

Secondary Distribution Substations - Particular Requirements for Outdoor Substation and Enclosures - Design and Installation Standard



TG-NET-SST-018	Secondary Distribution Substations - Particular Requirements for Outdoor Substation and Enclosures - Design and Installation Standard		Applies to	
			Distribution ✓	Transmission
Revision: 1.01	Classification: Public	Issue Date: November 2017	Review Date: November 2025	

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1 Introduction

- 1.1 This document is one of a suite of documents intended for designing and installing substations for adoption, and/or for use, by Scottish and Southern Electricity Networks (SSEN) Designers and Installers, covering the following situations.
- The Third party designs and constructs the substation and SSEN provide all the high and low voltage switchgear and transformer. SSEN adopt the substation.
 - The Third party designs and constructs the substation and the Third party provides all the high and low voltage switchgear and transformer. SSEN adopt the substation and plant.
 - The Third party designs and constructs the substation and SSEN provide the high voltage switchgear and metering unit. The Third party retains ownership of the substation.
 - Third party designs and constructs the substation; SSEN provide all the high voltage switchgear and transformers. Third party provides the low voltage switchgear. Third party retains ownership of the substation.
 - SSEN designs and installs the substation.
- 1.2 This document covers secondary distribution substations with high voltage operating voltages of 11kV and 6.6kV which are suitable outside of building complexes. Substations inside building complexes are covered in another section. It covers the design of enclosures for housing outdoor rated HV plant. It shall not be used for the design of substations with indoor rated HV plant. It also covers joint user substations where SSEN own plant, but do not own the substation building (section on Joint User Substation).
- 1.3 For the purposes of this specification Low Voltage (LV) shall mean up to and including 1kV. High Voltage (HV) shall mean a nominal system voltage of 6.6kV or 11kV (a system maximum voltage of 7.2kV or 12kV).
- 1.4 The suite of documents covers connections for demand only. They do not cover installations for connections for plant feeding generators. They do however include the provisions required for supply restoration using portable generators.
- Unless otherwise stated in this document 'the developer' shall cover the developer, builder, Independent Distribution Network Operator (IDNO) or Independent Connection Provider (ICP) or there appointed agents as well as SSEN Staff and agents.
- 1.5 SSEN use Secondary Distribution Substations (11kV or 6.6kV to 400V) to supply energy to the public. The design of the particular network in which the substation will be employed will influence the type of equipment that is selected for the particular application, the type of transformer and HV/LV protection arrangements.
- 1.6 All equipment must be purchased new. Used or reconditioned equipment is not acceptable.
- 1.7 The minimum size of transformer currently permitted to comply with the SSEN Losses Strategy is 500kVA. The minimum size of LV cable is 185mm² Aluminium with HV being 150mm² Aluminium.

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- 1.8 Specific requirements for cabling are covered in the documents in the reference section.

2 References

- 2.1 The documents detailed in Table 2.1 – Scottish and Southern Electricity Networks Documents, table 2.2 Miscellaneous Documents shall be used in conjunction with this document.

Table 2.1 – Scottish and Southern Electricity Networks Documents

Reference	Title
TG-NET-CIV-001	Foundation Arrangements for Secondary Distribution Plant Installed in Fenced Enclosures and Pad Mount Transformers
TG-NET-CIV-002	Foundation Arrangements for Secondary Distribution Plant Installed in GRP Enclosures
TG-NET-ENG-011	Deviations from 'G81' Design, Specification and Operational Documents or Approved Designs
TG-NET-SST-004	Bonding and Earthing
TG-NET-SST-005	Secondary Distribution Substations – Common Clauses
TG-NET-SST-015	Miscellaneous Materials
TG-NET-SST-018	Secondary Distribution Substations - Particular requirements for outdoor substation and enclosures (not inside building complexes)
WI-NET-SST-009	Safety, Ownership Signs, Fencing and Security Requirements Applicable to Substations

Table 2.2 – Miscellaneous Documents

Reference	Title	Revision
ESM.0000.A3.0055.DWG	Envico TR 7	
TR 18	Envico TR 18	
SSE-GRP-001	Standard Substation Enclosures	B
SSE-GRP-002	Standard Substation Enclosures	
SSE-GRP-003	Standard Substation Enclosures	A
SSE-GRP-004	Standard Substation Enclosures	
SSE-Fencing-001	Standard Fencing Details	
SSE-Fencing-002	Standard Fencing Details	

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3 Acronyms

3.1 The acronyms shown in table 3.1 are used in this document;

Table 3.1

Acronym	Definition
SEN	Scottish and Southern Electricity Networks
BS	British Standard
CT	Current Transformer
DMS	Document Management System
EMF	Electric and Magnetic Fields
ENA	Energy Networks Association
ESQCR	The Electricity Safety, Quality and Continuity Regulations
EPR	Earth Potential Rise
FRA	Fire Risk Assessment
GRP	Glass Reinforced Plastic
HV	High Voltage
LSOH	Low Smoke, Zero Halogen
LV	Low Voltage
ICP	Independent Connection Provider
IDNO	Independent Distribution Network Operator
RME	Ring Main Equipment
SF6	Sulphur Hexafluoride

4 Deviations from this Document

- 4.1 There may be times when it is necessary to propose a 'deviation in design' from this document.
- 4.2 Where this is required a 'deviation in design' request must be submitted to SEN in accordance with TG-NET-ENG-011. This process also applies to SEN Connections and other Designers.
- 4.3 SEN can refuse, or require, an alteration to a request. It is therefore imperative that signed agreement is obtained before construction or installation is undertaken to avoid the possibility of rework or rejection of the scheme.

5 Fire Resistance

- 5.1 Subject to no other requirements dictated by the fire risk assessment the following minimum requirements for fire protection is required.
- 5.2 Substation doors will always open outwards (away from the plant).
- 5.3 SEN substations shall be designed with a minimum 1 hour fire resistance where not abutting a building (bin stores and cycle sheds may be an exception if permitted by the fire risk assessment). The ventilation of the enclosure does not need to comply with this requirement.

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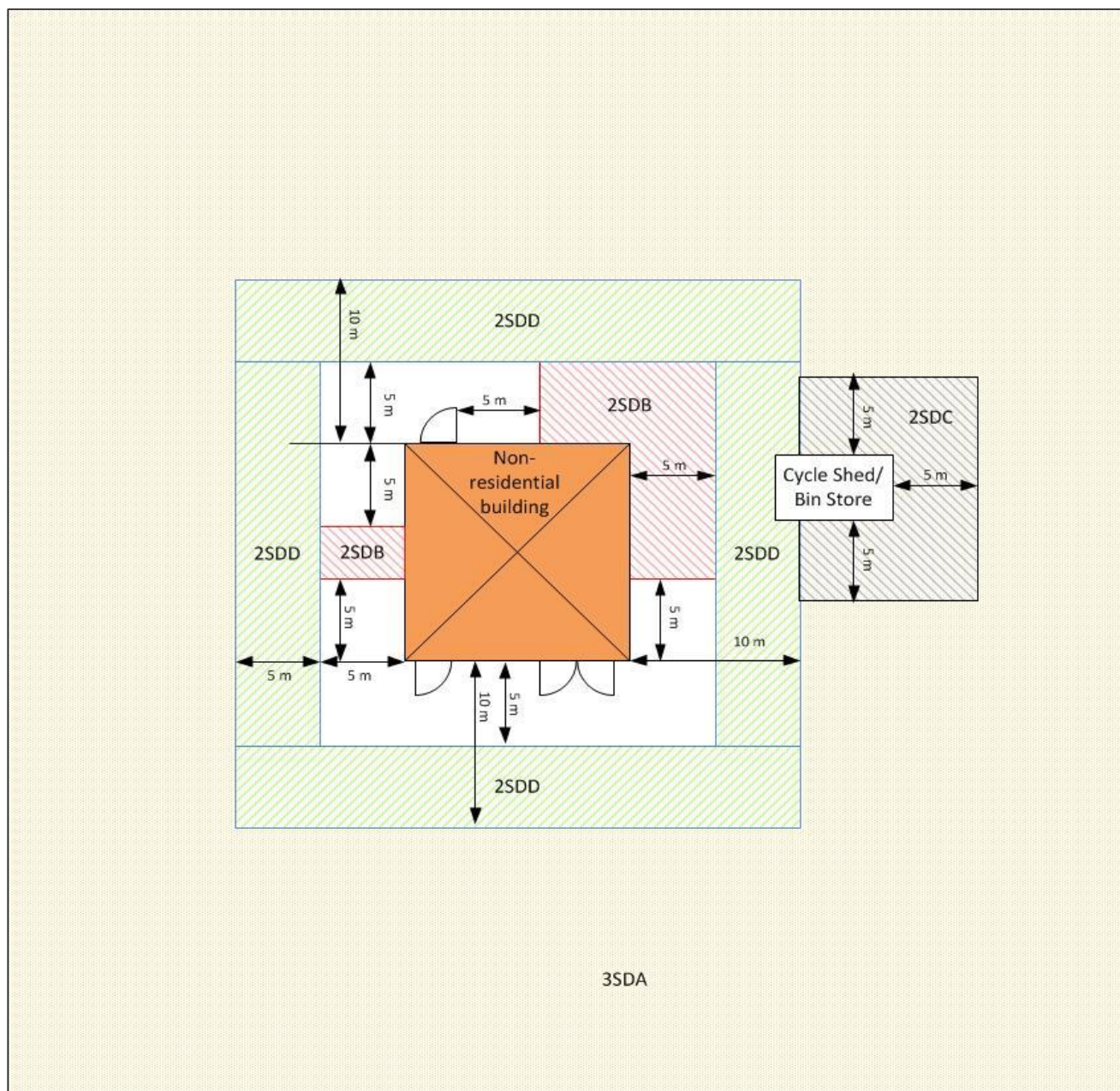


