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Level 2

Design, Installation and Testing of Earthing in Signalling Power Systems

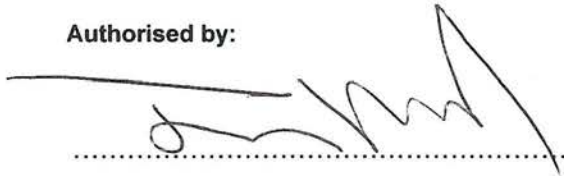
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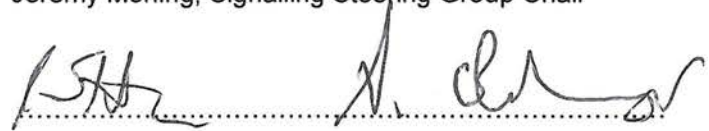


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User information

This Network Rail standard contains colour-coding according to the following Red–Amber–Green classification.

Red requirements – No variations, could stop the railway

- **Red requirements shall** always be complied with and achieved.
- Red requirements shall be presented in a red box **with the word “shall” or expressed as a direct instruction**.
- Accountability for the efficacy of red requirements lies with the Professional Head/Standard Owner.
- Red requirements are monitored for compliance.
- Corrective actions shall be enforced if variations are discovered through functional checks (e.g. engineering verification visits, audit or Operations Self-Assurance).

Amber requirements – Controlled variations, approved risk analysis and mitigation

- **Amber requirements shall** be complied with unless variation has been approved in advance.
- Amber requirements shall be presented with an amber sidebar **and with the word “shall” or expressed as a direct instruction**.
- Accountability for the efficacy of these requirements lies with the Professional Head/Standard Owner, or their nominated Delegated Authority.
- Amber requirements are monitored for compliance.
- Variations **may** be permitted. Variations are approved by the Standard Owner or through existing Delegated Authority arrangements.
- Corrective actions shall be enforced if **non-approved** variations are discovered through functional checks (e.g. engineering verification visits, audit or Operations Self-Assurance).

Green – Guidance

- Guidance is based on good practice. Guidance represents supporting information to help achieve **Red** and **Amber** requirements.
- Guidance shall be presented with a dotted green sidebar **and with the word “should” (usually in notes) or as a direct instruction**.
- Guidance is **not mandatory** and is not monitored for compliance.
- Alternative solutions may be used. Alternative solutions do not need to be formally approved.
- Decisions made by a competent person to use alternative solutions should be backed up by appropriate evidence or documentation.

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Issue record

Issue	Date	Comments
1	September 2015	First issue

Compliance

This Network Rail standard is mandatory and shall be complied with by Network Rail and its contractors if applicable from 5th September 2015.

When this standard is implemented, it is permissible for all projects that have formally completed GRIP Stage 3 (Option Selection) to continue to comply with the issue of any relevant Network Rail standards current when GRIP Stage 3 was completed and not to comply with requirements contained herein, unless stipulated otherwise in the scope of this standard.

Reference documentation

664859-SIG-RPT-10	National FSP safety plan: earthing hazards review report
ASTM B228	Standard specification for concentric-lay-stranded copper-clad steel conductors
BS EN 12163	Copper and copper alloys. Rod for general purposes.
BS EN 13601	Copper and copper alloys. Copper rod, bar and wire for general electrical purposes
BS EN 50122-1	Railway applications. Fixed installations. Electrical safety, earthing and the return circuit. Part 1: Protective provisions against electric shock
BS EN 60228	Conductors of insulated cables
BS EN 62561-1	Lightning protection system components (LPSC). Requirements for connection components
BS EN 62561-2	Lightning protection system components (LPSC). Requirements for conductors and earth electrodes
BS EN 62561-5	Lightning protection system components (LPSC). Requirements for earth electrode inspection housings and earth electrode seals
BS EN 62561-7	Lightning protection system components (LPSC). Requirements for earthing enhancing compounds
BS 5467	Electric cables. Thermosetting insulated, armoured cables for voltages of 600/1000 V and 1900/3300 V
BS 6004	PVC insulated, non-armoured cables for voltages up to and including 450/750 V, for electrical power, lighting and internal wiring

