



## 1 SCOPE

This document defines the SP EnergyNetworks Low Voltage Earthing Policy and Application Guide. It provides an approach that should be adopted when delivering solutions for the issues of mixed earthing arrangements and for other service refurbishment.

## 2 ISSUE RECORD

This is a controlled document

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## 3 ISSUE AUTHORITY

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## 4 REVIEW

This document shall be subject to periodic review in the event of any changes to Statutory Legislation or Industry Standards.



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## **6 DEFINITIONS**

For the purpose of this specification, the following definitions shall apply:

The Company	Refers to SP Distribution Ltd, SP Transmission Ltd and SP Manweb plc.
SP Distribution Limited	The Distribution Licence Holder for the distribution service area formerly known as ScottishPower
SP Transmission Limited	The Transmission Licence Holder for the transmission service area formerly known as ScottishPower
SP Manweb plc	The Distribution Licence Holder for the distribution service area formerly known as Manweb
PowerSystems	SP PowerSystems Ltd. Operator of the network assets on behalf of The Company
SP EnergyNetworks	The brand name of the division of ScottishPower Group of Companies that encompasses SP Distribution Ltd, SP Transmission Ltd, SP Manweb plc and SP PowerSystems Ltd.
The Engineer	PowerSystems' nominated representative having authority over technical matters contained within this Policy
Approved	Equipment approved in accordance with PowerSystems' Equipment Approvals Procedure, and which is considered suitable for installation on The Company's networks



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Earthing System Definitions:

TN-C-S System	A system in which neutral and protective functions are combined in a single conductor up to the cut-out and then separate within the installation. (Also known as PME or CNE)
TN-S System	A system having separate neutral and protective conductors throughout the system. (Also known as SNE)
TT System	A system having one point of the source of energy directly earthed, the exposed-conductive-parts of the installation being connected to earth electrodes electrically independent of the earth electrodes of the source. (No company earth provided)
PNB System	Protective neutral bonding

## **7 RELATED DOCUMENTS**

It is important that users of listed documents ensure that they are in possession of the latest issue together with any amendments.

### **SP EnergyNetworks**

DOC-00-217 Low Voltage Earthing Manual Index

EPS-01-005 Policy for Supplies to Mobile Phone Base Station Sites

### **Statutory Legislation**

EaWR – Electricity at Work Regulations

ESQCR – The Electricity Safety, Quality and Continuity Regulations 2002

### **British Standards**

BS7671 – Requirements for Electrical Installations of Buildings (IEE Wiring Regulations 17<sup>th</sup> Edition 2008)

### **Electricity Association Engineering Recommendation (ER)**

G12/3 – Requirements for the Application of Protective Multiple Earthing to Low Voltage Networks

[http://psportal.scottishpower.com/publish/Document/4b8f22\\_fb3e49c436\\_-7d990a098b8b?rev=4](http://psportal.scottishpower.com/publish/Document/4b8f22_fb3e49c436_-7d990a098b8b?rev=4)

### **HSE Guidance Notes**

HS(G)41 – Health & Safety Executive Guidance Note – Petrol Filling Stations

## **8 INTRODUCTION**

The provision of a Company earth to LV customers has evolved as the Company network has evolved, in line with statutory legislation, and as the guidance for acceptable building services installations standards has evolved principally the IEE Wiring Regulations (BS7671). The current legislation which this policy refers to are the Electricity at Work Regulations (EaWR) and, in particular, the Electricity Supply Quality and Continuity Regulations (ESQCR).

Further industry guidance is detailed in G12/3, referred to in the guidance notes to the ESQCR Regulations.

The earthing of Low Voltage networks and the provision of earth terminals to customers can generally be achieved in one of the following ways:

- Combined neutral and earth conductors (CNE) earthed at several points (protective multiple earthing – PME), known as TN-C-S
- Separate neutral and earth conductor (SNE) bonded and earthed at or near the substation known as TN-S
- A phase and neutral conductor is provided to the customer's supply terminals (a supply with the transformer earthed as normal, however, no network earth) and the customer is responsible for providing a suitable connection to earth and the fitting of an appropriate Residual Current Device (RCD), known as TT
- Combined neutral and earth conductor earthed adjacent to the customer's supply terminals (protective neutral bonding – PNB – applies to a dedicated transformer supplying a single customer)

## **9 POLICY**

### **9.1 New Networks and Extensions to Existing Networks**

This section applies to “greenfield sites” and extensions to existing networks. Other than for the exceptions listed below, all new low voltage distributing mains and services shall utilise CNE construction and have PME applied.

