Company Standard

Conditions Governing Connection to the Distribution System at Medium Voltage

Connections at MV and 38kV

Embedded Generators at LV, MV and 38kV

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Contents

Foreword

This document is referenced in the Distribution Code and sets out requirements for Customer equipment at the interface between the Distribution System and the Customer's installation.

For interface arrangements at low voltage please refer to the National Code of Practice for Customer Interface 4thd Edition 2008.

1 Introduction

i. Scope

This document applies to demand installations connected to the Distribution System (users of category A, B1 and B2 in the Distribution Code). It applies to connections at MV and 38kV and Embedded Generators at LV, MV and 38kV.

It replaces documents previously known as:

- Conditions Governing Electricity Supply at Medium Voltage
- Conditions Governing Connection to the Distribution System:
  Connections at MV and 38kV
  Embedded Generators at LV, MV and 38kV
- Conditions Governing Electricity Supply at Medium Voltage using dedicated Dual Radial Incomers
- Conditions Governing Electricity Supply at 38kV
- Requirements for Connection of Generators to ESBN Distribution Network

ETCI are currently developing requirements for LV, MV and 38kV connections, should there be any conflict between this document and documents produced by ETCI, ETCI documents shall prevail.

ii. Associated Documentation

Documents associated with these conditions are:

- Distribution Code
- National Code of Practice for Customer Interface 4thdEdition 2008.
- S.I. No. 299 of 2007 Part 3 . A Statutory Instrument i.e. government legislation.
- Conditions Governing Connection to the Distribution System 2012 DTIS-250701-BDW
- Guide to the Process for Connection to the Distribution System.

  It is anticipated that this document will be superseded in time by additions to the Distribution Code and to the National Code of Practice.

Please note:

- Where there is a conflict between these conditions and the Distribution Code, the Distribution Code will prevail.

2 Incomer Circuit Breaker

Table 2A: Customer's MV/38kV Main Incomer Circuit Breaker Requirements

No.	Item	Requirement			
1.	**Standard**	**IEC 60056 or equivalent**			
2.	**Rated Voltage**	**MV**	**24kV**		
		38kV	**52kV**		
3.	**Insulation Level**	**MV**	**Power Frequency**	**50kV** rms	
			Impulse Level 1.2/50μS	**125kV** peak	
		38kV		Phase-Phase & Phase-Earth	Across isolating distance**
			Power Frequency	**95kV** rms	**110kV** rms
			Impulse Level 1.2/50μS	**250kV** peak	**290kV** peak
4.	**Short Circuit Rating (RMS Symmetrical)** Always confirm with ESBN	**MV and 38kV (Normally)**		**12.5kA**	
		MV and 38kV (Designated Areas)*		**20kA**	
		MV Dual Radial		**20kA**	
5.	**Rated Frequency**	**50Hz.**			
6.	**No. of Poles**	**3**			
7.	**Earthing Switch**	**Capable of short-circuiting and earthing the ESBN main incomer cable** For single Circuit Breaker connections an earthing switch is required on the incoming and outgoing sides of the Circuit Breaker.			
8.	**Interlocking**	**Between Earthing Switch and Circuit Breaker such that the circuit breaker cannot remake onto a circuit without first removing the earthing mechanism**			
9.	**Locking**	**Lockable in 'OFF' position with ESBN danger lock** (7mm. minimum diameter hole)			
10.	**Visible point of Disconnection**	**If the Main Incomer Circuit Breaker, does not contain a visible break in the circuit, for example, is not withdrawable, the following additional requirements shall apply.**			
		Insulation Level		Phase-Phase & Phase-Earth	Across isolating distance**

		MV	**Power Frequency**	**50kV** rms	**60kV** rms
			Impulse Level 1.2/50μS	**125kV** peak	**145kV** peak
		Tests on the kinematic chain associated with the disconnector and earthing switch, shall be carried out in accordance with Annex A of IEC 62271-102. These tests shall be carried out by a recognised test laboratory. Copies of certification must be made available to ESBN on request.			
		Conformance with IEC 62271-102 Clause 5.502			

***Designated Areas** are within Dublin and Cork Cities and similar areas where the fault level could rise above 12.5kA because of the strength of the electrical network in that particular area.

On request, ESBN will confirm the fault level for the Customer by carrying out the required calculations taking into account the contribution of the Customer's proposed system.

**Applies to the disconnector, if separate from Circuit Breaker

Table 2B: Additional Interlocking Requirements in Embedded Generator Installations

No.	Mode	Requirement
1.	**Interlocking**	**Manual closing of either the generator circuit breaker or the main incoming circuit breaker circuit breakers shall be disabled when either the ESBN or generator source is live.** **In the exceptional circumstances of loss of either supply source and the generator LV control system, manual closing may be re-enabled, while having due regard to the consequences of unsynchronised paralleling**
		Interlocking shall prevent closure of interconnecting switchgear when both the generator and ESBN sources of supply are dead. It shall only be possible to close onto a dead busbar when either ESBN or generator source of supply is isolated
		It shall not be possible for the generator circuit breaker or the main incoming circuit breaker to close or to remain closed unless all three phases of the mains supply are normal.

Table 2C: Additional requirements for Dual Radial connections

No.	Item	Requirement
1.	**Busbar**	**The customer's main MV busbar to be located in a room immediately adjacent to the ESBN terminal station. The customer's busbar will consist of two sections with a Normally Open coupler. The two ESBN incomers will be terminated on opposite sides of the busbar and adjacent to the coupler.**

2.	**Interlocking**	**The customer will provide an electrical interlock between ESBN incomers and coupler so that no more than two out of three circuit breakers are closed for more than a 10s momentary interval.**

3 Earthing Switch

Table 3: Customer's Main Incomer Circuit Breaker Earthing Facilities Requirements

No.	Facility	Requirements
1.	**Earthing Switch**	**Capable of short-circuiting and earthing the ESBN main incomer cable**
2.	**No. of Poles**	**3**
3.	**Short-Circuit Withstand**	**≥ Circuit Breaker**
4.	**Locking**	**Lockable in 'ON' and 'OFF' positions with ESBN danger lock** (Minimum diameter hole = 7mm)
5.	**Interlocking with Circuit Breaker**	**Circuit breaker cannot remake onto a circuit without first removing the earthing mechanism**

4 Protection

4.1 Incomer Protection

For customers with generation additional requirements apply – see section 4.2.

Table 4A: Isolation and Maximum Permitted Relay Settings

No.	Item	Provided by	Requirement
1.	**Isolation of ESBN equipment from Customer's equipment**	Customer	**Customer to provide a means of isolating ESBN equipment in the event of a fault on the Customer's equipment.**
2.	**Max. Permitted Relay Settings on Main Incomer CB**	ESBN	**ESBN determined settings on the Customer's relay are necessary to provide selectivity with ESBN Distribution protection.**
3.	**Relay Settings on Main Incomer CB**	Customer	**The Customer determines the optimal settings on the Customer's Main Incomer protection relay appropriate to the installation. These may not exceed the maximum settings permissible as advised by ESBN (see Row 2. above)**

Table 4B: Protection Requirements

Item	Protection Type	Plant	Requirement	
Main Incomer CB's	Overcurrent	CTs	Standard	IEC 60044 or equivalent
		Relays	Standard	A, B and C of IEC 60255.
			Min. no. of elements	3
			Sensitivity	50AMPS @ MV
	Earth Fault	CTs and VTs as required	Standard	IEC 60044 or equivalent
		Relays	Standard	A, B, C and DT of IEC 60255
			Min. number elements	1
			Sensitivity	2AMPS @ MV

Table 4C: Protection Requirement

No.	Facility	Requirement
1.	Directional SEF	Required where Sensitive Earth Fault(SEF) is applied at the main incomer circuit breaker and the Customer's network could contribute more than 2 Amps of Earth Fault current
2.	Protection CTs	Individual phase CTs for overcurrent protection may be fitted on ESBN incoming cable, provided that they are: ❑ encapsulated in the switchgear ❑ of solid resin block type ❑ mounted directly below the main incomer circuit breaker If a core balance CT is required to achieve the earth fault sensitivity specified above, then it may be fitted to ESBN incoming cable, provided that: ❑ the terminations comprise bolt-up tees or other such facility, whereby the cables and terminations are completely safe to touch, even when energised, with the cover removed. or ❑ interlocking is in place such that access to the incomer cable chamber can only be gained, if the incomer CB is open and earths applied to the incomer cables.
3.	Core Balance CTs	Required where SEF is installed.
3.	CT Shorting Links	Required on CTs
4.	Customer's Protection Scheme	To take account of the main incomer circuit breakers maximum permissible relay settings
5.	Protection VTs	Individual phase VTs for voltage measurement or directional protection shall not be fitted on the ESBN incoming cable, unless they are providing voltage measurements for the Embedded Generator Interface Protection

4.2 Embedded Generator Interface Protection (EGIP/G10)

Generator interface protection is designed to disconnect the generator from the ESBN during abnormal system conditions by tripping a dedicated circuit breaker or recloser, located as close as practically possible to the interface between the IPP equipment and the ESBN distribution network. See section 4.4 for possible variations in the target circuit breaker in some cases.

The objective of generator interface protection is to preserve the safety of ESBN personnel, the general public and avoid damage to the Distribution system.

This protection is in addition to and separate from the generator protection and other protection fitted by the installer to protect the customer's personnel and installation.

Table 4D: Additional Requirements for Embedded Generator Installations –Generator Interface Protection Devices

No.	Device	Requirement
1.	Protection Devices	Independent of other equipment and protection.
		Located in a separate and secure compartment
		Relays configured by ESBN must not have their configuration altered without written ESBN permission.
		Both a Primary and a Secondary (back-up) Circuit breaker is required per installation
		Comply with IEC Standard 60255
		Protection Relay types specified by ESBN
		Be electronically set relays of Protection Grade
		Relay Elementaries available on request from egipwitnesstesting@esb.ie
		Accessible from ground level
		Clearly identified
		Monitor installation at ESBN Distribution Connection Voltage (unless otherwise agreed by ESB).
		Monitor Line Voltage for Under and Over Voltage protection
		Fail safe operation In the event that the Load Shedding Controller or watchdog contacts energise, indicating the failure of an EGIP relay, VT or DC supply: - Generator or main incomer CB should be tripped - Alarm should be sent to the Distribution Control Centre (DCC) where it has been put on ESBN SCADA
		Prevent reclosure of the CB that EGIP trips, until all EGIP relays have fully reset, and conditions on the ESBN system have returned within normal parameters for at least 5 minutes'

4.2.1 Required Protection Functionality and Settings for Autoproducers/embedded generators up to and including 2MW "G10"

This section is intended for Independent Power Producers (IPPs) to determine what Embedded Generation Interface Protection (EGIP/G10) they are required to install, as well as the settings which should be applied to each protection function. The requirements in this document only apply to generators connected to the ESBN distribution system at LV, MV and HV.

Table 4D2: Required Protection Functionality and Settings for Autoproducers/embedded generators up to and including 2MW "G10"

Requirement
If the total sum of relevant MEC extensions since 1st September 2012 exceeds 2MW, then the ≥2MW clause applies(EGIP), not the <2MW clause(G10) • **In the case of an extension, Increase in Installed Capacity applies** • **In the case of a modification, total Installed Capacity applies**
The <2MW clause applies to LV Connected generation designed to operate in parallel with the ESBN LV system which is greater than • **25A at low voltage[230V], when the DSO network connection is single-phase** • **16A at low voltage [230/400V], when the DSO network connection is three-phase.**
Where multiple generating sources [of the same or varied technologies] are on the same site and share access to the same ESBN connection point, where the aggregate rating exceeds: • **25A at low voltage, when the DSO network connection is single-phase** • **16A at low voltage, when the DSO network connection is three-phase.** **The <2MW clause applies.**
The customer shall ensure that the generator installation is adequately protected at all times and that it is suitable for connection to DSO network where manual and automatic switching including reclosure is a feature.
The relays shall monitor the installation at ESBN Connection supply voltage, (unless otherwise agreed in writing by ESBN).
The customer shall ensure that all interface relays, the generator circuit breaker and the main incoming circuit breaker are clearly identified.
Reclosure of the main incoming or generator circuit breaker following relay operation shall not be possible until all relays have reset correctly. Resetting shall be automatic.
In order to ensure disconnection of the generator from ESBN Distribution System during abnormal system conditions the following protection shall trip the main incoming circuit breaker or generator circuit breaker as appropriate: • **Over and Under Voltage** • **Over and Under Frequency** • **Loss of Mains** • **Directional Overcurrent** • **Earth Fault – Except as specified** • **RoCoF**
Protection requirements for continuous parallel shall apply in full.
Peak Lopping:

In such cases, Over/Under Frequency, Earth Fault and Loss of Mains Protection shall not be required. **Over/under voltage protection and Directional Overcurrent protection shall be required. The Directional Overcurrent setting if required shall be less than the current rating of the smallest generator installed (typically 50%).**
Directional Overcurrent: **For generators whose installed capacity is less than 1 MW at Medium Voltage or less than 200kW at Low Voltage, Directional Overcurrent protection shall not be required.**
NVD: **Medium Voltage NVD protection is not required where all of the following three conditions are met** **1. Non-exporting via automatic control** **2. Max generation kVA< 25% MV transformer kVA** **3. Max real power less than 200kW**
TESTING: **Before ESBN will grant permission for parallel operation:** **1 The customer shall fully test the synchronising facilities and protection equipment specified in these requirements to the satisfaction of ESBN in accordance with the Appendix 2 .** **Such tests, some of which may require a short duration supply interruption to the installation, are the responsibility of the customer and shall be carried out by the customer or the customer's contractor/consultant and at the expense of the customer. The customer shall ensure that adequate equipment to perform the inspection test is available.** **2 Paralleling shall not take place, even for testing/commissioning purposes, without the prior consent of ESBN.**

4.2.2 Required Protection Functionality and Settings

This section is intended for Independent Power Producers (IPPs) to determine what Embedded Generation Interface Protection (EGIP) they are required to install, as well as the settings which should be applied to each protection function. The requirements in this document only apply to generators connected to the ESBN distribution system at LV, MV and HV.

Tables 4E to 4L in Section 4.2.1 should be used to determine which protection types are required for a particular Embedded Generator (EG) installation. The protection requirements have been set out by connection voltage, generator type and connection type, as listed in the first three rows of each of Tables 4E to 4L. The requirements depend on the type of generator, synchronous, asynchronous and inverter-connected synchronous and the type of connection and the requirements are presented in the tables accordingly. This results in either two or 3 categories for each voltage.

