PR-NET-OSM-073

USE OF HIGH VOLTAGE MOBILE GENERATORS

OPERATIONAL SAFETY MANUAL – SECTION 11.2

Scottish & Southern Electricity Networks

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1 Introduction

1.1 This document details the **Approved** Procedure for the temporary connection and use of **High Voltage Mobile Generator Sets** connected to the Scottish and Southern Electricity Networks Distribution (**SSEN-D**) **System**.

1.2 Adopting a common approach to the use of **High Voltage Mobile Generator Sets** will assist in the safe and efficient transfer of **Generators** and operators between all parts of the Company, particularly in emergencies.

1.3 It should be noted that there will be circumstances where the use of **Mobile Generators** is not practicable due either to operational or safety grounds.

2 Scope

2.1 The scope of this document relates to the temporary connection and use of **High Voltage Mobile Generator Sets** which are under **SSEN-D**'s control, whether owned by **SSEN-D** or hired by **SSEN-D**.

2.2 It applies to situations where **High Voltage Mobile Generators Sets** are required to operate in parallel with the Distribution **System** or to operate as a stand-alone unit.

2.3 The scope of this document does not apply to:

- Permanently connected **Generators**
- Customer owned **Generators**
- **Low Voltage Generators** (See PR-NET-OSM-072 Use of Low Voltage Mobile Generators - Operational Safety Manual – Section 11.1).

3 References

The documents detailed in Table 3.1 - Scottish and Southern Electricity Networks Documents, Table 3.2 - External Documents, and Table 3.3 - Miscellaneous 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-078	Reporting Requirements for Electricity, Safety, Quality, and Continuity Regulations - Operational Safety Manual - Section 12.7
PR-NET-OSM-072	Use of Low Voltage Mobile Generators – Operational Safety Manual – Section 11.1
FO-NET-OPS-056	Mobile Generators: Connection / Disconnection and Environmental Risk Assessment
FO-NET-OPS-062	Form of Consent for Temporary Siting of Mobile Generator-Substation
WI-NET-OSM-002	Personal Protective Equipment and Workwear for Live Environments
PR-NET-OCS-006	Carriage of Dangerous Goods – Networks
N/A	SSEN SHE Handbook (Held in Safety, Health and Wellbeing SharePoint Site)

Table 3.2 - External Documents

Reference	Title
ESQCR	Electricity Supply, Quality and Continuity Regulations (as amended)

NRSWA	New Roads and Street Works Act (as amended)
ENA ER G59	Recommendations for the Connection of Generating Plant to the Distribution Systems of Licensed Distribution Network Operators
ENA ER G99	Requirements for Connection of Generation Equipment
ENA ER G84	Recommendations for the Connection for Mobile Generating Sets to Public Distribution Networks

Table 3.3 - Miscellaneous Documents

Reference	Title
Occupational Safety Manual	This can be found in the Safety, Health and Environmental 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 **Operational Safety Rules**.

4.2 **Generator**

A term describing a prime mover (normally a diesel engine) coupled to an AC Alternator which converts mechanical power into electrical power.

4.3 **High Voltage Generator Set**

The term describing the cumulative apparatus required to generate onto **SSEN**s **High Voltage System**, e.g. **Generator**, Step-up Transformer and associated ancillary **Apparatus**.

NOTE: The term '**Generator**' and '**Mobile Generator'** are interchangeable in this **Approved** Procedure.

4.4 **Mobile Generator**

A transportable **Generator for** temporary connection to the **System**.

4.5 **Portable Generator**

A small **Generator** for supplying small single-phase loads.

NOTE: Commonly referred to as a suitcase **Generator** within **SSEN-D**.

4.6 **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**.

4.7 **Protection**

Function, device or equipment for automatically detecting fault conditions and for initiating operation of **Apparatus** to disconnect the fault conditions.

4.8 **Synchronise**

The act of synchronising the output of a **Mobile Generator** to match the **System** followed by the closing of the circuit breaker to enable both **Systems** to operate in parallel in order for the **Generator** to pick up load either prior to the normal supply being disconnected or providing network support.

