

# Distribution Code Consultation DCRP/MP/21/01

## Title: Minor technical modifications to EREC G98 and G99

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**Target Audience:** All current and prospective manufacturers, developers, owners and operators of generation (and storage) of any size connecting new generation equipment to distribution networks.

**Date Published:** 19<sup>th</sup> February 2021

**Deadline for responses:** 17:00 19<sup>th</sup> March 2021

### Summary:

This Distribution Code public consultation is seeking the views from stakeholders on proposed modifications to existing Distribution Code documents including a number of updates, corrections, clarifications and additions. Together these modifications are referred to as minor technical modifications.

### 1 Introduction

The transition from ERECs G83 / G59 to ERECs G98 / G99 resulted in significant changes to generation connection requirements and compliance demonstration. It is taking time for manufacturers and generators to familiarise themselves with the new technical and compliance requirements, and for DNOs to embed new processes in their organisations. Issues with the understanding and implementation of ERECs G98 and G99 can be brought to a number of forums. The bulk of these amendments have arisen from feedback to the Distributed Energy Resources Technical Forum<sup>1</sup>.

The modifications proposed here are a batch of issues raised since the last modifications to EREC G98 and G99. They span all Types of Power Generating Module (A – D) and include new requirements as well as clarifications to existing requirements.

The opportunity has been taken to review the compliance forms in ERECs G98 and G99. Completing / reviewing EREC G98 or G99 forms and demonstrating compliance has been a learning curve for both generators and DNOs. Feedback on the compliance forms has been incorporated.

Included in this consultation document are the following appendices:

- Annex 1 – Proposed Changes to Dcode
- Annex 2 – Proposed changes to G98
- Annex 3 – Proposed changed to G99

### 2 The Defects

The documents proposed for modification are;

- Distribution Code v45 (Issued 12 June 2020)

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<sup>1</sup> [http://www.dcode.org.uk/panels/distributed-energy-resource-\(der\)-technical-forum.html](http://www.dcode.org.uk/panels/distributed-energy-resource-(der)-technical-forum.html)

- EREC G98 (Issue 1 Amendment 4 – June 2019)
- EREC G99 (Issue 1 Amendment 6 – 9 March 2020)

## **2.1 Summary of Key Changes**

### **2.1.1 Distribution Code**

Data describing the source of energy for generation, and the conversion technology, has been redefined in the Grid Code. DNOs need to report routinely to the NETSO on the generation connected to distribution networks using the Grid Code delineations. In parallel with this requirement the DNOs now have a licence obligation to populate and update the Embedded Capacity Registers.. The new list of energy sources and energy conversion technologies has been added to the Distribution Data Registration Code to replace the previous list in Schedule 5(b). In addition a clarification on the nature of grid references has been added to Schedule 5(a), again recognizing the requirements of the Embedded Capacity Registers.

The definitions of Minimum Stable Operating Level and Minimum Regulating Level have been added to align with their use in G99. The use of these terms in the Distribution Code is confined to the Distribution Data Registration Code. Minimum Stable Operating Level already existed in the Distribution Code, but was termed Minimum Generation.

Annex 1 includes the whole of the definitions and to the Distribution Data Registration Code showing the amendments in context.

### **2.1.2 G98**

G98 will be updated to remove references to the withdrawn BS EN 50438. Relevant references will be made to BS EN 50549. BS EN 50549 does not include some essential requirements that BS EN 50438 used to include, so these will be added to EREC G98. There is also a new requirement proposed for EREC G98 regarding cyber security (2.3.10) and new text on a family approach to type testing (2.3.6).

The remaining proposed modifications are clarifications.

### **2.1.3 G99**

There are a number of new requirements proposed for EREC G99, relating to:

- Rapid resynchronisation (2.4.9)
- Annex C.6 Functional Specification for Dynamic System Monitoring (2.4.22)
- Cyber security (2.4.5)

The remaining proposed modifications are minor or simple clarifications.

## **2.2 Distribution Code Modifications**

There are no other changes than those described in 2.1.1.

## **2.3 G98 Modifications**

### **2.3.1 Definitions**

The definition of Registered Capacity will be amended such that, for inverter connected Microgeneration, the Registered Capacity is the lesser of the inverter rating or the rating of the energy source, rather than simply the inverter rating. This will align the definition more closely with that in EREC G99.