The correct table must first be chosen for a particular generation installation. The single line diagrams shown for each voltage level in Figures 1 to 9 should be referred to in order to define the connection type of the generator installation. For example, considering a windfarm consisting of Inverter Interfaced Embedded Generators (IIEG), connected via dedicated 20kV overhead line, the interface protection requirements are as listed in Table 4G. The connection type is as illustrated in Figure 1.

Once the protection types have been established from the correct Protection Requirements Table (from Tables 4E to 4L), the relevant settings for the required EGIP relays can then be read from Table 4M. The drawing numbers for the required relay elementary drawings can then be found in Appendix A4.

Table 4E: Embedded Generation Interface Protection Requirements – Connection type LV

Generator Installation Type

Connection Voltage:	**LV**
Generator Type:	**All**
Connection Types:	**Dedicated feeder (A)** **Shared feeder (B)**
Operation:	Continuous / Peak Shaving / Peak Lopping
System Neutral Earthing Types:	TN Systems(neutral connected to earth)TT systems (Directly Earthed)

Required Interface Protection for this Generator Installation

No.	Protection Required	Notes / Exceptions
1	**Under and Over Voltage**	Required
2	**Under and Over Frequency**	Not required for embedded generators used exclusively for Peak Lopping
3	**Loss of Mains**	Not required for embedded generators used exclusively for Peak Lopping
4	**Directional Overcurrent**	Directional Overcurrent protection shall not be required less than 200kW

Table 4F: Embedded Generation Interface Protection Requirements – MV Category 1

Generator Installation Type

Connection Voltage:	**MV (10kV or 20kV)**
Generator Type:	**Synchronous (not Inverter-Connected)**
Connection Types:	**Dedicated feeder (A)** **Shared feeder (B)** **Transformer feeder (C)**
Operation:	Continuous / Peak Lopping
System Neutral Earthing Types:	Resistance-Earthed Neutral Isolated Neutral
Earth Fault Operation Types:	EFT (Earth Fault Tripping) – Set to trip for single phase earth faults FPE (Faulted Phase Earthing) – Indicate only for single phase earth faults ESBN will advise the type of earth fault operation in service on a case-by-case basis

Required Interface Protection for this Generator Installation

No.	Protection Required	Notes / Exceptions
1	**Under and Over Voltage**	Required
2	**Under and Over Frequency**	Not required for embedded generators used exclusively for Peak Lopping
3	**Loss of Mains**	Not required for embedded generators used exclusively for Peak Lopping
4	**Directional Overcurrent**	Required. Directional Overcurrent protection shall not be required For generators whose capacity is less than 1 MW
5	**Earth Fault**	Resistance-Earthed Neutral with EFT: NVD protection, and earth fault functionality of overcurrent protection, to be set to trip for single-phase earth faults
		Isolated Neutral with EFT: NVD protection, and earth fault functionality of overcurrent protection, to be set to trip for single-phase earth faults
		Isolated Neutral with FPE: NVD protection, and earth fault functionality of overcurrent protection, to be set to indicate only for single phase earth faults

Table 4G: Embedded Generation Interface Protection Requirements – MV Category 2

Generator Installation Type

Connection Voltage:	**MV (10kV or 20kV)**
Generator Type:	**Asynchronous or** **Inverter-Connected Synchronous**
Connection Types:	**Dedicated feeder (A)** **Shared feeder (B)** **Transformer feeder (C)**
Operation:	Continuous / Peak Lopping
System Neutral Earthing Types:	Resistance-Earthed Neutral Isolated Neutral
Earth Fault Operation Types:	EFT (Earth Fault Tripping) – Set to trip for single phase earth faults FPE (Faulted Phase Earthing) – Indicate only for single phase earth faults ESBN will advise the type of earth fault operation in service on a case-by-case basis

Required Interface Protection for this Generator Installation

No.	Protection Required	Notes / Exceptions
1	**Under and Over Voltage**	Required
2	**Under and Over Frequency**	Not required for embedded generators used exclusively for Peak Lopping
3	**Loss of Mains**	Not required for embedded generators used exclusively for Peak Lopping
4	**Backup Under Voltage**	Not required for mains-excited embedded generators
5	**Earth Fault**	Resistance-Earthed Neutral with EFT: NVD protection to be set to trip for single-phase earth faults
		Isolated Neutral with EFT: NVD protection to be set to trip for single-phase earth faults
		Isolated Neutral with FPE: NVD protection to be set to indicate only for single phase earth faults

Figure 1: Dedicated MV Feeder Connection

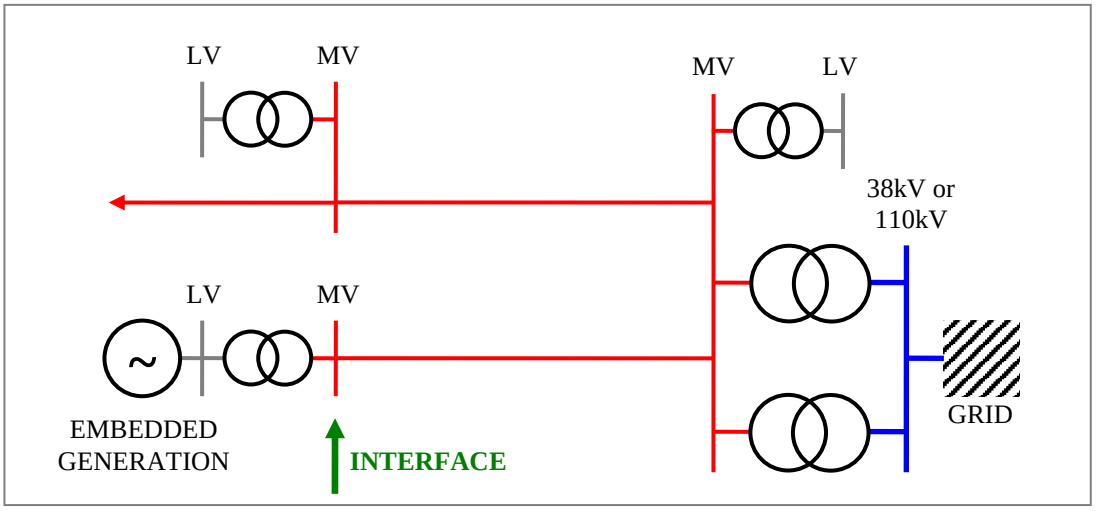


Figure 2: Shared MV Feeder Connection

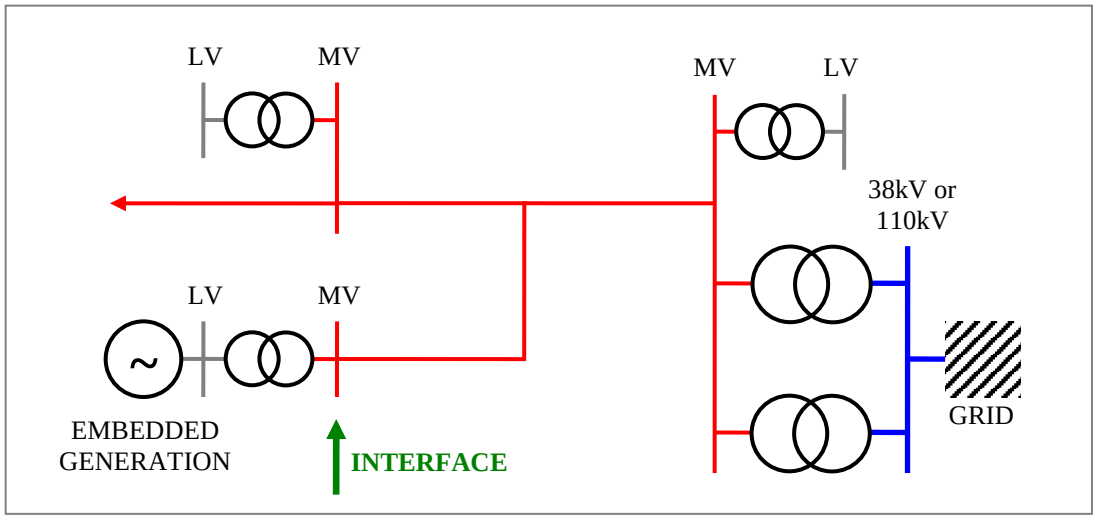


Figure 3: MV Transformer Feeder Connection

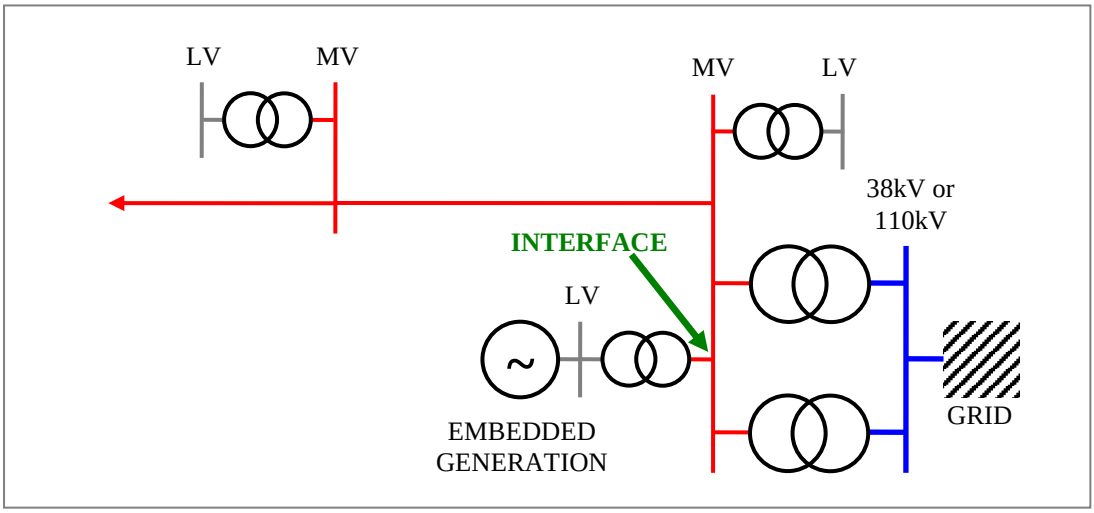


Table 4H: Embedded Generation Interface Protection Requirements – 38kV Category 1

Generator Installation Type

Connection Voltage:	**38kV**
Generator Type:	**All generator types**
Connection Type:	**Dedicated feeder (A)** **Shared feeder (B)**
Operation:	Continuous / Peak Shaving / Peak Lopping
System Neutral Earthing Type:	Arc-Suppressed Neutral
Earth Fault Operation Type:	Indicate only for single phase earth faults

Required Interface Protection for this Generator Installation

No.	Protection Required	Notes / Exceptions
1	**Under and Over Voltage**	Required
2	**Under and Over Frequency**	Not required for embedded generators used exclusively for Peak Lopping
3	**Loss of Mains**	Intertripping should be used instead of ROCOF where a suitable communications channel is available Not required for embedded generators used exclusively for Peak Lopping
4	**Impedance**	Intertripping must be enabled where a suitable communications channel is available
5	**Earth Fault**	NVD protection, and earth fault functionality of impedance protection, to be set to indicate only for single phase earth faults. (For an "over the fence connection"–(Where the ESBN Sub and Customer Sub are adjacent/share a common boundary) it is possible to use ESBN detection for NVD, where ESBN VTs are present)
6	**Differential**	Fully cabled feeders only

Table 4I: Embedded Generation Interface Protection Requirements – 38kV Category 2

Generator Installation Type

Connection Voltage:	**38kV**
Generator Type:	**All generator types**
Connection Type:	**Transformer feeder (C)**
Operation:	Continuous / Peak Shaving / Peak Lopping
System Neutral Earthing Type:	Arc-Suppressed Neutral
Earth Fault Operation Type:	Indicate only for single phase earth faults

Required Interface Protection for this Generator Installation

No.	Protection Required	Notes / Exceptions
1	**Under and Over Voltage**	Required
2	**Under and Over Frequency**	Not required for embedded generators used exclusively for Peak Lopping
3	**Loss of Mains**	Not required for embedded generators used exclusively for Peak Lopping
4	**Busbar Impedance**	Required
5	**Busbar Differential**	Required
6	**Earth Fault**	NVD protection, and earth fault functionality of impedance protection, to be set to indicate only for single phase earth faults

Figure 4: Dedicated 38kV Feeder Connection
Note: This includes dedicated 38kV feeder connections into 38kV/MV stations