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BS 6346	Electric cables. PVC insulated, armoured cables for voltages of 600/1000 V and 1900/3300 V
BS 6746C	Specification for PVC insulation and sheath of electric cables. Colour chart for insulation and sheath of electric cables
BS 7430	Code of practice for protective earthing of electrical installations
BS 7671	Requirements for electrical installations. IET wiring regulations
GE/GN 8642	Guidance on hazard identification and classification
GE/GN 8643	Guidance on risk evaluation and risk acceptance
GK/RT 0053	Control of unwanted voltages on telecommunications equipment at stations
NR/L1/INI/CP1010	Policy on working safely in the vicinity of buried services (formerly NR/L1/AMG/1010)
NR/L2/AIF/1020	Buried services data provision (formerly NR/L2/AMG/1020)
NR/L2/INI/CP1030	Working safely in the vicinity of buried services (formerly NR/L2/AMG/1030)
NR/L2/OHS/0047	Application of Construction (Design and Management) Regulations to Network Rail construction projects
NR/L2/SIGELP/27410	Specification for Class II based signalling power distribution supplies
NR/L2/SIG/11201	Signalling design handbook
NR/L3/SIGELP/27420	Target earth calculation methodology for signalling power systems
NR/L3/SIGELP/50001 module NR/SPS T001	Working on or near 650V signalling power supplies. Earth electrode testing
NR/SP/OHS/00102	Work activity risk assessment
S0158/SAF/REP/000/04	Earth Installation Specification – Hazid Report
SSI 8503	SSI application manual – Earthing and bonding of solid state interlocking equipment

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1 Purpose

This specification details the design, installation, construction, testing and commissioning requirements for safety earthing systems to limit touch voltage potentials on exposed conductive parts forming part of signalling power systems, to meet the requirements of BS EN 50122-1.

2 Scope

This specification applies to new or added safety earthing systems to apparatus housings, which include signalling apparatus housings (SAHs), location cases (LOCs), functional supply points (FSPs), relocatable equipment buildings (REBs) and relay rooms supplied by signalling power systems using an IT electrical system.

The requirements for the design and installation of earthing systems in this specification may also be applied to the following:

- Safety earthing systems forming part of a TN or TT electrical system;
- Safety earthing systems for the armour forming parts of armoured BS 5467 or BS 6346 cable when used as part of an IT electrical system;
- Safety earthing systems for power sources distributing IT electrical systems, normally comprising principal supply points and distribution interface transformer assemblies (DITAs) in either Class I or Class II signalling power distribution systems, in accordance with NR/L2/SIGELP/27410.

NOTE: Three methods of fault protection can be utilised at SAHs, namely: local safety earthing, traction bonding and use of a Class II based system.

3 Definitions

Buried earth conductor	Buried conductors in the form of horizontal conductors, earth rods, earth mats and reinforced concrete etc.
Circuit protective conductor (CPC)	A protective conductor connecting exposed conductive parts of an apparatus housing and its local earth electrode to other apparatus housings and their local earth electrodes, to create a low-resistance earthing system.
Earth electrode	One or more earth rods connected end-to-end via integral screw threads and threaded connectors.
Earth mat	A matrix of copper tapes riveted together.
Exposed conductive part	Conductive part of equipment which can be touched and which is not normally live, but which can become live when basic insulation fails, as defined in BS 7671.

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Fall of potential (FOP)	A method of testing the earth electrode and its earth resistance where test electrodes are used. A test electrode is used to inject current into earth which is collected by the earth electrode under test. The earth resistance is calculated based on the potential difference between the test electrode and the earth electrode under test.
Fast transient earth (FTE)	A connection with the general mass of earth that provides the earth connection for lightning surge arrestors and other fast transient devices.
Functional supply point (FSP)	The point where the power supply distribution system connects with an item of supplied equipment. It may be co-located with signalling equipment.
IT electrical system	An electrical distribution system having no direct connection between live parts and earth, but with the exposed conductive parts of the installation being earthed.
Location case (LOC)	See 'Signalling apparatus housing'.
Main earth terminal (MET)	The principal earthing point for an item of equipment. For LOCs, it will be the external case earth terminal on the master LOC, connected through to an internal case earth terminal. For an FSP, it will be the copper earth busbar internal to the case. In an equipment room, it will be the main termination connected to the equipment room's main earth busbar.
Principal supply point	The point of common connection of one or more electrical sources from which energy may be distributed.
Relocatable equipment building (REB)	See 'Signalling apparatus housing'.
Relay room	See 'Signalling apparatus housing'.
Screw pile	A corrosion-protected steel rod principally intended for mounting and support of above-ground structures. It is of larger diameter than a standard earth rod and has helical fluting to assist rotary driving into the ground.
Signalling equipment room (SER)	See 'Signalling apparatus housing'.
Signalling apparatus housing (SAH)	An enclosure, commonly referred to as a location case (LOC), relocatable equipment building (REB), relay room or signalling equipment room (SER), for housing signalling equipment. It may also contain power supply equipment.