Figure 5.2

TG-NET-SST-018	Secondary Distribution Substations - Particular Requirements for Outdoor Substation and Enclosures - Design and Installation Standard		Applies to	
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Table 5.1

Substation Code	Design for Fire					Design for noise	
	Distance From Any Building	Application	Limitations	Fire Rating	Minimum Enclosure	Distance From Building	Limitations
2SDB	0 to 5 m	Non-residential building	Abutting or facing blank walls.	Either substation or building shall have a 4 hour fire rating on adjacent walls	GRP or padmount	0 to 5 m	Excluding Residential buildings School Classrooms Bedrooms of residential care homes, flats and student accommodation Hospital wards and the like
2SDC	0 to 5 m	Unfrequented Non-residential building	Abutting or facing any walls. Bin stores or cycle sheds. Excludes rooms containing bulk gas intakes.	1 hour	GRP or padmount	Any	None
2SDD	5 to 10 m	Any	None	1 hour	GRP or padmount	5 to 10 m	None
3SDA	Over 10 m	Any	None	None	Fenced or padmount	Over 10 m	None

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6 Glass Reinforced Plastic Substation Enclosure

6.1 The preferred option for developments such as housing, commercial or industrial sites is a substation enclosure manufactured from Glass Reinforced Plastic (GRP). GRP Enclosures (subject to a site security assessment) should also be considered for sites where plant is subject to excessive pollution which could result in deterioration of the plant. The site required solely for SSEN equipment shall be 4m by 4.5m (5m by 5m in Scotland) with an additional provision for access and cabling as shown in Figure 6.1.

6.1.1 The site-specific access and cable routes will be secured in any transfer. The preferred suppliers for GRP housings are given in TG-NET-SST-015. Other suppliers may be used providing that the enclosure is manufactured and tested to BS 61330 and has been approved by SSEN prior to manufacture.

All types of 1500kVA transformers and 1000kVA transformers fitted with six-way cabinets can now be installed in the latest standard GRP enclosure; the TR18. They may not fit legacy designs of GRP, such as the TR7, and the sizes of these enclosures must be checked before attempting to use them.

Simulated brick and similar can also be provided in preference to natural brick if desired and approved by the local planning authority. These enclosures will be subject to a 'deviation in design'.

6.2 Should an IDNO be required to supply metering switchgear (IDNO interface site) then the IDNO will provide a separate GRP kiosk external to the SSEN GRP enclosure to house the metering. Metering shall not be installed inside a substation or GRP enclosure to be adopted by SSEN. A smaller size, TR7, can be used for this purpose.

6.3 The following are standard colours to BS 4800 for SSEN approved GRP enclosure

- Beige (08 C 33)
- Holly Green (14 C 39)
- Grey (dark admiralty 18 B 25 or Goose 00 A 05)
- Brown (dark 08 D 45 or caramel 08 C 37)

Other BS/RAL colours are available although White or Black shall not be used.

6.4 The foundation arrangements for the GRP Enclosures are shown in TG-NET-CIV-002 and cover a number of different arrangements. It also includes details for construction of the bases. A GRP lintel is also available for the latest GRP enclosure which can be used as a substitute for the two concrete lintels. This is shown on Envico drawing TR18.

6.5 Following installation of the earthing and cables the ground between the edge of the enclosure foundation and site boundary shall be covered by either a minimum of 100mm concrete, tarmac/sub-base, or 150mm shingle, with a finished level 50mm below the top of the enclosure foundation. Where concrete is used an expansion joint shall be installed abutting the enclosure foundation. Where the enclosure is situated on a managed grassed area, then grass is acceptable on the sides and the rear of the enclosure.

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- 6.6 The excavatable area can be covered using GRP anti-slip open, or closed, mesh grating. The grating shall be cut to suit cable exits and held down by appropriate 'T' fixings. The colour can be either grey or green. The thickness shall be approximately 50mm and have a deflection of not more than 1% for a 1 tonne load on a 1m² section. Steel angle shall be used to support the grating. The angle shall be securely fixed to the concrete foundation. Where a closed mesh is used at least two key holes shall be made through the surface to allow the mesh to be lifted using standard light duty manhole lifting keys.
- 6.7 Figure 6.2 shows the position of the transformer and switchgear. Where the HV supply is a tee-off the cable shall be terminated in the right-hand cable box. Within the TR 18 enclosure drawing the plant is deliberately positioned over to the left hand side to allow for future automation to be installed, installation of the GRP enclosure and space for inspection of the rear of the unit. The drawing is applicable to all transformer sizes and all Schneider LV pillars. The controlling dimensions to the side wall depend on the cabinet or transformer and shall be not less than 300mm between the enclosure and the radiator fins or not less than 350mm between the enclosure and cabinet
- 6.8 Figure 6.3 shows a typical frontage with figure 6.4 showing the signs which are required. Table 6.1 lists the signs and SSEN stock numbers.

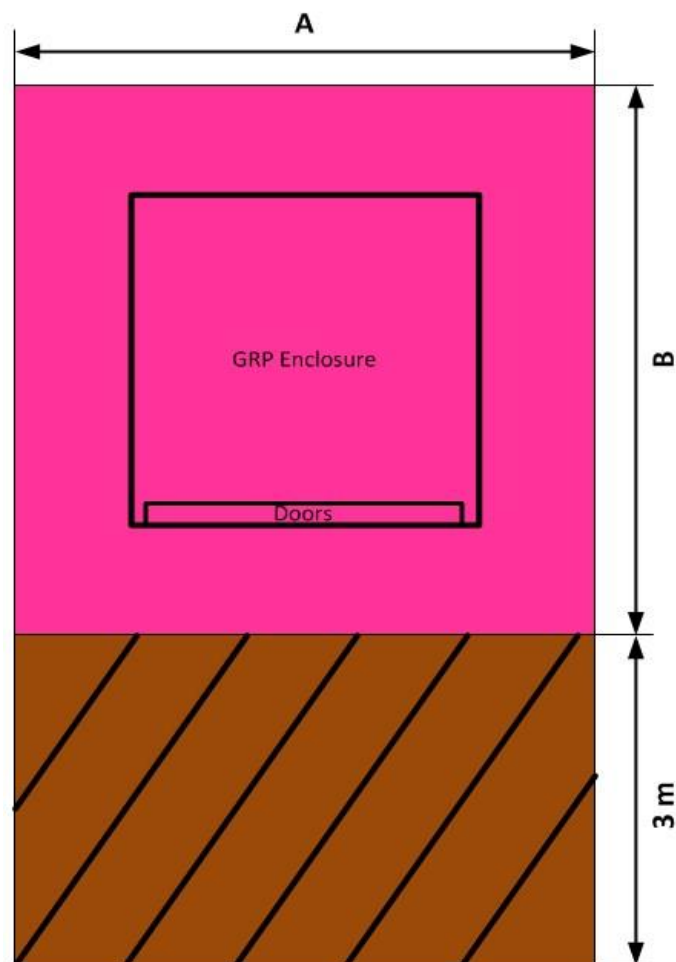
Table 6.1

Sign	Type	Stock Number	
		Main Business	National Networks
Ownership Notice	2	115050 (north) 115720 (south)	110089 (north) 110090 (south)
Safety Sign	2	114965	114965
Sub Watch	small	110104	110104
No Smoking	Large, screw fixing	114528	114528

- 6.9 In high risk areas or areas which have general public access additional Safety Signs shall be fitted on the two sides and rear as shown in figure 6.5.
- 6.10 Signs shall be fitted using stainless steel pop-rivets and washers to the door or glued using CT1 adhesive.

