

Distribution Code Consultation DCRP/21/02/PC

Title: Update of G100 and inclusion in Annex 1 of the Distribution Code

Target Audience: All current and prospective manufacturers, developers, installers, owners and operators of generation (and storage) and controllable demand of any size connecting to distribution networks and where agreed control of the maximum import or export is to be implemented.

Date Published: 11th June 2021

Deadline for responses: 17:00 9th July 2021

Summary:

This Distribution Code public consultation is seeking the views from stakeholders on proposed modifications to EREC G100, and on its inclusion in Annex 1 of the Distribution Code, ie bringing the document under formal Distribution Code governance.

1 Introduction

Engineering Recommendation (EREC) G100 “Technical Requirements for Customer Export Limiting Schemes” was published in July 2016 in response to the growth in generation, and latterly storage, and the need to manage its effects appropriately on the upstream distribution network, without the significant expense of network reinforcements.

The document was broadly accepted by stakeholders and broadly adopted by all DNOs, although it has no formal status.

In the last couple of years a number of shortcomings have been brought to the DNOs’ attention, mainly through stakeholder feedback at the Distributed Energy Resources Technical Forum.

It is proposed to revise EREC G100 to address these issues, and to formally include it in the Distribution Code governance.

Included in this consultation are the following appendix,

Appendix 1 – Pages from DCode v45

Appendix 2 – EREC G100 Issue 2 (separate document)

2 The Defects

The following defects have been identified:

2.1 The criteria used for determining size of generation are opaque

Although EREC G100 does separately refer to the network thermal limits, voltage limits and constraints arising from protection, it is not clear for the thermal and protection limitations what the

criteria are that are used by the DNO in assessing G100 installations, or whether these are appropriate.

2.2 The maximum response time as restrictive and arbitrary

An overall maximum response time of 5s is required, for every installation and for every limiting criterion. For most technologies this is not a problem, but is overly challenging for some technologies such as reciprocating gas engine driven generation, or micro hydro installations.

2.3 Confusion over its application to zero export agreements

The current drafting of EREC G100 requires tolerances to be applied to settings. If a setting is zero (for zero export) it is confusing to apply a tolerance to this. Additionally, an EREC G100 export limitation scheme might be overkill for zero export, where simple reverse power protection in accordance with the provisions of EREC G99 might be more appropriate.

2.4 Modern communication technologies not accounted for

The only form of non-wired communication allowed in the current EREC G100 is licensed private radio. This is very restrictive and not appropriate for domestic installations – which might become a key EREC G100 application area in the future.

2.5 No coverage of import limits

The current EREC G100 does not include import limits in its scope. Given the rise of new high load devices, such as electric vehicles, batteries and heat pumps for example, the principles of protecting the distribution network from controllable devices should be extended to load as well as generation.

2.6 No guidance on multiple schemes in one installation

The growth of distributed energy technologies means that installations with multiple limitation schemes are already a reality. Guidance is needed on how these should be considered.

2.7 Inconsistent application by DNOs

The current EREC G100 is quite prescriptive of situations it caters for which means that some situations are more open to inconsistent interpretation between DNOs. A move to making the requirements more obvious at the level of principles should reduce the scope for inconsistent application, and possible individual DNO additional requirements.

2.8 No governance of the requirements

As the requirements are those that DNOs wish to agree with customers in relation to the technical requirements for connection to the network, there seems to be no good reason why these currently sit outside the Distribution Code. It also complicates any appeal route that might be needed for disagreements.

3 The proposed amendments to EREC G100

It is proposed to retain the overall general structure of EREC G100. However the document will now cover both export and/or import. The revised document will also formalise an approach that will be built around new concepts of modes of operation and clear criteria for design limits.

The following sections describe the key aspects of the new draft EREC G100.

3.1 Modes of Operation

To aid clarity of understanding of EREC G100's requirements, the following modes of operation have been defined:

3.1.1 Mode 1

This is the normal operating mode of the limitation scheme. The limitation scheme operates to keep the current flow (and/or voltage conditions) at the connection point within limits – ie the current flow within the maximum import or export limits and the voltage within statutory limits. Depending on the design of the installation the limitation scheme will be actively controlling sources of generation and/or the controllable demand to avoid breaching the limits. Or alternatively the installation will be naturally well balanced with the limitation scheme only reacting and when the equilibrium is sufficiently disturbed.

3.1.2 Mode 2

The limitation scheme should not normally enter mode 2. Mode 2 caters for unusual circumstances, such as the sudden loss of local demand that would normally be absorbing local generation, for example. In this mode, the current flows across the connection point, or the voltage at the connection point exceed those agreed. In mode 2 the limitation scheme has to react to return the conditions to those of mode 1 within the maximum allowed time associated with whichever technical limit(s) has been breached.

