

7. TECHNICAL SPECIFICATIONS FOR SUPPLY OF EARTHING SYSTEM

1.0 SCOPE OF WORK

- 1.1 Design, assembling, testing, painting, supply, delivery at site with all related accessories as per the specifications as specified below. Compliance with the provisions of this specification shall not relieve the Bidder of the responsibility of furnishing apparatus and accessories of proper design, electrically and mechanically suited to meet the operating requirements under the specified service conditions and be suitable for the purpose of which they are intended.

2.0 CODES & STANDARDS

- 2.1 The design, material, assembling, inspection and testing shall comply with all currently applicable statutes, regulations and safety codes in the locality where the system will be installed. The equipment shall also conform to the latest applicable standards and codes of practice as mentioned below.

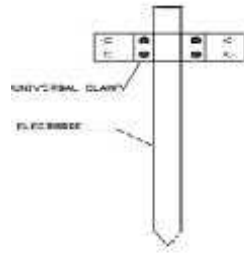
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Sr.	Item	Relevant IS / IEC
1	Code of Practice for Earthing	IS 3043
2	Insulation Co-ordination Application Guide	IS 3716
3	Code of Practice for Protection of Buildings and Allied Structures against Lightning	IS 2309
4	Indian Electricity Rules, 1956	
5	Indian Electricity Act, 1910	
6	National Electrical Code	
7	Low Voltage Electrical Installations-Part 5-54: Selection & Erection of Electrical equipment- Earthing arrangement & protective conductors.	IEC 60364
8	Protection Against Lightning –Part 3: Protection of structures & life Hazards	IEC 62305

TECHNICAL REQUIREMENTS

- 4.1 The earth grid shall consist of main grounding grid conductors forming a closed ring network with required number of Rod type earthing stations connected to it to provide a common earth for electrical equipments and metallic structures. Two distinct connections shall be made from each earthing station to the main grounding/earthing mat through GI/Cu. flat.
- 4.2 Earthing system should offer a resistance of less than 2 ohms throughout the year. In places where Soil resistivity is more, total length of the earthing rod has to be increased by adding 1m length rods (one over the other) to achieve low and stable resistance value. In rocky places, multiple earth rods have to be installed and inter-connected to get the required value.
- Minimum length for each earthing station to be 3 meters.
- 4.3 The earth bus in required numbers shall be installed in various plant open areas and rooms. Each earth bus shall be provided two distinct connections by GI/Cu flats / Cu. Flexible cable from the main grounding grid conductors available nearby. The plant/building equipment, metallic structures, tanks, etc. shall be brought to earth by providing two distinct connections between earth bus installed nearby and that equipments, tank, apparatus, etc.
- 4.4 Solid Copper coated rods are recommended as earth electrode than a pipe due to the fact that solid rods have much longer life and can be easily driven by electric/hydraulic hammers. Copper has much longer life than all other materials as explained in IS 3043.
- 4.5 GENERAL CONSTRUCTIONAL DETAILS
- 4.5.1 Pipe Electrode Earth Station
1. Copper coated Solid steel Rods shall be made of high tensile low carbon steel rod, molecularly bonded with 99.9% electrolytic copper with minimum coating thickness of 250 microns as per IEC 62561 part -2: Requirement for Conductor & Earth Electrodes.
 2. The length of the earth rod shall be 1 meter at least or as per manufacturer's recommendation, so that driving into the ground is easier. For dry areas, length of the rods can go up to several meters by driving the rods one over the other.
 3. For all the installation minimum length of the earthing rods shall be 3 mts minimum by adding similar rods.
 4. Earth rods should be of diameter 20 mm minimum. Additional rods should be added without external couplers. The earth rods should have peg & bore arrangement or similar such arrangement so that additional rods are added without external couplers.
 5. Interconnecting Strips / Earthing Conductor: Copper coated steel strips / tapes should be used to interconnect different earthing rods as well as horizontal earthing (Ring earthing). These strips should have a coating thickness of minimum 70 microns.
 6. The earth resistance shall be maintained with a suitable soil treatment.
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7. The earth lead shall be fixed to the pipe with a nut and safety set screws. The clamp shall be permanently accessible
 8. Connectors/fasteners for connecting Electrode with Earthing conductor/strip should be of Stainless Steel as it is compatible with all other materials viz Copper, GI etc. Fasteners should be made of Stainless steel