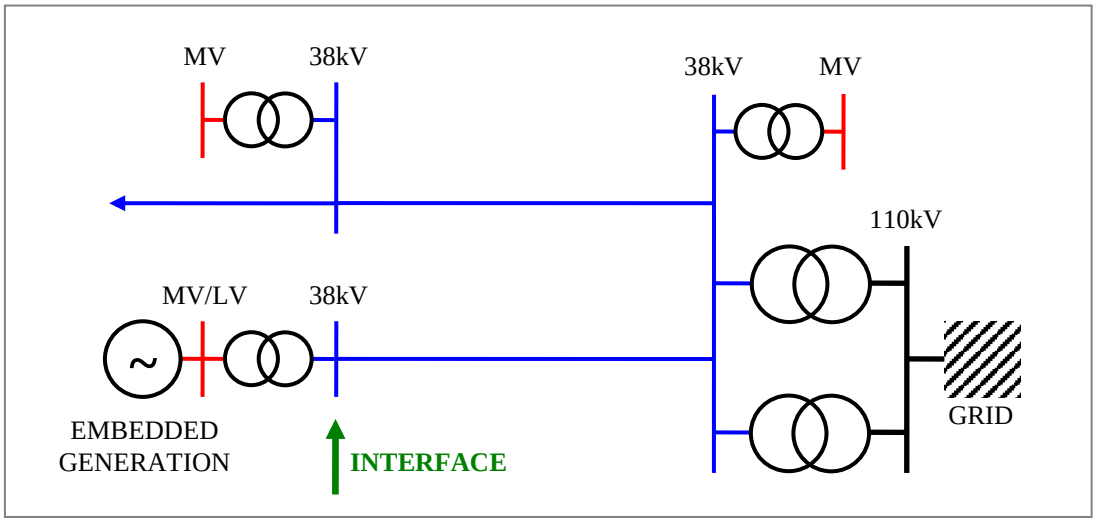


Figure 5: Shared 38kV Feeder Connection

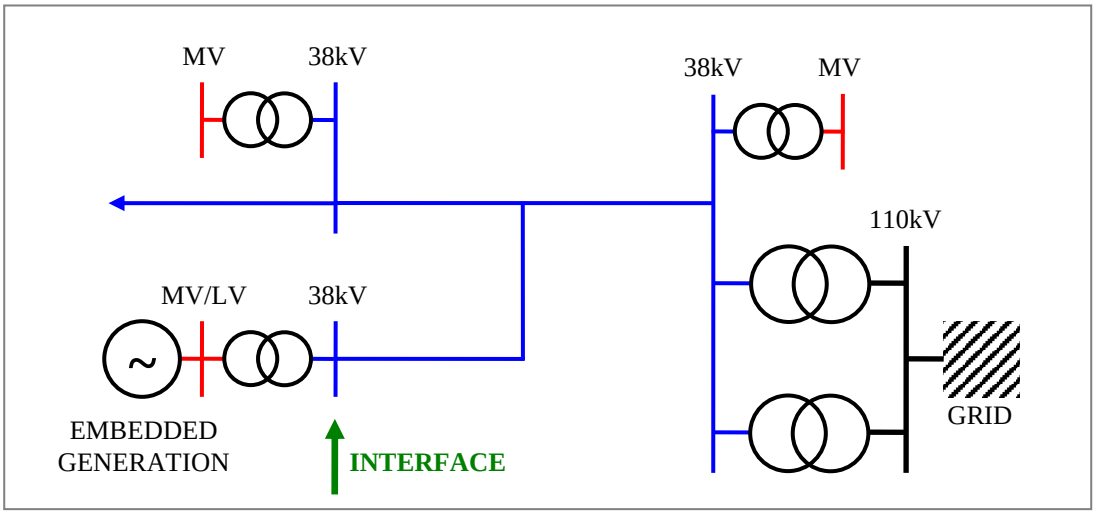


Figure 6: 38kV Transformer Feeder Connection
Note: This includes 38kV cubicle connections in 38kV/MV stations

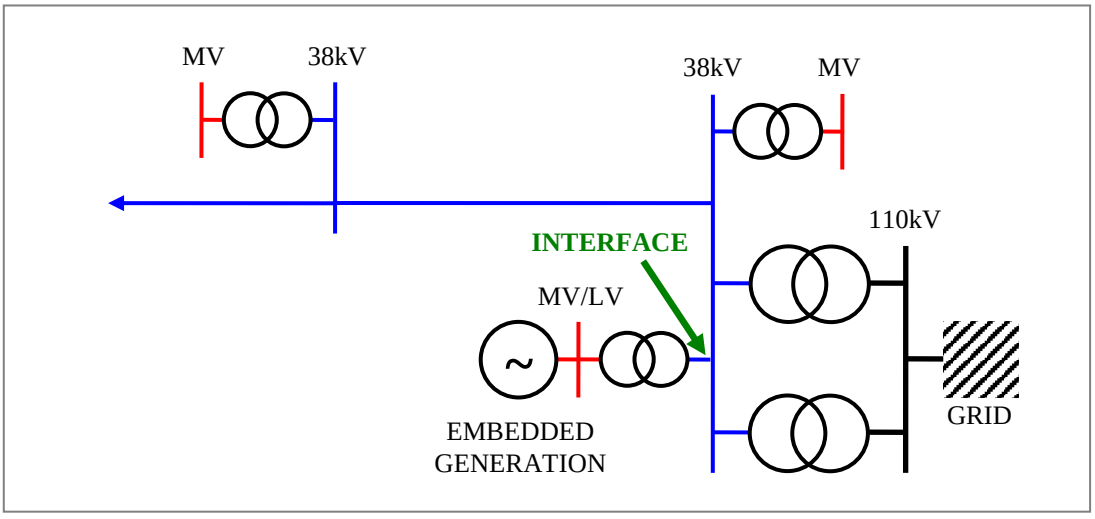


Table 4J: Embedded Generation Interface Protection Requirements -110kV Category 1

Generator Installation Type

Connection Voltage:	**110kV**
Generator Type:	**All generator types**
Connection Type:	**Dedicated feeder (A) – Fully cabled underground** **Shared feeder (B) – Fully cabled underground**
Operation:	Continuous / Peak Shaving / Peak Lopping
System Neutral Earthing Type:	Solidly-earthed Neutral
Earth Fault Operation Type:	Trip for single phase earth faults

Required Interface Protection for this Generator Installation

No.	Protection Required	Notes / Exceptions
1	**Under and Over Voltage**	Required
2	**Under and Over Frequency**	Not required for embedded generators used exclusively for Peak Lopping
3	**Loss of Mains**	A Special Protection Scheme should be used to provide Loss of Mains protection Not required for embedded generators used exclusively for Peak Lopping
4	**Impedance**	Intertripping must be enabled using impedance protection
5	**Earth Fault**	NVD protection, and earth fault functionality of impedance protection, to be set to trip for single phase earth faults
6	**Differential**	Required

Table 4K: Embedded Generation Interface Protection Requirements -110kV Category 2

Generator Installation Type

Connection Voltage:	**110kV**
Generator Type:	**All generator types**
Connection Type:	**Dedicated feeder (A) – Overhead line** **Shared feeder (B) – Overhead line**
Operation:	Continuous / Peak Shaving / Peak Lopping
System Neutral Earthing Type:	Solidly-earthed Neutral
Earth Fault Operation Type:	Trip for single phase earth faults

Required Interface Protection for this Generator Installation

No.	Protection Required	Notes / Exceptions
1	**Under and Over Voltage**	Required
2	**Under and Over Frequency**	Not required for embedded generators used exclusively for Peak Lopping
3	**Loss of Mains**	A Special Protection Scheme should be used to provide Loss of Mains protection Not required for embedded generators used exclusively for Peak Lopping
4	**Impedance (Duplicate)**	Duplicate impedance protection must be installed, with intertripping enabled
5	**Earth Fault**	NVD protection, and earth fault functionality of impedance protection, to be set to trip for single phase earth faults Directional Comparison Sensitive Earth Fault protection is also required

Table 4L: Embedded Generation Interface Protection Requirements -110kV Category 3

Generator Installation Type

Connection Voltage:	**110kV – connected to a DSO operated 110kV busbar**
Generator Type:	**All generator types**
Connection Type:	**Transformer feeder (C)**
Operation:	Continuous / Peak Shaving / Peak Lopping
System Neutral Earthing Type:	Solidly-earthed Neutral
Earth Fault Operation Type:	Trip for single phase earth faults

Required Interface Protection for this Generator Installation

No.	Protection Required	Notes / Exceptions
1	**Under and Over Voltage**	Required
2	**Under and Over Frequency**	Not required for embedded generators used exclusively for Peak Lopping
3	**Loss of Mains**	A Special Protection Scheme should be used to provide Loss of Mains protection Not required for embedded generators used exclusively for Peak Lopping
4	**Busbar Impedance**	Required
5	**Busbar Differential**	Required
6	**Earth Fault**	NVD protection, and earth fault functionality of differential and overcurrent protection, to be set to trip for single phase earth faults

Figure 7: Dedicated 110kV Feeder Connection

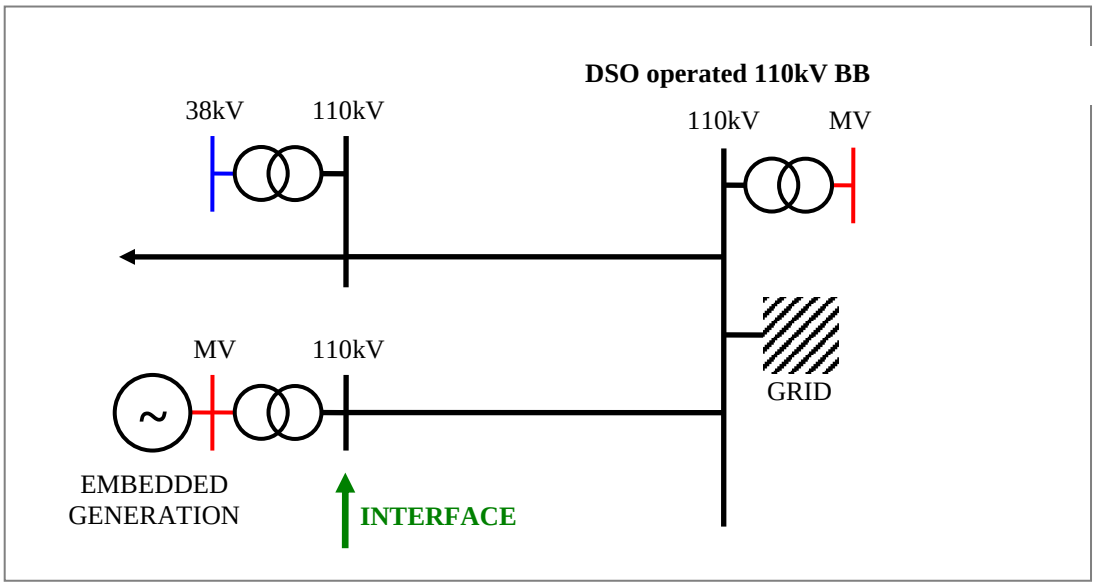
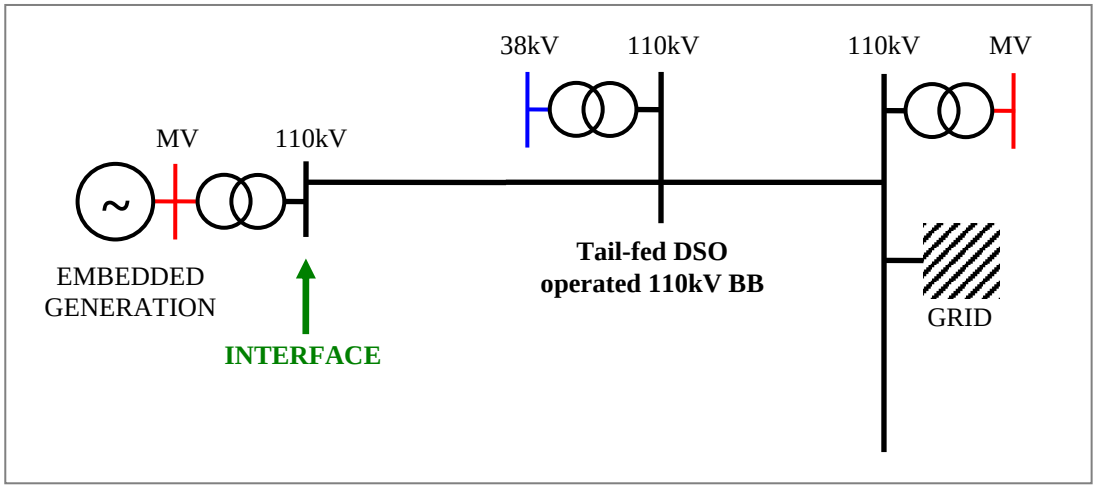


Figure 8: Shared 110kV Feeder Connection



Tables 4M and 4N below summarises the recommended protection settings for Embedded Generation installations. Note: Tables 4E to 4L must first be used to determine which of the protection types listed below are required a specific Embedded Generation installation.

Table 4M: Additional Requirements for Embedded Generators – Protection Types and Summary of Protection Settings

Non Synchronous Generators:

	LV Single Ph	**LV 3 Phase**	**10kV**	**20kV**	**38kV**	**110kV**
Under Voltage						
Stage 1	29V 0.5 sec	52V 0.5 sec	1.3kV 0.5 sec	2.6kV 0.5 sec	4.9kV 0.5 sec	14kV 0.5 sec
Stage2 (Use if only single stage)	191V 3 sec	332V 3 sec	8.7kV 3 sec	17.4kV 3 sec	33kV 3 sec	85kV 3 sec
Over Voltage						
Stage 1	258V 0.7 sec	448V 0.7 sec	11.5kV 0.7 sec	22.9kV 0.7 sec	44.6kV 0.7 sec	126kV 0.7 sec
NVD (15% to be used where station has high capacitive contribution)	N/A	N/A	30% or 15% 6 sec Trip or Alarm	30% or 15% 6 sec Trip or Alarm	Alarm To DCC	Trip
Under Freq						
Stage 1 47 Hz	47Hz 0.5 sec	47Hz 0.5 sec	47Hz 0.5 sec	47Hz 0.5 sec	47Hz 0.5 sec	47Hz 0.5 sec
Stage 2 47.5 Hz (Where only 1 stage available)	47.5 Hz 20 sec	47.5 Hz 20 sec	47.5 Hz 20 sec	47.5 Hz 20 sec	47.5 Hz 20 sec	47.5 Hz 20 sec
Over Freq						
Stage 1 52 Hz	52 Hz 20 sec	52 Hz 20 sec	52 Hz 20 sec	52 Hz 20 sec	52 Hz 20 sec	52 Hz 20 sec
Stage2 52.5 Hz	52.5 Hz 0.5 sec	52.5 Hz 0.5 sec	52.5 Hz 0.5 sec	52.5 Hz 0.5 sec	52.5 Hz 0.5 sec	52.5 Hz 0.5 sec
Dir Overcurrent						
Peak Lop	50% Dir 0.2sec	50% Dir 0.2sec	50% Dir 0.2sec	50% Dir 0.2sec	50% Dir 0.2sec	50% Dir 0.2sec
Stand-By	50% Dir 0.2sec	50% Dir 0.2sec	50% Dir 0.2sec	50% Dir 0.2sec	50% Dir 0.2sec	50% Dir 0.2sec
Generation	140% 0.2s	140% 0.2s	140% 0.2s	140% 0.2s	Imp Diff	Imp Diff
RoCoF**	**Type A Async mains Excited**				**Type B Inverter AC/DC/AC***	
	1Hz/sec 0.6 sec				2 Hz/sec 0.3 sec	
Vector Shift	Set at 6 degrees, Trip time < 0.5 sec. Vector Shift is not preferred but maybe allowed by ESB.					