### **2.3.2 Foreword**

A sentence has been removed from the Foreword (end of first paragraph) that is out of date (“Micro-generators that conform to this EREC G98 can be connected in advance of 27 April 2019 as they also conform to the pre-existing EREC G83 requirements.”).

### **2.3.3 References**

The titles of EREC G5 and EREC P28 have been updated in the references section.

### **2.3.4 Removal of reference to EN 50438**

In the initial drafting of EREC G98 from EREC G83, a number of requirements were removed from G98 and replaced with references to EN 50438, in order to align with Standard documentation. EN 50438 has now been withdrawn; and replaced with EN 50549 Part 1, but this does not fully replicate EN 50438 and does not detail test requirements. Test requirements are expected to be detailed in EN 50439 Part 10 which is currently in draft. The DNOs and the DER technical forum expressed a preference to remove reference to EN 50438 from G98, and reinstate the requirements that had previously been removed. This will include edits to:

- The Foreword
- 1.4 (remove references to CE marking)
- 2.1 (remove reference to EN 50438)
- 2.8 (remove text)
- 2.11 (remove reference to EN 50438)
- 3.2 standards publications
- 6.2.2 (remove references to CE marking)
- 7.2.1 (reinstate wiring requirement including new Figure 1 example of warning label)
- 7.3.1 (reinstate labelling requirement)
- New 7.7 Earthing (reinstate earthing requirements)
- 9.3 (reinstate LFSM-O details)
- 9.5.1 (remove reference to EN 50548 and replace with EN 50549-1)
- 9.6.1 (reinstate automatic connection requirement)
- 10.1.10 (operation within expected temperature range and other environmental factors)
- 10.2.1 (remove reference to EN 50548)
- 11.1 (reinstate power quality requirement)
- 11.2 (reinstate DC injection limit)
- 11.3 (reinstate requirement to conform with EMC standards)
- 11.4 (remove reference to EN 50438)
- Form C (mods to the introduction, remove reference to EN 50438 and refer instead to G98 annexes)
- A.1.1.1, A.1.2.2, A.1.2.3 (remove reference to EN 50438)
- A.1.2.7, A.1.2.8, A.1.2.9 (include test descriptions for active power feed-in at under-frequency and active power feed-in at over-frequency and operating range)
- A.1.3.2, A.1.3.4 (include test descriptions for power factor, DC injection) and removal of A.1.3.7 (EMC standards)
- Similarly for A2
- Changes in a number of clauses from Controller to Micro-generator

### **2.3.5 Replace “Product ID” with “system reference”**

The terms Product ID is used in G98, as this was the term used on the ENA Type Test Verification Report register to refer to the manufacturer’s reference number. Since the ENA update of the Type Test register, the term “system reference” is now used. This will be amended in 2.12 and the relevant forms.

### **2.3.6 Family approach to type testing**

VDE, a German testing and certification institution, accepts an approach to type testing within “families” of Generating Units. A family is a model produced by a manufacturer that varies in size. Within a limited range (with different ranges for synchronous generating units and Power Park Modules) if the compliance of one Generating Unit in a family has been demonstrated, all units in that family can be considered type tested. It is the responsibility of the manufacturer to justify why the results for one unit are transferrable (eg they have the same control system).

New clauses will be added to G98 6.3 (and G99 15.6) to allow for the same approach.

### **2.3.7 Update Figure 2 circuit diagram**

7.3.3 contains an example of a circuit diagram that could be displayed at the connection point. The current figure includes a FIT (Feed in Tariff) meter, which is out of date as the FIT has closed to new applicants. The figure will be updated to remove the FIT meter, and combine the separate import and export meters into a single device.

### **2.3.8 Modification to G83 installations**

A new paragraph 8.4.4 will be added to G98 to cover the scenario whereby significant changes are made to a EREC G83 Micro-generator. In this case, it would need to comply with EREC G98. The wording for this paragraph is based on EREC G99 20.3.4. A footnote will be included referring the reader to EREC G99 Annex A.6 for guidance on what is considered a significant modification.

### **2.3.9 Minimum stable operating level**

Two new clauses are proposed for G98, 9.3.3 and 9.3.4, in relation to the Micro-generator not being expected to operate below its minimum stable operating level in the provision of LFSM-O.

### **2.3.10 Cyber security**

A new requirement for all equipment within the scope of G98 to comply with “ENA and Department for Business, Energy and Industrial Strategy (BEIS) Distributed Energy Resources (DER) – Cyber Security Connection Guidance” where applicable and the PAS 1879 “Energy smart appliances – Demand side response operation – Code of practice” has been introduced in Section 9. Both of these documents will be added to the list of references.