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Figure 6.1



Area owned by SSEN

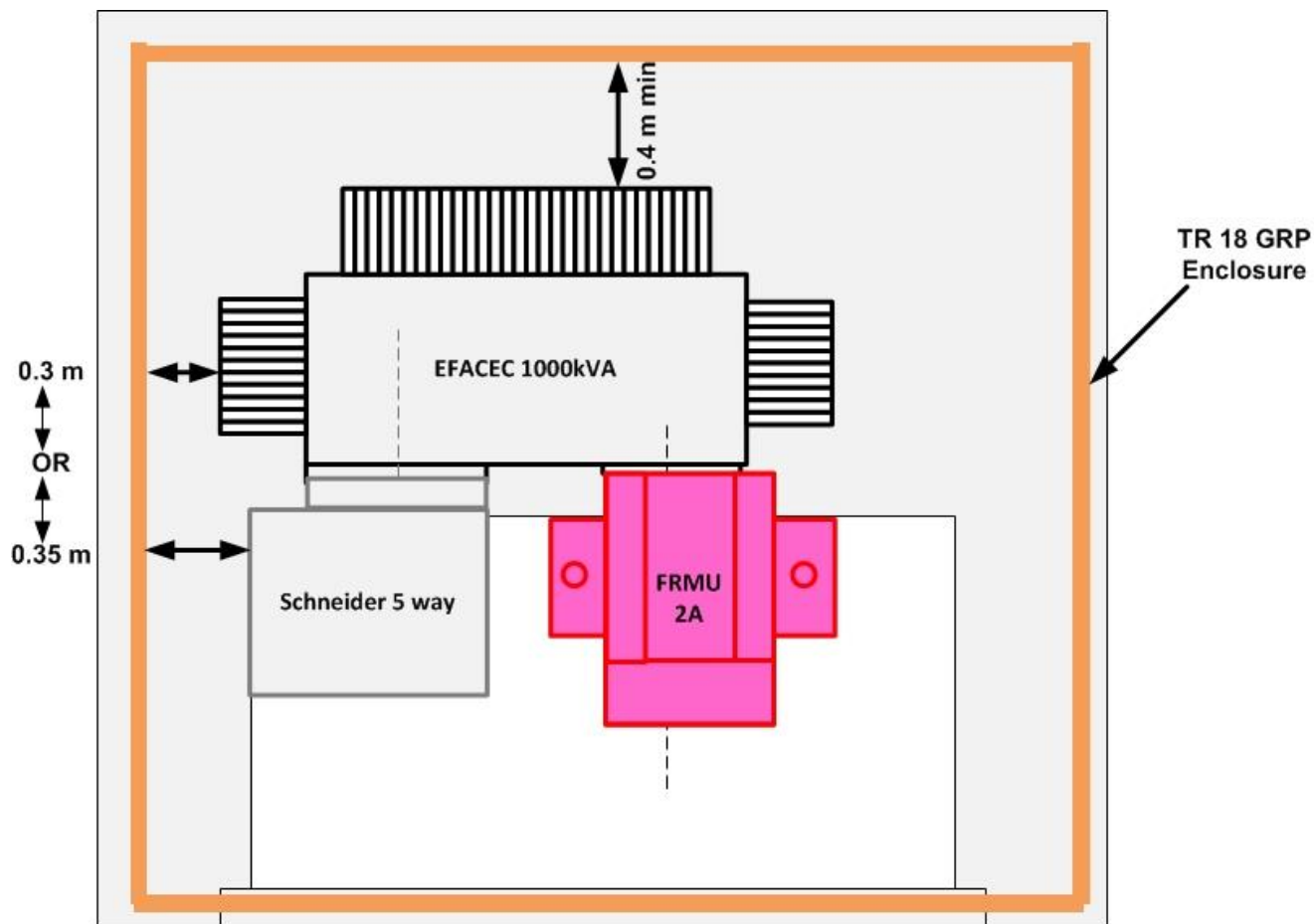


Cable route/access area to be kept clear of obstructions

	'A' m	'B' m
Scotland	5	5
Elsewhere	4	4.5

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Figure 6.2



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Figure 6.3



Figure 6.4



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Figure 6.5

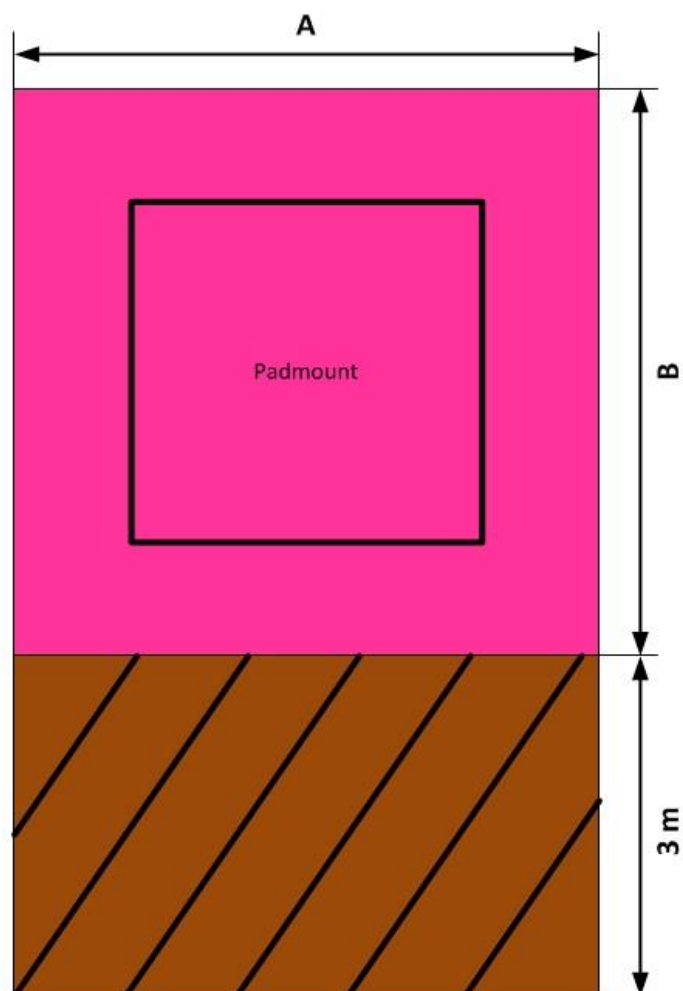


7 Padmount Substation Site

- 7.1 The site required solely for the SSEN padmount transformer shall be 4m by 4m with an additional provision for access and cabling as shown in Figure 7.1. The site specific access and cable routes will be secured in any lease/transfer. Access rights are required back to the nearest adopted highway.
- 7.2 The foundation arrangement is shown in TG-NET-CIV-001 along with the installation methods and concrete requirements.
- 7.3 Following installation of the earthing and cables, the ground between the edge of the foundation and site boundary shall be covered by either a minimum of 100mm of concrete or tarmac or 150mm of shingle, with a finished level 50mm below the top of the foundation. Where concrete is used an expansion joint shall be installed abutting the foundation.
- 7.4 The ground bearing pressure must be sufficient to prevent foundation slippage or failure. An example calculation for determining the bearing pressure is shown in Appendix A.
- 7.5 Fencing is not required around a pad mount transformer unless it is situated in a high risk area.