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 **Shall** 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.

6.3 **Generators Shall** only be connected, disconnected or operated by suitably **Authorised Persons,** including staff or contractors, who have the specific authorisation to do so as indicated on their Certificate of Operational Authorisation.

6.4 Prior to authorisation, persons must have completed **Approved** training related to the connection, operation (including **Synchronisation**, where relevant), and disconnection of **High Voltage Generator Sets** to the Distribution **System** and have received training in the operation of the specific type(s) of **High Voltage Generator Set** they are to be authorised to connect.

6.5 There are 4 levels of authorisation for **Generators**:

1. **Low Voltage Dead** Operation / Connection
2. **Low Voltage Live** and **Dead** Operation / Connection
3. **High Voltage Dead** Operation / Connection
4. **High Voltage Live** and **Dead** Operation / Connection

6.6 The connection, operation and disconnection of a **Synchronising Generator Shall** require the **Authorised Person** to be authorised for '**Live** Operation / Connection' of **Generators**.

6.7 Where the **Authorised Person** is unfamiliar with the connection and operation of a particular type of **High Voltage Generator Set**, they **Shall** arrange for a suitably competent person, which may include technicians from the **High Voltage Generator Set** hire company, to attend site and provide advice on operating the **High Voltage Generator Set** and its **synchronising** equipment.

7 Personal Protective Equipment

7.1 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.

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

8 General Requirements

8.1 Quality of supply

8.1.1 **Mobile Generators Shall** be able to support the load they are required to supply and to maintain the supply voltage and frequency within the statutory limits

8.1.2 The statutory limits for voltage and frequency are specified in the Electricity Safety, Quality and Continuity Regulations 2002 (as amended):

- **High Voltage**: 11,000V +6% / -6%
- Frequency: 50Hz ± 1%

8.1.3 For an islanded network a slightly wider tolerance is permitted under EN 50160:

- **High Voltage**: 11,000V +10% / -10%
- Frequency: 50Hz ± 2%

8.2 Generator Siting and SHE Considerations

8.2.1 All connections and disconnections of **High Voltage Generator Sets** to **SSEN-D Systems Shall** be carried out in accordance with:

- **SSEN-D**'s **OSR**
- **SSEN-D**'s Occupational Safety Manual, Occupational Health Manual and Environmental Manual

NOTE: The requirements in this **Approved** Procedure address relevant statutory requirements for **High Voltage Generator Sets** stated in The Electricity at Work Regulations 1989 (as amended) and The Electricity Safety, Quality and Continuity Regulations 2002 (as amended).

8.2.2 A **High Voltage Generator Set Shall** be deemed to be part of the Distribution **System** at the time isolation is applied to the **Generator.** This **Shall** be immediately prior to the first cable connection, normally the **Earth**, being made to the Distribution **System**.

8.2.3 A Risk Assessment **Shall** be completed for each connection and disconnection of a **High Voltage Generator Set**. This is to enable site hazards and necessary precautions to be identified, and to ensure safe connection and operation.

8.2.4 An Environmental Risk Assessment **Shall** also be completed for each **Generator** site to assess the environmental impact. This should be recorded on form FO-NET-OPS-056. This form also details the connection and disconnection procedures to be adhered to for **Low Voltage Systems**. The Environmental Risk Assessment **Shall** include details on refuelling the **Generator**, if this is applicable. Requirements for transporting fuel and refuelling **Generators** detailed in the **SSEN-D** Environmental Manual **Shall** be followed.

8.2.5 The land owner's consent, if required, **Shall** be obtained before any **High Voltage Generator Set** is sited. The details of any comments or conditions imposed by the land owner **Shall** be recorded on FO-NET-OPS-062. In the case of a **High Voltage Generator Set** to be connected to restore supplies during a **System** fault, and where it has not been possible to obtain the land owner's consent prior to siting, then the land owner's consent **Shall** be obtained as soon as reasonably practicable thereafter.

8.2.6 If permanently established **High Voltage Mobile Generator Set** connection sites are to be set up, the land owner's consent **Shall** be obtained for their siting and use, and details **Shall** be retained in the relevant **SSEN-D** Depot and noted on the network control system in a site information marker.

