

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install complete grounding for electrical systems, structures, and equipment.

1.2 REFERENCES

A. Standards referenced in this Section are:

1. ANSI/NETA ATS, Acceptance Testing Specifications for Electrical Power Equipment and Systems.
2. ASTM B8, Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard or Soft.
3. UL 467, Grounding and Bonding Equipment.
4. NETA Acceptance Testing Specifications.

1.3 QUALITY ASSURANCE

A. Qualifications:

1. Field Acceptance Testing Firm: Retain services of independent testing firm to perform acceptance field testing of grounding system. Testing firm shall have experience in testing grounding systems and shall be a member company of NETA.

B. Regulatory Requirements

1. National Electrical Code, (NEC).
 - a. NEC Article 250, Grounding and Bonding.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:

1. Shop Drawings:
 - a. Listing of grounding connector types identifying where each will be used.
 - b. Layouts of each structure's ground grid.
 - c. Test point construction details.
2. Product Data:
 - a. Manufacturer's technical information for grounding materials proposed for use.

3. Testing Plans:
 - a. Ground resistance test procedure.
- B. Informational Submittals: Submit the following:
 1. Field Quality Control Submittals
 - a. Results of ground resistance tests at each test point.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Bare Ground Cable:
 1. Manufacturers: Provide products of one of the following:
 - a. Cablec Corporation.
 - b. General Cable Corporation.
 - c. Southwire Cable Company.
 - d. Approved equivalent.
 2. Material: Soft-drawn, bare copper stranded cable complying with ASTM B8. No. 4/0 AWG minimum size unless otherwise shown or indicated on the Drawings.
- B. Ground Rods:
 1. Manufacturers: Provide products of one of the following:
 - a. Copperweld, Bimetallics Division.
 - b. ITT Blackburn Company.
 - c. Approved equivalent.
 2. Material: Copper-clad rigid steel rods, 3/4-inch diameter, ten feet long.
- C. Grounding Connectors:
 1. Products and Manufacturers: Provide one of the following:
 - a. Pressure Connectors:
 - 1) O.Z./Gedney, Division of General Signal Corporation.
 - 2) Burndy Corporation.
 - 3) Approved equivalent.
 - b. Welded Connections:
 - 1) Cadweld by Erico Products, Incorporated.
 - 2) Therm-O-Weld by Burndy Corporation.
 - 3) Approved equivalent.
 2. Material: Pressure connectors shall be copper alloy castings, designed and fabricated specifically for items to be connected and assembled with Durium or silicone bronze bolts, nuts, and washers. Welded connections shall be by exothermic process utilizing molds, cartridges, and hardware designed specifically for connection to be made.
- D. Grounding Additive:

1. Grounding additive, in its set form, shall have resistivity of not more than 20 ohm-cm.
 2. Product and Manufacturer:
 - a. Ground Enhancement Material (GEM) by Erico
 - b. Approved equivalent.
 3. Grounding additive shall be permanent and maintenance-free, without requiring recharging with salts or chemicals that may be corrosive, and shall maintain its earth resistance with time.
 4. Grounding additive shall set up firmly and not dissolve or decompose or otherwise pollute soil or groundwater.
 5. Grounding additive shall be suitable for installation in dry form or in slurry form.
 6. Grounding additive shall not depend on continuous presence of water to maintain its conductivity.
- E. Ground Test Well
1. Provide heavy-duty test well suitable for heavy-duty traffic.
 2. Manufacturer
 - a. Advanced Lightning Technology
 - b. Approved equivalent.
 3. Diameter and Material: 12.75-inch outside diameter, Schedule 80 PVC.
 4. Depth: Two feet.
 5. Cover: Provide test well with cast iron cover marked, "Ground" with cast iron ring to support lid.
- F. Ground system components shall comply with UL 467.

PART 3 – EXECUTION

3.1 INSPECTION

- A. Examine conditions for the Work and notify ENGINEER in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with Work until unsatisfactory conditions are corrected.

3.2 STRUCTURE GROUND SYSTEM

- A. Provide ground grids as shown and indicated on the Drawings.
- B. Provide No. 4/0 bare copper cable around exterior perimeter of structures at not less than 2.5 feet below grade, unless otherwise shown or indicated on the Contract Documents.
- C. For structures with steel columns, provide No. 4/0 ground cable from grid to each column around perimeter of structure. Connect cable to steel with exothermic welds.

- D. Connect grids to continuous underground water pipe system, when practical.
- E. For new structures with concrete foundation or footings, connect structure's reinforcing steel or other concrete-encased electrode to grounding grid.
- F. Provide accessible test points for measuring the ground resistance of each grid.
- G. Weld all buried connections except for test points.

3.3 EQUIPMENT GROUNDING

- A. Ground electrical equipment in compliance with Laws and Regulations and the Contract Documents.
- B. Equipment grounding conductors shall be bare stranded copper cable of adequate size installed in metal conduit where required for mechanical protection. Ground conductors, pulled into conduits with non-grounded conductors, shall be insulated. Insulation shall be green.
- C. Control panels grounding conductors shall be bare stranded copper cable of adequate size to ground grid from AC ground bus, and an insulated stranded copper cable of adequate size to ground grid from DC ground bus.
- D. Connect ground conductors to conduit with copper clamps, straps, or with grounding bushings.
- E. Connect to piping by welding or brazing. Use copper bonding jumpers on gasketed joints.
- F. Connect to equipment by means of lug compressed on cable end. Bolt lug to equipment frame using holes or terminals provided on equipment specifically for grounding. Do not use hold-down bolts. Where grounding provisions are not included, drill suitable holes in locations recommended by equipment manufacturer or designated by ENGINEER.
- G. Connect to motors by bolting directly to motor frames, not to soleplates or supporting structures.
- H. Connect to service water piping by means of copper clamps. Use copper bonding jumpers on gasketed joints.
- I. Scrape bolted surfaces clean and coat with conductive oxide-resistant compound.

3.4 FIELD QUALITY CONTROL

A. Site Tests:

1. Test completed grounding systems for resistance to ground using an electrical three-terminal ground resistance tester. Test all grounded cables and metal parts for continuity of connection. ENGINEER and OWNER will witness the testing.
2. Grounding system maximum resistance shall not exceed five ohms under normally dry conditions when measured by resistance tester. Resistance values above five ohms shall be brought to ENGINEER's attention. Provide additional ground rods as required to attain a resistance to ground of less than five ohms for each ground grid. Add grounding additive installing additional ground rods to increase their effectiveness.
3. Acceptance Testing:
 - a. Perform acceptance testing of grounding system. Testing shall be performed by testing firm in accordance with ANSI/NETA ATS.
 - b. Test Equipment, Calibration and Reporting: Test equipment, instrument calibration, and test reports shall comply with ANSI/NETA ATS.

++ END OF SECTION ++