*Note : Type B reset interval should be set to >0.3 seconds to detect step changes.
** “Trickle Feeds”: Where Generators that run in parallel with the network that have an import value of approx. 100KW or less a ROCOF setting of 0.4Hz/s for 0.6s can be used

Table 4N: Additional Requirements for Embedded Generators – Protection Types and Summary of Protection Settings

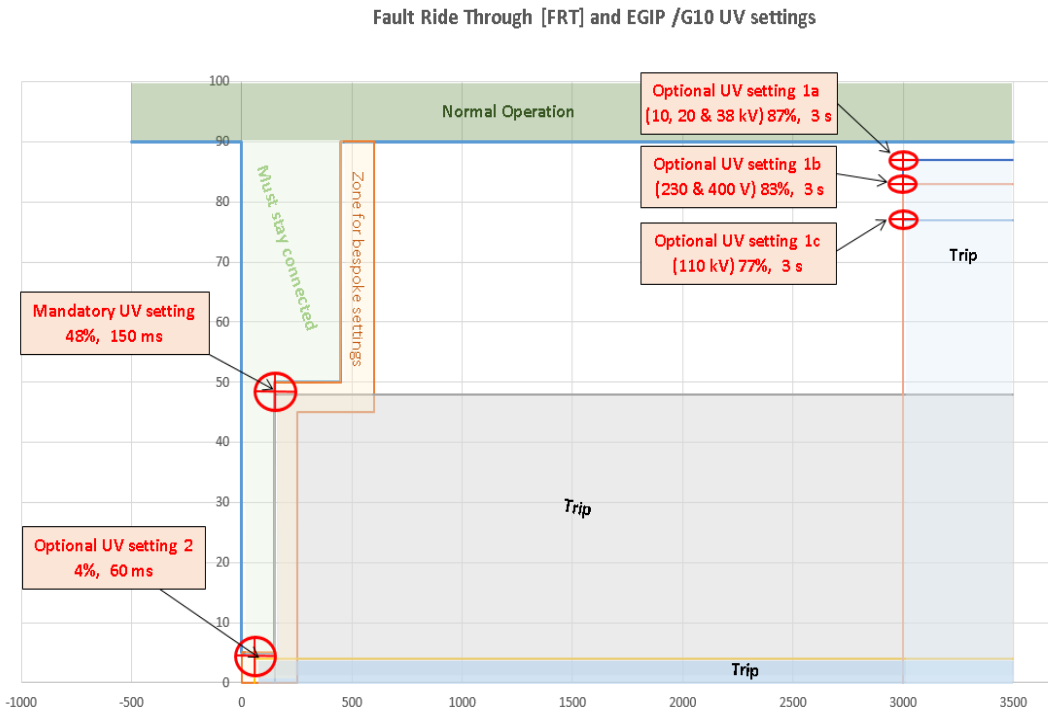
Synchronous Generators:

	LV Single Ph	LV 3 Phase	10kV	20kV	38kV	110kV
Under Voltage						
Stage 1 (Optional)	29V 0.5 sec	52V 0.5 sec	1.3kV 0.5 sec	2.6kV 0.5 sec	4.9kV 0.5 sec	14kV 0.5 sec
Mandatory UV Setting	110V 0.15 sec	192V 0.15 sec	4.8kV 0.15 sec	9.6kV 0.15 sec	18.2kV 0.15 sec	52.8kV 0.15 sec
Stage 2 (Optional)	191V 3 sec	332V 3 sec	8.7kV 3 sec	17.4kV 3 sec	33kV 3 sec	85kV 3 sec
Over Voltage						
Stage 1	258V 0.7 sec	448V 0.7 sec	11.5kV 0.7 sec	22.9kV 0.7 sec	44.6kV 0.7 sec	126kV 0.7 sec
NVD (15% to be used where station has high capacitive contribution)	N/A	N/A	30% 6 sec Trip or Alarm	30% 6 sec Trip or Alarm	Alarm To DCC	Trip
Under Freq						
Stage 1 47 Hz	47Hz 0.5 sec	47Hz 0.5 sec	47Hz 0.5 sec	47Hz 0.5 sec	47Hz 0.5 sec	47Hz 0.5 sec
Stage 2 47.5 Hz (Where only 1 stage available)	47.5 Hz 20 sec	47.5 Hz 20 sec	47.5 Hz 20 sec	47.5 Hz 20 sec	47.5 Hz 20 sec	47.5 Hz 20 sec
Over Freq						
Stage 1 52 Hz	52 Hz 20 sec	52 Hz 20 sec	52 Hz 20 sec	52 Hz 20 sec	52 Hz 20 sec	52 Hz 20 sec
Stage2 52.5 Hz	52.5 Hz 0.5 sec	52.5 Hz 0.5 sec	52.5 Hz 0.5 sec	52.5 Hz 0.5 sec	52.5 Hz 0.5 sec	52.5 Hz 0.5 sec
Dir Overcurrent						
Peak Lop	50% Dir 0.2sec	50% Dir 0.2sec	50% Dir 0.2sec	50% Dir 0.2sec	50% Dir 0.2sec	50% Dir 0.2sec
Stand-By	50% Dir 0.2sec	50% Dir 0.2sec	50% Dir 0.2sec	50% Dir 0.2sec	50% Dir 0.2sec	50% Dir 0.2sec
Generation	140% 0.2s	140% 0.2s	140% 0.2s	140% 0.2s	Imp Diff	Imp Diff
RoCoF**	**Type C Synchronous >3 MWs/MVA**				**Type D Synchronous <3 MWs/MVA**	
	0.6 Hz/sec 0.6 sec				1 Hz/sec 0.6 sec	
Vector Shift	Set at 6 degrees, Trip time < 0.5 sec. Vector Shift is not preferred but maybe allowed by ESB.					

** “Trickle Feeds”: Where Generators that run in parallel with the network that have an import value of approx. 100KW or less a ROCOF setting of 0.4Hz/s for 0.6s can be used

4.2.3 Requirement to remain Synchronised

The Fault Ride Through Requirements outlined in the Distribution Code DCC10.5.1 (I) and the Grid Code CC.7.3.1.1 (h) and the requirement to remain synchronised CC.7.3.1.1 (f) when translated to Under Voltage Protection Settings are shown in Figure 1 below. Please note that the zone for bespoke settings has been exaggerated for illustrative purposes, the correct values for all requirements and settings are detailed in the tables of this document.



ESB Networks requires that all synchronous generators **must implement the Mandatory Under Voltage Setting of 48% retained voltage for 0.15 s**. It is at the Generator's discretion if they implement either/both of the optional settings.

Table 4O: Additional Requirements for Embedded Generators – Protection Types and Summary of Protection Settings

Protection Type	Item	Requirement
Impedance Protection	Operational Settings	As issued by ESBN Networks
	Number of Phases	3
Directional Overcurrent Protection	Operational Settings	As issued by ESBN Networks
	Number of Phases	3
Differential Protection	Operational Settings	As issued by ESBN Networks
	Number of Phases	3
	Directional Comparison Earth Fault	As issued by ESBN Networks

Earth Fault	Neutral Voltage Displacement Settings	30%, 5s
	Neutral Voltage Displacement Trip	Systems with Solidly-Earthed Neutral, Resistance-Earthed Neutral or Isolated Neutral with EFT
	Neutral Voltage Displacement Alarm	Systems with Isolated Neutral with FPE or Arc-Suppressed (Reactance-Earthed) Neutral. Connection to DCC
Watchdog Alarm	DC supply and Relay Healthy Watchdog Alarm	In the event that the LSC or watchdog contacts energise, indicating the failure of an EGIP relay or CD supply: -Generator or main incomer CB should be tripped - Alarm should be sent to the Distribution Control Centre (DCC)

4.3 Ownership and Control of EGIP

In all cases, the installed protection must be to ESBN specifications, including relay models used and elementary drawings used in the protection system design, the issued relay configuration must not be altered to provide extra functions. The relevant drawings are listed in Appendix A1 of this document and copies of these, including any subsequent revision, are available on request from the ESBN project team.

4.3.1 Smaller generators connected at MV

In the case of EG installations connected to the ESBN system at MV (10kV or 20kV), ownership and maintenance of the EGIP relays and the breaker used for EGIP remains with the IPP if the installed capacity of the installation is up to and including 2MVA.

4.3.2 Larger generators connected at MV and at HV

In the case of EG installations connected to the ESBN system at MV with an installed capacity in excess of 2MVA as well as all EG installations connected at HV (38kV or 110kV), the following sections apply.

4.3.2.1 Generation only installations

Ownership of the EGIP relays and the breaker used for EGIP shall be with ESBN Networks.

4.3.2.2 Generation is but one part of an installation (e.g. CHP in a factory)

Ownership of the EGIP relays and the breaker used for EGIP shall be with ESBN Networks. Additionally the customer may elect that EGIP also trips an in-plant (generator) circuit breaker.

4.4 Protection Coordination and EGIP Target Circuit Breaker

In all cases it EGIP must measure system quantities and be wired to trip a circuit breaker or recloser, located as close as practically possible to the interface between the IPP equipment and the ESBN distribution network. This is readily achievable for dedicated generation installations.

In cases where the embedded generation is but one part of a customer installation (e.g. CHP in a large factory) an additional approach may be considered by the customer, whereby EGIP is configured for two-stage tripping of circuit breakers with downstream customer generator breakers tripping faster than the main incomer circuit breaker. In such instances, ESBN may at its discretion, specify alternative EGIP trip times to be applied to the main incoming circuit breaker and the generator circuit breaker to allow time coordination.

Where a customer is concerned about the potential impact of Rate of Change of Frequency protection on the non-generation part of the plant, the required loss-of-mains protection can instead be implemented by means of an intertripping scheme, as designed by ESBN Networks.

See figures 10 to 12, showing some example cases of MV connected installations and the locations of EGIP and the target circuit breaker in each case.

Figure 10: MV connected EG <2MVA installed capacity

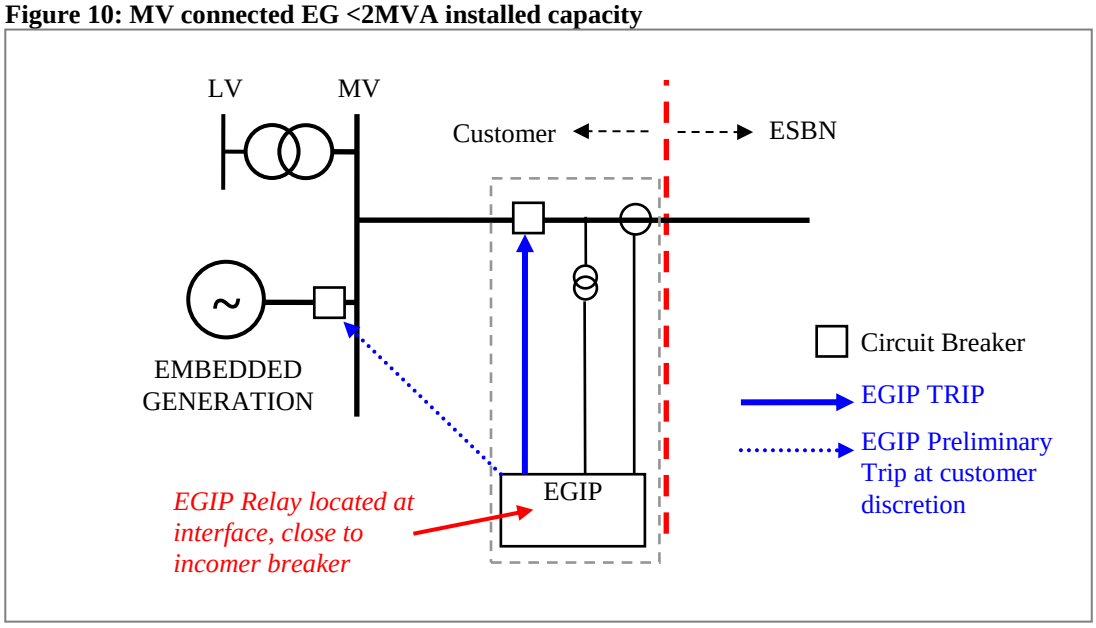


Figure 11: MV connected EG <2MVA installed capacity with LV generator

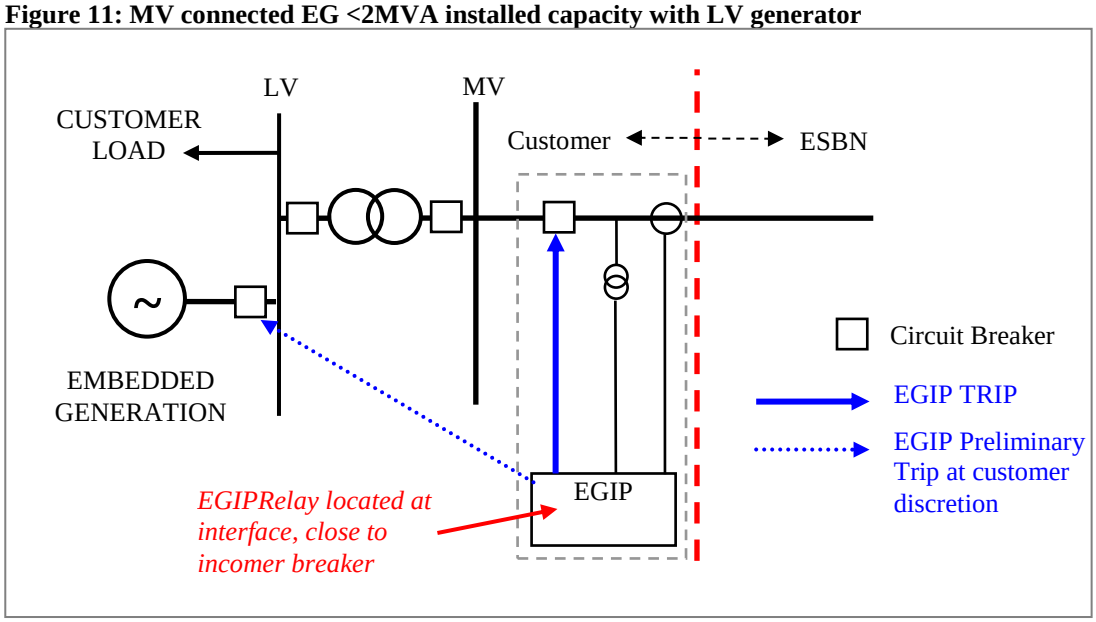
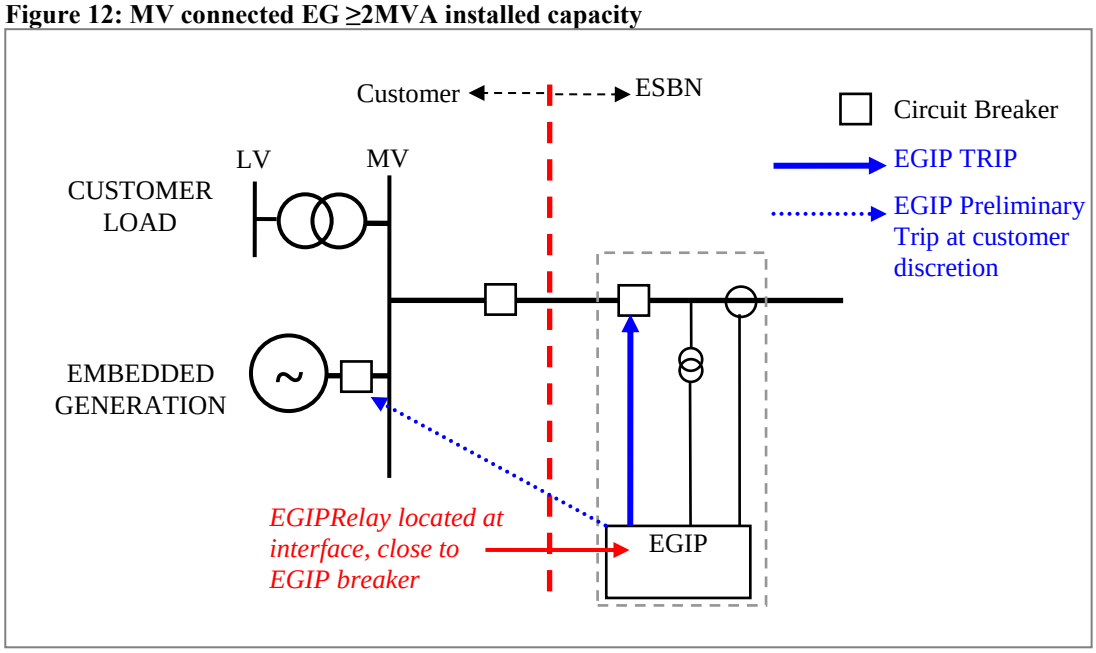