8.2.7 All persons **Shall** use **Approved** tools, instruments, connectors and equipment for the connection/disconnection of a **High Voltage Generator Set**.

8.2.8 When siting any **High Voltage Generator Set**, account **Shall** be taken of access required by operators, pedestrians, road users including:

- Safe access for operators
- Access and egress for vehicles
- Any height, weight and width restrictions whilst siting **High Voltage Generator Set**
- Off loading facilities

8.2.9 Due consideration **Shall** be given to ensuring the necessary **Working Clearance** from any nearby overhead lines.

8.2.10 **High Voltage Generator Sets** should be sited in locations where the risks of step and touch potential to members of the public are reduced.

8.2.11 **High Voltage Generator Sets Shall** be positioned to avoid creating unnecessary hazards for staff and / or public. Where this is impractical, suitable control measures **Shall** be employed to prevent **Danger**, e.g. installing road plates to cover cables that could cause tripping etc.

8.2.12 Consideration should also be given to the effects of noise when siting **Generators** near hospitals, residential areas or other sensitive areas, particularly if **Generators** will run during the night.

8.2.13 The use of **Generators** is classified as "Works" under the New Roads and Street Works Act (NRSWA) and appropriate street works notices, signing and guarding **Shall** be provided, as applicable.

8.2.14 **Generators Shall** be positioned on flat or level ground to maximise stability, useable fuel capacity and to ensure engine oil pick up. Generally, the maximum slope should not exceed 15°.

8.2.15 **High Voltage Generator Sets Shall** be positioned with sufficient room around the equipment to allow operation, refuelling and erection of any security fencing. Any vents **Shall** be kept clear of debris.

8.2.16 Prior to connecting a **High Voltage Generator Set** to the **System** or starting a **High Voltage Generator Set**, delimiting and or supervision should be arranged such that the general public and all non-essential staff are kept clear of any part of the **Generator**, **High Voltage** or **Low Voltage** leads, **Earth** connections, **Earth** spikes, etc.

8.2.17 When selecting a site for a **High Voltage Generator Set**, the following issues **Shall** be considered and, if necessary, control measures **Shall** be recorded in FO-NET-OPS-056:

- Size/rated power output of **High Voltage Generator Set** required
- Ease of access for **Plant**, equipment and any delimiting
- Noise consideration in residential areas
- Connection arrangements
- Arrangements for limiting unauthorised access
- Availability of a suitable **Earth**, or the practicalities of establishing any temporary **Earthing**

8.2.18 If a **High Voltage Generator Set** is to be left connected and unattended while in operation, then a risk assessment **Shall** be carried out to determine the hazards and **Dangers** of the site and whether an operator must remain on-site during running. The following list gives situations where an operator could be required to remain on site:

- When the **High Voltage Generator Set** is being used in a location where there is a likelihood of vandalism or theft
- When the connection of the **High Voltage Generator Set** leads to the **High Voltage** Distribution **System** would present a greater **Danger** or increased risk to any person entering the temporary substation, or delimited area around a **High Voltage Generator Set**, whether Authorised to do so or not
- When multiple **High Voltage Generator Sets** are connected in large **High Voltage** installations
- Where the presence of the **High Voltage Generator Set** would create a significant safety risk to the general public if not attended

This list is not exhaustive and there could be other situations, where an operator could be required to remain on site.

8.2.19 Any **High Voltage Generator Set** that is to be left unattended **Shall** be inspected at least once in every 24-hour period to ensure that any problems that could occur with the equipment, such as fuel leaks or vandalism, can be detected as soon as is reasonably practicable. If the **Generator** requires to be refuelled within the 24-hour period, no additional inspection is required. The inspection **Shall** include a check of all connections, both to **Earth** and the **System**, and to check for any external fuel leaks.

