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Engineering Recommendation G83

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27 May 2019

Recommendations for the Connection of Type Tested
Small-scale Embedded Generators (Up to 16A per Phase) in
Parallel with Low-Voltage Distribution Systems

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Amendments since publication

Issue	Date	Amendment
Issue 1	September 2003	Revision
Issue 1-1	June 2008	Revision (ammendment1)
Issue 2	December, 2012	Full revision of the previous version G83/1-1 2008 to ensure alignment with the requirements of EREC G59/2
Issue 2-1	01 July 2018	RoCoF and VS immunity requirements – amendments to; 5.3.1, 5.3.3, Appendix 4
Issue 2-2	14 March 2019	Amendments to add new fuel/technology type to Appendix3
<u>Issue 2-3</u>	<u>27 May 2019</u>	<u>Note added to section 2 to make it clear that generation connected on or after 27 April 2019 must comply with G98. Unnecessary dated references removed from Section 3</u>

2 Scope

This Engineering Recommendation provides guidance on the technical requirements for the connection of **Type Tested Small-Scale Embedded Generators (SSEGs)** in parallel with public low-voltage distribution networks. For the purposes of this Engineering Recommendation a **SSEG** is a source of electrical energy rated up to and including 16 Ampere per phase, single or multi-phase, 230/400 V **AC**.

This corresponds to 3.68 kilowatts (kW) on a single-phase supply and 11.04 kW on a three-phase supply. The kW rating shall be based on the nominal voltage (ie 230V) as defined in BS EN 50160 and the Electricity Supply Quality and Continuity Regulations (ESQCR).

SSEGs commissioned on after 27 April 2019 must comply with EREC G98. EREC G83 is not applicable to generation commissioned on or after that date.

Where the **SSEG** includes an **Inverter** its rating is deemed to be the **Inverter's** continuous steady state rating.

There are two connection procedures described in this document.

The first connection procedure covers the connection of one or more **SSEG** systems, either single or multi-phase within a single **Customer's Installation**.

Multiple **SSEG** systems shall be accepted within a single **Customers Installation** provided that the aggregate rated capacity of the systems is not greater than 16A per phase².

The second connection procedure covers the connection of multiple **SSEGs** (other than within a single **Customer's Installation**) in a **Close Geographic Region**, under a planned programme of work.

This Engineering Recommendation only specifies the connection requirements applicable to those **SSEG** installations that are designed to normally operate in parallel with a public distribution network. Those installations that operate in parallel with the **DNO's Distribution System** for short periods (ie less than 5 minutes) or as an islanded installation or section of network are considered to be out of scope, on the basis that it is not possible to devise generic rules that will ensure safe operation under all operating conditions.

The generic requirements for all types of **SSEG** systems are defined in the main text of this Engineering Recommendation, whilst the generic and technology specific type testing requirements are defined in the annexes. The generic requirements relate to the connection, installation and network design requirements for connection of a **SSEG** to a public low-voltage **Distribution System**. **SSEGs** that are not **Type Tested** to conform to the requirements of this document can only be connected via the guidelines laid down in Engineering Recommendation G59.

Annexes A and B describe a methodology for testing the particular types of electrical interface between the **SSEG** and the **Distribution System** whilst Annex C describes a methodology for testing technology specific **SSEG** requirements. The purpose of the type tests is to demonstrate compliance with the generic requirements of this Engineering Recommendation. By satisfying the test conditions in the relevant annex the **SSEG** can be considered an approved **SSEG** for connection to a public low-voltage **Distribution System**.

² The manufacturer may restrict the rating of the SSEG by applying software settings provided these settings are not accessible to the customer

In the event that a new type testing annex is required then this should be formally initiated by the **GB Distribution Code Review Panel (DCRP)**.

The Appendices contain pro forma that relate to the connection, commissioning, type testing, and decommissioning of **SSEGs**.

This document does not remove any statutory rights of an individual or organisation; equally it does not remove any statutory obligation on an individual or organisation.

Connection agreements (ie the legal documentation supporting the connection of a **SSEG**), energy trading and metering are considered to be out of scope. These issues are mentioned in this document only in the context of raising the reader's awareness to the fact that these matters might need to be addressed

3 Normative References

The following referenced documents, in whole or part, are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

Standards publications

BS 7671-~~2008~~ Requirements for Electrical Installations

IEE Wiring Regulations Seventeenth (Amendment 1 2011) Edition.

BS EN 50160-~~2010~~

Voltage characteristics of electricity supplied by public electricity networks.

BS EN 50438-~~2008~~

Requirements for the connection of micro-generators in parallel with public low-voltage distribution networks.

BS EN 60034-4-~~2008~~

Methods for determining synchronous machine quantities from tests.

BS EN 60255 series*

Measuring relays and protection equipment.

BS EN 60664-1-~~2007~~

Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests (IEC 60664-1:2007).

BS EN 60947 series*

Low Voltage Switchgear and Controlgear.

BS EN 61000-3-2-~~2006+A2:2009~~

Limits for harmonic current emissions (equipment input current up to and including 16 A per phase).

BS EN 61000-3-3-~~2008~~

Limits – Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current < 16A per phase and not subject to conditional connection.

BS EN 61000 series*

Electromagnetic Compatibility (EMC).

BS EN 61508 series*

Functional safety of electrical/ electronic/ programmable electronic safety-related systems.

BS EN 61810 series*

Electromechanical Elementary Relays.

BS EN 62116

Test procedure of islanding prevention measures for utility-interconnected photovoltaic Inverters.

IEC 60255-5: ~~2001~~

Electrical relays. Insulation coordination for measuring relays and protection equipment. Requirements and tests.

IEC 60725

Considerations or reference impedances for use in determining the disturbance characteristics of household appliances and similar electrical equipment.

IEC 60909-1 (~~Second Edition~~): ~~2002~~

Short circuit calculation in three-phase AC systems.

IEC 62282-3-2 ~~ed1.0~~: ~~2006~~

Fuel cell technologies - Part 3-2: Stationary fuel cell power systems - Performance test methods.

****Where standards have more than one part, the requirements of all such parts shall be satisfied, so far as they are applicable.***

Other publications

Health and Safety at Work etc Act (HASWA): 1974

The Health and Safety at Work etc Act 1974 also referred to as HASAW or HSW, is the primary piece of legislation covering occupational health and safety in the United Kingdom. The Health and Safety Executive is responsible for enforcing the Act and a number of other Acts and Statutory Instruments relevant to the working environment.

Electricity Safety, Quality and Continuity Regulations (ESQCR)

The Electricity Safety, Quality and Continuity Regulations 2002 - Statutory Instrument Number 2665 -HMSO ISBN 0-11-042920-6 abbreviated to ESQCR in this document.

Electricity at Work Regulations (EaWR): 1989

The Electricity at Work regulations 1989 abbreviated to EaWR in this document.

Engineering Recommendation G5/4-1 (2005)

Planning levels for harmonic voltage distortion and the connection of non-linear equipment to transmission and distribution networks in the United Kingdom.

Engineering Recommendation G59/2, Amendment 1 (2011)

Recommendations for the Connection of Embedded Generating Plant to the