

1. SCOPE

This Safety Instruction applies the principles established by the ScottishPower Safety Rules (Electrical and Mechanical), setting down the requirements in those situations where it is necessary to protect personnel carrying out work in substations with exposed **High Voltage (HV)** conductors from **Danger** which may be outside the safe work area.

2. ISSUE RECORD

This is a [Reference](#) document. The current version is held on the EN Document Library.

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Issue Date	Issue No.	Author	Amendment Details
September 2015	4	Phil Currie	Re-drafted to separate: (a) work on HV Apparatus (Section 10) (b) work adjacent to HV Apparatus (Section 12) 10.1: Safe work area shall be erected before issue of Safety Document . 10.3: Requirement to demarcate Apparatus that is " <i>Not Part of the System</i> " when adjacent to Live Apparatus . 10.3: Guidance for work on towers in substations. 10.6: Demarcation equipment shall not be used for any other purpose. Also minor changes to equipment dimensions. 10.7 (ii): Clarification about Live conductors over-sailing the work area. 10.8: Added option of using Danger Notices as well as red pennants. 10.10: Guidance added for areas requiring Castell key entry
18/01/2017	5	Gary Evans	11.3 and 12.9 Use of flexible type Danger Notices changed back to a 'shall where practicable' requirement.

3. ISSUE AUTHORITY

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4. REVIEW

This is a [Reference](#) document which has a 5 year retention period after which a reminder will be issued to review and extend retention or archive.

5. DISTRIBUTION

This Energy Networks' Safety Instruction is maintained by EN Document Control and is part of the ScottishPower Safety Rules which is published to the SP Energy Networks Internet site.

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7. DEFINITIONS

Terms printed in bold type are as defined in the ScottishPower Safety Rules (Electrical and Mechanical).

*Not Part of the **System** – **Apparatus*** which has no electrical connections to the **System** and cannot be energised from any part of the **System** by closing an **Isolating Device** or a switch and where the Safety Rules do not apply. Removal of jumpers shall not be considered adequate to class conductors as *Not Part of the **System***, jumpers shall be considered as a link on **HV Apparatus**.

8. PLANT AND APPARATUS IDENTIFICATION

Plant and **Apparatus** on which work is to be carried out shall be readily identifiable or have fixed to it a means of identification, which will be effective throughout the course of the work.

9. DANGERS

The main **Dangers** to personnel in substations are electric shock, burns or falling arising from:

- (i) Mistaking **Apparatus** which is **Live**, or must be considered to be **Live**, for that on which it is safe to work;
- (ii) Inadvertently infringing **Safety Distance**;
- (iii) Inadequate precautions to suppress or safely discharge induced or impressed voltages on equipment;
- (iv) Failure to maintain an adequate equipotential zone;
- (v) Insecure or inadequate hand or footholds;
- (vi) Failure to make proper use of access equipment, fall arrest, permanent attachment, or other safety equipment.

Apparatus shall be regarded as **Live**, unless declared safe by the issue of a **Safety Document** and properly demarcated in accordance with this Safety Instruction.

10. BOUNDARIES AND SAFE WORKING AREAS – WORKING ON HV APPARATUS

10.1 Where work is to be carried out on **HV Apparatus** in proximity to other **HV Apparatus** which may be **Live**, or must be regarded as **Live**, then subject to the requirements of 10.3 below, the limits of the safe work area shall be clearly defined by a conspicuous and identifiable boundary mark that shall be erected prior to the issue of a **Safety Document**.

10.2 **Primary Earths** and **Drain Earths** which require to be permanently attached, shall, where reasonably practicable, be positioned so that both the line end clamps and earth end clamps are outside the safe work area. These earths shall be applied adjacent to the safe work area, to provide a visual reference for the **Working Party**.

10.3 The boundary mark shall only be fixed where:

- the **HV Apparatus** to be worked on has been **Isolated** and **Earthed**; or
- the **HV Apparatus** is “*Not Part of the **System***” and a **Senior Authorised Person** determines that demarcation is advantageous to avoid the risk of inadvertent access to **Live Apparatus** in the same substation.

