

## **PART 1 - GENERAL**

### **1.1 RELATED REQUIREMENTS**

- .1 Section 01 91 13 – Commissioning Requirements
- .2 Section 26 05 00 – Common Work Results - Electrical

### **1.2 REFERENCE STANDARDS**

- .1 American National Standards Institute /Institute of Electrical and Electronics Engineers (ANSI/IEEE )
  - .1 ANSI/IEEE 837-[02], IEEE Standard for Qualifying Permanent Connections Used in Substation Grounding.

### **1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for [grounding equipment] and include product characteristics, performance criteria, physical size, finish and limitations.

## **PART 2 - PRODUCTS**

### **2.1 EQUIPMENT**

- .1 Clamps for grounding of conductor: size as indicated as required to electrically conductive underground water pipe.
- .2 Copper conductor: minimum 6 m long for each concrete encased electrode, bare, stranded, tinned, soft annealed, size as indicated.
- .3 Rod electrodes: copper clad steel 19 mm diameter by minimum 3 m long.
- .4 Plate electrodes: copper, surface area 0.2m<sup>2</sup>, minimum 1.6 mm thick.
- .5 Grounding conductors: bare stranded copper, soft annealed, size as indicated.
- .6 Insulated grounding conductors: green, copper conductors, size as indicated.
- .7 Ground bus: copper, size as indicated, complete with insulated supports, fastenings, connectors.

- .8 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
  - .1 Grounding and bonding bushings.
  - .2 Protective type clamps.
  - .3 Bolted type conductor connectors.
  - .4 Thermit welded type conductor connectors.
  - .5 Bonding jumpers, straps.
  - .6 Pressure wire connectors.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION GENERAL**

- .1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories. Where EMT is used, run ground wire in conduit.
- .2 Install connectors in accordance with manufacturer's instructions.
- .3 Protect exposed grounding conductors from mechanical injury.
- .4 Make buried connections, and connections to conductive water main, electrodes, using [copper welding by thermit process.
- .5 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .6 Soldered joints not permitted.
- .7 Install bonding wire for flexible conduit, connected at one end to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.
- .8 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.
- .9 Install separate ground conductor to outdoor lighting standards.
- .10 Connect building structural steel and metal siding to ground by welding copper to steel.
- .11 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.
- .12 Bond single conductor, metallic armoured cables to cabinet at supply end, and load end.
- .13 Ground secondary service pedestals.

#### **3.2 ELECTRODES**

- .1 Make ground connections to continuously conductive underground water pipe on street side of

- water meter.
- .2 Install water metre shunt.
  - .3 Install concrete encased electrodes in building foundation footings, with terminal connected to grounding network.
  - .4 Install rod, plate electrodes and make grounding connections as indicated.
  - .5 Bond separate, multiple electrodes together.
  - .6 Use size 2/0 3/0 or 4/0 AWG copper conductors for connections to electrodes.
  - .7 Make special provision for installing electrodes that will give acceptable resistance to ground value where rock or sand terrain prevails. Ground as indicated.

### **3.3 SYSTEM AND CIRCUIT GROUNDING**

- .1 Install system and circuit grounding connections to neutral of primary V system.

### **3.4 EQUIPMENT GROUNDING**

- .1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, generators, elevators and escalators, distribution panels, outdoor lighting, cable trays.

### **3.5 GROUNDING BUS**

- .1 Install copper grounding bus mounted on insulated supports on wall of electrical room and communication equipment room.
- .2 Ground items of electrical equipment in electrical room and IT equipment in communication equipment room to ground bus with individual bare stranded copper connections size 2/0AWG.

### **3.6 COMMUNICATION SYSTEMS**

- .1 Install grounding connections for telephone, sound, fire alarm, security systems, intercommunication systems as follows:
  - .1 Telephones: make telephone grounding system in accordance with telephone company's requirements.
  - .2 Sound, fire alarm, security systems, intercommunication systems as indicated.

### **3.7 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

- .2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.
- .4 Disconnect ground fault indicator during tests.

**END OF SECTION**