A section will be added to Form C Type Test Verification Report for the manufacturer to confirm that the Micro-generator complies with the cyber security requirements.

### **2.3.11 Energy source and energy conversion technology**

A list of generation (including storage) technologies is contained in:

- The Distribution Data Registration Code (DDRC) in the Distribution Code
- EREC G98 Form B Installation document
- EREC G99 Standard Application Form (SAF) Part 3 (page 21) and

A Distribution Code Review Panel (DCRP) working group is reviewing data and data transfer requirements, including reviewing the list of generation technologies. It is proposed to align these lists with the latest data reporting requirements in the Embedded Capacity Registers. In G98, the list is at the end of Form B Installation document, Appendix 3.

### **2.3.12 Electricity storage device capacity**

The G99 Standard Application Form (SAF) is being updated to include an additional field for storage devices: electricity storage device capacity (kWh). It is proposed that this information will also be requested in the G98 and G99 application forms.

### **2.3.13 Small rotating machines**

The G98 and G99 Type A testing approach is based on G83, and to a lesser extent G59. These were originally written with inverters exclusively in mind, although drafting was completed for synchronous machines. Little explicit recognition was made of induction generators. It seems that there was very little experience of the application of G83 to rotating machines because of the absence of rotating machines of that size (3kW) from the market. G98 and G99 carried most of this drafting forward as far as possible, not least to be backward compatible.

Small machines generally have a limit of stable operation – probably in the 30% to 60% of Registered Capacity. Below this they become uncontrollable/unstable. This is a feature of all rotating machines.

G98 and G99 include suggested tests that require operation at 10% of Registered Capacity, which some manufacturers state is not possible.

G99 explicitly recognizes this for Type C rotating machines, and allows tests to be proposed by the Generator that do not take the module below its Minimum Stable Operating Level – this is an issue principally for Frequency Sensitive Mode (FSM).

Modifications are proposed to allow different test loadings above the Minimum Stable Operating Level (MSOL). These modifications are proposed to Annex A, and include modifications to:

- A.2.2.4 Loss of mains protection test loading levels
- A.2.3.1 Harmonic test power levels
- New footnotes 7 and 8 on the loss of mains and harmonic tests in Appendix 3, Form C

### **2.3.14 Compliance forms**

The opportunity is being taken to review the G98 compliance form, Appendix 3 Form C. Amendments will include:

- More guidance throughout on completing the test sheets.
- A new field for electricity storage devices to capture energy storage capacity (kWh).
- Additional tests for operating range (test 1 20 seconds at 47 Hz and test 6 RoCoF withstand).
- Additional test (test 5) for continuous operating range.
- Additional row for the manufacturer to indicate, for three-phase Micro-generators, whether harmonic measurements for all three phases are identical. Where they are not, the Manufacturer is requested to complete the measurement form for each phase.
- Guidance to delete as appropriate for standard impedance in voltage fluctuations and flicker test.
- Move location of test start date / test end date / test location to the top of the voltage fluctuations and flicker test, to make it clearer that this needs to be completed.
- In Power Factor test, remove four rows for results at different levels of Registered Capacity and replace with a single row for measured output.
- LFSM-O test: add a note about measurement tolerances with reference to A.1.2.8.
- Fault level contribution: add a note to complete all entries, even if the fault contribution is zero.
- Logic interface: Add a row requesting a high level description of logic interface, with reference to 9.4.3.

These modifications are not retrospective; there is no need to consider reviewing/retesting existing type tested devices for compliance with these modifications. They will only apply to type tested power generating modules manufactured after the introduction date of this modification to G98.

## **2.4 G99 Modifications**

### **2.4.1 Foreword**

A sentence has been removed from the Foreword (second paragraph) that is out of date (“Power Generating Modules that conform to this EREC G99 can be connected in advance of 27 April 2019 as they also conform to the pre-existing EREC G59 requirements.”).

### **2.4.2 References**

The Distributed Energy Resources – Cyber Security Connection Guidance published by the ENA and the Department for Business, Energy and Industrial Strategy (BEIS) will be added to the list of references in G99. A footnote to the same document will also be added to 14.1.4(f).

