Stage 2: Code Administrator Consultation	At what stage is this document in the process?
# GC0129: ## Mod Title: Updating the Grid Code to use Engineering Recommendation G5/5 - Harmonics	01 Proposal 02 Code Administrator Consultation 03 Draft Grid Code Modification Report 04 Final Grid Code Modification Report

Purpose of Modification: Engineering Recommendation G5 is being updated to Version 5, this change seeks to align the references to G5 within the Grid Code.

The purpose of this document is to consult on GC0129 with Grid Code Parties and other interested industry members. Parties are requested to respond by 5pm on 11 October 2019 to grid.code@nationalgrideso.com using the Code Administrator Consultation Response Pro-forma which can be found via the following link:

https://www.nationalgrideso.com/codes/grid-code/modifications/gc0129-updating-references-engineering-recommendation-g5

Published on: **20 September 2019**

Length of Consultation: **15 Working Days**

Responses by: **5pm on 11 October 2019**

Low Impact

National Grid Electricity System Operator, Relevant Transmission Licensees, Distribution Network Owners and Users connecting harmonic sources and/or resonant plant

Contents

Timetable

The Code Administrator recommends the following timetable:

Consideration by the Grid Code Review Panel	30 May 2019
Code Administrator Consultation Report issued to the Industry	20 September 2019
Draft Final Modification Report presented to Panel	21 October 2019
Modification Panel decision	29 October 2019
Final Modification Report issued to the Authority	8 November 2019
Decision implemented in Grid Code	1 March 2020 or 6 months after Ofgem decision, whichever is the later

Any questions?

Contact:
Rashpal Gata-Aura

Rashpal.gataaura@nationalgrideso.com

07790370039

Proposer:
Gregory Heavens

Greg.Heavens@nationalgrideso.com

01189 363 522

National Grid ESO Representative:

Phil Smith

philip.smith4@nationalgrid.com

07779560468

Proposer Details

Details of Proposer: (Organisation Name)	National Grid Electricity System Operator
Capacity in which the Grid Code Modification Proposal is being proposed: (e.g. CUSC Party)	The Company
Details of Proposer's Representative: Name: Organisation: Telephone Number: Email Address:	 Gregory Heavens National Grid ESO 01189 363 522 Greg.Heavens@nationalgrideso.com
Details of Representative's Alternate: Name: Organisation: Telephone Number: Email Address:	 Robert Wilson National Grid ESO 07799 656402 Robert.Wilson2@nationalgrideso.com
Attachments (Yes/No): **No**	

Impact on Core Industry Documentation.

Please mark the relevant boxes with an "x" and provide any supporting information

BSC	
CUSC	
STC	
Other	**X**

This modification is being made along with the update to Engineering Recommendation G5 and the corresponding change to the Distribution Code.

1 About this document

GC0129 was proposed by National Grid Electricity System Operator and was submitted to the Grid Code Modifications Panel for its consideration on 30 May 2019. The Grid Code Panel unanimously decided to send GC0129 straight to Code Administrator Consultation for 15 Working days once there was sufficient certainty on the corresponding change to the Distribution Code.

This Code Administrator Consultation has been prepared in accordance with the terms of the Grid Code. An electronic copy can be found on the National Grid ESO's Website, https://www.nationalgrideso.com/codes/grid-code/modifications/gc0129-updating-references-engineering-recommendation-g5, along with the Grid Code Modification Proposal Form.

2 Summary

Defect

The Distribution Code Review Panel (DCRP) has recently held a consultation to update Engineering Recommendation (EREC) G5 to issue 5 (G5/5). EREC G5 defines planning levels and compatibility levels for the assessment of voltage distortion from User's equipment and installations with harmonic emission to be connected to transmission systems and distribution networks in the United Kingdom.

The Grid Code references EREC G5 issue 4 (G5/4) in several places; this modification seeks to align the references to G5 to issue 5.

