box with a separate grounding conductor.
- P. Motor Frames: Motors operating with any terminal at over 150 volts to ground shall have their frames grounded according to Article 250-122 in the N.E.C.

- Q. Fountains and Pools: All fountains and pools shall be properly grounded in accordance with Article 680 of the NEC.
  - R. Rigid Nonmetallic Conduit Systems: Install a continuous grounding conductor in accordance with NEC.
  - S. Feeder and Branch Circuits: Provide a separate, insulated equipment grounding conductor in each feeder or branch circuit. Terminate each end on a grounding lug, bus, or bushing.
  - T. Bolted Connections: Connections requiring bolting shall be made up with Monel metal bolts, washers, and nuts. Connections shall be made only after surfaces have been cleaned, or ground to expose virgin metal. No strap grounding clamps shall be used.
  - U. Isolated Grounding Systems: Use insulated equipment grounding conductor and connect only to service grounding electrode.
  - V. Power Feeders: Ground the raceway, shield (where applicable), armor (where applicable), and ground conductors in 5/15 kV and 600 volt power feeders in accordance with the NEC. Bond all pull boxes and splice boxes in accordance with the NEC.
  - W. Branch Circuits: Install an insulated ground wire, sized per the NEC, in all branch circuits, conduits, flex, and junction boxes.
- 3.2 COORDINATION:
- A. General: Coordinate installation of grounding connections for equipment with equipment installation work. Inspect grounding and bonding system conductors and connections for tightness and proper installation. Torque all nuts and bolt properly.
  - B. Connections: Use exothermic welds for connecting bonding and grounding conductors where they are concealed or inaccessible.
- 3.3 TESTING:
- A. Ground Resistance Test: Measure ground resistance from system neutral connection at service entrance to convenient ground reference point using suitable ground testing equipment. Service ground resistance shall not exceed 5 ohms. Overall system resistance shall not exceed 15 ohms. Test shall be performed using a Biddle Megger or equivalent test instrument operated in accordance with the test instrument manufacturers operating/test procedure. Test readings shall be taken after 30 and 60 seconds of Megger operation at slip speed. The test shall not be performed immediately following wet weather conditions.
  - B. Submittals:
    - 1. Contractor shall furnish all instruments and personnel required for tests. Submit two copies of certified test results for Owner's record and submit four copies of certified test results to Architect for review. Test reports shall include date and time of tests, relative humidity, test results, temperature, and weather conditions.
    - 2. Submit equipment calibration certificates to owner for verification.

**END OF SECTION 26 05 26**