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Figure 7.1



Area owned by SSEN



Cable route/access area to be kept clear of obstructions

	'A' m	'B' m
Scotland	4	4
Elsewhere	4	4

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Figure 7.2



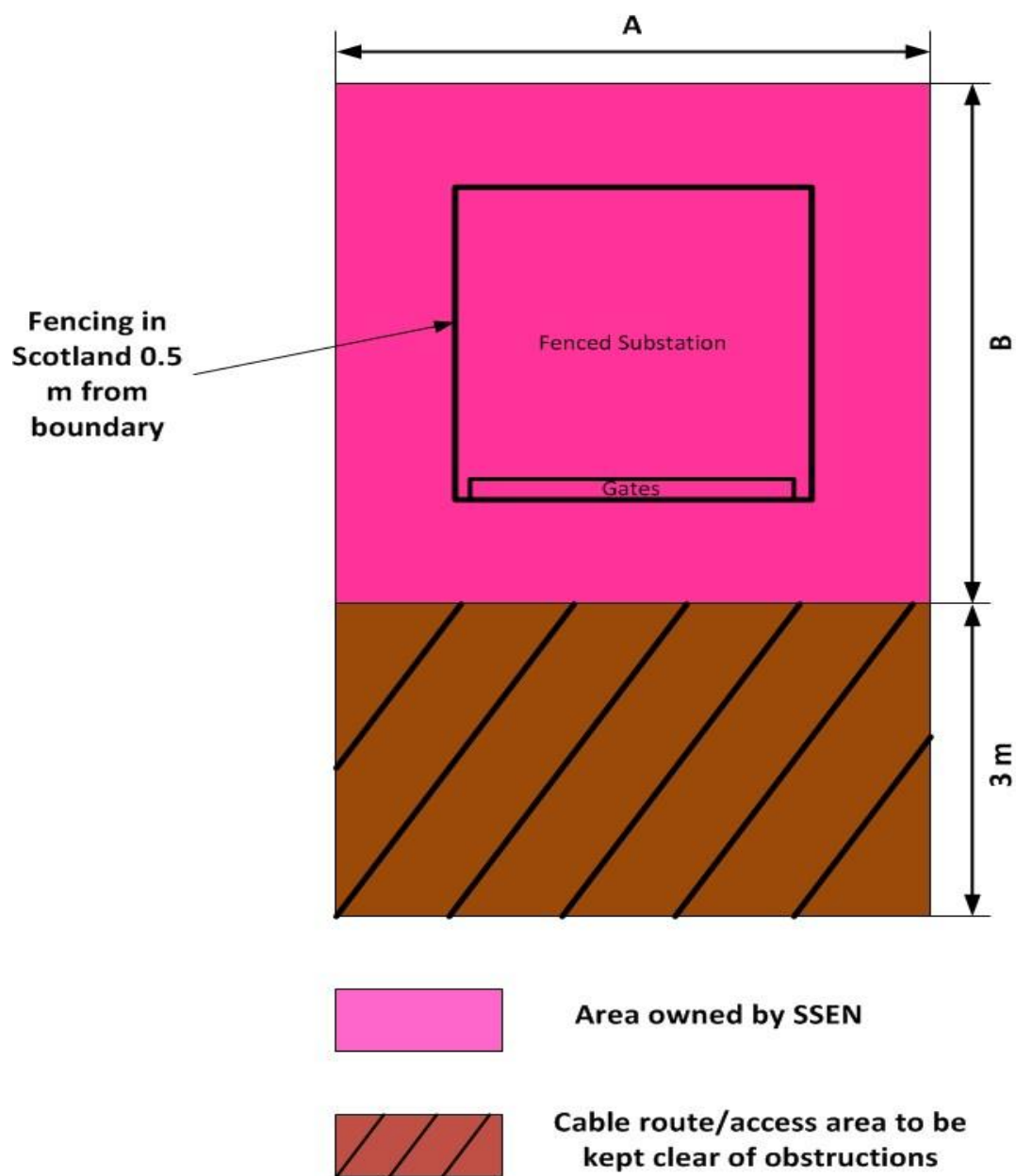
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8 Fenced Substation Enclosure

- 8.1 For a standard fenced substation a site of a 4m x 4.5m (5m x 5m in Scotland) is required. The requirement is shown in Figure 8.1. The site specific access and cable routes will be secured in any lease/transfer.
- 8.2 Whilst the preferred solution for substation enclosures is either a GRP or brick built structure, palisade fencing can also be installed providing it is suitable for the risk grade of the substation. The site security risk assessment will dictate if a fenced enclosure is appropriate. Palisade fences shall conform to the requirements of BS 1722-12, type GP18, with rounded and notched pales. The surface finished shall be natural galvanised. Green powder coating can be used where required under local planning standards. Drawings SSE Fencing 001 and 002 Option 1, "front elevation to be palisade fence and gate with two palisade gate post" shall to be used for new substation builds. Where possible, Option 1 shall be used for replacement of existing fences with Option 2 being used only if absolutely necessary due to local planning constraints.
- 8.3 Where additional security is required a BS 1722-12, type GP24 with triple pointed and splayed pales shall be used.
- 8.4 Wooden fencing is only permitted where the substation is installed in a residential garden and the fencing is required for screening; at least one side must always be of palisade or expamet (legally required to provide visibility into the substation from outside), Figure 8.2 shows a typical palisade enclosed substation. Only the sides of the fence within the residential garden are permitted to be wooden. Wooden fencing shall comply generally with the requirements of BS 1722-5 except where modified by drawings SSE-Fencing-001 and 002.
- 8.5 Metallic fences surrounding substations designed to this standard are not required to be earthed.
- 8.6 A brick built, open construction (no roof) can be provided subject to one side being formed of palisade panelling
- 8.7 The foundation arrangement is shown in TG-NET-CIV-001 along with the installation methods and concrete requirements.
- 8.8 The area inside the enclosure shall be sand filled and covered with a minimum of 150mm of stone chippings or coarse gravel once the electrical works have been completed.
- 8.9 In Scotland, the boundary of the site shall be enclosed in edging stones. The area between the edging stones and the substation fence shall be filled to a minimum depth of 150mm of stone chippings or coarse gravel.
- 8.10 Provisions shall be made in the legal documentation giving SSEN rights of access to all external sides of the enclosure for the purposes of repair, maintenance and replacement of the enclosure.

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Figure 8.1



	'A' m	'B' m
Scotland	5	5
Elsewhere	4	4.5

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Figure 8.2

9 Brick Built Substation Enclosure

9.1 General Requirements

Substations can be incorporated as part of a range of buildings such as attached to a garage block, bicycle or bin store. Locations attached to domestic properties are not permitted. Substations shall be located a minimum of 5m from a domestic property. An open type substation which is accessible from an adjacent roof is not permitted.

The requirements in this section are a minimum and can be exceeded if required.

9.2 Design and construction drawings are shown on drawings SSE/GRP/001 to 004. These drawings are supplemented with photographs in this section. Note the photographs support aspects of this document to aid clarity and are not specific to any particular design.

9.2.1 Concrete shall be to compressive class C25/30 to BS 8500.

9.2.2 The concrete shall be poured in a continuous manner until the shuttering is filled. Brickwork or blockwork installed within the shuttering, forming part of the final base is not permitted without the permission of SSSEN.

9.2.3 Surface shall be float finished with finished tolerances, length way, width way and across the diagonals of 2mm.

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9.3 Roofs

- 9.3.1 Brick built substation enclosures shall preferably have a removable pitched roof –this shall be fabricated from GRP in either a flat or simulated ridged tile style. The roof shall be designed to be removable to allow the installation or removal of equipment using a crane.
- 9.3.2 An approved GRP roof is available see TG-NET-SST-005 for suppliers.
- 9.3.3 Where there is specific planning or environmental demands, SSEN may accept a traditional tiled roof although this is not the preferred solution. Our GRP roof suppliers are willing to meet with local planning officers to discuss what can be achieved with a GRP roof.

9.4 Enclosures

- 9.4.1 The brick built enclosure will be provided with double access doors with a locking system, roof and ventilation arrangements. The structure shall be single skinned with support piers as necessary.
- 9.4.2 The external dimensions of the building shall be approximately 4m by 4m. The site required solely for SSEN equipment shall be 6m by 6m with an additional provision for access and cabling as shown in Figure 9.1.
- 9.4.3 The internal height of the substation shall be 2.5m, where cables exit underground or 3.5m where they are installed overhead in a cable tray.
- 9.4.4 The area shown brown/hatched black is the minimum unobstructed area required for access to the site and will have cables routed beneath it. The site specific access and cable routes will be secured in any transfer back to the nearest adopted highway.
- 9.4.5 Provision shall be made in the legal documentation giving SSEN rights of access to all external sides of the enclosure for the purposes of repair, maintenance and replacement of the enclosure.
- 9.4.6 Provision shall also be made for the unrestricted passage of air through the ventilation ducts maintaining a minimum clearance of 1m between the ventilation grill any structure or planting.
- 9.4.7 Where the volume of the enclosure exceeds 29m³ the developer shall obtain any necessary planning consent.
- 9.4.8 Following installation of the earthing and cables the ground between the edge of the enclosure foundation and site boundary shall be covered by either a minimum of 100mm concrete or tarmac/sub-base with a finished level 50mm below the top of the enclosure foundation. Where concrete is used an expansion joint shall be installed abutting the enclosure foundation.
- 9.4.9 Gutters are not required.
- 9.4.10 The proposal drawings of the arrangement shall be submitted to SSEN for inspection by the Civil Engineering Section.

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9.5 Ventilation

- 9.5.1 Ventilation is deemed adequate where it provides at least four air changes an hour (which equates to 250m³ per hour) and limits the ambient temperature to a maximum 40°C.
- 9.5.2 Low level ventilation is required in the side of the substation with high level ventilation in the opposite side. At least 1m² of inlet and 1m² of outlet area is required per transformer. Where more than one transformer is installed SSEN shall be consulted regarding the venting arrangements. Typical vent sizes are 1140mm x 450mm with two on each side
- 9.5.3 As an alternative, or in addition, low level ventilation is required in the back of the substation with high level ventilation in the doors (doors can be fully louvered).
- 9.5.4 Louvres shall be made of heavy duty GRP, aluminium or steel and be fitted with an anti-vermin mesh on the inside.
- 9.5.5 Screening/vegetation which could prevent or reduce the effectiveness of the ventilation shall not be allowed to encroach within 1m of the wall of the substation.