What

EREC G5 has been modified as outlined below, this list is taken from the Distribution Code's Consultation on G5 that was sent on 13 March 2019. Please refer to the 'DCRP/MP/19/03 - EREC G5 Issue 5' tab at http://www.dcode.org.uk/dcode-modifications/2019-modifications/ for any updates made since this date.

Planning and compatibility levels for individual harmonics have been revised, while keeping the planning and compatibility levels for voltage total harmonic distortion (THD) the same as G5 Issue 4 (G5/4). As a result for some harmonics these levels have increased. No planning or compatibility level has decreased compared to G5 Issue 4.

i. *Defining voltage ranges for which the tables of planning and compatibility levels are applicable. These voltage levels have been adapted to align with typical voltages in use in the UK.*

ii. *The planning and compatibility levels are now extended to 5 kHz (the 100th harmonic). The measurement of harmonics above 2.5 kHz is at the discretion of the NO (see below for definition) facilitating the connection. It is also recommended to consider the assessment of these harmonics at the discretion of the NO.*

iii. *Clearly defining interharmonics and revising interharmonic limits in accordance with IEC 61000-34-30, IEC 61000-4-7 and IEC 61000-2-2.*

iv. *Revising limit for voltage notches in terms of the notch depth and duration.*

v. *Updating the three stages of assessment. G5 Issue 5 similar to its predecessor, Issue 4, has three stages of connection process. These are Stage 1 for connection*

of equipment to LV, Stage 2 for connection of equipment which failed Stage 1 and any other connection to voltages below 33 kV, and Stage 3 for any other connection.

vi. *Stage 1 has been completely revised; it is designed for connections at LV. It is designed as a linear process such that assessments are applied in stages and substages. If a substage is passed, then the new user can connect; if the substage is failed, then the next substage of assessment is undertaken. In total there are four substages in Stage 1.*

vii. *Stage 2 has been completely revised; it is designed for connection at voltages below 33 kV and for those new users that have failed Stage 1. It has also been designed as a linear process, such that assessments are applied in substages.*

viii. *A new section has been added to Issue 5 that sets criteria for the connection of resonant plant, such as power factor correction capacitors to LV and voltages up to 11 kV. This ensures that the network background harmonic levels are not amplified excessively.*

ix. *Stage 3 has been completely revised; it is designed for connections above 33 kV and for those new users that have failed Stage 2. The connection process has been clearly outlined.*

x. *In Stage 3, the harmonic limits are based on the apportionment of the harmonic headroom. This is a major difference between G5 Issue 5 and Issue 4.*

xi. *Defining the minimum requirement and format for harmonic specification that NO has to issue to a new user, to ensure consistency.*

xii. *Requirement for the compliance report has been included in Issue 5 to ensure consistency.*

xiii. *G5 Issue 4 did not provide any guidance on the concurrent connections, when two or more new users apply to connect to the network in the vicinity of each other in a short time window. G5 Issue 5 sets the connection process for such cases*

Why

The changes are required to align the Grid Code and the Distribution Code with the new requirements of EREC G5/5. In addition, it is recommended that text and diagrams in EREC G5/5 should not be duplicated in the Grid Code and that the Grid Code should only signpost the reader to EREC G5/5.

How

The current baseline of the Grid Code has been reviewed for references to EREC G5/4 and Electromagnetic Compatibility Leve. Changes are being proposed based on this; please see Section 9 for more detail.

3 Governance

Justification for Normal Governance Procedures

Though it could be argued that the Grid Code changes could meet the criteria for Fast-Track Self-Governance, it is proposed that this modification is made under normal governance arrangements.

The update to EREC G5 is subject to approval by the Authority (Ofgem) before publication. Choosing the Normal Governance route will allow the Authority to consider the changes to the Grid Code along with EREC G5.

Requested Next Steps

This modification should:

- Follow the normal governance route and proceed to Code Administrator Consultation

The material effects of this change come from the update to EREC G5, which has been subject to both a working group and public consultation.