When working on overhead line towers that are located in substation compounds, access and demarcation shall be in accordance with PSSI 4 and PSSI 16 and not this Safety Instruction unless the **Senior Authorised Person** determines otherwise.

- 10.4 Boundary marks shall only be fixed, moved or removed by a **Senior Authorised Person** or by an **Authorised Person** under the **Personal Supervision** of a **Senior Authorised Person**.
- 10.5 **Safety Distance** shall be maintained at all times to **Apparatus** on which it is unsafe to work. This includes any overhead conductors which pass over the work area and on which work is not to take place. In order to ensure that the **Safety Distance** is maintained, the risks associated with the work being carried out shall be assessed by the **Senior Authorised Person** issuing the **Safety Document** and the boundary of the safe work area and the access way to the safe work area positioned accordingly.
- 10.6 The equipment to be used to mark the safe work area shall not be used for any other purpose and shall be as follows:
- (i) Rope supports comprising approximately 1000mm high, red coloured uprights, with yellow angled crossarm attachments in accordance with Figure 1;
 - (ii) High visibility non-conducting orange coloured rope, having a diameter not less than 10mm;
 - (iii) Green coloured stacking cones, approximately 450-500mm high, in accordance with Figure 1.

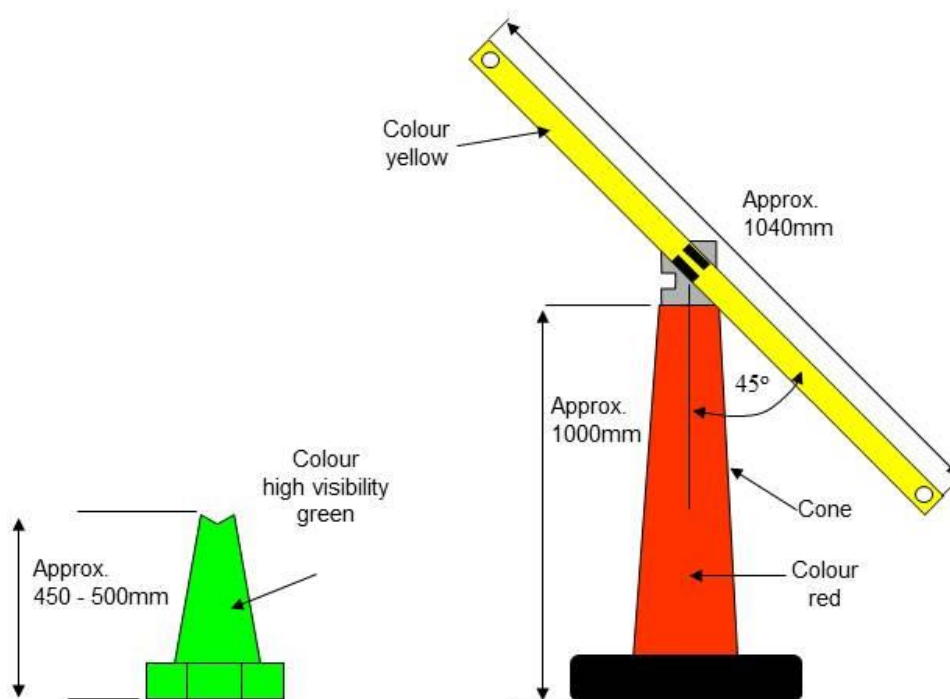


Figure 1: Equipment for roping off access way and/or safe working area in substations

- 10.7 Demarcation of safe work areas (other than those that require Castell key(s) for entry – for these see section 10.10).