The reference to ETR (Engineering Technical Report) 126 will be updated to EREP (Engineering Report) 126. References to this document in the following paragraphs of G99 will be updated: 11.4.2, 11.4.5, 12.4.2, 12.4.6, 13.4.2 and 13.4.8.

The reference to BSEN50549 has been expanded to clarify that this is a suite of documents by adding the word “series”.

### **2.4.3 Definitions**

The definition of Connection Agreement will be modified to clarify that site requirements relate to the Power Generating Facility.

The definition of Fully Type Tested will include a clarification ( $\leq 50$  kW), as per 2.4.12.

Minimum Regulating Level (MRL) will be moved to precede Minimum Stable Operating Level (MSOL), to be in correct alphabetical order. The definition of MRL and MSOL have been rewritten to provide clarity in respect of their differences and to clearly align with the Grid Code.

The definition of Droop has been amended to qualify the reference to “power” as being the defined term “Active Power”.

### **2.4.4 Provision of a model**

There is an inconsistency between clauses 6.3.7 and 6.3.8 regarding the requirement to provide a validated detailed model of the power generating module. Clauses 6.3.7 and 6.3.8 have been consolidated to confirm that detailed models of Type A and Type B PGMs are needed where the DNO deems it necessary to ensure system stability and security, whereas detailed models are always required for Type C and D PGM and for the generating units which comprise a PPM. Validation of all models is covered by clause 6.3.8 (was clause 6.3.9)

In addition, DNOs have raised concerns that, when provided with black box models of Power Generating Modules (as per 6.8.3.4(b)), they have not been able to confirm whether or not the model suitably represents the performance of the Power Generating Module. It is proposed that new text is added to 6.8.3.4(b) as follows:

This includes providing guidance on the model or study cases and scenarios, should the **DNO** request such information.”

### **2.4.5 Cyber security**

A new requirement for all equipment within the scope of G99 to comply with “ENA and Department for Business, Energy and Industrial Strategy (BEIS) Distributed Energy Resources (DER) – Cyber Security Connection Guidance” where applicable and the PAS 1879 “Energy smart appliances – Demand side response operation – Code of practice” has been introduced in Section 9. Both of these documents will be added to the list of references.

A section will be added to Compliance Verification Reports (A2-1, A2-2 and A2-3), the PGMDs and the commissioning forms (A3, B3 and C3) for the manufacturer and generator to confirm that the Power Generating Module complies with the cyber security requirements.

#### **2.4.6 Intentional islanding**

It is proposed that the section in G99 on islanding (9.6) is amended to allow for the situation whereby a Generator wishes to deliberately support a customer installation in the event of a loss of connection to the DNO's distribution network. The requirements for such a situation will be set out in a new clause 9.6.2, as follows:

“Wherever a **Generator's Power Generating Module** runs in parallel with the **DNO's Distribution System** 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.

When 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.

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.

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 P28 on voltage disturbances on the **DNO's Distribution Network**.”

#### **2.4.7 Monitoring of tripping supplies**

Forms A3-1, A3-2, B3 and C3 all have the following requirement:

“Loss of tripping and auxiliary supplies. Where applicable, loss of supplies to tripping and protection relays results in either PGM lockout or an alarm to a 24 hour manned control centre.”

The requirement is contained in EREC G99 10.3.8 (and 10.2.2(a)(i)). Additional clarity will be provided in these clauses and forms that either the Power Generating Module or the Generating Unit should be tripped (rather than the whole PGM).

#### **2.4.8 Output power with falling frequency for gas turbines**

EREC G99 contains output power with falling frequency requirements in sections 11.2.3, 12.2.3 and 13.2.3 for Type A, Type B and Types C and D respectively. The equivalent requirement in the Grid Code (ECC6.3.3.1) currently has a relaxation on this requirement for Combined Cycle Gas Turbines (CCGT). This relaxation states that the response to this requirement from CCGT only needs to be provided for five minutes if to continue to provide a response after that period of time would put the gas turbine at increased risk of tripping. This is to recognise the inherent characteristics of gas turbines losing power output at low frequencies ie at lower rotational speed of the turbine. This relaxation for CCGT is not currently captured in EREC G99. This was simply an oversight when EREC G99 was drafted.

Amendments will be made to the relevant sections of G99 to make this allowance for CCGTs. The amendments are in line with the Grid Code text.

Figures 11.1, 12.1 and 13.1 will also be amended to reflect this change.