Figure 12: MV connected EG ≥2MVA installed capacity



5 Synchronising

Table 5: Synchronising Requirements in Embedded Generator Installations

No.	Mode	Requirement
1.	Synchronising	Upon closing of a circuit breaker that connects the generator to the ESBN system, synchronisation of the generator with the system is the responsibility of the IPP.

6 Boundaries

Table 6: Ownership and Operational Boundaries

No.	Item	Boundary
1.	Ownership	The ownership boundary between ESBN Distribution circuits and Customer circuits is the termination point of ESBN main incomer cable on the Customer's plant.
2.	Operational	The system/operational boundary between ESBN Distribution circuits and Customer circuits is the Customer's main incomer circuit breaker

7 Warning Notices and Labels

Table 7A: Warning Notices and Labels

No.	Plant Item	Requirement	
1.	Main Incomer CB.	Labels	'Main ESBN Incomer '
			'<feeder designation> '
		Warning Notices	'The system boundary between the ESBN System and <Customer name> System is the Main Incomer Circuit Breaker '
			'The Main Incomer Circuit Breaker is under the operational control of <name of Customer's authorised person> '
4.	Earthing Sw. (for earthing ESBN Main Incomer Cable)	Warning Notice	'This earthing switch is under the control of ESBN and must be operated by ESBN operator only.'
5.	Relays	Labels	All protection relays must be clearly and correctly labelled

Table 7B: Additional Requirement for Dual Radial Feeds

No.	Plant Item	Requirement	
1.	Customer coupler CB	Warning Notice	'This point may only be operated with the approval of the ESBN Controller

Table 7C: Additional Requirement for embedded Generator Installations

No.	Plant Item	Requirement	
1.	Main Incomer CB	Warning Notice	'Warning Generator may be operating in parallel with ESBN Distribution System '

8 Operation

Table 8A: Operational Requirements

No.	Item	Requirement
1.	Operations Procedure	Document containing Operations Procedures to be agreed between the Customer and ESBN Networks
2.	Customer Switchroom	Access to be restricted to competent personnel only
3.	Customer Equipment	Operation, Maintenance and Testing to be carried out by fully trained and competent personnel only
4.	Customer Switch Panel	Connection sequence of all connected equipment to be clearly shown
5.	Single Line Diagram	Single Line Diagram of the Customer's network to be mounted in prominent location in the Customer's switchroom

Table 8B: Additional Operational Requirements for MV Dual Radial Installations

Dual radial connections may be made available as an enhanced supply type subject to feasibility on the local network. The connection MIC must be >=1MW.
network. Dedicated dual radial connection will not be offered.

<table>
<tr><th>No.</th><th>Item</th><th>Requirement</th></tr>
<tr><td></td><td>Feeder load distribution</td><td>The customer must operate the coupler circuit breaker normally open and maintain feeder load distribution according to the regime advised by ESBN. The available loading regimes are as follows:
<table>
<tr><td>Loading regime</td><td>Feeder1</td><td>Feeder2</td></tr>
<tr><td>DR1</td><td>0%-20%</td><td>80%-100%</td></tr>
<tr><td>DR2</td><td>20%-40%</td><td>60%-80%</td></tr>
<tr><td>DR3</td><td>40%-60%</td><td>40%-60%</td></tr>
<tr><td>DR4</td><td>60%-80%</td><td>20%-40%</td></tr>
<tr><td>DR5</td><td>80%-100%</td><td>0%-20%</td></tr>
</table>
ESBN may, from time to time, require operating to a different loading regime. The customer will be advised in writing and this will supersede the operating regime advised at the initial contract stage.</td></tr>
<tr><td>1.</td><td>Operation of Customer's Network</td><td>Site specific Operations Procedures document to be agreed between the Customer and ESBN</td></tr>
<tr><td></td><td>Operation of Customer's Network</td><td>Customer's network shall be operated in radial configuration with normally open points at appropriate MV and LV locations</td></tr>
<tr><td></td><td>Operation of Customer's Network</td><td>The customer shall ensure that no more than two out of three circuit breakers are closed for more than a 10s momentary interval.</td></tr>
</table>

	Operation of Customer's Network	**The Customer shall transfer load to one feeder and switch off auto-changeover to facilitate ESBN annual maintenance and other operational requirements.**
	Operation of Customer's Network	**ESBN SCADA Distribution Control Centre must be notified in advance of operation of ESBN incoming circuit breakers and Coupler circuit breaker, as per agreed Operations Instructions**
	Operation of Customer's Network	**Before the Customer parallels his internal MV distribution circuits or LV distribution circuits, the Coupler circuit breaker must be closed and all load transferred to one incoming circuit. When the Customer has completed his switching and restored his radial system the coupler circuit breaker can be opened - see specific agreed Operations Instructions.**
		In the event of loss of one of the ESBN feeders the customer may close the coupler after first opening the lost feeder.
		All subsequent modifications to the Customer's MV feeding arrangements and network configuration, must be advised to ESBN Operations Staff, as set out in the Operations Procedure.

Table 8C: Additional Operational Requirements for Embedded Generator Installations

No.	Item	Requirement
1.	**Operation of Neutral**	**Neutral of MV and 38kV Generators shall be unearthed when operated in parallel with ESBN Distribution System**
		Neutral of LV Generators shall operate in accordance with ETCI regulations

Table 8D: Modes of Operation of Embedded Generators covered by this document

No.	Mode	Operation	
1.	Continuous Parallel	Unrestricted periods of operation, subject to Connection Agreement conditions are permitted under continuous parallel mode for asynchronous and synchronous machines.	
2.	Peak Reduction	Generators may operate in two short time parallel modes, Peak Shaving or Peak Lopping in order to reduce the Customer's maximum demand	
		Peak Shaving	Refers to the parallel operation of a Customer's generator where the generator supplies part of, or, the Customer's entire load.
		Peak Lopping	This refers to where the Customer's generator supplies the Customer's entire load and operates independently of ESBN Networks. It is however, operated in parallel for short periods at start-up and shutdown of the generator to facilitate a smooth transfer of power from the mains to the generator. The generator may operate in parallel with ESBN Distribution System for period's not exceeding 3 minutes at start-up and shutdown of the generator.
3.	Automatic Mains Failure (AMF) Standby Feature	Generators under 1 and 2 above with AMF standby usage in the event of failure of ESBN connection. (Upon restoration, ESBN connection shall be resumed)	
4.	Standby Generators	Standby generators do not have the facility to operate in parallel with ESBN therefore the rules of the Electro-Technical Council of Ireland shall apply	
5.	Testing	**PARALLEL OPERATION FOR TEST PURPOSES LIMITED TO 6 MINUTES PER 24 HOURS (OUTSIDE WDRI PERIOD)**	
6.	Emergency	Sustained parallel operation in emergency conditions such as Load Shedding may be agreed between ESBN and the Customer The decision to override the timing mechanism to allow such operation shall be agreed between ESBN and the Customer Note: Generators installed for Peak Lopping would not be permitted sustained parallel operation	

9 Cable Termination

Table 9A : Cable Termination Requirements for MV and 38kV Connections

No.	Plant Item	Provided by	Requirement	
1.	Main Incomer Cable	ESBN Networks	No. cables	3 per CB (normally) (some connections may require 6 per CB, always check with ESBN Networks)
			No. cores per cable	1
			Insulation	XLPE
			Sheath	Black(PE) polyethylene
2.	Terminating Kits for Main Incomer Circuit Breaker	Customer	Suitable for terminating ESBN main incomer cable (see table 9b below)	
3.	Space in Customer's Switchroom	Customer	Adequate space to terminate ESBN main incomer cable	

Table 9B: Guide to typical Distribution System MV and 38kV Cable Sizes

Subject to change. Always confirm with ESBN

Item	Voltage	Core Size (mm2)	Core Type	Screen	
				Size (mm2)	Type
1.	MV	185	Aluminium	25	Cu
		400	Aluminium	25	Cu
		630	Copper	35	Cu
2.	38kV	630	Aluminium	35	Cu

10 Metering

Table 10A: Location and Space Requirements of Metering Cabinets

Number of metering cabinets required may vary, always confirm with ESBN Networks.

Plant	Item	Requirements			
Metering Cabinet	Size(mm)		width	height	depth
		MV	580	580	185
		MV Dual Radial	600	1800	600
		38kV	600	1000	600
	Location	To be agreed between Customer and ESBN Networks			

Table 10B: Location and Space Requirements of Metering Cubicles containing metering VTs and CTs.

Plant	Item	Requirements	
Metering Cubicles	Location	MV MV Dual Radial	Installed in ESBN Terminal Station Summation metering will be applied across the two incoming feeders.
		38kV	Equipment installed in ESBN Terminal Station or in location agreed between Customer and ESBN Networks

11 Terminal Station

Table 11: Terminal Station and Site Requirements

No.	Item	Requirement		Provided By
1.	Connection	Provide connection at one point in a position agreed between ESBN and Customer		ESBN Networks
2.	Terminal Station	MV	Built to ESBN specification 18134 for Generation >2MW or ESBN specification 13320 otherwise	

Table 11: Terminal Station and Site Requirements

No.	Item	Requirement		Provided By
			Provide unrestricted access to the Terminal Station at all times over a surfaced right-of-way in accordance with the dimensions specified in ESBN specification 13320	Customer
		MV Dual Radial	Built to ESBN Ltd specification 13320 with the Dual Radial Floor plan.	
			Provide unrestricted access to the Terminal Station at all times over a surfaced right-of-way in accordance with the dimensions specified in ESBN Ltd specification 13320	
		38kV	Construct safety fence around Terminal Station to ESBN specification 10241. Provide unrestricted access to the Terminal Station at all times over a surfaced right-of-way of 5 metres minimum width	
3.	Cable Access	Cable connection access to enable connections from the terminal station to other network or customer as necessary		
4.	Power	Provide 5kVA LV supply free of charge for heating and lighting of Terminal Station		
5.	Cable Trenching	Excavation, ducting and reinstatement of cable/earthing trenches within confines of site		
6.	Indemnity	Indemnify ESBN against any claim that may arise by reason of excavation, ducting, trenching or backfilling		
7.	Planning Permission and Site Transfer	It is the responsibility of the Customer to obtain and comply with planning permission for the site and the legal transfer of the site to ESBN as per 'Acceptance of Offer' requirements detailed in clause 6. 0 in the 'Guide to the Process for Connection to the Distribution System'		
8.	Arrangements for Occupation of site	If necessary, grant possession rights in writing to ESBN pending completion of legal formalities of the site transfer		

12 Earthing

Table 12A: Earthing Requirements

No.	Connection Type	Requirement		
1.	MV	Earthing in Terminal Station to be carried in accordance with ESBN specification 13320		
2.	MV Dual Radial	Customer's MV Earth Grid	Max Resistance	20 Ohms
			Min size of Conductor	25mm2 Copper
			Equipment Bonded to MV Earth Grid	All MV equipment and exposed metalwork
				Earth screens on ESBN MV Cables
				Enclosures for metering equipment
				Enclosures for metering VT/CT secondary leads
				Metal doors and frames
				Earth Mat - installed 0.2 metres below ground level (1 metre wide x full width of metal doors)
				If combined resistance of LV and MV earth grid <=1 Ohm then Customer's LV earth grid must be bonded to MV earth grid If combined resistance >1 Ohm then, LV and MV Earths Grids must be separated. See table 12B below
		Customer's LV Earth Grid	Customer's LV neutral and LV equipment in MV switchroom to be earthed in accordance with ETCI Regulations	
3.	38kV	Earthing in Terminal Station to be carried out in accordance with ESBN Drawing No. 205724 provided to the Customer by ESBN local office		

Table 12B: Additional Requirements for MV Dual Radial Installations where Combined Resistance of LV and MV Earth Grid >1 Ohm

No.	Item	Earthing Requirement		
1.	Separation of MV and LV Earth Grids	Soil Type	Normal	Minimum Separation 4 Metres
			Rocky	Minimum Separation 10 Metres
2.	LV Switchgear in immediate vicinity of MV Equipment	Metal frames of LV Switchgear must be bonded to MV Earth Grid		
		20mm minimum clearance in air between metal frame of LV switchgear and LV phase and neutral conductors		
3.	Outer Walls of Switchroom	Constructed from Non-conductive material		

13 Commissioning and Certification

Table 13A: Commissioning, Certification and Test Information

No.	Certification/Information	When	Provided By
1.	**Main Incomer Circuit Breaker Protection Relay Settings**	**Minimum of five working days before Energisation Date** These relay settings will be supplied to the Customer at an earlier date provided the ESBN System Protection Team have been given all the relevant Customer information EGIPwitnesstesting@ESB.ie	**ESBN Networks**
2.	**ESBN Protection Equipment**	**Minimum of five working days before Energisation Date** These relay settings will be supplied to the Customer at an earlier date - provided the ESBN System Protection Team have been given all the relevant Customer information via the NC5 Application, and once connection agreement is issued. EGIPwitnesstesting@ESB.ie	**ESBN Networks**
3.	**Customer Protection CT Ratios** Note: Should be chosen in accordance with the sensitivity requirements	**Terminal Station Completion**	**Customer**
4.	**Protection Relay Type**		
5.	**Primary and Secondary Test Sheets for the Main Incomer Circuit Breakers Protection Relays**	**Two working days before Energisation Date***	
6.	**Confirmation of Relay Settings**		
7.	**Declaration of Fitness for Service**	**Energisation Date**	
8.	**Earthing has been installed as outlined in this document**	**Energisation Date**	

*except where an active connection is required for the test to be carried out

Table 13B: Additional Information Required for Dual Radial Installations

No.	Certification/Information	When	Provided By
1.	Measured resistance of MV and LV earth grids	Energisation Date	Customer
2.	Distance separating MV and LV earth grids if combined resistance >1 Ohm		

Table 13C: Additional tests required for Embedded Generation Installations

Note: Paralleling shall not take place for testing, pre-commissioning or commissioning purposes without the prior consent of ESBN.

