Electrical Services Standard Specification
13.0 - Earthing

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For
ROYAL HOLLOWAY
UNIVERSITY OF LONDON
# AMENDMENTS

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13.1 **INTRODUCTION**

This specification relates to the requirements for the supply and installation of the earthing systems within the project boundary.

The appropriate British Standards, in particular BS 7430 and BS 7671 and their amendments shall be adhered to at all times.

**ALL WORKS ARE TO BE INSPECTED BY THE TENDERING CONTRACTOR PRIOR TO PRICING**

**HEALTH AND SAFETY STATEMENT**

Health and Safety precautions are required to be taken during the process of undertaking works within buildings cannot be underestimated.

Reference shall be made to Royal Holloway University Health and Safety Policy and Contractors Guidance documents available from Royal Holloway University of London Estates Office.

The Health and Safety Executive (HSE) publish a series of guidance documents regarding different methods of protecting the workforce and people in general when undertaking potentially dangerous work activities.

Installers engaged in any work shall be registered with the Construction Skills Certificate Scheme (CSCS) and be in possession of a valid skills card.
13.2 EARTHING

13.2.1 Nature and Extent of Works

The works to be undertaken in this Section cover the detailed design, supply, installation and testing of all necessary earthing, materials required for the LV distribution, IT installation, and all other installations, all in accordance with the requirements of BS.7430 and BS.7671.

13.2.2 General Requirements

The earthing of the installation covered by this contract shall comply with the following requirements:

(a) It shall be carried out in accordance with appropriate sections of the 17th edition of the Regulations for the Electrical Equipment of Buildings issued by the Institution of Electrical Engineers and the current British Standard Code of Practice for Earthing.

(b) At all main switchgear positions, an earth bar of copper strip minimum 50 x 6mm, complete with test disconnection link, shall be provided. All equipment including the metal sheath and armouring of cables, the metal case of all enclosures, distribution boards and metal support frames shall be bonded directly to it.

(c) All strips shall be of soft high conductivity copper, untinned except where otherwise specific and where fixed externally, run in the ground, through walls, floors, etc., and where liable to corrosion they shall be served with corrosion resisting tape or coated with corrosion resisting sheath.

(d) All multicore cables, unless otherwise indicated, shall have their armour bonded to earth at each end of the cable. The installation to be carried out in accordance with the relevant sections of this specification.

(e) Where single point bonding is used, the point of bonding should be chosen with regard to the routine accessibility of unqualified personnel to the isolated end.

(f) Earthing of LV distribution equipment shall be made by means of connections to the sub-main cable where these are metal sheathed or armoured, providing this meets the requires of the BS.7671 in all respects. Supplementary earths shall be provided where detailed on the schematic layout drawings or indicated on the circuit distribution charts.

(g) All underground joints shall be brazed and all above ground joints shall be bolted and soldered.

(h) Where copper strip is fixed to the building structure it shall be by means of purpose made brass or bronze saddles.

(i) Fixings shall be made using purpose made plugs and clamps.

(j) All conductive parts of the structure and installation shall be connected to the main earthing system.

(k) All steel structures shall be provided with earthing straps.
(l) Tanks and vessels containing flammable liquids or gas shall be earthed by a connection to the earthing system or by bonding to earthed metal structures.

(m) Isolated metalwork shall be bonded to the earth network including dry risers.

(n) Each pipe shall have a minimum of one connection to the earthing system, subject to continuity check along its run length.

(o) When connecting differing materials together, the required material transition plates shall, in general, be inserted, in order to ensure that electrolytic actions is avoided. All connecting materials shall be corrosion-proof and suitable for the conditions prevailing.

(p) Bolts, nut and washers for any fixing of the earth tape shall be brass of the high tensile grade or where liable to corrosion they shall be Bronze.

(q) All extraneous metal shall be bonded to the earth network.

(r) Main equipotential bonding shall be by means of conductors with a cross-sectional area of not less than 50mm² or as indicated on the drawings.

(s) Local supplementary bonding shall be of minimum cross sectional area of 4mm² and shall be adequately protected where necessary.

(t) Each sub-circuit shall be run with a separate circuit protective conductor cross-sectional area as identified in the circuit distribution chart. Where necessary, to meet the requirements of Section 607 of BS.7671, additional (dual earths) shall be provided.

(u) Each ductwork run shall be bonded to earth and continuity along its length shall be ensured.

(v) Insulation metal shall be bonded to ensure it is earthed adequately.

13.2.3 **Main Bonding**

Main bonding conductors shall comprise single core green/yellow LSF cable connected from the main earth bars to the following:-

(i) Main incoming water pipes.
(ii) Main incoming gas pipes.
(iii) Workshop and Catering area gas lines.
(iv) Main flow and return pipes of the domestic hot water system.
(v) Chiller Pipework.
(vi) Ventilation ductwork (main branch) of Air Handling Units.
(vii) Structural steelwork.
(viii) Lift guide rails.