Mode 2 will define the maximum sizes of generation and/or demand that can be connected with a limitation scheme in place. Mode 2 allows for excursions outside of normal operating ranges for short periods of time, to allow the limitation scheme to respond. But clearly there are still limits as to how much overstressing of the DNOs network can be tolerated for short times. It is these criteria that set the technical limits in mode 2 and which define the maximum generation or demand that can be connected.

3.1.3 Mode 3

This is the mode where the limitation scheme is in a failed state; either because of some internal failure, or because the excursions into mode 2 are too many or have an aggregate duration that signify a fundamental lack of appropriate control. It is proposed that excursions into mode 2 are limited and mode 3 operation is triggered when:

- i. The total time in mode 2 in any 24 hours exceeds 8 minutes.
- ii. There are more than three excursions (each of less than 5 minutes) into mode 2 in any 24 hour period.
- iii. The time between any two consecutive mode 2 excursions is 10 minutes (measured from the time of re-entry into mode 1 from mode 2 following the first excursion).

In mode 3, the behaviour of the loads and generation controlled by the limitation scheme are substantially curtailed or switched off, so that the DNO's network cannot be overstressed.

To return to normal operation from mode 3, the fail safe feature needs to be reset as explained in 3.4 below.

3.1.4 Mode 4

This is simply a recognition that the installation might need to be operated with the limitation scheme out of service. Under these conditions the DNO and the customer should have agreed how the installation can be operated, ie what demand and generation can run and under what limits so that the upstream network and other connected customers are not at risk.

3.2 Technical Limits

3.2.1 Thermal

All upstream network components will have thermal limits but in general the ultimate thermal limits are unlikely to be breached by a single installation. A typical worst case might be that the installation imposes currents that need to be cleared within 5 minutes to avoid damage.

To simplify application, DNOs will initially assume that any current over the agreed maximum that is not greater than the 5 minute thermal limit is acceptable. However, the maximum time that it will be allowed to persist will be 1 minute by default. Exceptionally those technologies which are known to be slow acting in terms of controllability (eg particularly gas reciprocating engines and micro hydro) will be allowed 3 minutes.

3.2.2 Voltage

Excursions outside statutory limits should not occur by design and therefore not in mode 1. However recognizing that circumstances will sometimes cause high or low volts, the limits are suggested to be limited to 1 minute for small excursions (within 2 percent) outside statutory limits, to 1 second for larger high voltage excursions, and 2.5 seconds for voltages below 80% of nominal.

The design of the installation will also need to take into account the effect of the limitation scheme on flicker or other voltage phenomena.

Note that if generation is raising the local voltage, that generation will trip when the local voltage reaches 114% of nominal (at LV; 110% for HV).

3.2.3 Protection Coordination

In addition to the thermal limits, high current flows can cause maloperation (or degradation in the case of fuses) of the DNO's protection.

Where fuses are used in the interface between the customer and the DNO, or upstream in the DNO's network, an overload factor of 1.25 will be applied to the fuses' nominal rating.

Where the DNO's protection is provided by relays, then a normal grading exercise will be undertaken to determine the optimum balance of setting versus the current flows imposed in mode 2.

3.3 Maximum installation size

As alluded to in 3.1.2 it is the limiting factor from any of the three criteria, thermal, voltage or protection that will fix the maximum installation size. In many cases the planned installation will not reach the mode 2 technical limits. But in other cases the lowest of these limits will set an upper limit on the generation and/or loads that can be connected without upstream reinforcement.

3.4 Fail safe

The existing fail safe requirements have been updated to recognize internal failures in the limiting scheme, communication problems between dispersed components of the scheme (or power failures to them) and also inappropriate excursions into mode 2 (see 3.1.3).

It is proposed that domestic customers can reset the limitation scheme from mode 3 back into mode 1 up to three times in 30 days. If there are more than three mode 3 operations in 30 days, the customer will need to seek professional assistance before the limitation scheme can be reset. For non-domestic installations it is proposed that the scheme can be reset without limit; however each reset can only be attempted four hours after entering mode 3. This will provide an incentive for the scheme owner to resolve the reason for mode 3 operation.

3.5 Communication and cyber security.

The requirements have been updated to allow the use of common communication media, such as wifi. In allowing this, it opens up the risks of unauthorised interference such that the basic operation is compromised. Manufacturers and installers of need to recognize this in relation to the risks it poses both to the limitation schemes owner, as well as the DNO.

Although it seems implicit in the existing G100, it is also a requirement of the revised text that the inputs to the transducer(s) are monitored, as well as communication with the transducer(s) itself. This seems very straightforward for voltage inputs, but it probably implies some sort of active monitoring of

the current transformer secondary circuit. The working group is keen to understand if any stakeholders see any problem with this requirement.