The safe work area shall be defined in the following manner:

- (i) The rope supports, as described in 10.6 above, shall be placed not more than 7 metres apart and shall, subject to 10.8, be so located that no structure supporting **Live HV Apparatus** is contained within the safe work area. The rope supports shall be placed with the higher end of the crossarms at the inside boundary of the safe work area. Where the substation fence or wall or fixed division or screen is located on one or more side(s) of the safe work area, then this may be considered to be a boundary mark;
 - (ii) Where reasonably practicable, the safe work area shall be set up so that there are no exposed **Live HV** conductors crossing overhead. Where this is not reasonably practicable, those **Persons** involved with the work shall be made aware of the hazard by the inclusion on the **Safety Document** of the precautions required to avoid **Danger**. The requirements of PSSI 8 shall be strictly observed;
 - (iii) Ropes, as described in 10.6 above, shall be attached to and strung between the ends of the crossarms, one to the outside or lower ends and the other to the inside or higher ends. The ropes shall be arranged so as to leave a gap at the entrance to the safe work area. The access way to the safe work area shall be marked as in 10.9 below;
 - (iv) At intervals not exceeding 6 metres, the green coloured cones, described in 10.6 above, shall be placed within the safe work area at a distance of 1 metre from the inside higher rope of the boundary mark;
 - (v) The boundary mark supports and ropes of the safe working area shall not carry any notice, nor shall any part of a substation fence or wall or fixed division or screen which may define a boundary mark of a safe work area.
- 10.8 In situations where it is not possible to define the safe work area as in 10.7 above, e.g. due to steel lattice supports carrying more than one circuit, or terminal towers within substations, special precautions shall be taken to delineate unsafe access by affixing red pennants or **Danger Notices** at working levels before work commences.
- 10.9 The access way to the entrance of the safe work area shall be marked in the following manner:
- (i) The rope supports, as described in 10.6 above, shall be placed not more than 10 metres apart on a route leading to the entrance to the safe work area and shall be so arranged that no structure supporting **Live HV Apparatus** is contained within the access way. In 33kV and below substations the access way between the entrance of the safe work area and the substation entrance gate or door shall be defined and marked. The rope supports shall be placed with the higher end of the crossarms at the inside boundary of the access way. Where a substation fence or wall is located to one side of the access way then this fence or wall may be considered to form one side of the access way. The width of the access way shall be the minimum required to provide unrestricted access for the work to be undertaken;
 - (ii) Work shall not be carried out in the access way, and where it is not possible to arrange an access way without exposed **Live HV** conductors crossing overhead, those **Persons** involved with the work shall be made aware of the hazard and the requirements of PSSI 8 shall be strictly observed;
 - (iii) Rope, as described in 10.6 above, shall be attached to and strung between the higher ends of the crossarms. No rope shall be attached to the lower ends;
 - (iv) Green cones shall not be placed in the access way.

Typical arrangements for defining the safe work area are shown in Figures 2 and 3.