All cabling will be sized in accordance with BS.7671.
13.2.4 Supplementary Bonding

Supplementary bonding for all systems shall be provided by the Installer in accordance with BS.7671.

Bonds shall be 4mm² green and yellow LSF insulated, and in concealed parts of the installation shall be concealed as far as is practicable in voids. Generally, bonding lugs will not be available on extraneous conductive parts and allowance shall be made for purpose-made clamps or clips, drilling or utilising fixing or connecting bolts with the permission of the installer of the service or equipment.

The following shall be used as guidance to requirements:-

1. Bond between the hot and cold water pipes and metallic waste at each basin, sink, bath or shower, and to the basin, sink, bath or shower tray if metal.

2. Bond from the connection in (1), to any radiator, metal rail, WC water pipe or other conductive part in a bathroom or shower room.

3. Bond from each radiator to its connecting pipework if the pipework does not provide a sound metal to metal contact.

4. Bond from the exposed conductive parts of the electrical system in each space to the heating, water and gas pipework in that space unless tests indicate adequate earth continuity of the pipework back to a main bonding point.

5. Bond between any fixed conductive parts, ‘exposed’ or ‘extraneous’ within 2m of each other unless tests show adequate continuity.

6. In every space with a metal frame tiled ceiling, bond at one point on the frame to the exposed conductive parts of the lighting installation. In corridors bond once every thirty metres. Test to ensure continuity of the ceiling grid to be carried out.

7. In every space bond from the exposed conductive parts of the lighting installation at one point to each ventilation duct system entering that space unless tests show adequate continuity of the ductwork back to a main bonding point.

8. Across flexible ductwork connections to grilles/diffusers.

9. In metal frame partitions bond at one point in every electrically continuous section of the frame to the exposed conductive parts of any mains voltage electrical system within that partition. Bond also from the metal partition to any medical gas pipe system entering the partition.

10. Bond together all metal pipes, ducts, trunking, tray plate, etc., at the top and the bottom of each service riser except ‘all electric’ risers and connect to the nearest electrical earth terminal.

11. Bond across the flexible ductwork at each end of each air handling unit or axial fan.

12. Bond across the flexible coupling from the motor to the impeller casing on each pump.
13. Bond at one point across any system of anti-vibration mountings which separates metallically any rotating plant from its frame.

14. Bond together and to the control panel, every metal pipe, duct or trunking in each plant room, near the point where they enter or leave the plant room.

15. On metal tanks bond from the tank to each metal pipe connecting to the tank unless the connections form a sound metal to metal contact and bond across metal pipework entering and leaving a plastic tank.

Supplementary bonding connection shall not be made to terminals inside socket outlets or spur units due to the possibility of accidental contact being made with live terminals, all earth bonding shall be made external to such fittings.

Both raised floor and ceiling framework shall be bonded locally to the electrical system adjacent to each distribution board via minimum 10mm² green and yellow LSF cable.

13.2.5 Special Earthing Requirements

**LV Systems:**

A low resistance earth electrode system shall be provided for the HV network which shall be used for earthing the HV Switchgear metalwork associated with the HV Switchgear.

Additionally a further system shall be provided for the LV distribution system.

**General Electrical Installation**

The earth loop impedance shall satisfy the basic earthing requirements of BS.7671.

A main earth bus bar mounted on porcelain insulators shall be erected on the wall in the earthing point locations for each system with connections to the equipment as detailed in the foregoing sections of this specification.

**Main Earth Electrode**

A soil resistivity test shall be carried out prior to the main earth electrode being installed. This will determine the earth bed matrix required to achieve a value of less than 1 ohm.

**Generator 1**

Final connections from the designated columns for the generator earth shall be carried out by the Installer.

A main earth bus bar mounted on insulators shall be erected on the inside of the wall of the generator area with connections to the generator as follows:-

(a) Insulated stranded cable connections to the generator neutral.

(b) Bare conductors to generator frame.

(c) Bare conductors to control panel frame.

(d) Bare conductors to switchgear frame.
(e) Insulated stranded conductor to generator earth electrode.

Data Systems Earthing Requirements

(i) A functional earth (FE) connection is required to serve each patch panel.

(ii) 1 x 25mm$^2$ earth wire (cream coloured with FE markings) shall be run from the earth bar in the Main Communications Room to each of the patch rooms.

(iii) Connection from the 25mm$^2$ earth to the Structured Cabling Patch Frames within each patch room shall be via a 6mm earth wire to the same specification.