PR-NET-OSM-051

NEUTRAL EARTHING EQUIPMENT

OPERATIONAL SAFETY MANUAL - SECTION 6.9

Scottish & Southern Electricity Networks

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1 Introduction

1.1 This document defines the **Approved** procedure for work and where applicable testing on **Neutral Earthing Equipment (NEE)**

1.2 Compliance with the following procedure **Shall** enable staff to work safely and reduce the risk of injury to themselves and their colleagues.

2 Scope

2.1 The scope of this document **Shall** be limited to persons who hold the appropriate competence and authorisation to access Substations and Switching sites for work on **NEE** equipment.

2.2 The procedures included herein have been developed to minimise incidents associated with human error by ensuring that:

- A consistent approach is maintained for the safe access to **NEE** equipment located in Substations and Switching sites
- At all times consideration is given to the operating characteristics of the **System** and the **Dangers** imposed

2.3 This document applies to **NEE** equipment energised at a nominal **System** voltage up to and including 132kV.

3 References

The documents detailed in Table 3.1 - Scottish and Southern Electricity Networks Documents, should be used in conjunction with this document.

Table 3.1 - Scottish and Southern Electricity Networks Documents

Reference	Title
PR-NET-OSM-006	SSEN Distribution Operational Safety Rules – Operational Safety Manual – Section 1.1
PR-NET-OSM-028	Switching Terminology and Approved Abbreviations - Operational Safety Manual - Section 4.4
PR-NET-OSM-043	Access to Substations and Switching Sites - Operational Safety Manual – Section 6.1
PR-NET-OSM-011	Management of Work or Testing in Substations with Exposed Live Busbars and/or Gas Insulated Apparatus.- Operational Safety Manual – Section 6.2
PR-NET-OSM-048	Restoration of Energy Sources - Operational Safety Manual - Section 6.6
WI-NET-OSM-002	Personal Protective Equipment and Workwear for Live Environments
N/A	SSEN SHE Handbook (Held in Safety, Health and Wellbeing SharePoint Site)

4 Definitions

4.1 The words printed in bold text within this document are either headings or definitions. Definitions used within this **Approved** procedure are defined within the list presented immediately below, or within Section 2 of the **OSR**.

4.2 **Neutral Earthing Equipment (NEE)**

A device (typically resistive or reactive) designed to limit the current that would flow through the neutral point of a transformer or generator in the event of an **Earth** fault.

4.3 **Operational Safety Rules (OSR)**

The **SSEN-D** Distribution set of rules, as read with related documents and procedures, that provide generic safe systems of work on the **System** therefore ensuring the health and safety of all who are liable to be affected by any **danger** that might arise from the **System.**

5 General Responsibilities

5.1 Persons who are required to operate and undertake work on the **System Shall** have a thorough understanding of the work and ensure on-site risks are suitably assessed and appropriate control measures put in place before, during and after all activities.

5.2 Persons must ensure that, at all times during the work (or associated testing), **General Safety** arrangements are maintained and that other work areas are not adversely affected by the activities for which they are responsible.

6 Authorisation

6.1 It **Shall** be the responsibility of the individual to ensure that any actions performed are within the bounds of their competency and authorisation level.

6.2 Competence and authorisation certificates **Shall** be retained personally and be made available upon request.

7 Records

Where a common **NEE** is used for a number of transformers, the neutral earthing arrangements and **Switching** facilities available **Shall** be recorded by the **Control Engineer** on the **System** diagram.

8 Personal Protective Equipment

8.1 Persons who are required to work or carry out **Switching** on or near the **System Shall** wear suitably **Approved** Personal Protective Equipment (PPE). Furthermore, where warning labels or signs identify the existence of a particular hazard, additional and appropriate PPE **Shall** be worn.

8.2 As a minimum, PPE **Shall** meet the requirements of WI-NET-OSM-002.

9 General Requirements

9.1 **NEE**s are normally fitted into the neutral/**Earth** connections of Primary and Grid transformers to control the current which flows to **Earth** under fault conditions.

9.2 **NEE**s **Shall** be equipped with a rating plate that includes general plant details as well as the expected resistance value at 20ºC with +/- tolerance (see Appendices for LER calibration requirements).

9.3 Unless otherwise specified the nominal current rating at normal **System** voltage **Shall** be 1000A for all **NEE**s.