The draft includes references to emerging documents which are relevant to this area and with which compliance might be an appropriate requirement. Stakeholders views on how best to cover off this emerging area would be very welcome.

3.6 Access to DNOs' instrument transformers

Because the limitation schemes monitor current and voltage at the connection point the question of access to the DNOs instrument transformers (ie the metering current and voltage transformers and/or the DNOs protection transformers) often arises. A new section of the Distribution Code has been drafted to give guidance on this topic.

3.7 Type Testing

The existing G100 makes provision for manufacturers to provide type test reports and declarations of conformity. The text has been updated to align with the approach used by the ENA for the registration of type tests for ERECs G98 and G99.

3.8 Domestic Installations

It is expected that there might be many more EREC G100 limiting schemes implemented in domestic installations in future, helping to manage the growth of domestic storage, heat pumps and electric vehicles. EREC G100 suggests some standard sizes of CLSs related to other technical thresholds applying to the installation of domestic low carbon technologies (eg, domestic generation, storage and EVs).

3.9 Multiple Installations

There is a challenge where a customer wishes to have more than one limiting scheme installed, such as those accompanying electric vehicles and solar generation and battery combination. Such devices are provided by the manufacturers of the main equipment, and are proprietary devices that are generally not compatible. In some cases it might be possible to configure one as the master device and somehow control the others, but this is both complex and cannot be guaranteed.

It is proposed that such arrangements cannot in aggregate have capacity more than the mode 2 limits, and also if in aggregate they are of greater capacity than the mode 1 limits, ie import and/or export, then additional fail safe back-up protection should be installed.

3.10 Testing and commissioning

The original EREC G100 section on testing and commissioning has been expanded and rewritten to accommodate full testing of the correct operation of the limitation scheme in modes 1, 2 and 3, including recovery from mode 3. Proforma test and commissioning sheets have been included as appendices B and C.

4 Implementation

It is expected that manufacturers and installers will need some time to implement the new requirements, and therefore a formal implementation date of 01 September 2022 is proposed. However some customers will wish to avail themselves of the new approach before that date. It is therefore proposed to allow the existing issue of G100 to run in parallel until that date, when the existing issue will be withdrawn. Customers will be able to implement export related CLSs to either version of G100 when Issue 2 is published, until the mandatory implementation date of Issue 2, ie 01 September 2022, and Issue 1 is withdrawn.

The foreword and scope sections of Issue 2 explain this.

A new clause (DPC6.8) is proposed to give legal force to G100 Issue 2.

5 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.

6 Consultation Questions

1. Do you agree with the general intent of the proposed modification? If not, please explain your views.
2. Do you agree that the revised EREC G100 should be included in the Distribution Code (as a new requirement by reference in DPC6), be listed in Annex 1 and included under Distribution Code governance in the future? And if not, why not?
3. Do you agree that the proposed modifications satisfy the applicable Distribution Code objectives? If not, please explain your concerns.
4. Do you support the formal description of the modes of operation and the migration between them?
5. Do you agree with the fail safe approach, and with the excessive mode 2 operation criteria? If not, would you propose different criteria?
6. Do you agree with the proposed approach to resetting the limitation scheme and recovering from mode 3? In particular do you agree that it is appropriate to distinguish the capability to reset the CLS between domestic and commercial/industrial installations? An alternative would be to make a distinction between fully type tested CLSs and those which are not fully type tested; the WG would be interested in views on this.
7. Do you agree with the design limits? Do you support the thresholds proposed?
8. Do you support the approach to communication media? Do you agree with the suggested approach to cyber security? Given this is a developing area we would particularly like to hear from manufacturers and installers on this point.
9. Do you have any comments on the requirement to monitor the integrity of the secondary circuit of the current transformers used?
10. Do you support the approach proposed for multiple limitation devices installed in a single premise?
11. Do you have any comments on the proposals for domestic installations?
12. Do you have any comments on the proposed type testing regime?
13. Is there the right balance of principle and detail in Section 5 on testing? Do you have any detailed comments on how testing should be prescribed?
14. If you have any detailed comments on the proposed drafting, please provide those comments in the proforma provided, or by marking up the consultation draft of G100.

7 Next Steps

Responses to this consultation should be sent to the Distribution Code Review Panel Secretary at dcode@energynetworks.org by [17:00, 9th July 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:

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8 Appendix Section

Appendix 1 –Pages from DCode (v45) that will require amendment in line with this modification, please see document included in consultation pack.

Appendix 2 – EREC G100 Issue 2, please see attached document within consultation pack.