9.6 Doors

- 9.6.1 Doors shall either be of GRP, aluminium or steel construction and shall open outwards. Composite aluminium/GRP may also be acceptable. Double doors are required with an external frame size of 2700mm wide by 2100mm high. Generally two doors are required; however a three door arrangement can be proposed (one normal door and one bi-folding door). Any proposed reduction in the size required by planning constraints must be subject to a 'deviation in design'. Consideration can be given to the incorporation of removable panels (either louvered or plain) providing the overall opening size can be maintained.
- 9.6.2 The type of material for the door may be dictated by the security rating required for the substation. It must not be assumed that GRP will be suitable in all circumstances. Steel security doors may be required.
- 9.6.3 The approved suppliers for doors are detailed in TG-NET-SST-015.
- 9.6.4 Steel security doors shall be installed where the prospective ESQCR vandalism code is 3. Steel doors can be plain or louvered (either fully or partly) with a minimum rating of 3 to LPS 1175. Plain or louvered extension panels can be used where necessary.
- 9.6.5 Wooden doors (soft or hardwood) shall not be provided in any circumstances.
- ## 9.7 Provision of heating, lighting and power
- 9.7.1 Heating is not required.
- 9.7.2 There is no requirement for lighting.
- 9.7.3 Where a transformer and low voltage cabinet is installed in the substation there is no requirement for

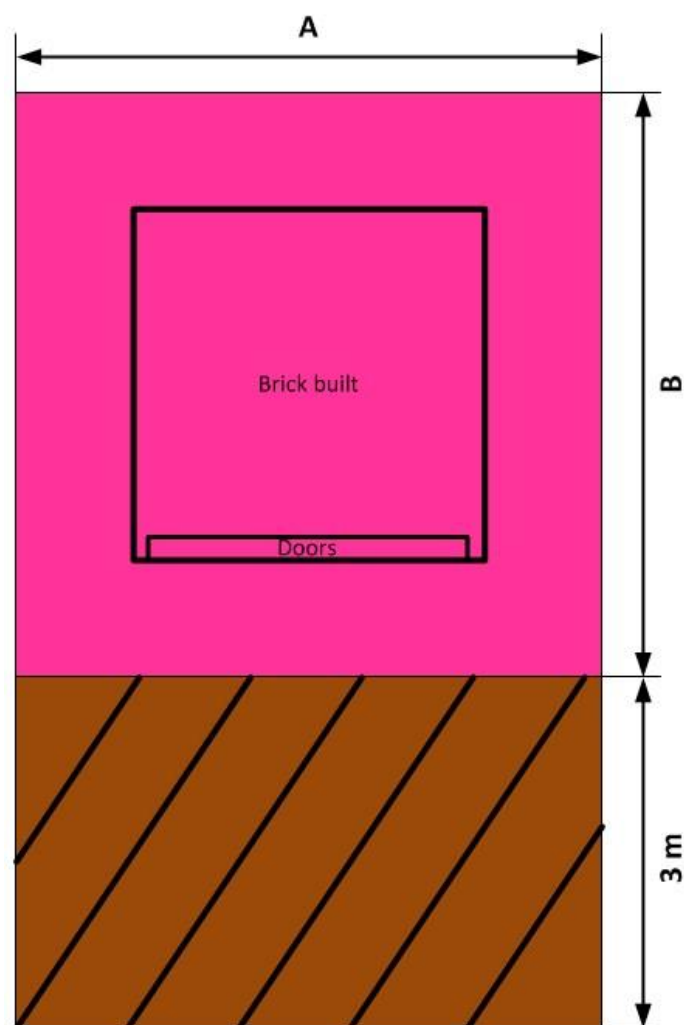
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power.

- 9.7.4 Where there is no transformer or the transformer is not fitted with a low voltage cabinet then a double 13A socket outlet shall be provided in the substation where a landlord's supply is available.
- 9.7.5 Where other monitoring and control equipment is required, SSEN may specify that a supply is required from a fuseboard fitted and controlled from within the substation where there is no alternative feed from the SSEN LV network.
- 9.8 Plinths
 - 9.8.1 Plinths shall be constructed of concrete and be sized in accordance with the dimensions shown in figure 9.2 and figure 9.3
 - 9.8.2 Figure 9.2 shall be used for enclosures with a removable roof. Figure 9.3 shall be used where the roof is not removable. Note the plinth must be on the right hand side when viewed from the outside of the face containing the doors.
 - 9.8.3 The area in front of the transformer base shall be sand filled and covered with a minimum of 150mm of stone chippings or coarse gravel once the electrical works have been completed
 - 9.8.4 The bearing pressure must be sufficient to prevent foundation slippage or failure. An example calculation for determining the bearing pressure is shown in Appendix A.
- 9.9 Dust from floors and walls
 - 9.9.1 Floors and walls shall be sealed using an appropriate sealer where there is a possibility of the liberation of dust.