9.4 Work on the **NEE Shall** be carried out during the maintenance of the associated power transformer unless otherwise specified, for example post-fault or corrective repair work.

9.5 Where work on the **NEE** requires resistance values to be tested, these tests **Shall** be carried under a **Permit-to-Work**.

9.6 For work on a transformer under a **Safety Document** with solidly **Earthed** neutral or **Neutral Earthing Equipment** connected solely to the transformer, there **Shall** be no requirement to **Isolate** the neutral.

9.7 Where flexible **Earthing** arrangements exist, i.e. air-insulated **NEE**s have points of common coupling with other **NEE**s, and to achieve safety from the **System**, appropriate controls **Shall** be enforced to ensure persons are not exposed to **Danger** during their operations or prescribed work activities.

10 Procedure

10.1 General

10.1.1 Persons who are required to undertake work or testing on a **NEE Shall** be aware of the **Dangers** that may arise. The main **Dangers** to persons include electric shock, burns or falls from height arising from:

- Persons working on wrongly identified **Apparatus**
- The **Apparatus** becoming **Live** whilst work is proceeding due to incomplete isolation of all possible sources of supply
- The **Apparatus** contains stored energy that has not been properly dissipated

10.1.2 Maintenance of a **NEE** and its associated isolators may be carried out as part of transformer maintenance under the same **Permit-to-Work**.

10.1.3 However, if any transformer with a possible connection to the **NEE** is to remain **Live**, such as those with a solid bolted connection, the **Senior Authorised Person Shall** agree a procedure with the **Control Engineer** to facilitate safe working on related isolators, and on the **NEE**.

10.1.4 The neutral of a **Live** transformer **Shall** always be connected to **Earth** either through a **NEE** or direct to **Earth** (if this is the system design).

10.2 Isolation and Earthing

10.2.1 The **NEE Shall** be **Isolated**, **Earthed** and released for work by the issue of a **Safety Document** in accordance with the **OSR**.

10.2.2 If the **NEE** is to be worked on while one or more of its associated transformers remain **Live**, all associated transformer neutrals **Shall** be **Earthed** via another **NEE** or where this is not possible, be connected directly to **Earth** before the **NEE** is **Isolated**. (This direct connection with **Earth** should be limited to as short a period of time as is practicable).

10.2.3 The following **Switching** operations apply:

- Associated **High Voltage** switchgear and Voltage Transformer(s) **Shall** be **Isolated**.
- **Caution Notices Shall** be applied at all points of isolation to convey a warning
- A **Circuit Main Earth Shall** be applied at the established point of isolation from the **System**

- Where applicable, standby **Earth** fault stage 1 trip links **Shall** be removed to prevent inadvertent operation of **Live** switchgear during testing
- **Low Voltage** supplies **Shall** be **Isolated** prior to the issue of the **Permit-to-Work**; however, the recipient of the **Permit-to-Work** may restore these **Low Voltage** supplies for the purpose of checking the function of the **NEE** heater for example, in accordance with PR-NET-OSM-048 Restoration of Energy Sources - Operational Safety Manual - Section 6.6.
- **Danger Notices Shall** be attached on or adjacent to **Live Apparatus** to define the limits of the work or test zone.
- Where **Additional Earths** are required, the number and points of application must be confirmed and then issued by the recipient of the **Permit-to-Work**.

NOTE: The application and removal of **Additional Earths** after the issue of a **Safety Document** is normally the responsibility of the recipient. **Additional Earths Shall** be returned and accounted for, before the **Permit-to-Work** is cleared.

11 Revision History

No	Overview of Amendments	Previous Document	Revision	Authorisation
01	New document created	TBC	1.00	Richard Gough
02				

Appendix A Calibration of a Separate Neutral Earth Resistor

1 General

Calibration of **NEE**s is carried out by passing a substantial Alternating Current (typically 10 amps) and measuring the voltage drop.

2 Procedure

2.1 The transformer and **NEE Shall** be Isolated, **Earthed** and released for work or testing by the issue of a **Safety Document** in accordance with the **OSR**.

2.2 The **Senior Authorised Person Shall**, at the time of issue of the **Safety Document**, demonstrate to the recipient by **Approved** means that the **NEE** and associated **Conductors** are **Dead**.

2.3 A **Permit-to-Work Shall** be issued for the disconnection, maintenance and where necessary any other appropriate work.