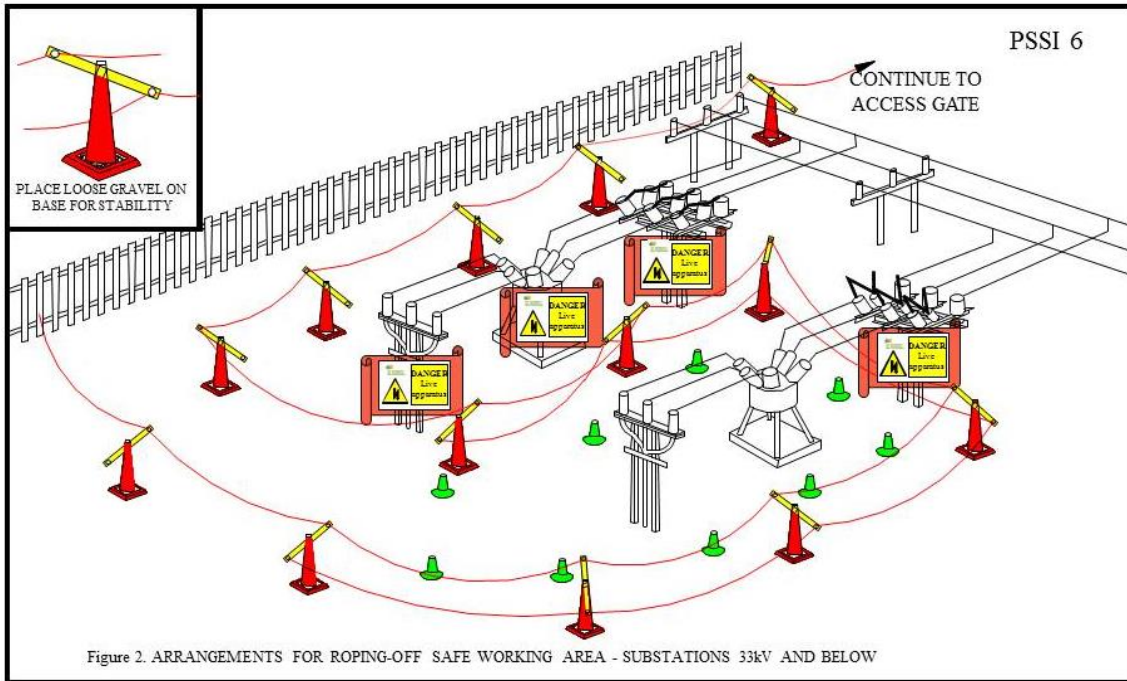


Figure 2: Arrangements for roping-off safe working area – substations 33kV and below

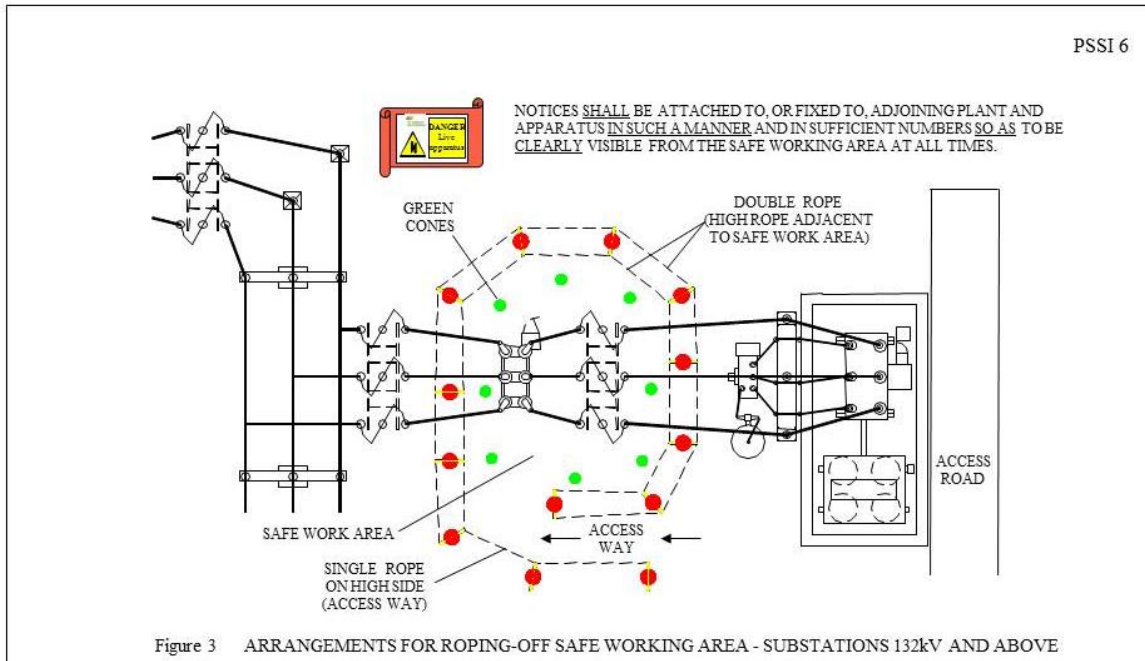


Figure 3: Arrangements for roping-off safe working area – substations 132kV and above

10.10 Demarcation of safe work areas that require Castell type key(s) for entry.

For **Apparatus** in an enclosure or caged area where entry can only be gained using a Castell type key(s) the safe work area shall be defined prior to the issue of the **Safety Document** as follows:

- (i) The cage itself shall define the boundary mark;
- (ii) The access gate to the safe work area shall be identified by the **Senior Authorised Person**;
- (iii) Two green cones shall be placed outside the cage, one either side of the access gate, to identify entry to the safe work area;
- (iv) The access way shall be defined as in section 10.9 above.