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Figure 9.1



Area owned by SSEN

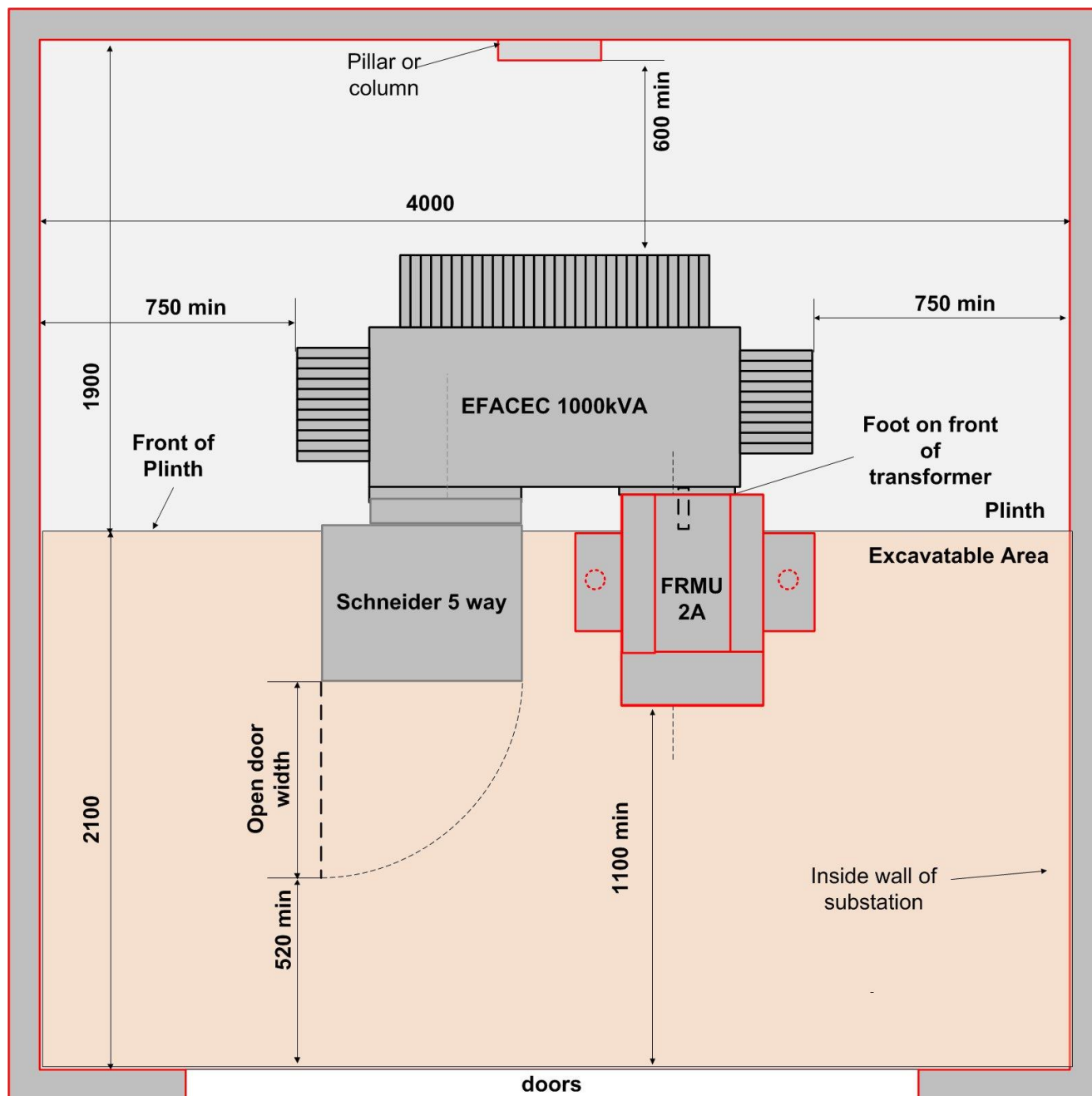


Cable route/access area to be kept clear of obstructions

	'A' m	'B' m
Scotland	6	6
Elsewhere	6	6

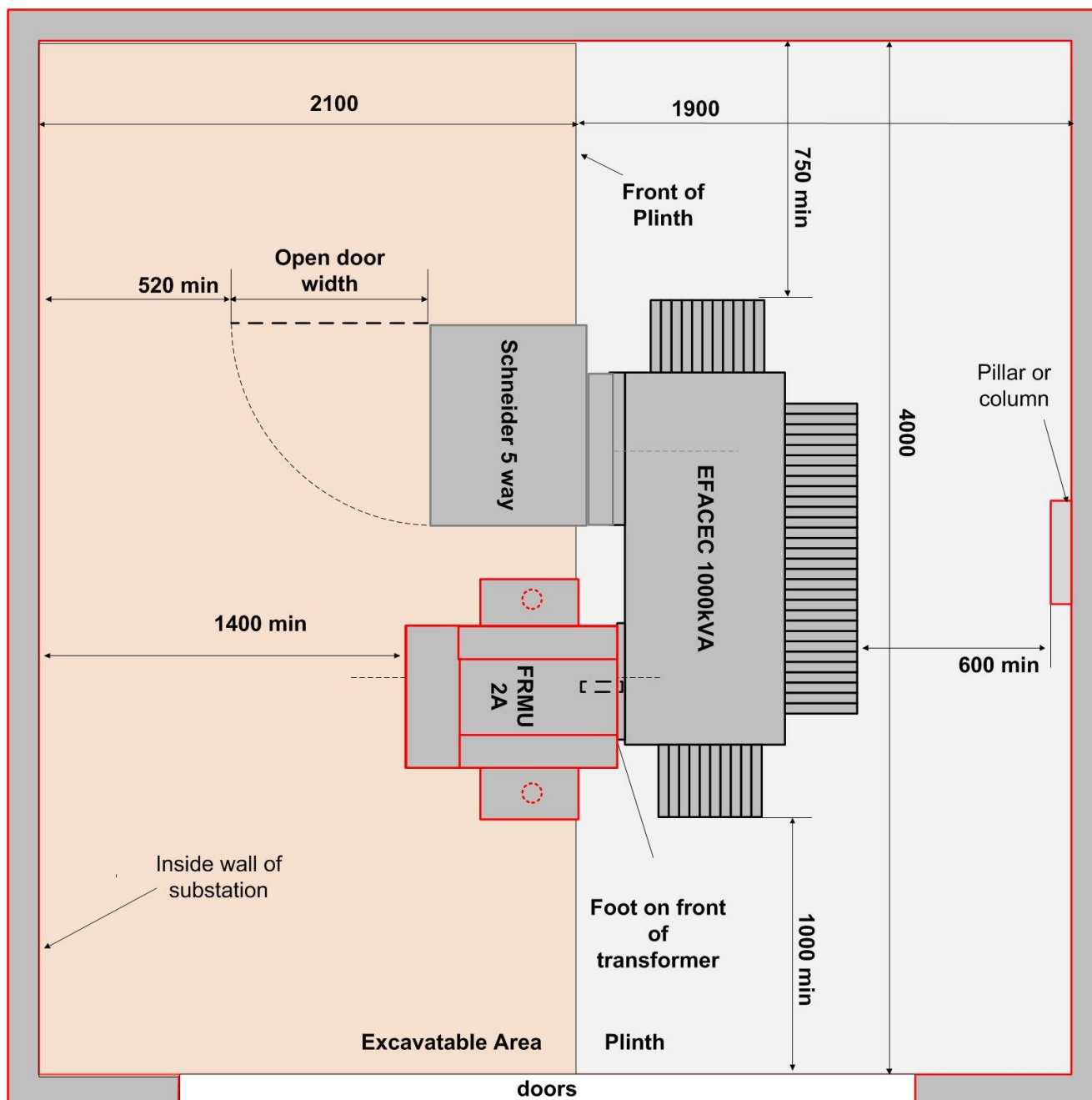
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Figure 9.2



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Figure 9.3



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- 9.9.2 Photographs of a Typical Brick Built Installation. These photographs show a building acceptable to SSEN, with the exception that it must be set back from the public footpath. Notes have been included were necessary to highlight specific requirements. The substation brickwork has been clad to match surrounding properties – the appearance of the substation maybe dictated by the local planning authorities as in this case.



Photograph 1 -The photograph shows a typical installation with a removable roof. The outside brick has been clad to match the surrounding buildings. The doors are GRP.



Photograph 2 - GRP roof showing lifting eyes.

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Photograph 3 - A separate wall plate is required. This shall be secured to the brickwork using restraining straps. The removable roof is secured to the wall plate using straps. The timber used for the trusses and wall plates shall be pressure treated with preservative.



Photograph 4 - Angle plates are required to be fitted to the GRP roof on both sides of the roof truss and secured to the roof trusses using either screws or bolts. A minimum of 12 are required. These are important to resist the action of high winds.

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Photograph 5 - The photograph shows the two high level vents (two low level vents are on the opposite side). Note the requirement for lintels above the vents and intermediate support piers. It is permissible to have restraining straps crossing the vents.

9.10 Figure 9.2 shows the position of the transformer and switchgear.

9.11 Figure 9.3 shows a typical frontage with figure 9.4 showing the signs which are required. Table 9.1 list the signs and SSEN stock numbers.

Table 9.1

Sign	Type	Stock Number	
		Main Business	National Networks
Ownership Notice	2	115050 (north) 115720 (south)	110089 (north) 110090 (south)
Safety Sign	2	114965	114965
Sub Watch	small	110104	110104
No Smoking	Large, screw fixing	114528	114528

9.12 In high risk areas or areas which have general public access additional Safety Signs shall be fitted on the two sides and rear as shown in figure 9.5.

9.13 Signs shall be glued using CT1 adhesive where signs are fitted to doors. Signs can be fitted to brickwork using stainless steel screws.

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Figure 9.3



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Figure 9.4



Figure 9.5



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10 Earthing of Unit and Padmount Transformers.

- 10.1 The clauses in this section give the requirements for earthing of unit and padmount transformers in various enclosures. For specific guidance on the requirements for earthing and bonding of substations, cables and overhead lines refer to SSEN document TG-NET-SST-004.
- 10.2 Earth electrodes are required to prevent undesirable potential rises occurring on substation equipment and are capable of passing earth fault currents of up to 6,000A for 3s. The resistance of the earth return path must be low enough to ensure the operation of the source circuit breaker protection.
- 10.3 Designs in accordance with this standard require a separate HV and LV earth electrode. Table 10.1 gives details of the maximum values for the HV and LV electrodes. Designs in compliance with this Design Standard shall have separate HV and LV earth electrodes. These electrode should have a segregation value of 0.9 or higher (refer to TG-NET-SST-004 for details of the test).

Table 10.1

Electrode	Maximum Resistance Ω
HV	50
LV	40

- 10.4 Table 10.2 shows where the LV neutral/earth – HV steelwork earth can remain in place or where it needs to be removed. With substations designed to this standard an Earth Potential Rise study is not required unless specifically requested by either SSEN or a third party in the case of substations housing jointly adopted plant (for instance SSEN and another DNO).

