

**G5 Review Working Group
Minutes of Meeting Held On 07/06/2019 10.30 at ENA**

Attendees:

Name	Initial	Company
Simon Scarbro	SS	WPD
Vincent Hay	VH	ENA
Darwin Aseka	DA	ENA
Simon Scarbro	SS	WPD
Nick Carter	NC	UKPN
Ben Gomersall	BG	National Grid
Forooz Ghassemi	FG	National Grid
Davor Vujatovic	DV	TNEI
Roshan Bhattarai	RB	NPg
John Reilly	JR	EDF
Ahmed Shafiu	AS	Siemens
<i>Teleconference</i>		
Patrick Osakue	PO	SSEN
Nigel Shore	NS	ABB
Wayne Turtill	WT	Mitsubishi Electric

Apologies:

Name	Initial	Company

ACTIONS LIST

No.	Detail	Leader	Date	Complete
1.	Circulate spreadsheet with consultation comments to members	VH	30/06/2019	
2.	Provide members with an update of the innovation project between WPD and Outram Research on power quality monitors.	SS	31/07/2019	
3.	Update / Revise section 6.3.1 on Point of Evaluation (POE) in reference with IEC standards.	FG / SS	30/06/2019	
4.	Revise table 7 within Clause 5.3 on compatibility levels to read a total harmonic voltage distortion (THD _v) of 8 for nominal voltage levels of 25 < kV ≤ 66.	VH	30/06/2019	
5.	Draft a response on behalf of the working group to explain why the group disagrees with the extension of planning and compatibility levels to harmonics above the 50 th order, subject to the discretion of the relevant NO facilitating the connection	AS	15/07/2019	
6.	Provide further clarity in section 6.2 for users on how far below the compatibility levels the temporary planning levels will be set up.	VH	30/06/2019	
7.	Prepare text in Annex B (Page 95) to correspond with the recommended addition of an active –harmonic filter representation	SS	30/06/2019	
8.	Draft a working group response explaining agreement with the apportionment of headroom instead of the first come-first served approach where the whole of the headroom is allocated to the first new user in a queue. (Question 13)	FG / VH	15/07/2019	
9.	Circulate a copy of the consultation document with tracked changes.	VH	30/06/2019	

NOTES

Item	Focus	Leader
1.	<p>Welcome, introductions, apologies.</p> <p>VH welcomed all members and introduced and introduced new members (NC and DA) to the working group.</p>	VH
2.	<p>Review of minutes and actions from the previous meeting on 7th April 2018</p> <p>There were no comments or outstanding actions from the previous meeting. FG gave a background of work undertaken to date and the activity since the last working group meeting in April 2018.</p> <p>A few months were spent on reviewing and updating the EREC G5-5 document largely based on comments received from Northern Powergrid. These comments were helpful with making the document consistent with other standards. The end solution was a document in a form that could be shared with the industry.</p> <p>A consultation paper along with several resources supporting the changes made had been prepared and provided to the DCRP to approve for DCode public consultation. The DCRP had approved the consultation but had mandated the working group host 2 stakeholder engagement workshops on the changes to educate stakeholders on the changes and maximise engagement with the consultation. These events were held in London on April 1st and Glasgow on April 10th. The attendance was limited but the workshops delivered good feedback and outputs. VH advised there was a video webinar of the London session available on the DCode website.</p> <p>http://www.dcode.org.uk/events.html</p> <p>The purpose of the days meeting was largely to address the stakeholder consultation and make any amendments necessary to the draft EREC G5/5 document.</p>	VH
3.	<p>DCode Consultation Process – Stakeholder Feedback</p> <p>3.1. Review Material Feedback</p> <p>After the DCRP public consultation feedback was received from 11 individual stakeholders with in excess of 80 comments. Some comments were editorial while others were technical. A significant comment was the objection to apportionment by one stakeholder. Other comments were on the measurement of fault level as an alternative to calculation. There were also many comments from manufacturers relating to the inclusion of active filter in combination with six-pulse three-phase converter equipment indicating broad support from manufacturers for editorials changes.</p> <p>A number of comments also related to the use of measurement devices as an alternative to calculation. SS took an action to provide the working group with an update of the innovation project between WPD and Outram Research on power quality monitors.</p> <p style="text-align: right;">Action: SS</p> <p>The concept of Point of Evaluation (PoE) needed to be defined as there was ambiguities in the terminology of remote node and how that related to PoE. FG took the action to revise document with respect to PoE.</p> <p style="text-align: right;">Action: FG</p> <p>BG, FG, SS, and VH had prepared a DCRP Stakeholder Feedback Summary Excel Workbook which was developed incorporating all stakeholder comments. This was made available to the working group for the meeting. BG, FG, SS, and VH had undertaken an initial review of the comments to identify which comments were technical and required input from the working group and which ones were editorial and could be amended in the document.</p>	