8.3 Procedures, Documents and Records

8.3.1 The following procedures **Shall** be kept with a **High Voltage Generator Set** and be available to any operator.

- An operating procedure; which **Shall** include pre-start checks, starting instructions, instructions to **Synchronise** (if necessary), running checks, stopping instructions and use of the emergency stop facility. These procedures will not be controlled documents, but **Shall** be updated as necessary if changes are made to the operation or controls on the **High Voltage Generator Set**.

8.3.2 The following documents and records **Shall** be kept:

- A log detailing the number of hours run
- A simple line diagram of the unit showing all switchgear, fuses and points of isolation (where fitted). If it is deemed necessary to avoid **Danger** and facilitate the safe use of the **High Voltage Generator Set**, the diagram **Shall** be kept with the **High Voltage Generator Set**
- A maintenance log sheet, which should also include details of cable repairs and testing
- Date of the last safety test of the **High Voltage Generator Set**
- Date and details of the last **Protection** test of the necessary equipment

8.3.3 Details of the procedures, documents and records required for hired **High Voltage Generator Sets** are contained within the **SSEN-D** Procurement Team document, TS-242 section 4.

9 Connection and Operation of High Voltage Generator Sets

9.1 Generator Leads and Connectors

9.1.1 Prior to use, all **High Voltage Generator Set** leads and connectors **Shall** be examined for any defects. Any lead or connector found to be defective **Shall** not be used until a permanent repair has been carried out.

9.1.2 All leads and connectors **Shall** be phase identified and visually examined to verify their phasing and physical integrity prior to connect An Insulation Resistance (IR) test **Shall** be carried out prior to connection.

9.1.3 Leads **Shall** not be run through metal fences or tied together using metal cable ties.

9.1.4 **High Voltage Generator Set** leads **Shall** be removed from drums, uncoiled and neatly laid out to avoid undue heating and loops in the cable run.

9.1.5 All **High Voltage Generator Set** leads **Shall** be protected from mechanical damage and supported as necessary. Any cables laid in the public highway or an area accessible to the general public **Shall** be suitably protected. to prevent **Danger** to the public and operators.

9.1.6 Screened single core **High Voltage Generator Set** leads **Shall** only have a screen connection to **Earth** at one end to prevent circulating currents. This will normally be at the **High Voltage Generator Set** end.

9.1.7 Notices **Shall** be fitted to highlight silent running mode.

CAUTION: Generator leads can be **Live** both from the **Generator** and from the **System**.

9.1.8 Larger **Mobile Generators**, typically those with a rated power of 500kVA and above, should be connected using all the multiple **Generator** leads per phase, which are supplied with the **Generator**, to supply its rated power output. Only in exceptional circumstances, where it is not practicable to use all **Generator** leads, may less than the supplied number per phase be used. In this case, the **Generator** output should be suitably down rated to avoid overloading the **Generator** leads and advice should be sought regarding alteration of overload and **Protection** settings.

9.1.9 Care **Shall** be taken not to cross **Generator** leads from different phases. The colour coding at both ends of each **Generator** lead **Shall** be the same and **Shall** be verified prior to use.

NOTE: Colour coding of **Generator** leads assists in prevention of crossing any leads.

CAUTION: When connecting to, or disconnecting from, a **Live System**, the other leads will be **Live** by virtue of the first connected, or any that remain connected

9.2 Connection Sequence

Generator leads **Shall** be connected to the **Generator** and then to the **System** in the sequence, **Earth**, Neutral, phases.

9.3 Earthing Connections

9.3.1 Correct earthing is essential to ensure the safe operation of **High Voltage Generator Set**. If it is not possible to obtain a suitable **Earth** for a **High Voltage Generator Set**, then the **High Voltage Generator Set Shall** not be connected.

9.3.2 Separate **Low Voltage System Earths Shall** not be used as an **Earth** for a **High Voltage Generator Set**. The staff on site are responsible for making the final decision as to whether a **High Voltage Generator Set** is connected or not.

