

EARTHING SYSTEM DESIGN PROCEDURAL REQUIREMENTS DOCUMENTATION

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PURPOSE AND SCOPE

Earthing systems are installed to protect life and assets from the potentially damaging effects of 50Hz faults (short circuits) or transient phenomena such as lightning and switching operations. Such systems typically comprise a below ground grid of bare copper conductors laid horizontally at a shallow depth – sometimes supplemented via connections to vertical earthing rods driven to greater depth – plus a series of above ground conductors that facilitate the connection of specific equipment to the below ground system. Earthing systems shall be managed as an 'underground service' in accordance with HSG47 'Avoiding Danger from Underground Services'.

This procedure defines the management of documentation associated with Substation and Overhead Line Earthing systems. The earthing process with respect to roles, along the phase of investment plan, is tabulated in Appendix A. Appendix B illustrates the earthing design flow chart.

This procedure applies to all projects which comprise the UK Transmission Construction Electricity Capital Programme, including associated revenue projects.

Technical and Design issues relating to Substation earthing are contained in TS 3.1.2. Overhead line earthing is covered by both TS 3.1.2 and TGN(E) 199. Routine Maintenance of the Substation earthing is covered by the existing Asset Management procedures.

PART 1 – PROCEDURAL

1 RESPONSIBILITIES

1.1 Development Engineer

The CDV Delivery Vehicle Development Engineer is responsible for the high level Earthing Designs for an Investment. The Earthing information shall be derived from available documentation and shall be taken into account when producing the scope of the Design Justification Report (DJR) and the Construction Design Specification (CDS). Details of the responsibilities of the Development Engineer are outlined in UKBP/TP146.

1.2 Project Manager

The CDV Delivery Vehicle Project Manager is responsible for ensuring that the earthing system is correctly installed in line with the agreed design and that accurate records are maintained through out the life of the project and for engaging an Earthing Consultant, as appropriate. At the project closure stage the CDV Delivery Vehicle Project Manager should ensure that all the updates are made and all documents are stored in Livelink. Details of the responsibilities of the Project Manager are outlined in UKBP/TP146.

1.3 Design Engineer (Verification)

The Design Engineer (Verification) is responsible for verifying the high level Earthing design information within the CDS and the subsequent Earthing designs within the Design Intent Document (DID). Information from Earthing Consultants shall be used as appropriate.

Details of the responsibilities of the Design Engineer (Verification) are outlined in UKBP/TP188.

1.4 Design Assurance(Assurance))

The Design Engineer (Assurance) is responsible for confirming that earthing details in the DJR, CDS and DID adhere to National Grid policies and procedures. Details of the responsibilities of the Design Engineer (Assurance) are outlined in UKBP/TP188

1.5 Electrical Network Investment – ENI (National Grid)

Electrical Network Investment – System Design (ENI-SD) is responsible for the calculations of Ground Return Current (I_{gr}), Earth Electrode Current and fault level information, where necessary, in line with NSBP128. Work requires detailed modelling may need to be carried out by ENI-Policy.

Electrical Network Investment – Policy (ENI-Policy) is responsible for the management and provision of available earthing information for as-built system, as well as maintenance of earthing technical specifications..

1.6 Asset Management – Maintenance Delivery – Electricity (MDE)

A UKBP/TP106 authorised Commissioning Engineer (NG) for the project shall witness the testing and commissioning of Earthing installations in line with UKBP/TP106. MDE undertakes the role of occupier role for operational sites.

1.7 Earthing Consultant

In compliance with TS 3.1.2, where necessary, the Project Manager shall engage suitably qualified Earthing Consultants.

The Earthing Consultant is responsible to the Design Engineer (Verification) for carrying out Earthing Surveys and Assessments where earthing data is not available, i.e. on new sites.

The Earthing Consultant shall produce a report containing the following;

- a) Soil resistivity measurement and soil model.
- b) Rise of Earth Potential (ROEP).
- c) Site impedance measurement.
- d) Touch and Step Potentials (including the impact on the third party).
- e) Grid mapping.
- f) Recommendations.

2 INVESTMENT PROPOSAL STAGE 2 (IP2) - DEVELOPMENT

The maximum rise of earth potential expected during faults must be identified and recorded in the IP2 high level earthing requirement and considered in the preparation of the DJR and CDS.

The data contained in the Earthing Consultant report is essential for the option selection at IP2. The following earthing issues shall also be considered at this stage;

- a) Isolation.

- b) Notification to Third Party.
- c) Wayleaves requirement.

The information above and that provided by ENI (See Appendix B) shall be recorded in the Project File and stored on Livelink.

The Overhead line and Cable Construction Design Specification should contain any specific earthing requirements that have been identified above.

3 INVESTMENT PROPOSAL STAGE 3 (IP3) – PROJECT DESIGN

The CDV Delivery Vehicle shall ensure issues relating to earthing are included in the Design Intent Document (DID), as identified in investment papers and the site specific Health and Safety File. Where fault levels of an existing Substation have been uprated, the earth mat shall be assessed by Earthing Consultants to confirm its ability to accept the increased fault rating or to recommend modifications.

The Design Engineer (Verification) shall ensure a detailed Earthing design. The following should be taken into consideration;

- a) Earthing Survey (additional) and Drawings. This task is carried out by the CDV Delivery Vehicle or an Earthing Consultant.
- b) Earth Return Current Figure. These figures are provided by Electrical Network Investment (ENI).

The Design Engineer (Verification) shall ensure production of earthing designs in line with TS 3.1.2. These should include, below and above earthing designs and Earthing Design calculations to meet National Grid requirements. The Earthing design documents shall be assured by the Design Engineer (Assurance) prior to being finalised and issued. The final calculations and drawings shall be stored as part of the project documentation on the National Grid CPM Livelink system.

4 DETAILED DESIGN & DELIVERY PROCESS (DDD)

The Project Manager shall ensure that the earthing system installation accords with the Earthing design documentation. The 'as installed' conditions shall be captured and the Earthing documentation updated as applicable.

'Spot checks' to witness the installation of the earth system shall be carried out by the Design Engineer (Verification) as detailed in TS 3.1.2. The Design Engineer (Assurance) shall be notified of the results of any 'Spot checks' carried out and where appropriate may attend site to witness the installation.

As part of the Commissioning, each joint and each earth rod shall be tested for resistance to confirm the calculated design values (SCT 46). If the testing does not confirm the calculated values, the Design Engineer (Verification) must investigate and offer a proposal to rectify the situation which shall be documented and assessed by the Design Engineer (Assurance).

The final tests shall be in accordance with TS 3.1.2 and SCT 46. They should include the overall resistance of the earth mat including chain impedance (i.e. Overhead line, cable sheath) and a random selection of the group impedance readings.

The CDV Delivery Vehicle shall carryout the tests witnessed by;

- a) Commissioning Engineer (National Grid)
- b) Commissioning Engineer (CDV Delivery Vehicle)