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## Engineering Recommendation G99

Issue 1 – Amendment [9X](#)

[3 October 2022](#)

Requirements for the connection of generation equipment in parallel with public distribution networks on or after 27 April 2019

## 2 Scope and Structure

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2.13 Power Generating Modules which by agreement between the Generator and the DNO have the capability to run in island mode, as described in section 9.6.3, will need to comply with the general requirements of this EREG G99, although the specific technical requirements, particularly in relation to the earthing requirements of Section 8, the design requirements of Section 9 and protection requirements of Section 10 shall be modified in accordance with any site-specific requirements that are specified in the agreement with the DNO and in any contract covering System Restoration services.

2.14 Except for **Limited Frequency Sensitive Mode – Overfrequency** and the requirements relating to output power with falling frequency or where otherwise....

... [note- 2.14 & 2.15 to be renumbered]

## 4 Terms and definitions

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

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### Black Start~~Anchor Plant~~ Capability

An ability in respect of a ~~Black Start Station~~Anchor Power Station, for at least one of its **Generating Units** to ~~Start-Up~~start-up from ~~S~~shutdown and to energise a part of the **Distribution Network** and be synchronised to the **Distribution Network** upon instruction from the **NETSO**, or instruction or signal from the DNO, within ~~two hours~~a time period defined in the System Restoration contract, without an external electrical power supply.

### ~~Black Start Station~~Anchor Power Station

A **Power Generating Facility** which is registered with the **NETSO** or DNO, as having a ~~Black Start Capability~~Anchor Plant Capability.

### System Restoration

The procedure necessary for a recovery from a situation where all electricity supplies have been interrupted and all generation has ceased in that part of the Distribution Network. In these cases, there is no immediate prospect of external electricity supply being available to that part of the Distribution Network from the Transmission System or any other source, and therefore electricity supplies cannot be restored without recourse to the System Restoration Capability of an Anchor Power Station.

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## 5 Legal Aspects

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5.6 The **DNOs** have statutory and licence obligations within which they have to offer the most economic, technically feasible option for connecting **Power Generating Facilities** to their **Distribution Networks**. The main general design obligations imposed on the **DNOs** are to:

- (a) maintain supplies to their **Customers** within defined statutory voltage and frequency limits;
- ~~(b)(a) ensure that the **Distribution Networks** at all voltage levels are adequately earthed;~~
- ~~(c)(b)~~ comply with the "Security of Supply" criteria defined in EREC P2;
- ~~(d)(c)~~ meet improving standards of supply in terms of customer minutes lost (CMLs) and the number of customer interruptions (CIs);
- ~~(d) ensure that the **Distribution Networks** at all voltage levels are adequately earthed;~~
- (e) facilitate competition in the connection, generation and supply of electricity.

5.7 Under conditions of **System Restoration** it is recognized that **DNOs** may relax some or all of the requirements (a) to (c) of section 5.6 for the duration of **System Restoration** for the purpose of re-establishing a stable network.

5.8 Failure to meet any of the above obligations will incur legal or regulatory penalties. The first two criteria, amongst others, define the actions needed to allow islanded operation

... [note - 5.8 to 5.19 to be renumbered]

## 9 Network Connection Design and Operation

### General Criteria

- 9.1.1 As outlined in Section 5, **DNOs** have to meet certain statutory and **Distribution Licence** obligations when designing and operating their **Distribution Networks**. These obligations will influence the options for connecting **Power Generating Modules**.
- 9.1.2 The technical and design criteria to be applied in the design of the **Distribution Network** and **Power Generating Module** connection are detailed in this document and DPC 4 of the **Distribution Code**. The criteria are based upon the performance

requirements of the **Distribution Network** necessary to meet the above obligations.

9.1.3 The **Distribution Network**, and any **Power Generating Module** connection to that network, shall be designed:

- (a) to comply with the obligations (to include security, frequency and voltage; voltage disturbances and harmonic distortion; auto reclosing and single phase protection operation).
- (b) according to design principles in relation to **Distribution Network's** plant and equipment, earthing, voltage regulation and control, and protection as outlined in DPC4, subject to any **Modification** to which the **DNO** may reasonably consent.

9.1.4 **Power Generating Modules** should meet a set of technical requirements in relation to its performance with respect to frequency and voltage, control capabilities, protection coordination requirements, **Phase (Voltage) Unbalance** requirements, neutral earthing provisions, islanding and ~~Black—Start Capability~~Anchor Plant Capability as applicable. The technical connection requirements in this chapter are common to all **Power Generating Modules**.

9.1.5 In addition requirements for **Type A Power Generating Modules** are detailed in Section 11. Requirements for **Type B Power Generating Modules** are detailed in Section 12. Requirements for **Type C and Type D Power Generating Modules** are detailed in Section 13.

9.1.6 The **Reactive Power** and voltage control requirements are given in Section 11, Section 12 and Section 13 for **Type A Power Generating Modules**, **Type B Power Generating Modules**, and **Type C and Type D Power Generating Modules** respectively. They are summarised in Table D.4 for information.