	<p>The working group reviewed the more material changes and agreed text modifications or stakeholder responses. At the conclusion of the meeting there were a number of comments outstanding to review. The working group agreed to allow FG, SS, BG, and VH to take a view and circulate for agreement. A revised copy of the spreadsheet was to be circulated with the working group notes.</p> <p style="text-align: right;">Action: VH</p> <p>The consultation response proforma posed shared with these stakeholders also contained 17 questions which stakeholders had responded to. The responses were discussed by members during the working group meeting. VH was to prepare a summary of the responses and circulate to the working group. For particular consultation responses which required debate the following notes and actions were agreed:</p> <p><u>Question 2:</u></p> <p><i>Do you agree with the compatibility levels for different voltage levels given in tables in Section 5.3?</i></p> <p>8 respondents agreed while 3 had no comment. Stakeholders were in general agreement to this.</p> <p>FG proposed that table 7 within Clause 5.3 should be revised to show a total harmonic voltage distortion (THD_v) of 8 instead of 5 for nominal voltage levels of 25 < kV ≤ 66. This would make this table be in line with IEC up to 35 kV. Members agreed that from 35 kV to 66kV wouldn't matter and the proposed change to THD from 5 to 8 would apply.</p> <p>VH took an action to revise table 7 within Clause 5.3 on compatibility levels to read a total harmonic voltage distortion (THDV) of 8 for nominal voltage levels of 25 < kV ≤ 66.</p> <p style="text-align: right;">Action: VH</p> <p><u>Question 3:</u></p> <p><i>Considering the growth in the network of equipment with harmonic emission at high order harmonics, do you agree with the extension of planning and compatibility levels to harmonics above 50th order, subject to the discretion of the relevant network operator facilitating the connection?</i></p> <p>6 respondents agreed while 5 disagreed. Respondents who disagreed suggested that this should be limited since Class A as measuring equipment that can go up to the 100th harmonic is not readily available. This could represent additional costs in harmonic monitoring equipment for network users if the network operator decides that harmonics above the 50th harmonic order are to be assessed.</p> <p>Respondents who agreed were of the opinion that there is readily available equipment for purchase or hire to service this requirement.</p> <p>Additionally, members were also made aware of situations where higher harmonics have been present and have caused a great deal of trouble. (59th and 61st re 3kHz PWM rate in UPS system).</p> <p>The working group agreed the requirement should be retained subject to it being clear that the network operator has discretion in this matter and recognising the limitations of existing measuring equipment, noting also that</p>	
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	<p>installation of new measurement equipment may not be economic in the short term.</p> <p>It should also be noted that measuring equipment up to the 100th harmonic is not readily available. Therefore this capability will take time.</p> <p>Respondents who disagreed were of the opinion that this should be limited, as Class A metering equipment currently available to measure up to the 100th harmonic is not readily available, and wound HV Voltage Transformers (VTs) are not linear for frequencies up to H100.</p> <p>This could represent additional cost in harmonics monitoring equipment for the network user if the network operator decides that harmonics above 50th order are to be assessed.</p> <p>Members proposed that EREC G 5-5 should provide a specific reason on why evaluating harmonics above the 50th harmonic will be required and not leave it open to the discretion/interpretation of the relevant network operator.</p> <p>Members agreed that a list of equipment that need evaluation above the 50th harmonics should be developed in consultation with electrical equipment manufacturers.</p> <p>The working group position is that further discussion is required on this matter.</p> <p>AS took an action to draft a position / response on behalf of the working group. Action: AS</p> <p><u>Question 7:</u></p> <p><i>EREC 5 Issue 5 allows network operators to set temporary planning levels when the background harmonic level is above the planning levels specified in EREC G5 Issue 5 (Section 6.2). The temporary planning levels must be below compatibility levels. Do you agree with network operators setting temporary planning levels as described in EREC G5 Issue 5?</i></p> <p>9 respondents agreed while 2 didn't comment.</p> <p>Stakeholders were in general agreement on condition that further clarity is provided for users on how far below the compatibility levels the temporary planning levels will be set up.