The current requirement 11.2.3.1 (b) reads:

“(subject to the provisions of paragraph 11.2.1) maintaining its **Active Power** output at a level not lower than the figure determined by the linear relationship shown in Figure 11.1 for system frequency changes within the range 49.5 to 47 Hz for all ambient temperatures up to and including 25°C, such

that if the system frequency drops to 47 Hz the **Active Power** output does not decrease by more than 5%.”

The proposed amended requirement 11.2.3.1 (b) will include the following additional text:

In the case of a **CCGT Module** this requirement shall be retained down to 48.8 Hz, which reflects the first stage of the automatic Low Frequency Demand Disconnection scheme. For system frequency below 48.8 Hz, the existing requirements shall be retained for a minimum period of 5 minutes while system frequency remains below 48.8 Hz, and any special measure(s) that may be required to meet this requirement shall be kept in service during this period. After that 5 minute period, if system frequency remains below the 49.5 Hz threshold, the special measure(s) must be discontinued if there is a materially increased risk of the Gas Turbine tripping. The need for special measure(s) is linked to the inherent Gas Turbine **Active Power** output reduction caused by reduced shaft speed due to falling system frequency. Where the need for special measures is identified in order to maintain output in line with the level identified in Figure 13.1 these measures should still be continued at ambient temperatures above 25°C maintaining as much of the **Active Power** achievable within the capability of the plant.”

The same changes will also be made to sections 12.2.3 and 13.2.3.

#### **2.4.9 Minimum Regulating Level**

In common with the Grid Code a review has been conducted of the use of the terms Minimum Regulating Level and Minimum Stable Operating Level in G99. As a result a number of instances of the term Minimum Stable Operating Level will be replaced with Minimum Regulating Level, including in paragraphs: 13.2.3.4(b)(i), A.7.2.4.1, B.5.2.5, B.6.2.6, C.8.6.3, C.8.6.5, C.9.5.4, C.9.5.6 and C.10.2.3. These change reflect those being introduced into the Grid Code in the GC0136 modification.

#### **2.4.10 Reactive Capability Test**

Due to an omission from previous versions of G99, it is proposed that an additional test is included in the set of reactive capability tests (Annex C.9.3) as follows:

“Operation at 50% **Registered Capacity** and maximum continuous lagging **Reactive Power** for 30 minutes”.

#### **2.4.11 Rapid re-synchronisation**

An RfG requirement A15 5 (c) on rapid re-synchronisation was omitted in error from the G99 Type C and D requirements. A new clause 13.7.2 will be added to G99 as follows:

“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.”

In addition a row will be added to the Type C and Type D PGMD to confirm operation of rapid resynchronisation, where it is required.

#### **2.4.12 Power Quality assessments and Type Testing**

It has been recognised that further clarity would be useful in respect of type testing associated with harmonics and voltage fluctuations / flicker for different sizes of generation. Working Groups have investigated these issues with industry experts and have recommended modifications to clarify that type testing of devices > 50 kW are not appropriate in relation to the power quality assessments (harmonics, fluctuation, flicker).

The proposed modifications include:

- The addition of ≤ 50 kW in the definition of Fully Type Tested
- Remove “partially” from “partially type tested” in 15.3.1 and 15.3.2, and use the defined term Fully Type Tested
- Remove “partially” from “partially type tested” in 22.1
- Broaden the scope of the table in 22.1 to cover Power Quality assessments (e.g. EREC G5 and EREC P28 assessments) as well as site tests; guidance provided on this
- Amendments to the Forms in Annex A (e.g. remove the term “partially”, add “≤ 50 kW”)
- Remove “partial” from C.9.1.5

#### **2.4.13 Family approach to type testing**

As per 2.3.5, new clauses will be added to G99 15.6 to allow for the family approach to type testing.

#### **2.4.14 Infrequent short-term parallel operation**

A new clause 15.7 is proposed to summarise the compliance demonstration requirements for Power Generating Modules that operate in infrequent short-term parallel operation mode.

#### **2.4.15 Replace “Product ID” with “system reference”**

As per 2.3.5, the term “Product ID” will be replaced with “system reference” throughout, including 16.1.2, 16.2.1 and the relevant forms.

#### **2.4.16 Energy source and energy conversion technology**

As per 2.3.11, the table of energy sources and energy conversion technologies will be included at the end of applications forms (A1-1, A1-2). The applicant will be asked to use a code to indicate their technology type in the application form.