10.11 Removal of safe work area and access way.

On completion of work the boundary mark shall be removed by the **Senior Authorised Person** or by an **Authorised Person** under his **Personal Supervision** after any associated **Safety Documents** have been cancelled and before any remaining earths have been removed.

11. DANGER NOTICES

11.1 **Danger Notices** shall be placed to inform personnel working in or approaching a safe work area that adjacent **Plant** and **Apparatus** is not included in the safe work area. The notices shall be attached to, or fixed adjacent to, adjoining **Plant** and **Apparatus** in such a manner and in sufficient numbers so as to be clearly visible from the safe work area at all times.

11.2 **Danger Notices** shall only be fixed, moved or removed by a **Senior Authorised Person** or by an **Authorised Person** under the **Personal Supervision** of a **Senior Authorised Person**.

11.3 **Danger Notices** shall, where practicable, be of the flexible, high visibility orange background type in accordance with Figure 4.

Flexible, with High Visibility Orange Background



Standard



Figure 4: Danger Notices

12. BOUNDARIES ESTABLISHED TO LIMIT THE WORK AREA ADJACENT TO HV APPARATUS

- 12.1 Where work is to take place in proximity to **Apparatus** which may be **Live** or must be regarded as **Live**, but there is no requirement to isolate and earth that **Apparatus**, then a **Senior Authorised Person** may decide that demarcation is required to define the limits of a work area. The extent of the barrier system and the arrangements for access to the point of entry to the work area are at the discretion of the **Senior Authorised Person**. The **Senior Authorised Person** shall give instructions to the **Working Party** or, where applicable, to the recipient of the **Safety Document** defining when and under what circumstances the barriers may be re-positioned or removed during the course of the work.
- 12.2 The equipment described in 10.6 above shall not be used to define a work area for this purpose.
- 12.3 The method of establishing demarcation barriers shall be suitable and sufficient for the site and the work activities involved, typical examples of suitable barrier systems are street works barriers or temporary metallic fencing. Metallic fencing shall be **Earthed** to the substation earth mat. Separate earthing systems shall not be connected and precautions shall be taken to avoid **Danger** from the reduced separation between earthing systems. It may be necessary to install a non-conductive panel between a temporary metallic fence and the permanent substation fence.
- 12.4 The **Senior Authorised Person** shall inspect the outdoor compound environment and ensure that there is no risk of confusion between a work area defined for this purpose and any other use of similar barriers.
- 12.5 Where reasonably practicable, the work area shall be set up so that there are no exposed **Live HV** conductors crossing overhead. Where this is not reasonably practicable, those **Persons** involved with the work shall be made aware of the hazard by the inclusion on the **Limited Work Certificate** of the precautions required to avoid **Danger**. The requirements of PSSI 8 shall be strictly observed.
- 12.6 A **Limited Work Certificate** may be issued to confirm the limits of the work or work area.
- 12.7 **Danger Notices** may be placed at the discretion of the **Senior Authorised Person**.
- 12.8 **Danger Notices** shall only be fixed, moved or removed by a **Senior Authorised Person** or by an **Authorised Person** under his **Personal Supervision**.
- 12.9 **Danger Notices** shall, where practicable, be of the flexible, high visibility orange background type in accordance with Figure 4.

13. EXCEPTIONS TO THIS SAFETY INSTRUCTION

- 13.1 When the method of demarcation in this Safety Instruction cannot be complied with, then the means of achieving safety for personnel carrying out work in a substation shall be the subject of a separate **Approved** procedure.