4 Why Change?

The Distribution Code Review Panel (DCRP) has recently held a consultation to update Engineering Recommendation (EREC) G5 to issue 5 (G5/5). EREC G5 defines planning levels and compatibility levels for the assessment of voltage distortion from Network User's equipment and installations with harmonic emission to be connected to transmission systems and distribution networks in the United Kingdom.

This modification is required to align the Grid Code and the Distribution Code with the new requirements of EREC G5/5. In addition, it is recommended that text and diagrams in EREC G5/5 should not be duplicated in the Grid Code and that the Grid Code should only signpost the reader to EREC G5/5.

5 Code Specific Matters

Technical Skillsets

It is not proposed that a Workgroup is required for this modification. If a Workgroup is formed that the skill set required is likely to be:

- Grid Code Governance Procedures; and
- Harmonics caused by the connection of resonant plant and equipment.

Reference Documents

The Consultation on updating EREC G5 can be found here:

http://dcode.org.uk/assets/files/DCode-Consultations/2019/DCRP_19_03_PC_Consultation_Pack.zip

6 Solution

It is proposed to update the references within the Grid Code to refer to EREC G5/5.

Please see Section 11 for the proposed changes to the text of the Grid Code.

7 Impacts & Other Considerations

This modification is being proposed alongside the update to G5 and the change to the Distribution Code. It is proposed that these will be presented to Ofgem as a package so the changes can be considered alongside each other.

Does this modification impact a Significant Code Review (SCR) or other significant industry change projects, if so, how?

This modification is not expected to impact any SCR's or other significant industry change projects or other Consumers directly.

Consumer Impacts

This modification is not expected to impact Consumers directly.

8 Relevant Objectives

Impact of the modification on the Applicable Grid Code Objectives:

Relevant Objective	Identified impact
(a) To permit the development, maintenance and operation of an efficient, coordinated and economical system for the transmission of electricity	Positive
(b) Facilitating effective competition in the generation and supply of electricity (and without limiting the foregoing, to facilitate the national electricity transmission system being made available to persons authorised to supply or generate electricity on terms which neither prevent nor restrict competition in the supply or generation of electricity);	None
(c) Subject to sub-paragraphs (i) and (ii), to promote the security and efficiency of the electricity generation, transmission and distribution systems in the national electricity transmission system operator area taken as a whole;	Positive
(d) To efficiently discharge the obligations imposed upon the licensee by this license and to comply with the Electricity Regulation and any relevant legally binding decisions of the European Commission and/or the Agency; and	None
(e) To promote efficiency in the implementation and administration of the Grid Code arrangements	None

Updating the Grid Code concurrently with the EREC G5 and the Distribution Code changes will align the GB framework. This should lead to an efficient, coordinated solution.

9 Implementation

It is proposed that this modification should be implemented concurrently with the changes to EREC G5 and the Distribution Code.

The proposed modification would be implemented 6 months from the time of Approval by the Authority or 1 March 2020 whichever is the later.

This will come into effect for connection offers issued by National Grid ESO to their customers from 1 March 2020 or earlier if mutually agreed by both parties.

No costs are foreseen in relation to the implementation of this Grid Code Modification.

10 Code Administrator Consultation: How to repond

If you wish to respond to this Code Administrator Consultation, please use the response pro-forma which can be found under the 'Industry Consultation' tab via the following link;

https://www.nationalgrideso.com/codes/grid-code/modifications/gc0129-updating-references-engineering-recommendation-g5

Responses are invited to the following questions;

1. Do you believe GC0129 better facilitates the Applicable Grid Code Objectives? Please include your reasoning.

2. Do you support the proposed implementation approach?

3. Do you have any other comments in relation to GC0129?

Views are invited on the proposals outlined in this consultation, which should be received by 5pm on 11 October 2019. Please email your formal response to: grid.code@nationalgrideso.com

If you wish to submit a confidential response, please note the following;

Information provided in response to this consultation will be published on National Grid ESO's website unless the response is clearly marked 'Private & Confidential', we will contact you to establish the extent of this confidentiality. A response marked 'Private & Confidential' will be disclosed to the Authority in full by, unless agreed otherwise, will not be shared with the Grid Code Modifications Panel or the industry and may therefore not influence the debate to the same extent as a non-confidential response. Please note an automatic confidentiality disclaimer generated by your IT System will not in itself, mean that your response is treated as if it had been marked 'Private & Confidential.