#### **2.4.17 Electricity storage device capacity**

As per 2.3.12; the G99 Standard Application Form (SAF) is being updated to include an additional field for storage devices: electricity storage device capacity (kWh). It is proposed that this information will also be requested in the G98 and G99 application forms.

#### **2.4.18 Small rotating machines**

Modifications to G99 are proposed to address the same issue discussed in this consultation paper in section 2.3.11. The modifications proposed to G99 include are in Annex 7 and include:

- A.7.2.2.4 Loss of mains protection test loading levels
- A.7.2.5.1 Harmonics test power levels
- New footnotes on the loss of mains and harmonic tests in Form A2-1

#### **2.4.19 Modelling equivalent of Customer's Installation**

Following stakeholder feedback it is agreed that there is a need to clarify that there is no intention to make a generator provide a detailed model of a full site (eg hospital), where the detailed electrical network is not relevant to the behaviour of the Power Generating Module and its compliance with G99. Network equivalents are acceptable.

A new paragraph will be included in Annex B.4 Simulation Studies for Type B Power Generating Module's. B.4.1.3 notes the requirement for Generators with a substantial Customer's Installation to include an equivalent for simulation modelling to adequately represent the Customer's Installation. For complex Customer Installations, the Generator can discuss this with the DNO.

#### **2.4.20 Demonstration of reactive capability**

The text in Annex B clause B.4.2.1 states that simulation studies should be provided to demonstrate reactive capability if required by the DNO. It is proposed that the text "If specified by the DNO" is deleted, to clarify that simulation studies are required (the PGMD requires that compliance with 12.5 is demonstrated for Type B Power Generating Modules). This is typically demonstrated with the simulation study in B.4.2.1, noting that B.4.1.1 allows the DNO and Generator to agree other ways of demonstrating compliance. Other amendments will also be made to this text in B.4.2.1 to align with Annex C.7.3.1 (see 2.4.23).

In addition, it is proposed to add the following footnote in relation to the report of simulation studies requested in B.4.2.1: "This report may include reference to the Generator Performance Chart."

Similar amendments will be made to C.7.3.1.

#### **2.4.21 Minimum Fault Level**

Discussions with stakeholders have recognized the benefit of defining a minimum short circuit power to be provided for simulation purposes, specifically, for Fault Ride Through simulations. DNOs have proposed that 50 MVA for Power Generating Modules that are Type B and above is a generic minimum fault level that can be used in most cases. For the few specific cases where the fault level might be lower than this there will need to be a specific discussion between the Generator/developer and the DNO. Annex B.4.4.3 and C.7.5.3 will be amended to include this.

#### **2.4.22 Annex C.6 Functional Specification for Dynamic System Monitoring**

Following discussions with relevant stakeholders some deficiencies with the existing drafting of Annex C.6 were identified. A short, focussed informal consultation was held with the intention of seeking preliminary views from monitoring equipment industry experts amongst the stakeholder community.<sup>2</sup> There are three areas where additional modifications to the requirements, or additional clarity, are being suggested. These relate to the accuracy requirements, the implementation of timing, and the triggering quantities.

Feedback was received from 5 parties, and the proposed modifications were updated accordingly. The proposed amendments include:

- A new clause C.6.2.4 on instrument transformers
- A new clause C.6.2.5 on overall accuracy
- Modifications to C.6.2.6 on time keeping

Subsequent to the informal consultation above, DNOs have also recognized that the fault recording specification does not make appropriate reference to negative and zero sequence values, although the dynamic system monitoring aspects fully cover this. As sequence values are a key part of fault

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<sup>2</sup> Informal Consultation – G99 Section C.6, Title: G99 Section C.6 "Functional Specification for Dynamic System Monitoring, Fault Recording and Power Quality Monitoring Equipment for Type C and Type D Power Generating Modules", Published: 23rd June 2020

analysis, these requirements have now been written in. It is not expected that this requires new functionality, it is just an appropriate statement of traditional and expected fault recording capability requirements.

In addition the DNOs are aware that National Grid Electricity System Operator are likely to revise their equivalent specifications (TS 3.24.70 and TS 3.2.4.71) to align more closely with C.6 and at that time improve the specification of the triggers for active power oscillation. It is possible that National Grid ESO's modifications might also need to be reflected in a future revision of C.6 – but that would follow from any formal change that National Grid ESO make to their technical specifications. National Grid ESO's proposals are governed by the Grid Code Review Panel.