9.3.3 In most cases it will be possible and acceptable to use any existing **System Earth** for **Earthing** of a **High Voltage Generator Set**. However, if the **High Voltage Generator Set** is being used to supply customers due to the unavailability of part of the normal Distribution **System,** there could be a risk that the **Earthing** of that part of the **System** to be supplied by the **High Voltage Generator Set** could have been disturbed. In such cases temporary **Earthing** should be installed to ensure the **High Voltage Generator Set** is suitably **Earthed** to provide adequate **Earth** fault **Protection**.

9.3.4 If connecting a **High Voltage Generator Set** at a Ground Mounted Distribution, there is no requirement to measure the existing **High Voltage System Earth** to determine its value. The **High Voltage Generator Set** may be connected to the **High Voltage System Earth** for the substation. In all other situations, for example, pole-mounted substations and temporary **High Voltage** Generation connection points, the **Generator Earth** resistance value **Shall** be measured and, if required, reduced to less than 50Ω. In this case, the **Generator** may then be connected to the measured **High Voltage Earth**.

9.3.5 All **Generators Shall** have separate neutral and **Earth Conductors**. The use of a combined neutral / **Earth Conductor** is deemed unsafe because of the risk that can arise if this single **Conductor** fails. As the **Earth Conductor** will form a parallel path with the neutral **Conductor** it should have an appropriate current carrying capacity. A 'token' **Earth** electrode **Shall** not be used as a substitute for this separate **Earth Conductor** as it could give rise to **Danger**.

9.4 Protection

9.4.1 Where a **High Voltage Generator Set** is connected in the absence of a normal **System** supply it **Shall** be equipped with **Protection** to ensure, so far as reasonably practicable, that the **System** voltage and frequency are maintained within statutory limits (see 8.1.1).

9.4.2 The **High Voltage Generator Set Shall** also be equipped with **Protection** that disconnects the **High Voltage Generator Set** in the event of a fault occurring in the **System** being supplied.

9.4.3 As a minimum, **High Voltage Generator Sets** should be equipped with the **Protection** required for **High Voltage Generator Sets** as detailed in Table 9.1 of this **Approved** Procedure. All **SSEN-D High Voltage Generator Sets Shall** be fitted with **Protection** which meets these minimum requirements.

9.4.4 Where a **High Voltage Generator Set** is only intended to operate in parallel with the **System** whilst load is being transferred from the **System** to the **High Voltage Generator Set**, then no additional **Protection** is required. However, **System** operating procedures **Shall** ensure that the transfer is completed within the shortest practicable time. In this case auto-reclose functions may be left in service on pole-mounted and ground-mounted circuit-breakers, providing the **High Voltage Generator Set** is fitted with overload **Protection**.

9.4.5 Any **High Voltage Generator Set** required to operate in parallel with the **System** for a sustained period **Shall** be equipped with:

- Loss of mains **Protection** complying with Engineering Recommendation G59 or G99 as appropriate
- Over-excitation **Protection** to prohibit excessive heating of the alternator

9.4.6 All **High Voltage Generator Set Protection Shall** be subjected to routine testing at least once every two years, to ensure that it continues to operate within specification. Records **Shall** be kept of any routine Protection testing.

9.4.7 Prior to supplying customers from any **High Voltage Generator Set**, a functional test of the **Protection** system(s) and related equipment should be carried out when at site. The functional test **Shall** include manual operation of the trip or emergency stop button to confirm correct operation.

9.4.8 Where it is necessary to temporarily switch off any G59 or G99 **Protection** fitted to the **Generato**r, to enable the **Generator** to **Synchronise** with the **High Voltage** network, the G59 or G99 **Protection Shall** be switched back into service either once the **Generator** is supplying the network or when it is running in parallel.

9.4.9 **High Voltage Generator Sets Shall** be fitted with overcurrent and **Earth** fault **Protection**.

9.4.10 All **Protection** relays intended for the **Protection** of **High Voltage Systems Shall** be of a standard not less than that required to satisfy the requirements of the Energy Networks Association (ENA) **Protection** Panel.

9.5 Phase Rotation

9.5.1 At three-phase installations the phase rotation **Shall** be checked, where practicable, prior to the disconnection of the normal supply and after the installation of the **High Voltage Generator Set** but before any three-phase equipment is used.