</p> <p>VH took an action to provide further clarity in section 6.2 for users on how far below the compatibility levels the temporary planning levels will be set up. Action: VH</p> <p><u>Question 8:</u></p> <p><i>Do you agree with the Stage 1 connection process, proposed in Section 7 that sets the procedure for connection of equipment to PCC voltages equal or below 400 V?</i></p> <p>9 respondents agreed while 2 didn't comment.</p> <p>Stakeholders were in general agreement. However with the insertion under table 19 that 6 Pulse + Active-harmonic-filter, is permitted as an alternative, if it has equivalent distortion levels to Active-front-end. Additionally, stakeholders asserted examples must be given under Stage1C, and Stage 1D with direction in ETR122, for the use of mitigation technology such as Active Harmonic Filters.</p>	
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	<p>Examples need to be in place for all combinations of non-linear loads that are equivalent to AFE:</p> <ul style="list-style-type: none"> -6 Pulse + Active Harmonic Filtration. <p>Notes to address this commentary were added below Table 19 and Table 21 of the draft EREC G5/5. A diagram of 6 Pulse + Active-harmonic-filter was added to Annex B of the draft EREC G5/5.</p> <p>SS took the action to add text to Annex B for the inclusion of a 6 Pulse + Active-harmonic-filter.</p> <p style="text-align: right;">Action: SS</p> <p>The working group clarified worked example documents were provided with the consultation. If respondents felt there was insufficient material, the working group suggested it would be helpful for respondents to provide case study examples. Can be done in parallel or after the delivery of EREC G5 Issue 5. Consideration will be given to the revision or review of Engineering Recommendation G5 Issue 5 2018 'Worked examples of Stage 1 and Stage 2 connections' which part replaces ETR 122. VH took the action to request case studies for worked examples.</p> <p style="text-align: right;">Action: VH</p> <p><u>Question 9:</u></p> <p><i>Do you agree with the Stage 2 connection process, proposed in Section 8 that sets the procedure for connection of equipment that failed Stage 1 and to the PCC voltages below 33 kV?</i></p> <p>9 respondents agreed while 2 didn't comment.</p> <p>Stakeholders were in general agreement. However the insertion under table 21 that 6 Pulse + Active-harmonic-filter, is permitted as an alternative, if it has equivalent distortion levels to Active-front-end. Additionally, stakeholders asserted examples must be given under Stage2C, with direction in ETR122, for the use of mitigation technology such as Active Harmonic Filters.</p> <p>Examples need to be in place for all combinations of non-linear loads:</p> <ul style="list-style-type: none"> AFE + 6Pulse + Active Harmonic Filtration 6 Pulse + Active Harmonic Filtration <p>Moreover members noted that there reference to 'less than or equal to 22kV' and 'below 33kV' are used interchangeably – consistency would help the reader understand the requirement.</p> <p>Consideration is required to confirm whether the intention is to include 25kV traction supplies or not.</p> <p>The same actions for question 8 were retained for question 9. Additionally, a clarification on the voltage threshold being 33kV was included in revised text of the document.</p> <p><u>Question 10:</u></p> <p><i>Do you agree with the inclusion of a process, proposed in Section 9, for the connection of resonant plant such as power factor correction capacitors and/or cables to the PCC voltage levels of 400 V and 11 kV?</i></p> <p>9 respondents agreed while 2 didn't comment.</p>	
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	<p>Stakeholders were in general agreement.</p> <p>Working Group members were of the opinion that this needs to be publicised and promoted by the UK Power Factor Correction suppliers Response: Relevant Trade Association needs to inform the suppliers (their members) of the obligation to comply with G5/5.</p> <p>VH took an action to publicise the implementation of the new standard through the DCode mailing list which is inclusive of all users of the DCode.</p> <p><u>Question 11:</u> <i>Do you agree with the quick and conservative initial assessment for connection of resonant plants to PCC voltage levels of 400 V and 11 kV? Failing the initial assessment would require assessment of resonant plant under Stage 3 assessment process.</i></p> <p>7 respondents agreed, 1 disagreed and 3 had no comment. Stakeholders were in general agreement. The Working Group agreed that further discussions were required.</p> <p>The working group were of the opinion that conservative approaches tend to increase cost of plant and potentially the user will need to use harmonic mitigation measures that might not be required if a proper analysis were to be carried out.