2.4 The **Permit-to-Work** 'Other Precautions' section **Shall** include the issue of an **Additional Earth** (or reference to an **Additional Earth** schedule) when required, to cater for special precautions.

2.5 The calibration of the **NEE Shall** where practicable be carried out with the **NEE** disconnected from the transformer.

Appendix B Calibration of a Liquid Neutral Earth Resistor

General

1. The calibration of the **NEE Shall** where practicable be carried out with the **NEE** disconnected from the transformer.
2. Where **NEE** neutral cables come together at a common connection point, the switches provided **Shall** be used so as to isolate each **NEE** in turn, allowing the application of an **Earth** to the **Isolated NEE**.
3. Where necessary calibration of **NEE**s is carried out by passing a substantial Alternating Current (typically 10 amps) and measuring the voltage drop
4. The resistance of the LER is obtained using Ohms Law and should be confirmed against the equipment specification

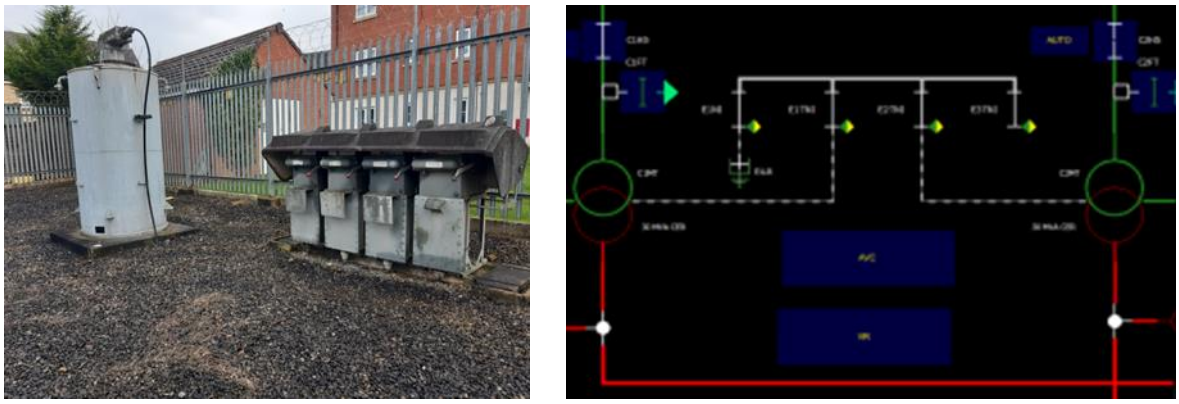

Figure B.1 - Common LNER, Physical and Digital Depiction

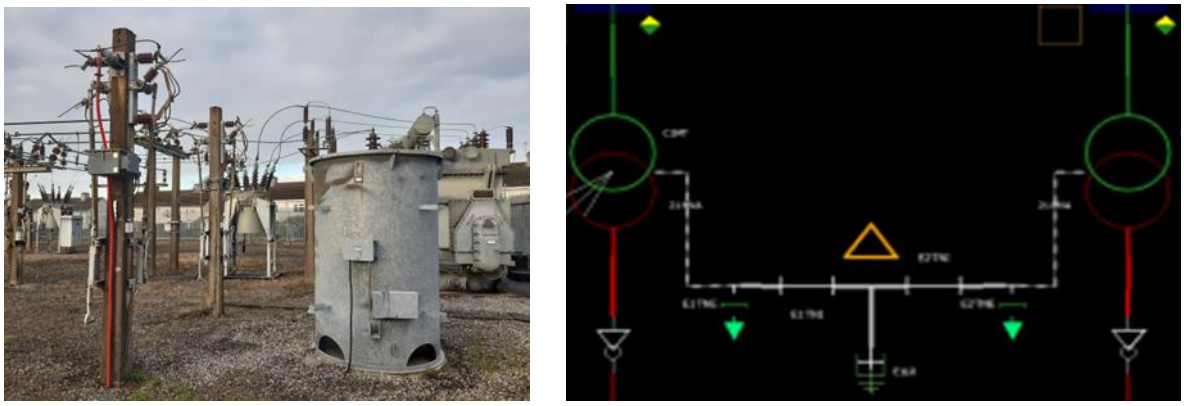

Figure B.2 - LNER and Common Connection Point, Physical and Digital Depiction