The following are exceptions to the above:

- (a) An existing SNE overhead line shall not be converted to PME in order that a single new customer may be connected PME. In this situation the network shall not be converted and the new customer shall be provided with a TN-S service via an SNE service and earth terminal.
- (b) Certain installations cannot be provided with an earth terminal. For example, in the case of temporary buildings and installations, caravans and boats, petrol filling stations etc., no network earth shall be provided. Customers should refer to the appropriate available guidance documentation including BS7671 and HS(G)41.

Other installations (e.g. farm premises, communications masts, swimming pools etc.) require special consideration before a PME earth terminal can be provided. In some instances, an SNE or PNB service and earth terminal may be provided. (Refer to Engineering Recommendation G12/3 for further guidance). Guidance on the provision of LV supplies to Mobile phone base stations is given in EPS-01-005.

### **9.2 Existing Networks**

#### **9.2.1 Repairs and Deviations**

All repairs and deviations to existing networks shall not alter the earthing arrangements and shall be carried out using SNE or CNE construction as appropriate to match the existing network.

## 9.2.2 TN-S (SNE fed) Customers

Wherever reasonably practicable, all customers using a TN-S service should have a separate neutral and earth return to a substation (not necessarily the source substation).

It should be noted, however, that previous approaches allowed existing TN-S customers without a separate neutral and earth return to a substation to retain their SNE earthing arrangement providing they were directly connected to a sufficient length of electrically continuous non-insulated metallic sheathed (i.e. PILC) cable. Particular care should be taken in such situations when carrying out repairs and deviations to the section of PILC cable.

## 9.3 Review of Earthing Arrangements

When the existing earthing arrangements on a network are being reviewed (for example when an overhead network is being undergrounded, existing earthing arrangements become inadequate or for other reasons), then PME should be applied, where reasonably practicable, and when technically and economically justified.

In some cases it may be appropriate to preserve the existing earthing arrangements to match the existing network.

## 9.4 Earthing of Customers Installations

The earthing and equi-potential bonding of a customer's installation is the responsibility of the customer. However, whenever a new service is installed, an earth terminal should normally be made available (subject to the requirements of section 9.1), providing the customer's installation complies with BS7671. When existing services are refurbished, the provision of an earth terminal must be risk assessed as per section 9.5.

The 13<sup>th</sup> edition of the IEE wiring regulations, which was published in 1955, permitted the use of a water pipe as an installation electrode with the full approval of the Water Supply Authorities. The 14<sup>th</sup> edition (1966) prohibited this practice for new installations but did not require users of existing installations to adopt alternative methods. A significant number of properties in certain areas may still rely on metallic water mains or services to provide an earth return path to ensure operation of customer protection devices in the event of an earth fault.

Actions by Water Supply Authorities, such as replacement of metallic pipes with non-metallic pipes, may render this earth ineffective. In these circumstances it is the responsibility of the customer to take remedial action which may include the installation of a Residual Current Device (RCD) or requesting SP EnergyNetworks to provide an earth terminal as per Section 9.5.

## **9.5 Provision of Earth Terminal**

The customer may formally request an inspection of the Company's earth provision. Where this has been requested, the following policy shall be adhered to.

When requested by the customer, SP EnergyNetworks shall inspect the service cable and cut-out and ascertain if a Company earth terminal is provided. This will be undertaken free of charge to the customer and depending on the outcome of that inspection, procedures outlined in section 9.5.1 or 9.5.2 shall apply. The 'Provision of Earths Policy Flowchart' contained within Appendix A provides guidance into the process that should be adopted. Appendices B and C are referred to in the flowchart.

**It is SP EnergyNetworks policy not to inspect customers' own installations (i.e. internal wiring and equipment) notwithstanding a direct request from the customer. Where customers require assistance of this nature they should be advised to employ an appropriately qualified electrician.**

### **9.5.1 Company Earth Terminal Provided**

Where a Company earth terminal is currently provided and is in use:

SP EnergyNetworks shall ascertain the Earth Loop Impedance (ELI) by measurement at the point of supply and compare the ELI to the maximum permissible levels detailed in Table 1.

If the measured ELI is above the levels detailed in Table 1, SP EnergyNetworks shall take measures where practicable to reduce the ELI value to an acceptable level. Where the ELI is greater than 200Ω remedial works shall be undertaken to reduce the value to less than 200Ω.

Where the ELI has a value higher than those in Table 1 but less than 200Ω, the Company shall, where practicable, provide and install an Approved **temporary** 100mA RCD between the customers meter and consumer unit/existing isolator.

This RCD is provided in order to maintain adequate protection to the Customer's installation in the event of an earth fault within that installation in lieu of an adequate metallic return path to the substation. The customer's main bonding conductor shall remain connected to the Company earth terminal. The installation of a temporary RCD shall be treated as a fault and the resolution of the fault and recovery of the installed RCDs, shall be managed through the Troublecall system. Where the measured ELI is below the maximum permissible levels detailed in Table 1, no further action is required.