</p> <p>The members were of the view that the document does not preclude users from doing their own more detailed assessment of resonant plant.</p> <p>The approach adopted was similar to the Stage 1 and 2 harmonic assessment where a crude assessment is done before more detailed assessment to ensure connection remains within planning requirements.</p> <p><u>Question 12:</u> <i>According to EREC 5, Issue 5, under Stage 3, it is the responsibility of the existing network operator to which the new user connects to carry out harmonic assessment and issue the harmonic specification which include harmonic limits. Do you agree with this?</i></p> <p>10 respondents agreed 1 had no comment. Stakeholders were in general agreement on condition that:</p> <ul style="list-style-type: none"> • Such Harmonic levels should be issued with the Connection Agreement to allow developers to include harmonic filtering in their procurement of equipment. • The text should make clear that it is the network operator's responsibility to provide a harmonic specification, or data that allows a harmonic specification to be derived, and that it is the network operator's responsibility to review the user's harmonic compliance report and decide whether compliance has been demonstrated. The current wording on Page 75 says "The NO hosting the connection is responsible for undertaking the Stage 3 harmonic assessment" but goes on to say "The new user shall carry out a harmonic compliance assessment". This seems contradictory and it should be made clearer that the user is responsible for undertaking the analysis. • It must be in a short timescale. 	
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	<p>Working Group members agreed that the text needs to be revised to make the responsibility of the network operator clearer. Text amendments were made to clause 10.1</p> <p>Question 13:</p> <p><i>In EREC G5 Issue 5, setting the harmonic limits under Stage 3 is based on the apportionment of the headroom. Do you agree with the apportionment of headroom instead of first come-first served approach where the whole of the headroom is allocated to the first new user in the queue?</i></p> <p>9 respondents agreed, 1 disagreed and 1 had no comment. Stakeholders were in general agreement with the exception of one stakeholder.</p> <p>Members acknowledged that one stakeholder was not able to confirm agreement with the “apportionment of headroom” approach at this stage, because an objective justification for this change has not been provided with the consultation.</p> <p>This stakeholder had asserted this would be a significant change to the Distribution and Grid Codes. And, the consultation paper did not include any detail of analysis of the benefits / lower costs to users and consumers that the workgroup calculates would come from adopting the method of “apportionment of headroom “ as compared to remaining with the existing method.</p> <p>Members also noted that the treatment of users with signed connection agreements but not yet connected was unclear. The G5/5 Forward includes the following, which introduces the risk that G5/5 will be retrospectively applied: “For practical reasons, connections subject to contract specifications based on ER G5/4-1 entered into before the effective date above may, at the discretion of the network owner/operator, be connected in accordance with that recommendation.”</p> <p>Stakeholders in disagreement also commented that:</p> <ul style="list-style-type: none"> • Although in practice they had never seen a first come first served connection taking the whole of the headroom. <p>Another stakeholder suggested headroom is explicitly able to be reserved. The working Group rejected headroom reservation.</p> <p>FG was to provide a report on headroom allocation and <i>FG</i> and <i>VH</i> will draft a customer response.</p> <p style="text-align: right;">Action: FG/VH</p> <p>Question 14:</p> <p><i>Due to the difference in number of connection, network arrangement and operational requirement, do you agree with the proposed different apportionments procedures for connection above 132 kV and for connection at or below 132 kV proposed in Stage 3, section 10.4.3.1 and 10.4.3.2?</i></p> <p>7 respondents agreed, 2 disagreed and 2 had no comment. The working group was in general agreement however they acknowledged that this required further discussion (refer to response to Question 13 above)</p>	
