SECTION 27 05 26

GROUNDING AND BONDING

PART 1 - GENERAL

1.01 GENERAL REFERENCE

A. The work of this Section is integral with the whole of the Contract Documents and is not intended to be interpreted outside that context.

B. Co-ordinate the work with all other services affecting the work of this Section.

1.02 DESCRIPTION OF WORK

A. The Contractor shall supply and install earthing, bonding and protection systems as indicated on the drawings and detailed in the Specification.

B. All systems shall comply fully with the relevant IEC/BS Standards.

C. Final details of installation must be approved by the Engineer. The number and location shown on the drawings are indicative only. The actual No. shall be determined at site and be subject to Engineer's approval.

D. The earthing and bonding systems shall be arranged to provide:

1. A low earth path resistance to ensure operation of protective devices.

2. Good operating condition for sensitive electronic equipment.

3. Full safety to personnel by limiting the contact voltage.

1.03 RELATED SECTION

1. Site Grounding
2. Concrete Reinforcement
3. Basic Electrical Materials and Methods
4. Wires and Cables
5. Raceway & Boxes
6. Wires Devices

1.04 EARTHING

A. Low voltage installations within the building shall be as per MOE - Kuwait specification.

B. The Earthing and Bonding networks shall generally meet the 50V maximum continuous contact voltage limitations for protection against indirect contact resulting in automatic disconnection of supply as detailed in the relevant IEC Standards.

1.05 BONDING

A. Equipotential bonding conductors shall be provided as required to ensure electrical continuity between exposed conductive parts and restrict contact voltage.

PART 2 PRODUCTS

2.01 MATERIALS

A. General

1. The main earth bars shall be constructed of high conductivity tinned copper, drilled, mounted on insulators and fixed as required.

2. All main earth connections shall be completed using the copper weld technique.

B. Earth Continuity Conductors

1. Sizes shall be as specified by BS Standards. In no case the conductor size shall be less than half that of associated phase conductors.

2. Insulation shall be of the same material as insulation in associated sub-circuits.

C. Main Earth Loops

1. 25 x 3mm tinned copper tape, unless otherwise indicated. Proper earth link connectors shall be provided at regular intervals for the main run of the copper tape.

D. Earth Electrodes

1. Earth electrodes shall be made of three sections of high strength steel alloy core with a welded copper covering, diameter 16mm, length 3.6mt.

2. One end of the rod shall be pointed without application of heat and with driving head at other end. The sectional rods shall be coupled with strong bronze couplers. The coupler shall be threaded to fit the rod section. For driving the rod into the ground threaded steel stud shall be used.

E. Earth Connectors

1. For connection of rod electrodes : bolted type.

F. Removable Earth Links

1. To compromise a bolted copper link fixed on porcelain insulators and complete with studs,

nuts and washers to take the earth tape and a bolted lug adequately sized for the final connection of the earth electrode.

G. Bolts, Washers and Nuts in Bolted Connections

1. High copper alloy or silicon bronze. Ferrous hardware is not acceptable.

H. Earth Pit Cover

1. To be of cast iron cover.
2. To have a recessed lifting hook.
3. To have a brass plate, engraved "Electrical Earth Below".
4. Naming to be different for lightning protection.

PART 3 EXECUTION

3.01 INSTALLATION

A. General

1. Low voltage installations in buildings not incorporating earth electrodes shall be provided with a suitable earth path by means of supply cable protective conductor.

B. Circuit Wiring

1. To have a green coloured insulated earth continuity cable connecting the earth bus or earth terminal in panel boards to the outlet or device earthing lugs.

C. Main Earth Loops

1. Fix in mechanical equipment rooms and other areas indicated on the drawings, in convenient locations, allowing two return paths to earth.
2. Fix copper tape to structure with copper or brass saddles and/or screws. Make tees and straight joints by rivetting and seating, welding or brazing.
3. Make branch connections between main loop and major equipment, such as switchboards, large motors and motor control boards, with copper tape of same size as main loop tape.
4. Make other branch connections to equipment with copper conductors of size not less than half that of relative phase conductors.
5. Equipotential bonding shall also be provided between the building conductive parts, including steel reinforcements and earth electrodes, thereby ensuring a complete equipotential system.

D. Remove Earth Links

1. Fix in every main earth lead to enable the electrode system to be disconnected for testing.

2. Install in an accessible position, above ground as close as possible to the earth electrode.

E. Exposed Earth Cables

1. Install and locate to provide maximum mechanical protection, utilizing ceiling corners, suspended ceiling and webs of beams as much as possible.

F. Bolted Connections

1. Multiple bolt type

2. Where bare copper is bolted in connections contact surfaces shall be silver electroplated.

G. Brazed Connections

1. Where earthing terminal connections are to be brazed to equipment, thoroughly clean metal prior to brazing and repaint impaired surfaces to prevent corrosion.

H. Connections between Dissimilar Metals

1. Protected by :

   a. Painting with a moisture resistance bituminous paint or compound or

   b. Wrapping with protective tape to exclude moisture.

I. Equipment Earthing

1. Connect all non-current carrying metallic parts of the electrical/mechanical installation to the earthing system.

2. Non current carrying metallic parts of the electrical installation include :

   a. Metal conduit cable armour (steel and aluminum), cable trays, G.S. conduits, outlet boxes, cabinets and the like.

   b. Exposed metal parts of apparatus.

   c. Enclosures, doors, grilles, barriers and the like protecting or shielding electrical equipment form direct access.

3. Series earthing of one piece of equipment to another is not acceptable.

J. Motors Earthing

1. Connect the motor terminal box to the relative earth loop. The terminal must be mechanically connected to the frame or where this is not feasible :-

2. Extend the earthing conductor through an insulated bushed opening in the connection

box and connect to the frame.

K. Main Switchboards Earthing

1. Connect the special earthing lug or bus-bars inside the cabinet to the main earth copper tape.

2. Connect all parts of the switchboards, other than "live" parts, to the earth bar in the board in an approved manner.

L. Distribution Boards Earthing

1. Connect an earthing conductor from the main distribution earth bus-bar to an earth connector welded to the cabinet and earthing bushings on the incoming and outgoing feeder conduits.

M. Cable Armour Earthing

1. Connect steel and aluminum armour to the earthing system.

N. Earth Rod Electrodes

1. Drive extensible rods of the same diameter into the ground either manually or by power driven hammer, to a suitable depth to obtain low resistivity in the particular soil.

2. Weld earth connectors to the top of the rods, in sufficient number to take all incoming cables.

O. Earth Pit

1. Construct a small concrete pit, complete with removable heavy duty cast iron cover with recessed lifting hook, at the head of the earth rod, to protect the rod and allow access to connections for testing.

3.02 SITE QUALITY CONTROL

A. Testing

1. Test earthing systems by the earth megger test.

2. Where steel conduit, trunking and/or cable sheath armouring, form a part of whole of the earth continuity conductor, the resistance between any point on the earthing system and the earth electrode shall not exceed 0.5 Ohm including the connection to the main earth electrode. Where the earth continuity conductor is composed entirely of copper than the said resistance shall not exceed 1 Ohm. The overall resistance between the earthing system and the general mass of earth shall be less than 2.0 Ohms

3. Install additional earth electrodes if these figures are not met.

4. Submit the copies of all tests and measurements to the Engineer for approval.

END OF SECTION