**Table 1 – Maximum ELI Values**

TN-C-S	0.35
TN-S Earth	0.80

In **exceptional** circumstances, and as agreed formally by the Zone Leader, where the cost of reducing the earth loop impedance is significantly prohibitive, then an approved RCD may be installed and then adopted by a customer on a permanent basis. A suitable record of the RCDs installed shall be maintained and be available for audit.

## 9.5.2 No Company Earth Terminal Provided

Where no Company earth terminal is provided or an earth terminal is provided but not in use:

SP EnergyNetworks shall where reasonably practicable and at the discretion of the appropriate Zone Leader, provide an earth terminal, on provision of a BS7671, Requirements for Electrical Installation – Periodic Inspection Report for an Electrical Installation, from a suitably approved electrical contractor detailing the condition of the existing electrical installation and compliance with BS7671, at the customer’s cost.

In addition, where appropriate, due consideration shall be given to the risks highlighted in G12/3, when dealing with Mixed systems within Common or Attached Buildings. **SP EnergyNetworks staff shall on no account inspect or test the Customer’s earthing arrangements (i.e. internal wiring and equipment).**

Where an installation does not comply with the current version of BS7671, a Company earth terminal shall not be provided or, where provided but not in use, shall be removed or rendered non-connectable.

Where it becomes evident that the customer’s installation may be unsafe, a formal letter will be issued to the customer detailing that the installation is unsafe and requires immediate attention. If the customer delays or refuses to arrange for the installation to be made safe, the Company shall be entitled to de-energise the supply, until such time as the installation is made safe.