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	<p>Members were also of the opinion that the source of the apportionment factors was not clear (e.g. how β is correlated with phase to phase voltage). There was no transparency on how the equations were derived.</p> <p>Question 15: <i>It is a requirement within EREC 5, Issue 5, to assess connection of resonant plant such as capacitor banks and cables and to ensure compliance with the harmonic limits. Do you agree with this requirement?</i></p> <p>9 respondents agreed, 1 disagreed and 1 had no comment.</p> <p>The working group acknowledged stakeholders were in general agreement and also acknowledged that this required further discussion because a network operator can install plant that will affect users thereby meaning that there will be less headroom for users.</p> <p>It was highlighted that EREC G5-5 did not properly address the background harmonics issues resulting from plant installed by a network operator. An example given was when a network operator installs series compensation to increase the power carrying capacity of transmission lines.</p> <p>Members agreed that network operators would apply to all those connecting/connected to the network.</p> <p>Post meeting clarification: The scope excludes NO system design itself. The NO can make network changes that will change the headroom and there is no need to consider EREC G5 directly. In evaluating network changes the NO would need to consider the electricity license conditions and those in the relevant code duties, including to develop and maintain an efficient, co-ordinated and economical system of electricity distribution, and comply with statutory obligations, including the network design requirements of the Electricity Safety, Quality and Continuity Regulations 2002, as amended.</p> <p>Members agreed with the feedback that the revised standard needs to be publicised and promoted by the UK Power Factor Correction Suppliers.</p> <p>Question 16: <i>Do you agree with the requirements of the compliance report that new users have to submit for a Stage 3 assessment?</i></p> <p>8 respondents agreed, 1 disagreed and 2 had no comments.</p> <p>The working group agreed stakeholders were in general agreement and acknowledged one respondent was in disagreement and had indicated that there needs to be a proposed format within EREC G 5-5 for the compliance report.</p> <p>The working Group rejected the addition of a template as they considered this outside the scope of the document and would be too prescriptive to include in the standard. It is up to the connecting user to demonstrate principles of 10.8 in a format they believe is suitable.</p> <p>Question 17: <i>Do you believe that the proposed modifications, as set out in the DCRP/19/03/PC Consultation Pack, would better facilitate the Applicable Distribution Code Objectives?</i></p> <p>8 respondents agreed, 1 disagreed and 2 had no comments.</p>	
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	<p>The respondent in disagreement stated that the ‘apportionment of headroom’ approach did not demonstrate that it met the Distribution Code objectives a, b and d.</p> <p>Those in agreement made reference to the additional examples mentioned in Questions 8 and 9 above.</p> <p>Members agreed that using the harmonic headroom report would best demonstrate that the proposed modifications meet the Distribution Code Objectives a, b and d. The Working Group response was to be as per Question 13.</p>	
4.	<p>Review of Latest ER G5/5 Draft</p> <p>Members agreed to make changes to the latest EREC G5/5 draft in line with the Stakeholder Commentary and the discussion in the working group. VH took an action to share the latest draft of the G5 Issue 5 document with the working group. Action: VH</p> <p>These have been addressed in the revised draft 14.13 to be circulated with the meeting minutes.</p> <p>VH took an action to confirm whether connection agreements already signed at the date of G5 Issue 5 implementation would be required to comply with G5/4-1 or the new G5 Issue 5. Update: NOs have the discretion as to what standard is applicable.</p>	
5.	<p>Next Steps</p> <p>The agreed changes to the document shall be incorporated into the latest version of the EREC G5/5 document. This shall be coordinated by <i>BG, FG, SS, and VH</i>. The revised draft will be circulated to members for agreement before a recommendation of a Report to Authority will be made to the DCRP in August. The Report to Authority would likely recommend an extended (3-6 month) implementation window to allow stakeholders to adjust to the new requirements. The date proposed is 01 March 2020.</p> <p>VH noted a Grid Code modification needed to be raised and subjected to Stakeholder consultation which may impact this timeline.</p>	
6.	<p>Date of next meeting</p> <p>VH advised that there was not going to be another working group meeting required unless material changes were required to the draft. The next meeting would be scheduled if required.</p> <p>A meeting has been scheduled for August 1st to review any changes and to agree the Report to Authority.</p>	