9.5.2 If this is not practicable, then any three-phase equipment or three-phase customers **Shall** be **Isolated** and, with the **High Voltage Generator Set** supply connected, the phase rotation **Shall** be checked at a suitable point, such as a three phase transformer or within an installation prior to energising three-phase equipment or customers.

9.6 Parallel Operation

9.6.1 If a **High Voltage Generator Set** is to remain connected in parallel with a **High Voltage System**, the operator **Shall** ensure that the G59 or G99 or “loss of mains” **Protection** is switched on.

9.6.2 **High Voltage Generator Sets** might be synchronised onto the **High Voltage System**, but if they become islanded then no parallel **Shall** be remade using a **High Voltage Generator Set**, as no facilities exist for **Synchronising** across the **High Voltage** open point created on the **System**. In this case, the **High Voltage System** fed from the **High Voltage Generator Set Shall** be switched-off and re-energised from the original source.

9.6.3 As **High Voltage Generator Sets** are normally connected in parallel with a **High Voltage System** for voltage support, the **Generator** should be loaded to not more than 80% of the **High Voltage Generator Set** rated power output. This will allow the **High Voltage Generator Set** a safety margin within which it can operate and accept some additional load due to frequency shifts on the **High Voltage System**. Care **Shall** also be taken to ensure that any VArs are minimised. Failure to do so could result in alternator failure due to overheating.

9.6.4 Any power factor correction equipment or large motors on the **High Voltage System Shall** be disconnected or remain switched-off during the time the **High Voltage Generator Set** is in use.

Table 9.1 - Protection Requirements for Mobile Generators Supplying Distribution Networks

RECOMMENDED PROTECTION	MODE OF OPERATION						SUGGESTED SETTINGS (Note 1) * Main protection requirements
	INDEPENDENT OR TRANSFER PARALLEL			PARALLEL WITH NETWORK			
	Portable Generating Set	LV Generation set	Step-up Unit	Portable Generating Set	LV Generation set	Step-up Unit	
Residual Current Device	*			N/A			30mA
Overvoltage		*	*	N/A	*	*	253V, 5 s (Max. setting 253V. Max. 8 s)
Undervoltage		*	*	N/A	*	*	216V, 5 s (Min. setting 216V. Max. 8 s)
Overfrequency		*	*	N/A	*	*	50.5Hz, 5 s (Max. setting 57.5Hz. Max. 8 s)
Underfrequency		*	*	N/A	*	*	49.5Hz, 5 s (Min. setting 42. Hz. Max. 8 s)
G99 Overvoltage				N/A	*	*	262V, 0.5 s (Note 2)
G99 Undervoltage				N/A	*	*	207V, 0.5 s (Note 2)
G99 Overfrequency				N/A	*	*	50.5Hz, 0.5 s
G99 Underfrequency				N/A	*	*	47Hz, 0.5 s
G99 Loss-of-mains				N/A	*	*	1.0Hz/s, time delay 0.5s (Note 3)
LV Overcurrent	*	*	*	N/A	*	*	1.2 x FLC, Thermal 7xFLC, Inst. (Note 4)
HV Overcurrent			*	N/A		*	1.3 x FLC, 0.2TM (Note 5)
LV Earth Fault			*	N/A		*	0.75 x FLC, 3 s
HV Earth Fault			*	N/A		*	0.3 x FLC, Inst.
NVD (Note 6)			*	N/A	*	*	30V, 0.125TM (Note 7)
Reverse power (if fitted)		*		N/A	*		10% - 15% of rated power (Note 8)