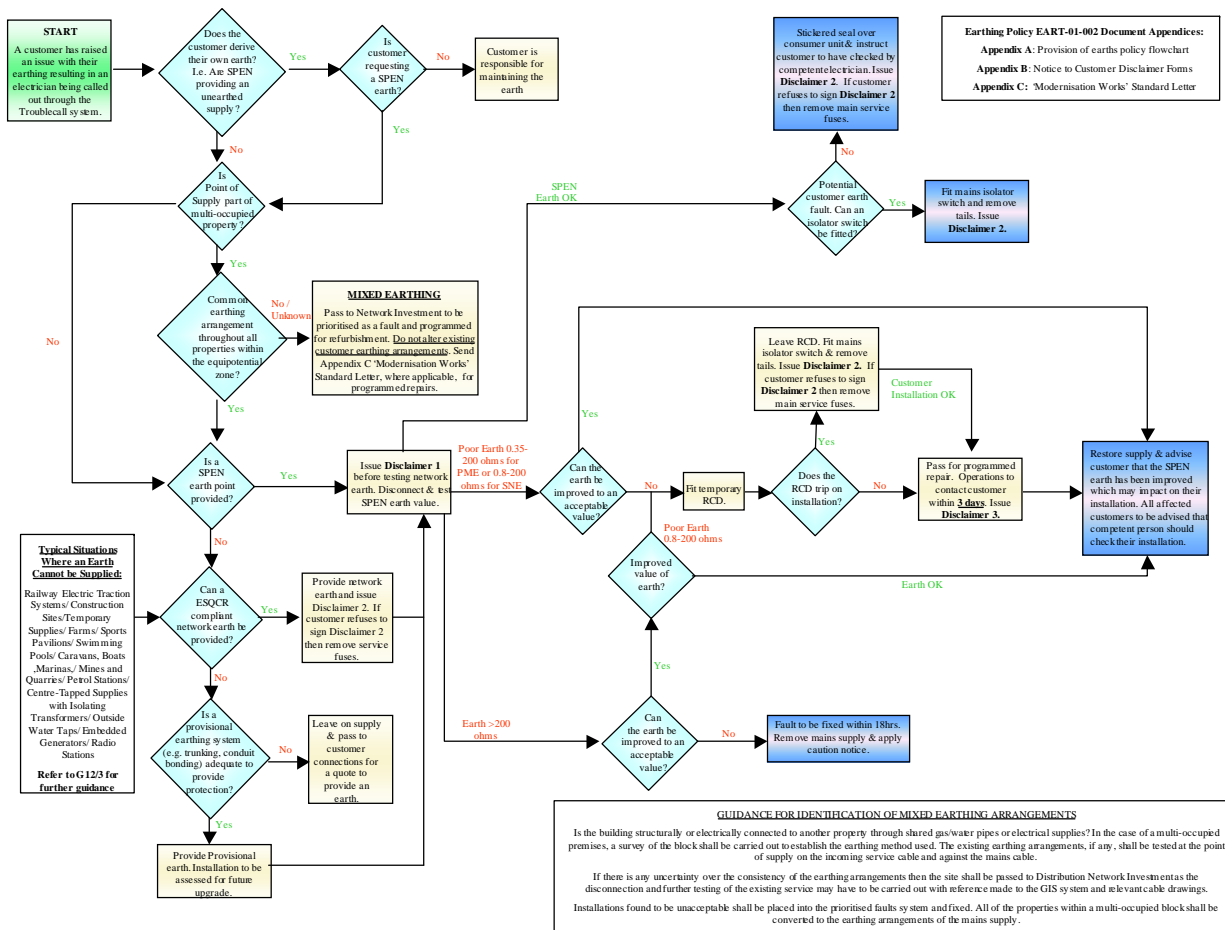
## **9.6 Access to Properties**

Access to residential properties shall be by mutual and amicable agreement with landowners whenever possible. In more difficult situations, Local Authorities can, and are usually willing to, assist with access to both Social Housing and private properties. Such assistance shall be sought prior to any further action. In exceptional circumstances, when access to property is unobtainable through negotiation with the resident and it is deemed by SP EnergyNetworks that essential remedial work is required within the property, then SP EnergyNetworks reserve the right to disconnect supplies to the property at that time. SP EnergyNetworks reserve the right to serve disconnection notices or to exercise our statutory rights of access into a property, although these options shall only be exercised through the Legal department.



**10 APPENDICES**

## Appendix A – Provision of Earths Policy Flowchart





## **Appendix B – Notice to Customer Disclaimer Forms**

### **Disclaimer 1:**

SP EnergyNetworks has been asked to carry out a check for safety on our electrical supply system at your request. During the commissioning of this test, your electricity supply will be disconnected and may not be re-connected, until all necessary repairs are completed and SP EnergyNetworks are satisfied that the electrical supply system is safe.

SP EnergyNetworks representative:

Sign \_\_\_\_\_  
Print \_\_\_\_\_  
Date \_\_\_\_\_

Customer / Nominated representative:

Sign \_\_\_\_\_  
Print \_\_\_\_\_  
Date \_\_\_\_\_



**Disclaimer 2:**

SP EnergyNetworks has completed a check for safety on your electrical supply system. During the commissioning of our supply cables we believe that a customer installation fault may be present and may require remedial work by a suitably qualified and competent Electrician. In the interest of safety, SP EnergyNetworks have left your distribution equipment in the “off” position.

It is your responsibility to ensure that this fault is rectified, and SP EnergyNetworks will only allow the electrical supply to remain connected if you agree to accept responsibility and liability for the remedial work.

Name \_\_\_\_\_

Address \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

1. I give permission for the fuse/fuses to be replaced and understand that SP EnergyNetworks have not tested the electrical installation at the above address
2. I have been advised that a more detailed inspection and test should be completed as soon as possible, and that this is my responsibility
3. I understand that SP EnergyNetworks is not responsible for the internal wiring at the above address

Tick this box if the isolator switch has been left in the ‘off’ position and the customer’s network is left off.

Customer / Nominated representative:

Sign \_\_\_\_\_  
Print \_\_\_\_\_  
Date \_\_\_\_\_

SP EnergyNetworks representative:

Sign \_\_\_\_\_  
Print \_\_\_\_\_  
Date \_\_\_\_\_



**Disclaimer 3:**

SP Energy Networks has carried out remedial work on your electrical supply system. Further programmed work is required and you will be contacted within 3 days to arrange the work. If you have any questions regarding the work please contact:

SP Distribution\*/SP Manweb\* on the following phone number \_\_\_\_\_  
(\*delete as appropriate)

and quote the Troublecall incident number \_\_\_\_\_

## Clamped Connections

With the exception of the approved Hepworth earth clamp shown below, mechanical earth clamps are not an acceptable method of earthing.

The Hepworth Earth Clamp is shown in the pictures below and requires a Live Working authorisation for its application.





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**Appendix C – ‘Provision of supply authority earth terminal’ Standard Letter**

Reference: Modernisation Work

Dear Customer,

SP Energy Networks are carrying out modernisation work on your electricity supply system. As a result of this work we will require access to your property on \_\_\_\_\_ - am/pm.

You should also be aware that as a result of the work, your supply will be disconnected during the following hours \_\_\_\_\_ am - \_\_\_\_\_ pm

I apologise in advance for any inconvenience caused, and assure you that the work will be completed at the earliest opportunity.

If you need to discuss the work please do not hesitate to make contact using the telephone numbers below:

Project Coordinator \_\_\_\_\_ Number \_\_\_\_\_

ScottishPower Customer Connections 01698 784567