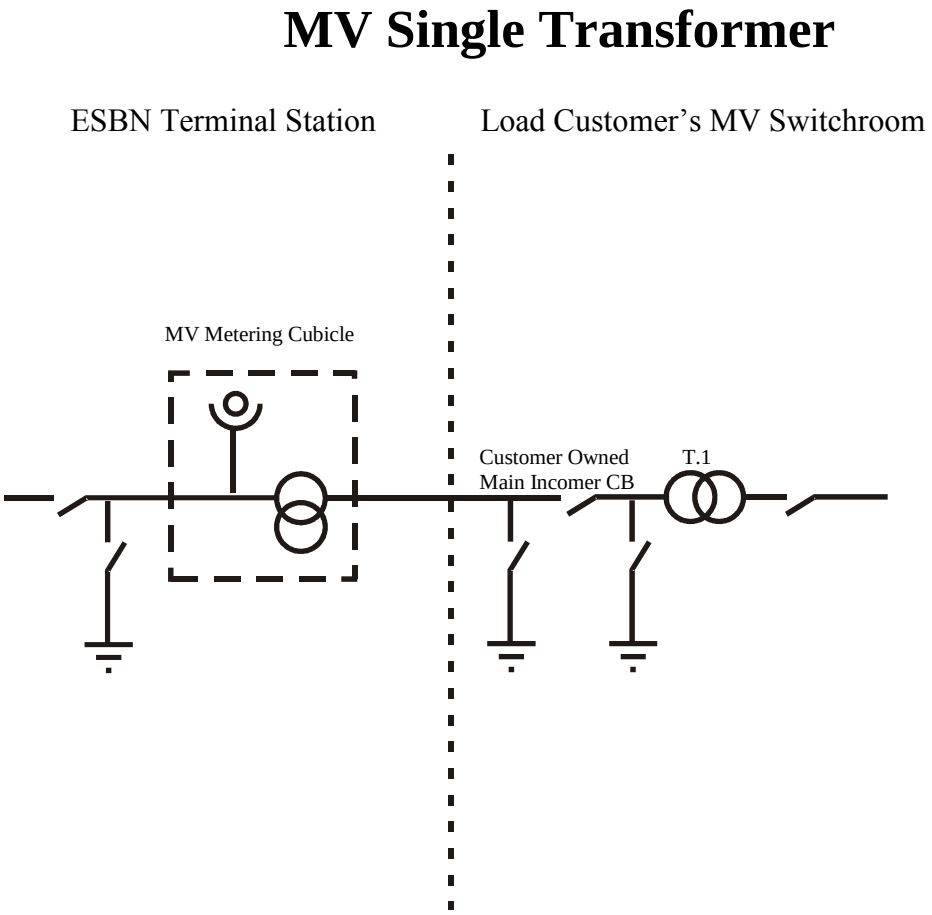
No.	Tests	Requirement	Carried out by	Witnessed by	Notice
1.	Synchronising Facilities and Interface Protection	Pre-commissioning Tests to be carried out prior to Compliance Tests	Customer on site	Results sent to EGIPwitnesstesting@ESB.ie	
		Compliance Tests to be carried out in accordance with Test Schedule in Appendix 2 of this document	Customer on site	ESBN Networks	Minimum of two weeks
2.	Interface Protection	Commissioning	ESBN Networks		Minimum of two weeks

Table 13D: Additional information required prior to Compliance Test date for Embedded Generation Installations

No.	Information	When	Provided by
1.	Confirmation that testing can proceed on agreed test date	Minimum of one working day before agreed test date	Customer
2.	Confirmation of completion of Customer's pre-commissioning tests		
3.	Completed pre-commissioning test result sheets		
4.	Details of equipment to be used on the test date		

Annex A. Schematics

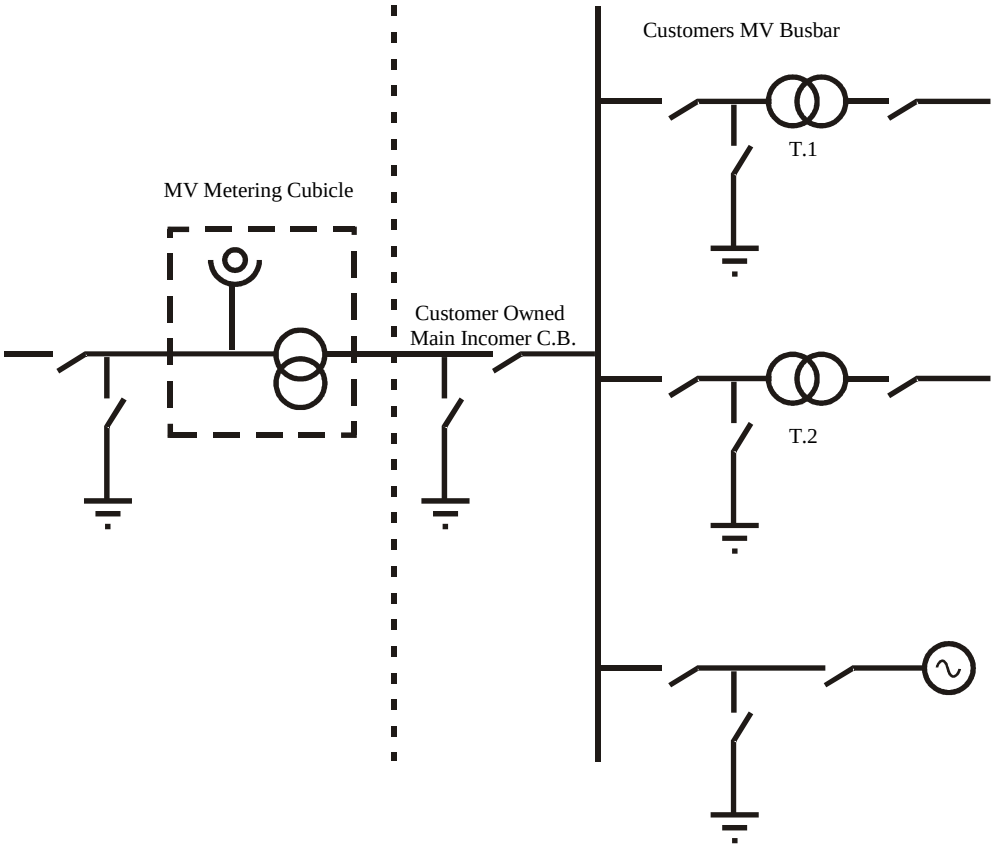
A.1.



No.	Item	Reqd. by	Requirement
1.	Earthing Facilities	ESBN	Earthing facility required on main incomer cable
		S.I. 44	Customer to consult S.I. 44 for earthing requirements on Customer's equipment
2.	Interlocking	ESBN	Interlocking to be provided between disconnection point and earthing facility on main incomer cable.
3.	Isolation of ESBN	ESBN	Customer to provide a means of isolating ESBN network in the event of a fault on Customer's equipment.
4	Disconnection Point	ESBN Safety Rules	If a visible point of disconnection is not provided at the interface point, then under ESBN safety rules, ESBN will have to approve the use of the proposed Customer's equipment as a 'point of disconnection'. ESBN will require the Customer to carry out a risk assessment on the use of the equipment as part of the approval process.

MV Multi Transformer

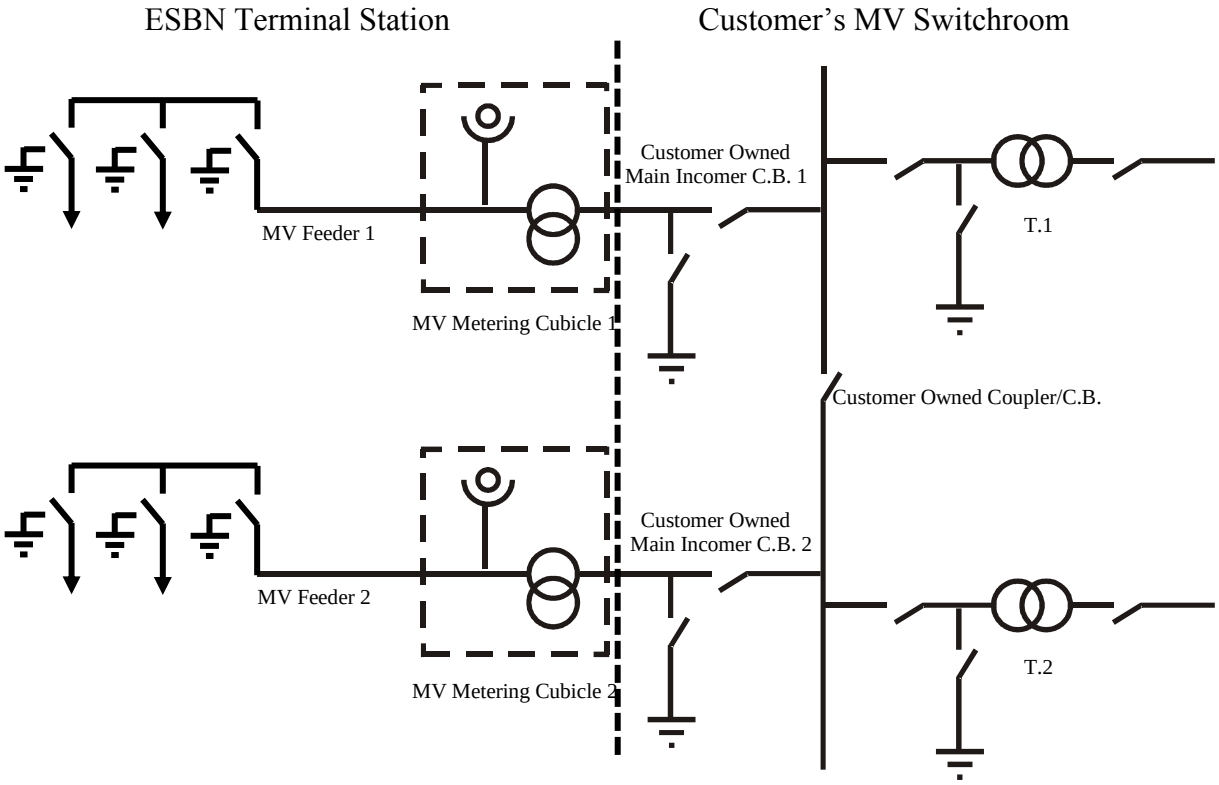
ESBN Terminal Station Customer's MV Switchroom



No.	Item	Reqd. by	Requirement
1.	Earthing Facilities	ESBN	Earthing facility required on main incomer cable
		S.I. 44	Customer to consult S.I. 44 for earthing requirements on Customer's equipment
2.	Interlocking	ESBN	Interlocking to be provided between disconnection point and earthing facility on main incomer cable.
3.	Isolation of ESBN	ESBN	Customer to provide a means of isolating ESBN network in the event of a fault on Customer's equipment.

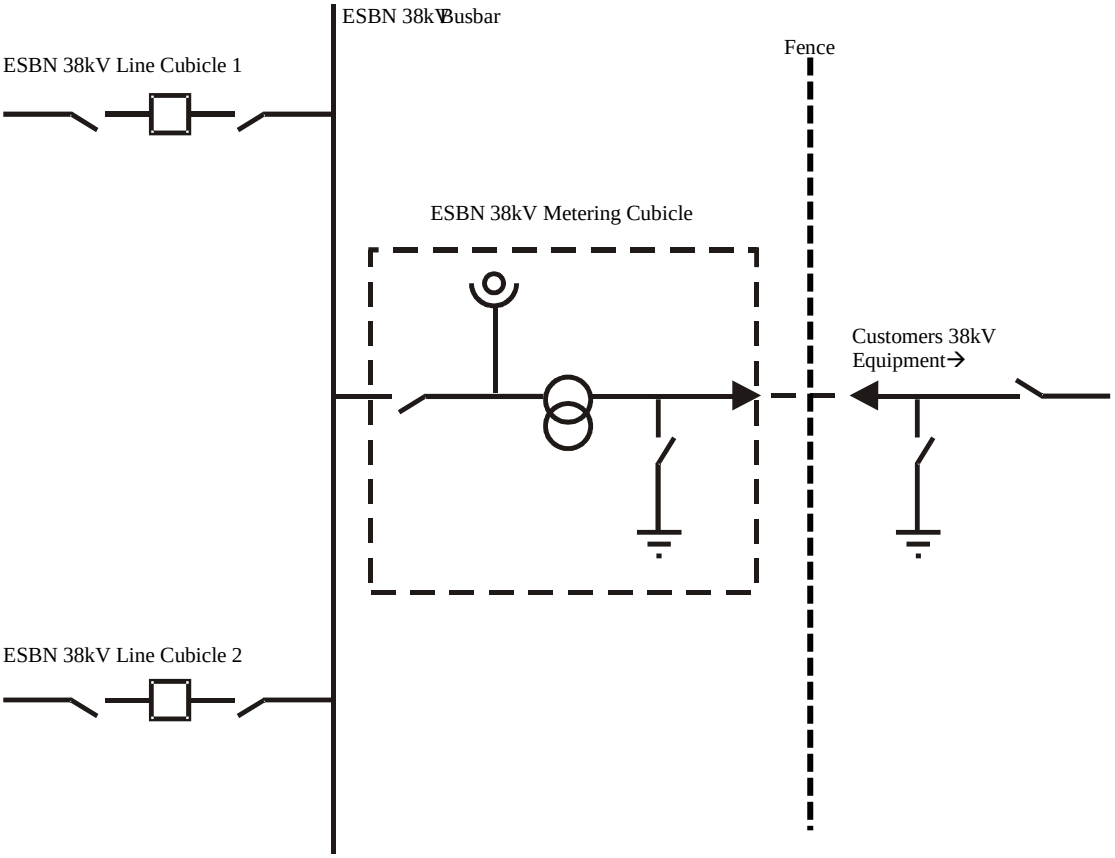
	Disconnection Point	**ESBN Safety Rules**	**If a visible point of disconnection is not provided at the interface point, then under ESBN safety rules, ESBN will have to approve the use of the proposed Customer's equipment as a 'point of disconnection'. ESBN will require the Customer to carry out a risk assessment on the use of the equipment as part of the approval process.**