11 Legal Text

This modification will update the Grid Code with the following changes:

Section	Defect
Glossary and Definitions	
Electromagnetic Compatibility Level	Has the meaning set out in **Engineering Recommendation G5**~~Engineering Recommendation G5/4.~~
Engineering Recommendation G5	Means Engineering Recommendation G5/5.
Planning Code	
APPENDIX C - TECHNICAL AND DESIGN CRITERIA PART 1 – SHETL's TECHNICAL AND DESIGN CRITERIA Item 6	ER G5~~/4~~ (Supported by ACE Report No.73)
APPENDIX C - TECHNICAL AND DESIGN CRITERIA PART 2 – SPT's TECHNICAL AND DESIGN CRITERIA Item 6	ER G5~~/4~~ (Supported by ACE Report No.73)

APPENDIX E - OFFSHORE TRANSMISSION SYSTEM AND OTSDUW PLANT AND APPARATUS TECHNICAL AND DESIGN CRITERIA Item 3	ER G5~~/4~~
Connection Conditions	
CC.6.1.5	The **Electromagnetic Compatibility Levels** for harmonic distortion on the **Onshore Transmission System** from all sources under both **Planned Outage** and fault outage conditions, (unless abnormal conditions prevail) shall comply with ~~the levels shown in the tables of Appendix A of~~ **Engineering Recommendation G5~~/4~~**. **Engineering Recommendation G5~~/4~~** contains planning criteria which **The Company** will apply to the connection of non-linear **Load** to the **National Electricity Transmission System**, which may result in harmonic emission limits being specified for these **Loads** in the relevant **Bilateral Agreement**. The application of the planning criteria will take into account the position of **GB Code** and **EU Code Users' Plant** and **Apparatus** (and **OTSDUW Plant and Apparatus**) in relation to harmonic emissions. **GB Code Users** must ensure that connection of distorting loads to their **User Systems** do not cause any harmonic emission limits specified in the **Bilateral Agreement**, or where no such limits are specified, the relevant planning levels specified in **Engineering Recommendation G5~~/4~~** to be exceeded.

European Connection Conditions	
ECC.6.1.5	The **Electromagnetic Compatibility Levels** for harmonic distortion on the **Onshore Transmission System** from all sources under both **Planned Outage** and fault outage conditions, (unless abnormal conditions prevail) shall comply with ~~the levels shown in the tables of Appendix A of~~ **Engineering Recommendation G5**~~/4~~. **Engineering Recommendation G5**~~/4~~ contains planning criteria which **The Company** will apply to the connection of non-linear **Load** to the **National Electricity Transmission System**, which may result in harmonic emission limits being specified for these **Loads** in the relevant **Bilateral Agreement**. The application of the planning criteria will take into account the position of **GB Code** and **EU Code Users' Plant** and **Apparatus** (and **OTSDUW Plant and Apparatus**) in relation to harmonic emissions. **GB Code Users** must ensure that connection of distorting loads to their **User Systems** do not cause any harmonic emission limits specified in the **Bilateral Agreement**, or where no such limits are specified, the relevant planning levels specified in **Engineering Recommendation G5**~~/4~~ to be exceeded.
Operating Code No. 5	
OC5.5.4 Harmonic Content	CC.6.1.5(a) or ECC.6.1.5(a) Measured harmonic emissions do not exceed the limits specified in the **Bilateral Agreement** or where no such limits are specified, the relevant planning level specified in **Engineering Recommendation G5**~~G5/4~~.