9.1.7 Every **Power Generating Module** and any associated equipment must be designed and operated appropriately to comply with cyber security requirements. The **Generator** shall consider all cyber security risks applicable to the **Power Generating Module** in terms of the communication between any energy management system etc and also in terms of interaction with any system of the **Manufacturer** for product management.

9.1.8 As explained in section 2.13 DNOs may relax certain aspects of section 9 for island operation, and section 5.7 during System Restoration.

~~9.1.89~~9.1.9 The **Generator** shall provide information describing the high level cyber security approach, as well as the specific cyber security requirements complied with. The.....

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## 9.6 Island Mode

9.6.1 There are two specific instances of island mode to be considered:

- (a) where the **Generator** wishes to deliberately move from the long-term parallel mode of operation to the situation where the **Generator's Power Generating Module(s)** is arranged to supply just the load presented by

the **Customer's Installation**, with the **Customer's Installation** disconnected from the **DNO's Distribution Network**; or

- (b) where one or more **Power Generating Modules**, belonging to one or more **Generators**, support an isolated part of the **DNO's Distribution Network**, maintaining supplies to other **Customers** of the **DNO**.

#### 9.6.2 Customer's Installation Island

9.6.2.1 Wherever a **Generator's Power Generating Module** runs in parallel with the **DNO's Distribution Network** for more than 5 minutes per month, the design of the **Power Generating Module** and the **Customer's Installation** must meet the requirements for long-term parallel operation and comply with all the appropriate requirements of this EREC G99.

9.6.2.2 Where a **Generator** intends to operate the **Power Generating Module** so that it supplies just the **Customer's Installation**, it is the **Generator's** responsibility to ensure the safety of the **Customer's Installation** in respect of electrical and general safety.

9.6.2.3 The arrangements of Figures 8.6 (HV) and 8.9 (LV) will generally be appropriate for earthing and switching arrangements. Exact designs of **Customer's Installations** will vary, but the functional requirements of these figures should be implemented.

9.6.2.4 It is the **Generator's** responsibility to ensure appropriate and safe synchronisation to, and disconnection from, the **DNO's Distribution Network**, respecting the requirements of EREC P28 on voltage disturbances on the **DNO's Distribution Network**.

#### 9.6.3 DNO Distribution Network Island

9.6.3.1 [The provisions of this section 9.6.3 apply to situations where island mode operation is envisaged both for the mutual benefit of \*\*DNOs\*\* and relevant \*\*Generators\*\*. For \*\*Anchor Power Stations\*\*, additional or different technical requirements may be imposed, again by mutual agreement, and recorded in the \*\*System Restoration\*\* services contract.](#)

9.6.3.42 A fault or planned outage, which results in the disconnection of a **Power Generating Module**, together with an associated section of **Distribution Network**, from the remainder of the **Total System**, creates the potential for island mode operation. It will be necessary for the **DNO** to decide, dependent on local network conditions, if it is desirable for the **Generators** to continue to generate onto the islanded **DNO's Distribution Network**. The key potential advantage of operating in island mode is to maintain continuity of supply to the portion of the **Distribution Network** containing the **Power Generating Module**. The principles discussed in this section generally also apply where **Power Generating Modules**

on a **Generator's** site is designed to maintain supplies to that site in the event of a failure of the **DNO** supply.

... [note – 9.6.3.1 to 9.6.3.8 to be renumbered]

## 10 Protection

### General

- 10.1.1 The main function of the protection systems and settings described in this document is to prevent the **Power Generating Module** supporting an islanded section of the **Distribution Network** when it would or could pose a hazard to the **Distribution Network** or **Customers** connected to it. The settings recognize the need to avoid nuisance tripping and therefore require a two stage approach where practicable, ie to have a long time delay for smaller excursions that may be experienced during normal **Distribution Network** operation, to avoid nuisance tripping, but with a faster trip, where possible, for greater excursions.
- 10.1.2 In accordance with established practice it is for the **Generator** to install, own and maintain this protection. The **Generator** can therefore determine the approach, ie per **Power Generating Module** or per installation, and where in the installation the protection is sited.
- 10.1.3 Where a common protection system is used to provide the protection function for multiple **Power Generating Modules** the complete installation cannot be considered to comprise **Fully Type Tested Power Generating Modules** if the protection and connections are made up on site and so cannot be factory tested or **Type Tested**. If the units or **Power Generating Modules** are specifically designed to be interconnected on site via plugs and sockets, then provided the assembly passes the function tests required in Form A2-4 (Annex A.2), the **Power Generating Modules** can retain **Type Tested** status.
- 10.1.4 **Type Tested Interface Protection** shall have protection settings set during manufacture. An **Interface Protection** device or relay can only be considered **Type Tested** if:
- (a) The frequency and LoM protection settings are factory set in firmware by the **Manufacturer** to those in Table 10.1 and cannot be changed outside the factory (except as provided by (e) below).
  - (b) The voltage protection settings are factory set to those in Table 10.1 and can be changed by agreement with the **DNO** and by personnel specifically instructed by the **Generator** to make this change.
  - (c) The access by the personnel specifically instructed shall be controlled by a password, pin or a physical switch that has the facility to be sealed.
  - (d) Any **Interface Protection** device functionality other than the voltage protection settings (eg such as any auto reclosing functionality) can only be changed by personnel specifically empowered to do so by the **Generator**.
  - (e) Any changes to device firmware etc, where **Type Tested** status is to be retained, outside of the original factory environment shall be undertaken

by personnel specifically empowered and equipped for that task by the **Manufacturer**.