#### **2.4.23 Simulation studies for reactive power capability**

The opportunity is being taken in this suite of minor technical mods to improve the wording in Annex C, paragraph C.7.3, which describes simulation studies to demonstrate reactive power capability. For Synchronous Power Generating Modules the text will be simplified. For Power Park Modules (PPM) the guidance is now separated for PPMs connected above 33 kV (C.7.3.2) and at or below 33 kV (C.7.3.3). Reference will be made to the envelopes of operation in chapter 13.

#### **2.4.24 Manufacturers' Information for Fault Ride Through**

Paragraph C.7.5.5 will be amended to clarify that Manufacturers' Information relates to information provided to either the DNO to demonstrate compliance with EREC G99, or to the NETSO, who will confirm Grid Code compliance with the DNO.

#### **2.4.25 Simulation studies for LFSM and FSM**

Paragraph C.7.6.5 will be modified to clarify that simulation studies in LFSM are required for Types B, C & D Power Generating Modules, and in FSM for Types C & D Power Generating Modules. This will align with the latest Grid Code non-material changes modification (GC0136).

#### **2.4.26 Frequency response tests**

Paragraphs C.8.6.6 and C.9.5.7 will be modified to clarify that this relates to operation at Module Load Point (MLP) 4 (with reference to Figure C.8.1 and C.9.3 respectively). This will align with the Grid Code GC0136 modification.

#### **2.4.27 Compliance forms**

This G99 amendment is being taken as an opportunity to review the compliance forms:

- G99 Type A
  - Form A2-1 Synchronous and Asynchronous (non inverter) Power Generating Modules up to and including 50 kW
  - Form A2-2 Synchronous Power Generating Modules > 50 kW and also for Synchronous Power Generating Modules ≤ 50 kW where the approach of this form is preferred to that in Form A2-1
  - Form A2-3 Inverter Connected Power Generating Modules
- G99 Types B, C & D Power Generating Module Document (PGMD)

Proposed amendments to the Type A forms include:

- A new field in Form A2-3 for electricity storage devices to record energy storage capacity (kWh)
- Additional test (test 5) for continuous operating range on Form A2-1, A2-2 and A2-3.
- Additional test 6 for RoCoF withstand on Form A2-1.

- Form A2-1 and Form A2-3 Power Quality Harmonics test record sheet – will add row to allow user to indicate single or three phase measurements<sup>3</sup> and add columns for measurements to be added for each phase (where the Power Generating Module is 3-phase).
- Form A2-1 and Form A2-3: move location of test start date / test end date / test location to the top of the voltage fluctuations and flicker test, to make it clearer that this needs to be completed.
- Form A2-3 LFSM-O test: add a note about measurement tolerances with reference to A.7.1.3.
- Form A2-3 Fault level contribution: add a note to complete all entries, even if the fault contribution is zero.
- Form A2-1, A2-2 and A2-3 Logic interface: add a row requesting a high level description of logic interface, with reference to 11.1.3.1.
- Form A2-4: clarify that the stability tests require the confirmation that Interface Protection does not trip (rather than, for example, Generating Unit protection). Similarly for Forms B2-2 and C2-2.
- Form A2-4: in wiring functional tests, clarify that the final bullet point requires confirmation that a trip on the Interface Protection trips the appropriate circuit breaker. Similarly for Forms B2-2 and C2-2.
- Form A2-4: clarify that the free-form section at the end of the form is for adding details about any other onsite tests which may be carried out (add grey header to section and make reference to this section in the notes at the top of the form).

#### PGMD:

- Addition of a note on the Power Generating Module Document (PGMD), for Type B and Types C and D, in the “Key to evidence requested box”, that “where multiple types of evidence are indicated in the “compliance” column in the **Power Generating Module Document**, this indicates that the evidence could be provided in a number of different formats, as determined by the **Generator** and/or **Manufacturer**.”
- Addition of “E” for Exempt in the key to compliance.
- Addition of new column in the section on PGMD issue notes for the DNO to add a review date and comment.
- Change the type of evidence requested for Power Quality (voltage fluctuations and flicker and harmonics) from TV (Type Test report) to T (tests) in accordance with the power quality assessment modifications discussed in 2.4.12, and expand the submission stage to include FONS.
- Remove a row in the Type C and D PGMD that refers to 12.2.1.
- Remove a row in the Type C and D PGMD (Part 2) that is a duplicate (13.3).
- Remove the requirement in Form C2-1 Part 1 to undertake simulation studies for synchronous generators in accordance with annex C.7.4.
- Addition of a row in the Type C and D PGMD for compliance with 13.7.2 rapid resynchronisation.
- Addition of a row in the Type C and D PGMD for compliance with Annex C.6 Dynamic system monitoring, fault recording and power quality monitoring equipment.
- Addition of a row in the Type C and D PGMD for compliance with Annex C.10 Minimum frequency response capability requirement profile and operating range.