9. The depth of an earth electrode pipe shall be in approximately in accordance with the drawing as well as on nature of soil. However as per general guidelines, the pipe electrode shall have to be placed at depth where soft earth is available. This is to reduce the effect of earth resistance.

10. *Inspection Chamber :*

Should have an inner dimension of 250 mm X 250 mm X 250 mm made of FRP material. Flush Mounted, removable cover of the earth pit should be able to withstand moderate loads.

The area inside the inspection chamber should be such that, the UNIVERSAL CLAMP/EBB/Bus bars not too deep inside the inspection chamber or projecting out of inspection chamber.

The chamber should have facility for marking earth resistance and latest testing date by paint at the cover and previous recorded values inside the cover.

If the earthing is shown in road ways subject to vehicular movement, the Inspection Chamber to be of Cast Iron Type to absorb the vehicular loads without any deformation / damage.

11. Earth Enhancement material:

This is a conductive mineral compound to provide low resistance to the earth termination system. Earth enhancing compound should contain minerals which in normal use is reliable and without creating any hazards to persons and the surroundings.

The material shall be chemically inert to sub soil and shall not pollute the environment. It shall provide a stable environment in terms of physical and chemical properties and exhibit low resistivity. It shall not be corrosive to the earth electrode itself. The material should have low resistivity less than 50 Ohm meter

4.4 EQUIPMENT EARTHING

All apparatus and equipment transmitting or utilizing power shall be earthed in the following manner. Copper/G.I. Earth strips/wires shall be used unless other-wise indicated.

4.5 ELECTRICAL AND PERFORMANCE REQUIREMENTS

4.5.1	Power Transmission Apparatus	<ol style="list-style-type: none"> 1. Metallic conduit shall not be accepted as an earth continuity conductor. A separate insulated continuity conductor of size 100% of the phase conductor subject to the minimum shall be provided. 2. Non metallic conduit shall have an insulated earth continuity conductor of the same size for metallic conduit. All metal junction and switch boxes shall have an inside earth stud to which the earth conductor shall be connected. The earth conductor shall be distinctly coloured (Green or Green / Yellow) for easy identification 3. Armoured cable shall be earthed by two distinct earth connections to the armouring at both the ends and the size of connection being as for the metallic conduit. 4. In the case of unarmoured cable, an earth continuity conductor shall either be run outside along with the cable or should form a separate insulated core of the cable 5. Three phase power panel and distribution boards shall have two distinct earth connections of the size correlated to the incoming cable size. In case of single phase DB's a single earth connection is adequate
5.0	DRAWINGS & INFORMATION	
5.1	Drawing for Plate Type Earthing Station – Annexure-1	
6.0	INSPECTION AND TESTING	
6.1	The entire earthing installation shall be tested as per requirements of Indian Standard Specification IS: 3043	
6.2	<p>The following earth resistance values shall be measured with an approved earth megger and recorded.</p> <ol style="list-style-type: none"> 1. Each earthing station 2. Earthing system as a whole 3. Earth continuity conductors 	
6.3	Earth conductor resistance for each earthed equipment shall be measured which shall not exceed 1 ohm in each case.	
6.4	Measurements of earth resistance shall be carried out before earth connections are made between the earth and the object to be earthed	
6.5	All tests shall be carried out in presence of the consultant / client	
7.0	METHOD OF MEASUREMENT	
7.1	Provision of earthing station complete with excavation, electrode, watering pipe, soil treatment, chamber with cover etc. shall be treated as one unit of measurement	
7.2	<p>The following items of work shall be measured and paid per unit length covering the cost of the earth wires / strips, clamps, labour etc.</p> <ol style="list-style-type: none"> 1. Main equipment earthing grid and connection to the earthing station. 2. Connection to the switch board, power panels, DB etc 	