NOTE 1: In some instances, it may be necessary to employ a setting other than the suggested setting (e.g. in order to avoid nuisance tripping) or to take account of different network configurations. In all cases the setting should not exceed the limits shown.
NOTE 2: These settings are based on 230 V nominal with +14% and -10%. It should be remembered that G99 [N17] protection is not provided in order to maintain statutory voltage limits.
NOTE 3: The RoCoF settings are a balance between the need to detect genuine conditions and the risk of unnecessary operation for the system conditions anticipated in the future from changes in the generation mix connected to DNO networks.
NOTE 4: Inst value based on data in ENA EREC Table D1. Brushless alternators may supply lower short circuit currents and a value of 3 x FLC, may be more appropriate for such units.
NOTE 5: The time multiplier of 0.2 is based on the use of a relay with a “standard inverse” characteristic.
NOTE 6: Neutral Voltage Displacement (NVD) protection required where high impedance earthing is employed, or where specified by the user.
NOTE 7: The setting of 30 V is based on the use of 11 000/110/63.5V VT with an open delta tertiary winding and an 11 kV network protected by 30 A fuses and EIDMT relay.
NOTE 8: Refer to Clause 5.5 for more information.

10 Use of High Voltage Generator Sets at Grid or Primary Sites

10.1 General

10.1.1 This section details situations where **High Voltage Generator Sets** are used to supply **High Voltage Systems**, which are normally supplied from primary substations, using **High Voltage Generator Sets** capable of supplying full load and maintaining frequency.

10.1.2 Wherever possible the **High Voltage Generator Set** should be positioned adjacent to the connection point on the **High Voltage System** to keep the **High Voltage Generator Set** leads to a minimum length and to enable use of the existing **High Voltage Earth** at the substation.

10.2 Operational Safety

10.2.1 The on-site Risk Assessment **Shall** identify the **SSEN-D** site supervisor for the connection and disconnection of the **High Voltage Generator Set**. This person **Shall** be a **Senior Authorised Person**, Authorised for **High Voltage** connection and disconnection.

10.2.2 The **SSEN-D** site supervisor **Shall** be responsible for ensuring implementation and maintenance of any safety precautions required during the work to connect and disconnect the **High Voltage Generator Set**. This includes issuing and cancelling any **Safety Documents** and issuing the warnings as detailed in this procedure.

10.2.3 The **SSEN-D** site supervisor **Shall** ensure that all safety precautions not yet in place for other work have been implemented prior to the **High Voltage Generator Set Earth** lead being connected to the **High Voltage Earthing System**. This is due to the risk of a rise in **HV Earth** potential in the event of a fault either at the **High Voltage Generator Set**, or elsewhere on the **HV System**. These precautions might include establishing a Limited Access Area, a Prohibited Access Area and the wearing of appropriate PPE.

10.2.4 Whether the **High Voltage Generator Set** is owned by **SSEN-D**, or hired from a contractor or hire company, the **SSEN-D** site supervisor **Shall** be responsible for implementing and maintaining any safety precautions required.

10.3 Earthing

10.3.1 Correct **Earthing** of the **High Voltage Generator Set** is vital to ensure the safety of all customers supplied by the **High Voltage Generator Set**. Under no circumstances should a **High Voltage Generator Set Earth** be connected to any **Low Voltage System Earth**.

10.3.2 The **High Voltage Generator Set** should be sited as close as possible to the connection point.

10.3.3 If connecting a **High Voltage Generator Set** at a Grid or Primary substation, there is no requirement to measure the existing **High Voltage System Earth** to determine its value. The **High Voltage Generator Set** may be connected to the **High Voltage System Earth** for the substation.

10.3.4 An exclusion zone of 2m **Shall** be placed around a **High Voltage Generator Set** due to the risk of creating a potentially fatal "touch potential" between the operator and the ground If there is a fault on the **System** , and:

- The **Generator Shall** be fenced off due to creation of a "hot site"
- External fuel tanks or containers within the exclusion zone **Shall** be bonded to the **High Voltage Generator Set**. Where tanks are situated outside of the exclusion zone

to allow refuelling they **Shall** not be bonded to the **Generator Earth** but have an electrical break in any steel reinforced hoses

- Dielectric safety footwear **Shall** be worn for all persons within the exclusion zone around a **High Voltage Generator Set**

10.3.5 The requirement of clause 10.3.4 (Bullet Point 1) to fence off the **Generator** may be removed if a risk assessment is carried out, detailing sufficient control measures to minimise **Danger**, to include:

- The **Generator Shall** be in a remote location, not readily accessible to the public
- The **Generator** and its immediate surrounding area **Shall** be supervised at all times it is connected to the **System** by a suitably **Authorised Person**
- Alternative methods should be considered to identify the hot zone, e.g. barriers and **Danger Notices**
- The **High Voltage Generator Set Shall** not be unfenced for a period longer than 4 hours during normal working hours, or 8 hours outside normal working hours

11 Revision History

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

Appendix A On Site Refuelling of High Voltage Mobile Generator Sets

1. The requirement to refuel a **Generator** on-site should be reduced, as far as practicable, by minimising periods of operation, requesting **Generators** with larger fuel tanks, or using separate on-site bulk fuel tanks.
2. When a **High Voltage Generator Set** is being sited, consideration should be given to refuelling requirements.
3. When refuelling a **Generator** where the bulk fuel tank is situated inside the limited access area. The fuel tanker **Shall** be bonded to the main **Earth** connection prior to the insertion of a fuel pipe or fuel line.
4. When refuelling a **Generator** where the bulk fuel tank is situated outside the limited access area. The fuel tanker **Shall** be connected to the **Generator** using an insulated fuel pipe or an insulated insert in the fuel line.
5. If integral fuel tanks are used great care **Shall** be taken when refuelling due to the touch and step potentials in the vicinity of the units
6. Operators involved in refuelling activities must wear appropriate PPE , including dielectric footwear, and, if not Authorised, must be supervised by a suitably Authorised **Senior Authorised Person**
7. Any on site fuel tanks positioned within the exclusion zone **Shall** be bonded to the **High Voltage Generator Set Earth**.
8. If due to the length of time a **Generator** will be running it will be necessary to refuel the **Generator** on more than two occasions, then a Risk Assessment **Shall** be made as to whether an extended running tank should be used to decrease the risk of fuel spillage during multiple refuelling.
9. If on-site refuelling of is required, the following conditions **Shall** apply:
    - All transportation of fuel **Shall** comply with the current Carriage of Dangerous Goods Regulations, as detailed in PR-NET-OCS-006
    - Wherever possible, fuel **Shall** only be transported in Intermediate Bulk Containers, road tankers or similar
    - An oil spill response kit **Shall** be available on site during refuelling operations
    - The operator **Shall** have been trained in the refuelling procedure, which also specifies the requirements for deploying any oil response material before refuelling starts based on the Environmental Risk Assessment
    - Refuelling can be carried out by one person using powered pumps, providing all the following conditions are met:
        - The fuel delivery nozzle **Shall** be fitted with automatic shut-off valves, which **Shall** be in working order
        - The delivery nozzle **Shall** operate on a "dead man" principal and **Shall** not be fitted with any means of keeping the delivery valve handle in the open position
        - The operative **Shall** be able to see the **Generator** fuel tank sight glass / gauge from the tank filling point and have easy access to any shut-off valve on the refuelling tank

- The operator **Shall** check the fuel delivery hose is free from defects or leaks before commencing refuelling

10. If any one of the above conditions cannot be met, or if refuelling is done by means of hand-operated pumps, the refuelling must be carried out by two people.

11. When refuelling:

    1) Before leaving the Depot carry out the normal vehicle safety checks, including fire extinguishers and ensure the oil spill response kit is complete. Replace any missing items

    2) Park as close to the **Generator** as practicable but with consideration for the safety of other road users. Use warning beacons and/or road signs as required

    3) Check the **Generator** is operating normally and there are no signs of interference

    4) Always place oil spill absorbent material down at the fill point of the **Generator** to catch any spillage

    5) Check the spill response kit is readily accessible

    6) Run out the refuelling hose to the **Generator**

    7) Check you can determine the fuel tank level to avoid overfilling

    8) Start the bowser pump and commence refuelling

    9) Do not jam the nozzle trigger in any way and never leave the filling point unattended

    10) When refuelling has been completed, stow away the hose. Recover the oil spill absorbent material and confirm the site is clean

    11) Where automatic engine lube gear is fitted to the **Generator**, check and top up conservator tank as required

    12) Advise the **Generator** Booking team of any abnormalities