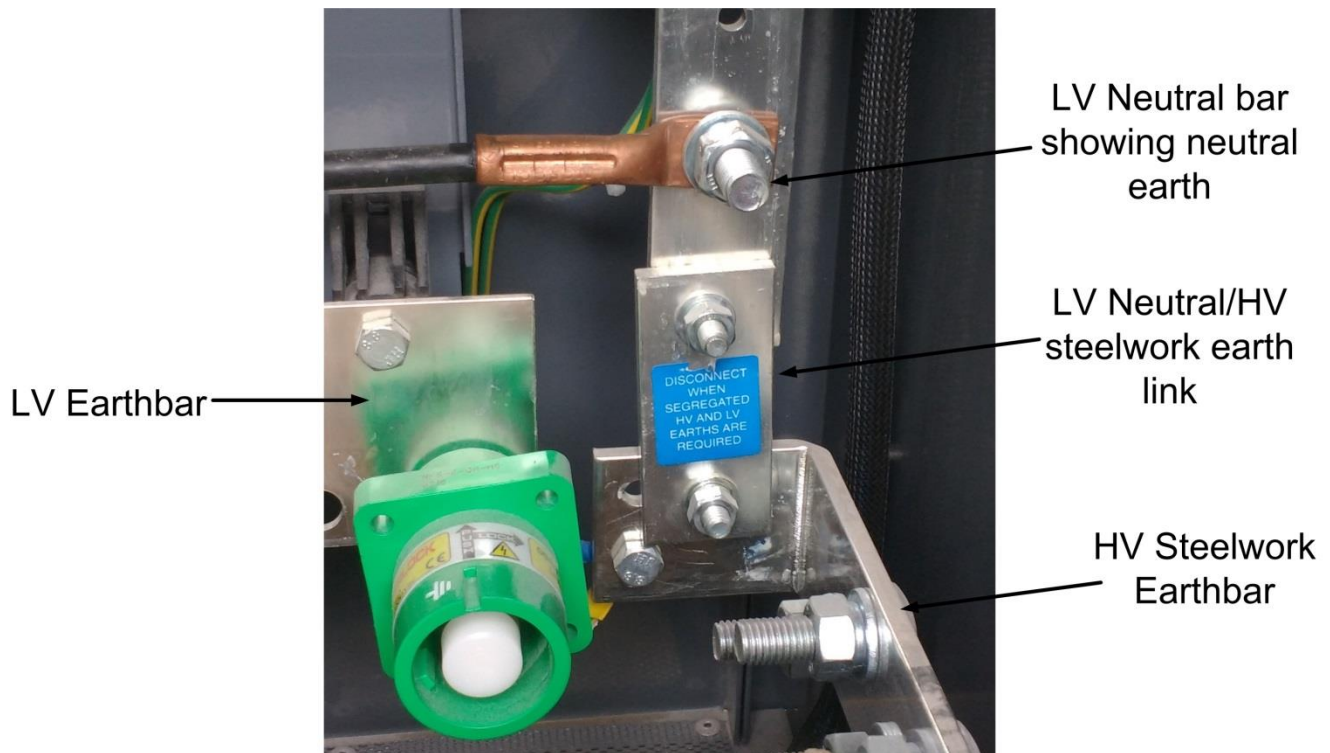
Table 10.2

Resistance of Combined LV and HV earths Ω	Earth Potential Rise V	Link Left In	Link Removed
≤ 1	≤ 430	✓	
≥ 1	≤ 430	✓	
≥ 1	≥ 430		✓
≤ 1	not calculated	✓	
≥ 1	not calculated		✓

- 10.5 Figure 10.1 shows a typical arrangement of an LV Neutral/Earth and HV Steelwork Earth Link. The configuration may be different in other items of plant.

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Figure 10.1



10.6 Table 10.3 gives details of the earthing arrangements for various installations.

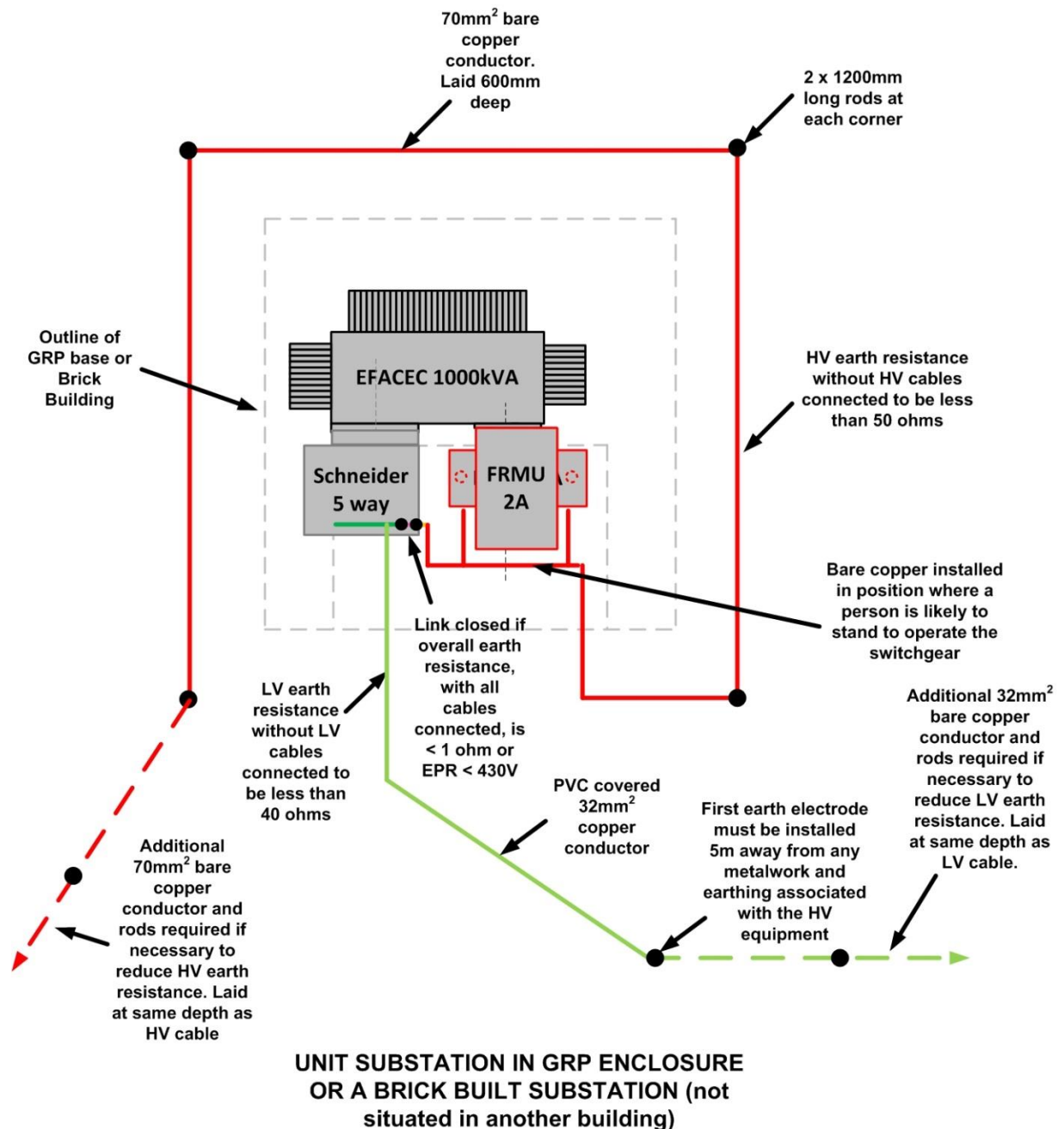
Table 10.3

Figure	Description
10.2	Unit substation in GRP enclosure or within a separate brick building
10.3	Unit substation in fenced site
10.4	Padmount transformer

10.7 The figures shown use typical plant currently available. Other approved designs may have different locations for the earth connections.

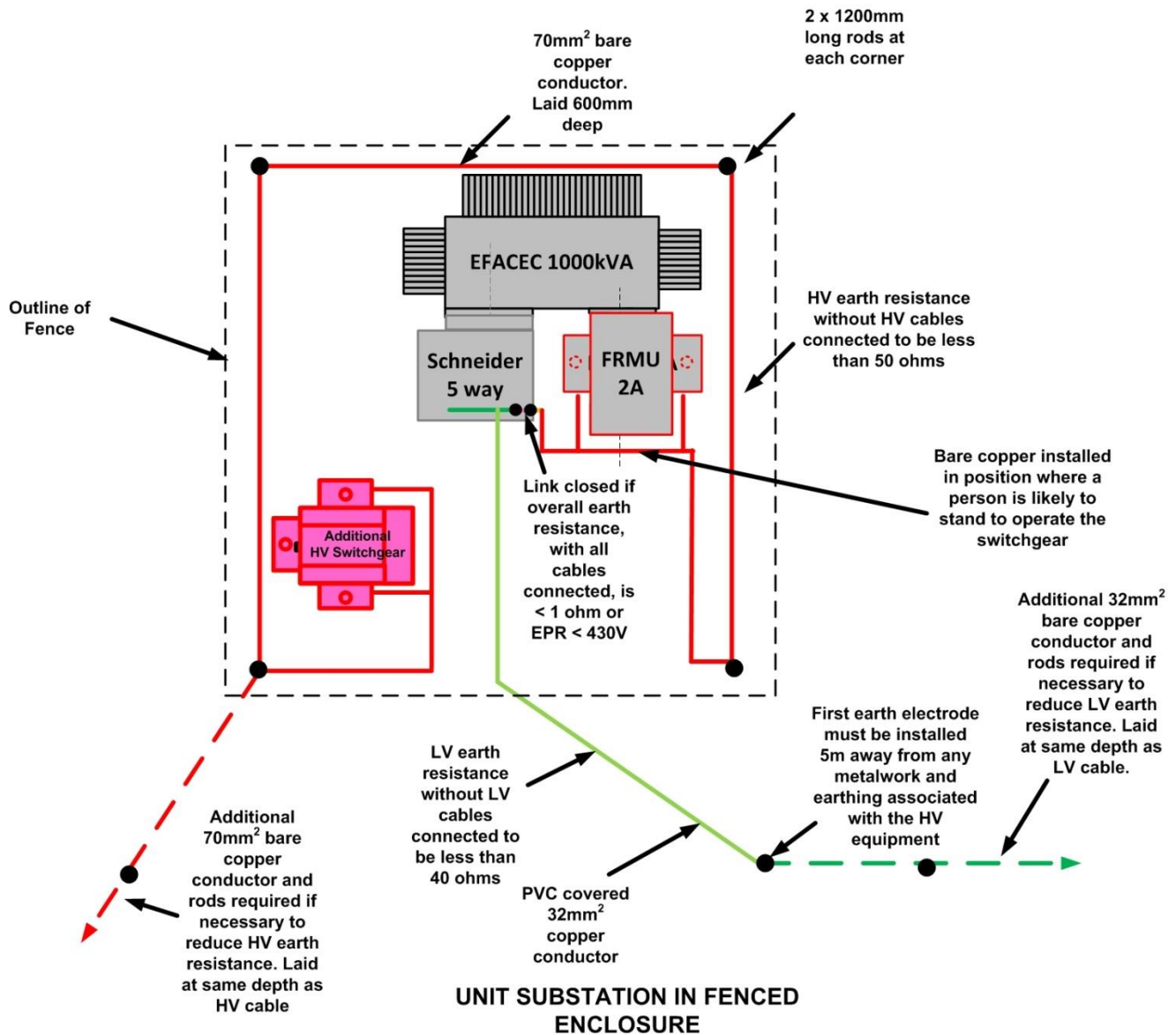
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Figure 10.2