MV Dual Radial Connection



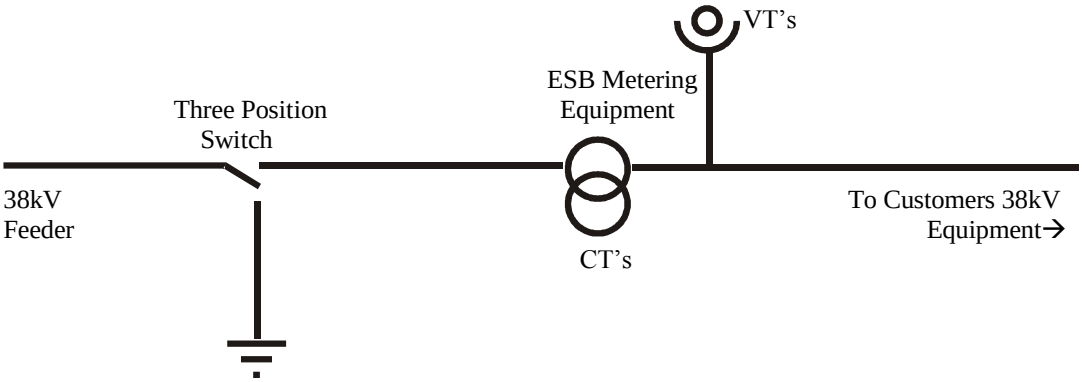
No.	Item	Reqd. by	Requirement
1.	Earthing Facilities	ESBN	Earthing facility required on main incomer cable
		S.I. 44	Customer to consult S.I. 44 for earthing requirements on Customer's equipment
2.	Interlocking	ESBN	Interlocking to be provided between disconnection point and earthing facility on main incomer cable.
3.	Isolation of ESBN	ESBN	Customer to provide a means of isolating ESBN network in the event of a fault on Customer's equipment.
4	Disconnection Point	ESBN Safety Rules	If a visible point of disconnection is not provided at the interface point, then under ESBN safety rules, ESBN will have to approve the use of the proposed Customer's equipment as a 'point of disconnection'. ESBN will require the Customer to carry out a risk assessment on the use of the equipment as part of the approval process.

38kV A.I.S. Connection



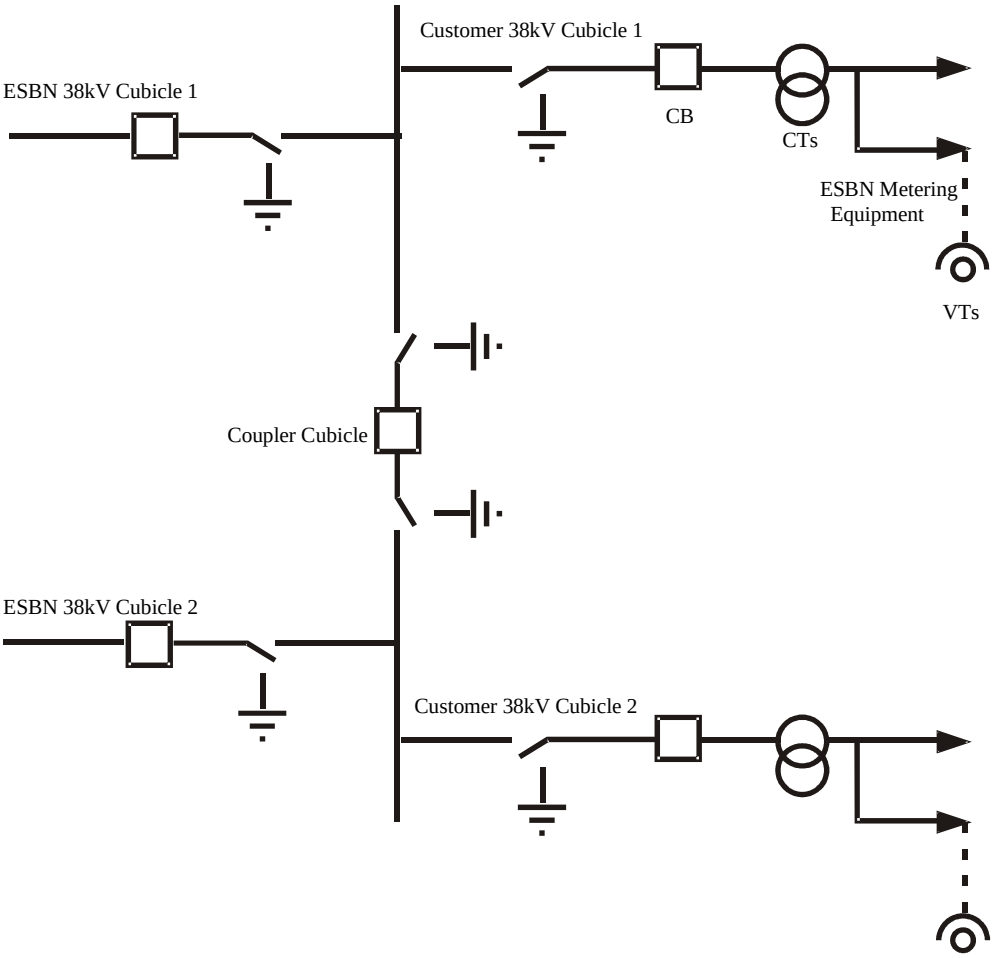
No.	Item	Reqd. by	Requirement
1.	Earthing Facilities	ESBN	Earthing facility required on main incomer cable
		S.I. 44	Customer to consult S.I. 44 for earthing requirements on Customer's equipment
2.	Interlocking	ESBN	Interlocking to be provided between disconnection point and earthing facility on main incomer cable.
3.	Isolation of ESBN	ESBN	Customer to provide a means of isolating ESBN network in the event of a fault on Customer's equipment.

38kV Generator



No.	Item	Reqd. by	Requirement
1.	Earthing Facilities	ESBN	Earthing facility required on main incomer cable
		S.I. 44	Customer to consult S.I. 44 for earthing requirements on Customer's equipment
2.	Interlocking	ESBN	Interlocking to be provided between disconnection point and earthing facility on main incomer cable.
3.	Isolation of ESBN	ESBN	Customer to provide a means of isolating ESBN network in the event of a fault on Customer's equipment.
4.	Interface Protection	ESBN	Interface breaker and Protection as per Section 4

38kV G.I.S. SF6 Connection



No.	Item	Reqd. by	Requirement
1.	Earthing Facilities	ESBN	Earthing facility required on main incomer cable
		S.I. 44	Customer to consult S.I. 44 for earthing requirements on Customer's equipment
2.	Interlocking	ESBN	Interlocking to be provided between disconnection point and earthing facility on main incomer cable.
3.	Isolation of ESBN	ESBN	Customer to provide a means of isolating ESBN network in the event of a fault on Customer's equipment.
4.	Interface Protection	ESBN	Interface breaker and Protection as per Section 4

Appendix 2 Test Schedule for Generators

INTERFACE PROTECTION
TEST SCHEDULE FOR CONNECTION OF GENERATORS
TO ESBN DISTRIBUTION SYSTEM

The customer shall provide detailed technical information through the NC5 form where all relevant sections must be completed. A single line diagram must be submitted with the NC5 on the proposed method of connection of the generator, synchronising, interlocking, and protection.
As already stated the Customer is responsible for carrying out the pre-commissioning prior to the witness testing date and compliance tests and should ensure that the following are provided:

(a) All test equipment, including:
- Variable voltage supply (3 phase if necessary),
- Variable frequency signal generator,
- Phase shifting current/voltage injection kit (for DOC),
- Rate-of-change-of-frequency
- Timer.

(b) Competent Commissioning personnel to operate the equipment.

The purpose of the tests is to check each protection element specified in the requirements for:

- Functional operation by secondary injection.
- Calibration by secondary injection.
- Fail-safe operation.

Operational tests are to be carried out to verify:

- Automatic synchronising and interlocking.
- Tripping of the isolating circuit breaker for protection operation.
- Fail safe operation of the trip circuit with back-up circuit breaker operation.

The Test Schedule has been drafted to include all protection elements. Depending on the type of machine and operating regime, some protection elements may not be required. If in doubt please check with ESBN EGIPwitnesstesting@ESB.ie to confirm which tests are applicable.

TEST PROCEDURE

The following test procedure is an example of the normal means of testing the elements of interface protection. Alternative test procedures may be acceptable but should be advised to ESBN prior to tests being arranged.

It is advisable that the people doing the tests understand what is required, and any queries on any aspects of the tests should be directed towards ESBN EGIPwitnesstesting@ESB.ie in advance of the agreed date. **Two weeks notice of this date is required.**

Confirmation (in the form of completed test reports) that all pre-commissioning tests have been completed and that the protection is ready for final testing should be sent to ESBN EGIPwitnesstesting@ESB.ie **at a minimum of 24 hours in advance** of the agreed date.

Notes**:** **PARALLEL OPERATION FOR TEST PURPOSES SHOULD NOT TAKE PLACE WITHOUT PRIOR WRITTEN PERMISSION FROM THE RELEVANT ESBN NETWORKS SYSTEM CONTROLLER. The Customer is responsible for the arrangement of this.**

SOME TESTS WILL REQUIRE A SHORT DURATION SUPPLY INTERRUPTION TO THE INSTALLATION, SUCH INTERRUPTIONS ARE THE RESPONSIBILITY OF THE CUSTOMER AND CARRIED OUT AT THE CUSTOMER'S EXPENSE.

1. VOLTAGE PROTECTION

Over Voltage - Calibration

(a) Secondary-inject each phase in turn, raising the voltage until the relay operates for the over voltage setting required. (Pick up)

(b) Note the total operating time.

(c) Reduce the voltage and check the reset value. (Drop Off)

Under Voltage - Calibration

(a) Secondary-inject each phase in turn, lowering the voltage until the relay operates for the under voltage setting required.

(b) Note the total operating time.

(c) Raise the voltage and check the reset value.

Over Voltage - Operation

(a) With the generator running in parallel, lower the voltage setting of each phase in turn, until the relay operates on over voltage, tripping the Isolating Switch.

(b) Note the total tripping time.

(c) Check that the Isolating Switch cannot be reclosed until the relay has reset correctly.

If the protection cannot be checked in this way, the correct operation of the relay and tripping of the Isolating Switch should be verified by secondary injection.(only applies to critical)

Under Voltage - Operation

(a) With the generator running in parallel, raise the voltage setting of each phase in turn, until the relay operates on under voltage, tripping the Isolating Switch.

(b) Note the total tripping time.

(c) Check that the Isolating Switch cannot be reclosed until the relay has reset correctly.

If the protection cannot be checked in this way, the correct operation of the relay and tripping of the Isolating Switch should be verified by secondary injection.

2. FREQUENCY PROTECTION

Over Frequency - Calibration

(a) Secondary-inject the relay, raising the frequency until the relay operates for the over frequency setting required.

(b) Note the total operating time.

(c) Reduce the frequency and check the reset value.

Under Frequency - Calibration

(a) Secondary-inject the relay, lowering the frequency until the relay operates for the under frequency setting required.

(b) Note the total operating time.

(c) Raise the frequency and check the reset value.

Over Frequency - Operation

(a) With the generator running in parallel, lower the frequency setting until the relay operates on over frequency, tripping the Isolating Switch.

(b) Note the total tripping time.

(c) Check that the Isolating Switch cannot be reclosed until the relay has reset correctly.

If the protection cannot be checked in this way, the correct operation of the relay and tripping of the Isolating Switch should be verified by secondary injection.

Under Frequency - Operation

(a) With the generator running in parallel, raise the frequency setting until the relay operates on under frequency, tripping the Isolating Switch.

(b) Note the total tripping time.

(c) Check that the Isolating Switch cannot be reclosed until the relay has reset correctly.

If the protection cannot be checked in this way, the correct operation of the relay and tripping of the Isolating Switch should be verified by secondary injection.

3. DIRECTIONAL OVERCURRENT PROTECTION

Directional Overcurrent - Calibration

(a) Secondary-inject each phase in turn, raising the current until the relay operates for the current setting required.

(b) Using a phase shifting kit, verify that the relay is directional, the characteristic is correct and that the relay blocks in the reverse mode.

(c) Note the total operating time.

Directional Overcurrent - Operation

(a) With the generator running in parallel, arrange for it to supply an overcurrent to the ESBN system. Confirm the relay operates tripping the Isolating Switch.

(b) Note the total tripping time.

(c) Check that the Isolating Switch cannot be reclosed until the relay has reset correctly.

If the protection cannot be checked in this way, the correct operation of the relay and tripping of the Isolating Switch should be verified by secondary injection.

4. LOSS OF MAINS PROTECTION

ROCOF - Calibration

(a) Using a rate of change of frequency test kit, secondary-inject the relay raising the rate of change of frequency until the relay operates for the required setting.

(b) Note the total operating time.

Vector Shift - Calibration

(a) Using a vector shift test kit, secondary-inject the relay raising the vector shift angle until the relay operates for the required setting.

(b) Note the total operating time.

Loss of Mains - Operation

The Loss of Mains test will require an interruption in ESBN supply. The Customer should arrange this for the date upon which the witnessing of the final compliance tests is to take place. Usually this will involve the opening of an ESBN Switch, in which case it will be necessary for the Customer to make an arrangement with the relevant ESBN system controller.