#### 2.4.28 Clarifications

Clarification will be provided in 12.5.1 that reactive capability is on the basis of nominal voltage.

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<sup>3</sup> Consideration was given to changing the units of Power Generating Module rating per phase (rpp) from kVA to kW, for consistency with Registered Capacity units. However, it is proposed to maintain kVA for consistency with BS EN 61000-3-12, which is the reference document for these tests.

Paragraph 20.3.3 will be amended to clarify that where changes are made to a Power Generating Module such that the Registered Capacity exceeds the 16 amps per phase threshold, a new G99 application is required.

EREC G99 Annex C.5.6 and C.5.7 contain references to the Grid Code clauses. However, the Grid Code clauses only apply where the Power Generating Module is required to comply with all or parts of the Grid Code. C.5.6.1 and C.5.7.1 will be amended to clarify that these sections only apply where the Power Generating Module is required to conform with the Grid Code.

A query has been received as to whether Figure C.9.3 (as referred to in paragraph C.7.6.6) should be applied as part of the simulations, compliance testing or both. It is proposed that clause C.7.6.6 is clarified as follows:

- C.7.6.6 To allow validation of the model used to simulate load rejection in accordance with paragraph 13.2.4 a further simulation study is required that shows simulation results for the largest positive frequency injection step or fast ramp (BC1 and BC3 of Figure C.8.1 and or Figure C.9.3) that will be applied during compliance tests as described in C.8.6 and C.9.5.

#### **2.4.29 Corrections**

Corrections to internal cross references in G99 are proposed, including:

- In B.5.4.2 the cross reference in bullet (ii) will be corrected from B.5.4.4 to B.4.5.2.
- Corrections to internal cross references in C.9.1.2 and C.9.5.3

Other minor typographical corrections are proposed throughout.

### **3 Applicable Distribution Code Objectives**

The applicable Distribution Code Objectives are to:

- (a) permit the development, maintenance, and operation of an efficient, co-ordinated, and economical system for the distribution of electricity; and
- (b) facilitate competition in the generation and supply of electricity; and
- (c) efficiently discharge the obligations imposed upon distribution licensees by the distribution licences and comply with the Regulation and any relevant legally binding decision of the European Commission and/or the Agency for the Co-operation of Energy Regulators; and
- (d) promote efficiency in the implementation and administration of the Distribution Code.

### **4 Consultation Questions**

1. Do you agree with the general intent of the proposed modification? If not, please explain your views.
2. If you have any detailed comments on the proposed drafting, please provide those comments in the proforma provided, or by marking up the consultation drafts of G98 and/or G99.
3. Do you have any comments in respect of the inclusion of the references to cyber security.
4. Do you agree that the proposed modifications satisfy the applicable Distribution Code objectives? If not, please explain your concerns.

## **5 Next Steps**

Responses to this consultation should be sent to the Distribution Code Review Panel Secretary at [dcode@energynetworks.org](mailto:dcode@energynetworks.org) by 1700 on 19<sup>th</sup> March 2021 on the pro-forma provided expressly for the purpose, or via any other convenient means. Responses after this date may not be considered.

**For more information, please contact:**

Christopher McCann – Code Administrator - [dcode@energynetworks.org](mailto:dcode@energynetworks.org)

**Annex 1 – Proposed changes to Distribution Code v47**

The document in this Annex covers the proposed changes to DCode Text. Please note this document does not contain the proposed changes to DCode v46 (Storage modification) which have recently been consulted on.

**Annex 2 – Proposed G98 Amendment 6 with Track changed modifications**

The document in this Annex covers the proposed changes to G98 Text. Please note this document does not contain the proposed changes to G98 as a result of amendment 5 (Storage modification) which have recently been consulted on.

**Annex 3 – Proposed G99 Amendment 8 with Track changed modifications**

The document in this Annex covers the proposed changes to G99 Text. Please note this document does not contain the proposed changes to G99 as a result of amendment 7 (Storage modification) which have recently been consulted on.