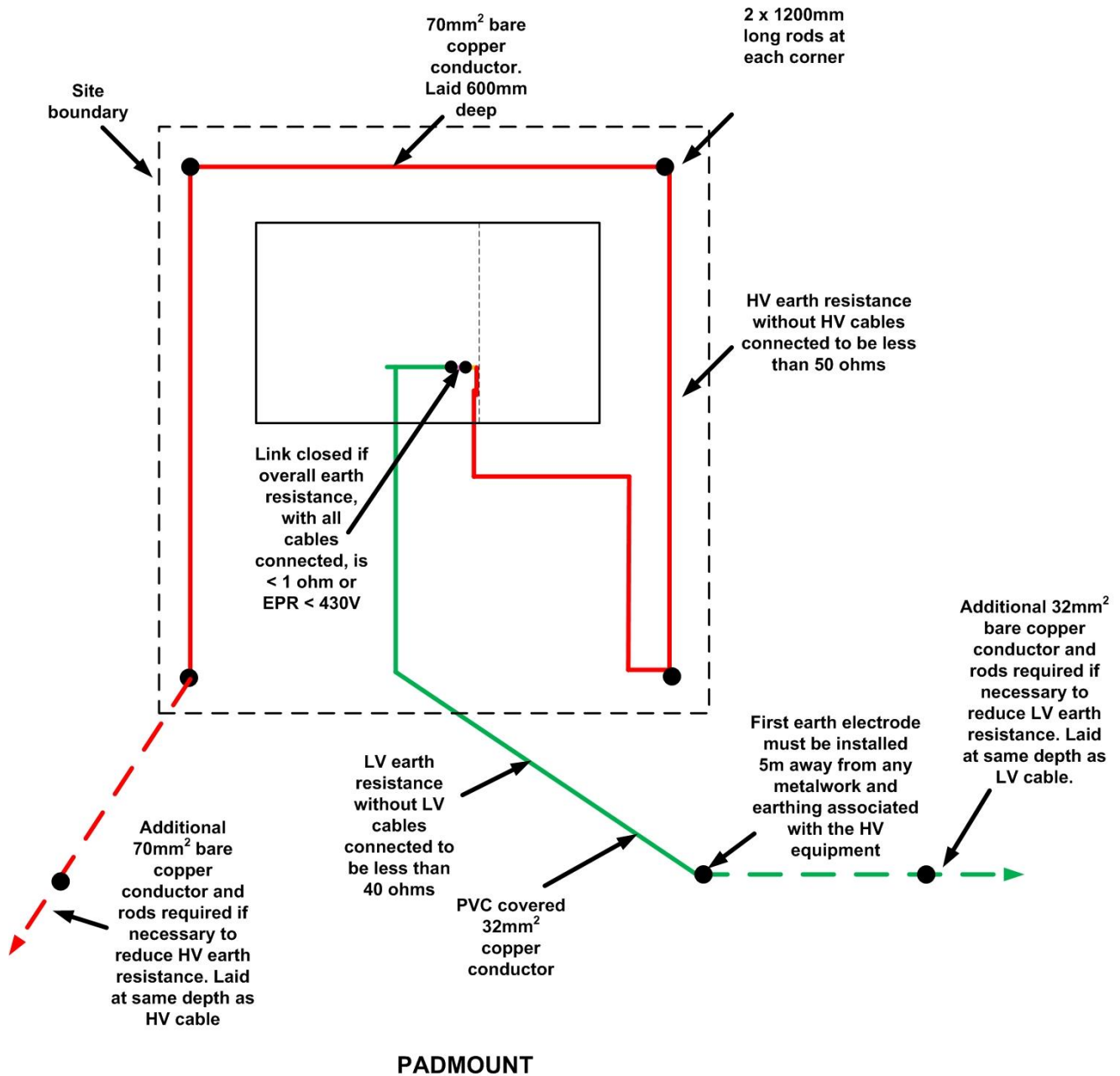
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Figure 10.3



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Figure 10.4



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11 HV Metering

- 11.1 The requirements for meter panels and multicore cables used for HV metering are covered in TG-NET-SST-018.

12 Applicable Standards

- 12.1 Third Parties must obtain copies of non SSEN Standards, such as BS or ENA documents, from the issuing organisations at their own expense. These documents may be subject to copyright.
- 12.2 Documents for use by third parties are classified as Public and are available on the SSEN website, <https://www.ssen.co.uk/competitioninconnections/>
- 12.3 Documents not displayed on the internet are not publicly available as they are deemed not to be needed by third parties. Where third parties require copies of these SSEN documents they can be requested from the SSEN DMS Administrator, Inveralmond House, 200 Dunkeld Road, Perth PH1 3AQ.
- 12.4 There will be a cost of £150 for each copy of each document (irrespective of size). This cost is due to the administration required to ensure that updates to the documents (which are controlled) are sent out to third parties.
- 12.5 Associated Documents
- 12.6 Table 12.1 details the documents used in the compilation of this Design Standard document.

Table 12.1

Document Reference	Document Title	Code
WI-NET-SST-009	Safety, Ownership Signs, Fencing and Security Requirements Applicable to Substations - Design and Installation Standard	D
TG-NET-SST-019	Secondary Distribution Substations - Particular Requirements for Substations Within Building Complexes - Design and Installation Standard	D

13 Revision History

No	Overview of Amendments	Previous Document	Revision	Authorisation
01	Reformatting of document into new template and re-numbered for new substation manual	TG-PS-883	1.00	Matthew Thomas
02	07.12.21 (AS) – Review date amended to maximum allowed, as authorised by Roger Yuile and John Balfour, via email trail received from Derek Paterson dated 11.11.21.	TG-NET-SST-018 (Rev1.00)	1.01	Roger Yuile

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Appendix A Examples of Ground bearing weight requirements for concrete foundations for secondary distribution substations

Base Dimensions = 1.25w x 1.7l x 0.6d

Base volume	= 1.275 m ³
Base area	= 2.125 m ²
Factor of safety on ground	= 1.6
Concrete density	= 2.4T/m ³
Transformer weight	= 7.0T
Weight of concrete = 2.4 x 1.275	= 3.06T
Total weight = 3.06 + 7.0	= 10.6T
Bearing pressure = (10.6 x 1.6)/2.125	= 7.98 T/m ²

For calculations of the soil bearing resistance must be greater than 8T/m²

Base Dimensions = 3w x 1.65l x 0.6d

Base volume	= 2.97m ³
Base area	= 4.95 m ²
Factor of safety on ground	= 1.6
Concrete density	= 2.4T/m ³
Transformer weight	= 7.0T
Weight of concrete = 2.4 x 2.97	= 7.128T
Total weight = 7.128 + 7.0	= 14.128T
Bearing pressure = (14.128 x 1.6)/4.95	= 4.57 T/m ²

For calculations of the soil bearing resistance must be greater than 5T/m²