7.3	<p>The cost of earthing the following items shall become part of the cost of the item itself and no separate payment for earthing shall be made.</p> <ol style="list-style-type: none"> 1. Motors - earthing forming part of the cabling / wiring for the motors. 2. Isolating switches and starters should form part of mounting frame, switch starter etc. 3. Light fittings - form part of installation of the light fittings. 4. Conduit wiring, cabling - should form part of the wiring or cabling. 5. Street lighting - should form part of the street light poles
8.0	TRANSPORT, DELIVERY AND STORAGE
8.1	<p>The prices shall be F.O.R. site basis including packing & forwarding charges. The quoted price must include all the costs for necessary mode of transportation up to the final location of earthing system or site store. All incidental expenses during transportation shall be part of quoted prices including transit insurance. The charges for loading and unloading of equipments at site should form part of offer.</p>
9.0	GUARANTEE & WARRENTY
9.1	<p>The Bidder shall stand guarantee for the performance of entire equipment and components for twelve (12) months from the date of commissioning or eighteen (18) months from the date of dispatch, whichever is earlier, as agreed up on and as reproduced in the purchase order within the tolerance specified or as permitted by the relevant standards for the equipment in his scope of supply.</p>
10.0	SPARES
10.1	Not applicable
11.0	MATERIALS REQUIRED
11.1	<p>All required hardware such as bolts, nuts, washers (round and spring type), anchor fasteners, screws, etc. of sizes and type as required shall be conforming to relevant IS. All hardware shall be hot-dip galvanized or zinc passivated /cadmium plated as per requirement of work either mechanical fabrication or electrical jointing.</p>
11.2	<p>All other items required for installation shall be as approved by site in-charge.</p>
12.0	INSTALLATION OF SYSTEM
12.1	<p>The plate/pipe electrode, as far as practicable, shall be buried below permanent moisture level but in no case less than 3 M below finished ground level</p>
12.2	<p>The plate/pipe electrode shall be kept clear of the building foundation and in no case, it shall be nearer by less than 2 M from outer face of the respective building wall / column</p>
12.8	<p>Construction of the earthing station shall in general be as shown in the drawing and shall conform to the requirement on earth electrodes mentioned in the latest edition of Indian Standard IS: 3043, Code of Practice for Earthing Installation.</p>
12.9	<p>The earth conductors (Strips / Wires, Hot dip G.I. / copper) inside the building shall properly be clamped / supported on the wall with Galvanized Iron clamps and Hot Dip GI screws / bolts. The conductors outside the building shall be laid at least 600 mm. below the finished ground level/</p>

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- 12.10 The earth conductors shall either terminate on earthing socket provided on the equipment or shall be fastened to the foundation bolt and / or on frames of the equipment. The earthing connection to equipment body shall be done after removing paint and other oily substances from the body and then properly be finished
- 12.11 Over lapping of earth conductors during straight through in joints, where required, shall be of minimum 75mm. long and bitumen coated.
- 12.12 The earth conductors shall be in one length between the earthing grid and the equipment to be earthed
- 12.13 Minimum distance of 2 mtr shall be maintained between other electric conductor, earthing conductor and the conductor laid for the lightning protection system. Earthing and lightning protection system conductors shall be bonded to each other to prevent side flashover in case of non-availability of adequate clearance.
- 12.14 The earthing met conductors, risers, earthing cables, etc. passing through walls shall be covered with galvanized iron sleeves for the passage through wall. Water stop sleeves shall also be provided wherever the earthing conductor enters the building from outside.
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Earthing Auguring Method