(a) With the generator running in parallel, simulate a single-phase loss of mains by opening a single pole switch on the supply side of the main incomer CB. Confirm the relay operates tripping the Isolating Switch.

(b) Note the total tripping time.

(c) Reset all relays and check that the Isolating Switch cannot be reclosed until the mains supply has been restored to normal.

(d) With the generator running in parallel, simulate a three-phase loss of mains by opening a switch on the supply side of the main incomer CB. Confirm the relay operates tripping the Isolating Switch.

(e) Note the total tripping time.

(f) Reset all relays and check that the Isolating Switch cannot be reclosed until the mains supply has been restored to normal.

5. EARTH FAULT PROTECTION

Earth Fault - Calibration

(a) Secondary-inject the relay, raising the voltage until the relay operates for the voltage setting required.

(b) Note the total operating time.

(c) Reduce the voltage and check the reset value.

Earth Fault - Operation

(a) With the generator running in parallel, lower the voltage setting until the relay operates, tripping the Isolating Switch.

(b) Note the total tripping time.

(c) Check that the Isolating Switch cannot be reclosed until the relay has reset correctly.

If the protection cannot be checked in this way, the correct operation of the relay and tripping of the Isolating Switch should be verified by secondary injection.

6. REVERSE POWER (IF APPLICABLE)

Reverse Power - Calibration

(a) Secondary-inject the relay, raising the power injected until the relay operates for the specified setting.

(b) Note the total operating time.

Reverse Power - Operation

(a) With the generator running in parallel, arrange for it to supply power to the ESBN system. Lower the setting until the relay operates, tripping the Isolating Switch.

(b) Note the total tripping time.

(c) Check that the Isolating Switch cannot be reclosed until the relay has reset correctly.

If the protection cannot be checked in this way, the correct operation of the relay and tripping of the Isolating Switch should be verified by secondary injection.

7. PROTECTION FAILSAFE OPERATION

Disconnect the power supply from each relay in turn and check that a trip signal is sent to the Isolating Switch.

8. NEUTRAL ISOLATION

Where neutral earthing is applied with an MV or 38kV generator operating independent of ESBN Networks, check that interlocking operates to disconnect this neutral during parallel operation of the generator.

9. SYNCHRONISING

(a) Check that auto-synchronising operates correctly for each synchronising point.

(b) Check that interlocking prevents closure onto a dead busbar, for all possible combinations of mains and generators.

(c) Check that interlocking prevents unsynchronised paralleling at all possible points of paralleling.

10. TIMING CONTROL FOR PEAK LOPPING/PEAK SHAVING

(a) Check that the time delay to trip is correct.

(b) Check that the trip signal causes the Isolating Switch to trip.

(c) Check that the override switch, if provided, can be sealed.

11. GENERATOR SHUTDOWN

For operation of the emergency stop or manual/automatic shutdown, verify that the Isolating Switch opens and the prime mover shuts down.

12. PROTECTION SEALS & LABELLING

Check that all protection relays specified in ESBN requirements are in a separate cabinet are labelled clearly and correctly and can be sealed.

13. WARNING NOTICE - PARALLEL OPERATION

Check that a warning notice of generator operating in parallel with the ESBN system is fitted to the Main Incoming Circuit Breaker.

After permission for parallel operation has been granted, no modification to the generator or associated equipment affecting any of the requirements contained herein, shall be carried out without prior written agreement of ESBN. If, in the opinion of ESBN, the customer fails to maintain compliance with the requirements or amended requirements at any stage after permission for parallel operation has been granted, ESBN reserves the right to withdraw such permission immediately and without prior notice where circumstances so require.

TEST SCHEDULE

FOR CONNECTION OF GENERATORS TO ESBN DISTRIBUTION SYSTEM

TEST RESULTS SHEETS

TEST RESULTS SHEET

SITE DETAILS	***GENERATOR DETAILS***
Location:	Type:
	Operating Mode:
Owner:	Rating:
Contractor:	Voltage:
Telephone No(s):	Supply Details:

Relay Details	**Manufacturer**	**Type**
Voltage: Frequency: Loss of Mains: Directional Overcurrent: Earth Fault:		

RELAY CALIBRATION					
PROTECTION FUNCTION	**NOMINAL VALUE**	**OPERATION/ SETTING**	**OPERATION VALUE**	**OPERATION TIME**	**RESET VALUE**
Over Voltage R-N or R-S S-N or S-T T-N or T-R	 V V V	Time	 V V V		 V V V
Under Voltage R-N or R-S S-N or S-T T-N or T-R	 V V V	Time	 V V V		 V V V
Over Frequency	50Hz		Hz		Hz
Under Frequency	50Hz		Hz		Hz
Directional Overcurrent R Phase S Phase T Phase	 A A A	50% or 140% Time ≤0.5 sec	 A A A		
Loss of Mains R Phase S Phase T Phase Three Phase	 df/dt Hz/s	Trip on Loss of Mains Time ≤ 0.5 sec	 Hz/s		
Earth Fault Detection	V		V		V

Test Results Sheet

OPERATING CONDITIONS		**FUNCTIONAL OPERATION TEST**		
		PROTECTION FUNCTION	**ISOLATING CB OPEN Y/N?**	**GENERATOR SHUTDOWN Y/N?**
Automatic Synchronising Interlocking to prevent closure onto Dead Busbar Standby/Independent operation – Auto/Man C/O Isolating CB manual close operation – Disabled		Emergency Stop Voltage Relay OV Voltage Relay UV Frequency Relay OF Frequency Relay UF Directional OC Relay Earth Fault Relay		
After a Protection Trip - Relay/s cannot be reset until ESBN supply is normal - Isolating CB cannot be closed until Relay/s reset		Protection Fail-safe Trip Circuit Supervision		
SEALING : Relays can accept Seals		Loss of Mains Relay - Single Phase - Three Phase		

After ESBN supply returns to normal, Automatic Restart / Resumption of Parallel Operation - Time Delay : 5 Minutes	
Timing Control - Hours of Operation : 2.5 Hours (Peak Shaving) 6 Minutes (Peak Lopping)	

NOTES:

NAME OF TESTER (block capitals): _____

POSITION WITHIN COMPANY: _____

COMPANY NAME: _____

ADDRESS OF COMPANY: _____

SIGNATURE OF TESTER: _____

DATE : _____

Appendix 3 Declaration of Fitness for Service

DECLARATION OF FITNESS FOR SERVICE

To : **Distribution System Operator, ESB**

Customer Name : _____

Address of Installation : _____

: _____

DETAILS OF CUSTOMER'S INSTALLATION:

Reference No. (Job ID or MPRN) _____

Supply Voltage _____

Number of circuit breakers (at supply voltage) _____

Length of cable (at supply voltage) _____

Number of Transformers (at supply voltage) _____

Other Equipment (at supply voltage) _____

Relay Settings (primary) (main incomer c/b) _____

Generator installed designed for operating in parallel with ESBN network? **Y/N**

CERTIFICATION:

I certify that the electrical installation at the above address has been inspected and tested and complies with the relevant requirements of S.I. no.44 1993 Part VIII. I also confirm that the installation complies with the Distribution Code and is fit for connection to ESBN Network.

_____

Name (block capitals) and Signature of Customer's Contractor/Technical Representative.

_____

Name of Company and Position within Company.

Date:

Appendix 4 EGIP Design References

EGIP protection system design must comply with ESBN standards. Guidance on the station design should be sought from the ESBN Renewable Connections team (Contact details as per the connection offer letter)
The required standard protection elementary drawings for EGIP relays are listed below. The latest revision of these drawings should be sourced from ESBN
EGIPwitnesstesting@ESB.ie.
Only the configuration supplied by ESBN will be accepted for witness testing.
Tables 4E to 4L in Section 4 of this document should first be used to establish which protection relays are required for a particular EG installation so that the correct elementary drawings can be selected from the list below.

A4.1 Relay Elementary Drawings for MV Interfaces

Protection Functions	**Title**	**Drawing Number**
Under and Over Voltage, Under and Over Frequency, Loss of Mains (ROCOF), Backup Under-Voltage	Elementary Diagram Of Protection For Embedded Generator Interfaces (EGIP) using the Siemens 7SJ804 Relay and Siemens 7RW600 Relay on MV Interfaces	PG406-D009-444-001
Directional Overcurrent (for synchronous generators)	Elementary Diagram Of Protection Using The Siemens 7RW600 and 7SJ804 Protection Relays General Application as Embedded Generator Interface Protection (EGIP) with Overcurrent on 20 kV (CB-Controlled) Distribution System Interfaces	PG406-D009-576-001
Earth Fault Protection (NVD)	Elementary Diagram Of Earth Fault Protection (NVD) For Embedded Generator Interfaces (EGIP) using the Siemens 7SJ804 Relay on MV Interfaces	PG406-D009-536-001PG406-D010-550-001-PG406-D010-551-001-
Contestable Build	General application of the Siemens 7RW600 and 7SJ804 relays as EGI protection to 20 kV (CB-controlled) distribution system interfaces in contestably-built substations. Elementary Diagram Of Protection Using The Siemens 7SA611 Distance Relay And Siemens 7SN600 Transient EF Relay Special Application to the IPP-End of Contestably-Built 38 kV Lines/Cables	PG406-D800-047-001- PG406-D800-050-001-

A4.2 Relay Elementary Drawings for 38kV Interfaces

Protection Functions	Title	Drawing Number
Under and Over Voltage, Under and Over Frequency, Loss of Mains (ROCOF)	Elementary Diagram Of Protection For Embedded Generator Interfaces (EGIP) using the Siemens 7SJ804 Relay and Siemens 7RW600 Relay on 38kV Interfaces	PG406-D009-444-002
Feeder Impedance Protection	Elementary Diagram Of Feeder Impedance Protection For Embedded Generator Interfaces (EGIP) using the Siemens 7SA611 Relay on 38kV Interfaces	PG406-D009-088-001 PG406-D009-230-001
Feeder Impedance Protection with Intertripping	Elementary Diagram Of Feeder Impedance Protection with Intertripping For Embedded Generator Interfaces (EGIP) using the Siemens 7SA611 Relay on 38kV Interfaces	PG406-D009-527-001
Earth Fault Protection (NVD)	Elementary Diagram Of Earth Fault Protection (NVD) For Embedded Generator Interfaces (EGIP) using the Siemens 7SJ804 Relay on 38kV Interfaces	PG406-D009-536-001-001
Cable Differential	Elementary Diagram Of Feeder Differential Protection For Embedded Generator Interfaces (EGIP) using the Toshiba GRL150 Relay on 38kV Interfaces	PG406-D009-412-001 PG406-D009-184-001 PG406-D010-462-001
Busbar Impedance	Elementary Diagram Of Busbar Impedance Protection For Embedded Generator Interfaces (EGIP) using the Siemens 7SA611 Relay on 38kV Interfaces	PG406-D010-326-001
Busbar Differential	Elementary Diagram Of Busbar Differential Protection For Embedded Generator Interfaces (EGIP) using the ABB REB 670 Relay on 38kV Interfaces	PG406-D009-456-002 to 008
Contestable Build	General application of the Siemens 7RW600 and 7SJ804 relays as EGI protection to 38 kV distribution system interfaces in contestably-built substations	PG406-D800-080-001-

A4.3 Relay Elementary Drawings for 110kV Interfaces

Protection Functions	Title	Drawing Number
Under and Over Voltage, Under and Over Frequency, Loss of Mains (ROCOF)	Elementary Diagram Of Protection For Embedded Generator Interfaces (EGIP) using the Siemens 7SJ804 Relay and Siemens 7RW600 Relay on 110kV Interfaces	PG406-D010-517-001
Loss of Mains (Special Protection Scheme)	Elementary Diagram Of Loss of Mains Protection For Embedded Generator Interfaces (EGIP) using a Special Protection Scheme (SPS) on 110kV Interfaces	PG406-D010-513-001
Feeder Impedance Protection with Intertripping. Trip for single phase earth faults	Elementary Diagram Of Feeder Impedance Protection For Embedded Generator Interfaces (EGIP) using the Siemens 7SA612 Relay on 110kV Interfaces	PG406-D010-284-001
Feeder Impedance Protection with Intertripping. Duplicate Impedance protection. Trip for single phase earth faults	Elementary Diagram Of Duplicate Feeder Impedance Protection For Embedded Generator Interfaces (EGIP) using the Toshiba GRZ100 Relay on 110kV Interfaces	PG406-D010-483-001
Overcurrent Protection of 38kV Transformer Feeders (in 38kV and 110kV substations)	Elementary Diagram Of Protection using the 7SJ804 Relays. Special Application to the 38kV-side of 38kV/MV power transformers	PG406-D010-548-001
Busbar Differential	Elementary Diagram Of Busbar Differential Protection For Embedded Generator Interfaces (EGIP) using the ABB REB 670 Relay on 110kV Interfaces	PG406-D010-544-002 to 009
Earth Fault Protection (NVD)	Elementary Diagram Of Earth Fault Protection (NVD) For Embedded Generator Interfaces (EGIP) using the Siemens 7RW600 Relay on 110kV Interfaces	PG406-D010-327-001-003
Busbar Impedance	Elementary Diagram Of Protection For Embedded Generator Interfaces (EGIP) using the Siemens 7SA611 distance Relay on 110kV Interfaces General Application (Non-SCS) as 110kV-Side "Backup" Protection to 110kV Busbar-Terminated 110/38kV and 110kV/MV Power Transformers	PG406-D010-509-001
Cable Differential	Elementary Diagram Of Feeder Differential Protection For Embedded Generator Interfaces (EGIP) using the Toshiba GRL100 Relay on 110kV Interfaces	PG406-D010-292-001
Contestable Build	General application of the Siemens 7RW600 and 7SJ804 relays as EGI protection to 110 kV distribution system interfaces in contestably-built substations Elementary Diagram Of Protection Using The Siemens 7SA611 Distance Relay Application as 38kV System "Backup" Protection on 38kV Busbar-Terminated 110/38kV Power Transformers	PG406-D800-082-001- PG406-D800-034-001-

Derogations

No Derogations are recorded against the Requirements of this document.

Terms & Definitions

For the purposes of this document, the following terms and definitions apply.

Term	Definition
Shall	Designates a Company Requirement, hence conformance is mandatory.
Should	Designates a Company Recommendation where conformance is not mandatory, but is recognised as best practice.
May	Designates a Permissive Statement - an option that is neither mandatory nor specifically recommended.

Table 1: Terms & Definitions