- 10.1.5 Once the **Power Generating Modules** has been installed and commissioned the protection settings shall only be altered following written agreement between the **DNO** and the **Generator**. Paragraphs 10.6.14 and 10.6.15 detail the protection setting calculation for non-standard **LV** connections and the display requirements respectively.
- 10.1.6 In exceptional circumstances additional protection may be required by the **DNO** to protect the **Distribution Network** and its **Customers** from the **Power Generating Module**.
- 10.1.7 Note that where the **Generator** installs an export limitation scheme in accordance with EREC G100 the installation will also need to comply with the requirements of that EREC.
- 10.1.8 Where a **Generator** has entered into an agreement with the **DNO** for island mode operation or has entered into a **System Restoration** services contract, the **DNO** and the **Generator** shall agree variations to the standard arrangements described in this Section 10 to the extent necessary to facilitate island mode operation and/or **System Restoration** services.

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### 13.7 ~~Black Start~~Anchor Plant Capability and rapid re-synchronisation

- 13.7.1 The **National Electricity Transmission System** is equipped with ~~Black Start~~Anchor Power Stations. It will be necessary for each **Generator** to notify the **DNO** if its **Power Generating Module** has a restart capability without connection to an external power supply, unless the **Generator** shall have previously notified the **NETSO** accordingly under the **Grid Code**. Such generation may be registered by the **NETSO** as an ~~n Black Start~~Anchor Power Station.
- 13.7.2 In case of disconnection of the **Power Generating Module** from the **Distribution Network**, the **Power Generating Module** shall be capable of quick re-synchronisation if required by the **NETSO**. If the **NETSO** requires rapid re-synchronisation it will agree the strategy with the **DNO** and the **Generator**. Where rapid re-synchronisation is required:
- (a) A **Power Generating Module** with a minimum re-synchronisation time greater than 15 minutes after its disconnection from any external power supply must be capable of houseload operation from any operating point on its **Power Generating Module Generator Performance Chart**. In this case, the identification of houseload operation must not be based solely on the **DNO's** switchgear position signals; and
  - (b) **Power Generating Modules** shall be capable of houseload operation, irrespective of any auxiliary connection to the **Distribution Network**. The minimum operation time shall be specified by the **NETSO**, taking into consideration the specific characteristics of prime mover technology.

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19.3.3 Prior to the issue of an **Interim Operational Notification** the **Generator** shall submit to the **DNO** to the **DNO's** satisfaction:

- (a) an update of any of the items required to achieve an **Energisation Operational Notification** and any updated DDRC data (both **Standard Planning Data** and **Detailed Planning Data**), with any estimated values assumed for planning purposes confirmed or, where practical, replaced by validated actual values and by updated estimates for the future and by updated forecasts for forecast data items such as demand;
- (b) details of any special **Power Generating Module(s)** protection. This may include Pole Slipping protection and islanding protection schemes as applicable;
- (c) a simulation study report in accordance with the provisions of Annex C.7 containing the results demonstrating compliance with EREC G99 **Frequency Sensitive Mode** requirements of paragraph 13.2.7, paragraph 13.2.4 (**LFSM-O**) and paragraph 13.2.5 (**LFSM-U**), **Fault Ride Through** requirements of Section 13.3 and **Fast Fault Current** injection requirements of Section 13.6 as applicable to the **Power Generating Module(s)** unless agreed otherwise by the **DNO**. If a **Power System Stabiliser** is fitted the appropriate studies should be undertaken in accordance with the **Grid Code**;
- (d) a detailed schedule of the tests and the procedures for the tests required to be carried out by the **Generator** to demonstrate compliance in order to gain a **Final Operational Notification**. Such schedule to be consistent with Section 13, Site testing and commission requirements, Annex C.7, together with Annex C.8 (in the case of **Synchronous Power Generating Modules**) or Annex C.9 (in the case of **Power Park Modules**); and
- (e) an interim Compliance Declaration completed by the **Generator** (including any **Unresolved Issues**) against the relevant EREC G99 requirements including details of any requirements that the **Generator** has identified that will not or may not be met or demonstrated. If applicable this should include a declaration that ~~black-start~~ **Anchor Plant Capability** compliance has been obtained from the **NETSO**.