

# Electricity Policy Document 333

Issue 4      January 2023

## Supply System Earthing



## Amendment Summary

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## 1 Foreword

The adopted standard upon which Electricity North West Limited earthing systems are based is Energy Networks Association Technical Specification (ENA TS) 41-24 latest issue. ENA TS 41-24 was revised in 2018 to align with BS EN 50522 which largely superseded BS 7374 in 2010. Electricity North West Limited shall apply the principles in both ENATS 41-24 and BS EN 50522.

## 2 Scope

This EPD defines the policy to be applied to the earthing arrangements for Electricity North West Limited' system operating over the voltage range LV to 132kV.

This policy applies to all new earthing installations on Electricity North West Limited distribution system. The policy is not intended to be retrospective; but where work is being done on the system, the opportunity should be taken to make modifications that will apply this policy to existing arrangements, where such work can reasonably be accommodated within the scope of the project.

This EPD supersedes EPD 333 Issue 1, Amendment 2.

## 3 Background

Existing earthing installations have in general been designed and built in accordance with the now superseded Engineering Recommendations S5 and S5/1, supplemented by Electricity North West Limited' own code of practice on PME CP 37/1.

The Engineering Recommendations S5 and S5/1 are superseded by EATS 41-24, and CP 37/1 is superseded by CP 332.

## 4 Neutral Earthing

The 132kV system shall be operated with the neutrals of all 132kV transformer windings directly connected to earth.

The 33kV system shall normally be earthed at the Electricity North West Limited owned bulk supply transformers only. Each bulk supply transformer shall be resistance earthed to a value of 1000 ampere per transformer using earthing resistors to Engineering Specification 350 of nominal value 19.05 ohm at 15°C. If earthing transformers are used to provide a neutral, these shall be in accordance with Engineering Specification 324.

The 11 and 6.6kV systems shall normally be earthed at the Electricity North West Limited owned primary substation supply transformers only. Each primary supply transformer shall be resistance earthed to a value of 1000 ampere per transformer using neutral earthing resistors to Engineering Specification 350 of nominal value 6.35 ohm for 11kV and 3.81 ohm for 6.6kV at 15°C. For the case of systems supplied from 11kV delta windings of 132kV transformers, there shall be provided earthing transformers to Engineering Specification 324.

The LV system shall be operated with solidly earthed neutrals. Neutrals of adjacent systems shall be interconnected subject to the requirements of the Electricity Safety, Quality and Continuity Regulations 2002.

Any proposal to operate other than as described above shall be referred to the Head of Safety and Policy for consideration.

## 5 Design Standards

Distribution substations operating with maximum voltages of 11 and 6.6kV shall have their earthing systems designed in accordance with the requirements of the Electricity Safety, Quality and Continuity Regulations 2002, EATS 41-24 and BS EN 50522. In all cases, provision shall be made to individually test the continuity and resistance of each earthing system component.

To achieve this within Electricity North West Limited, an earthing system (as appropriate) described in Electricity North West Limited CP 333 "Earthing Design for High Voltage Substations and Equipment" shall be installed.

The maximum earth resistance for electrode systems on an 11kV system is 40 ohm, and on a 6.6kV system, 25 ohm. This will ensure reliable operation of earth fault protection at these voltages.

All substations operating with maximum voltages exceeding 11kV shall have an earthing system designed in general accordance with EATS 41-24. Within Electricity North West Limited, staff may ensure compliance with these requirements by use of:

- (a) reference to CP335 Earthing Design for Grid and Primary Substations
- (b) reference to Electricity North West Limited Code of Practice 333 "Earthing Design for High Voltage Substations and Equipment"

## 6 Network Connection to Earth

The Electricity Safety, Quality and Continuity Regulations 2002 require network operators ensure, as far as reasonably practicable, their networks remain connected to earth for all foreseeable operating conditions. The neutral earthing arrangements of primary and grid transformers make it possible to have unearthed network on the high voltage side of the transformer when fed from the low voltage side, if the high voltage network becomes islanded. So far as reasonably practicable, no new connection or modification to the network shall create situations where unearthed network is possible, without the installation of auto tripping scheme to automatically disconnect the unearthed network following a protection operation during the normal running arrangement.

Existing situations where unearthed network can be created during abnormal network running arrangements shall be considered for mitigation. Where pilot cables are required and are available, cross tripping schemes shall be installed to automatically disconnect network in order to avoid it remaining unearthed.

## 7 Documents Referenced

| DOCUMENTS REFERENCED |  |
|----------------------|--|
| <b>EATS 41-24</b>    | Guidelines for the Design, Installation, Testing & Maintenance of Main Earthing Systems in Substations |
| <b>BS EN 50522</b>   | Earthing of Power Installations Exceeding 1kV  |
| <b>ESQCR</b>         | Electricity Safety, Quality and Continuity Regulations 2002  |
| <b>CP332</b>         | LV Service Connections & Application of PME  |
| <b>CP333</b>         | Earthing Design for High Voltage Substations   |
| <b>CP335</b>         | Earthing Design for Grid and Primary Substations   |
| <b>ES324</b>         | 132kV/ Lower Voltage Transformers, Earthing /Auxiliary Transformers & Neutral Earthing Reactors        |
| <b>ES350</b>         | Neutral Earthing Resistors at BSP & Primary Substations  |

## 8 Keywords

Earthing; design; substation; neutral