

# **Proposed Changes to Engineering Recommendations P2 and G5**

Security of Supply and Connection of Harmonic  
Sources

Consultation Paper



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## EXECUTIVE SUMMARY

NIE Networks periodically reviews the Distribution System Security and Planning Standards and when necessary proposes to make changes to better align the Standards with the equivalent standards that apply in the other regions of the United Kingdom (UK).

NIE Networks proposes changing the following Distribution System Security of Supply Engineering Recommendations (EREC): EREC P2 Issue 6 (P2/6) to be superseded by EREC P2 Issue 8 (P2/8) and EREC G5 Issue 4 (G5/4-1) to be superseded by EREC G5 Issue 5 (G5/5). Copies of EREC P2/8 and EREC G5/5 are provided on NIE Networks website within the Consultation Pack<sup>1</sup>.

The notable modifications in EREC P2 over the current version applied in Northern Ireland include:

- 1- Scoping EREC P2 as a Standard defining the security of supply to be achieved, whilst the Engineering Report (EREP) 130 becomes a supporting document describing how that security of supply should be achieved, a copy of EREP 130 (Issue 4) is also provided on NIE Networks website within the Consultation Pack<sup>1</sup>.
- 2- Remove F-Factors and other tables associated with the security contribution from Distributed Generation which are already duplicated in EREP 130;
- 3- Refresh the definition of demand to appropriately include consideration and treatment of flexible resources such as distributed generation (DG) and demand side response (DSR); and
- 4- Permit a reduction in the security of supply to customers with a maximum demand between 1MW and 8MW, connected to high voltage feeders and where the feeder has a total length not more than 1km.

The notable modifications in G5/5 over the current version applied in Northern Ireland include:

- 1- Full technical rewrite of the standard.
- 2- Change in values for planning level.
- 3- Harmonic order above 50<sup>th</sup> now covered.
- 4- Revision of Stage 1, 2 and 3 connection processes.

Stakeholders are invited to express a view on the proposed changes in EREC P2 and EREC G5 and any other aspect of this paper. Responses to this consultation should be sent to NIE Networks by 17:00 on Friday, 16<sup>th</sup> February 2024 on the pro-forma provided expressly for the purpose (pro-forma can be found in the Consultation Pack<sup>1</sup>), or via any other convenient means and should be addressed to:

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<sup>1</sup> <https://www.nienetworks.co.uk/consultation-on-proposed-changes-to-engineering-recommendations-p2-g5>

## 1. INTRODUCTION

Under Condition 19 of its electricity Distribution Licence (the Licence), NIE Networks is required to plan, develop, maintain and operate the distribution system in accordance with:

- The Distribution System Security and Planning Standards (the Standards); and/or
- Such other planning and operational standards adopted by NIE Networks from time to time with the approval of the Utility Regulator (the Regulator).

Moreover, the Licence requires NIE Networks to periodically review the Standards in consultation with parties liable to be materially affected.

NIE Networks now propose to adopt the changes made to Engineering Recommendations (EREC) P2 and EREC G5 in Great Britain to ensure equivalent Standard alignment.

It is also proposed to remove EREC P16 (EHV or HV Supplies to Induction Furnaces) from the Standards as this document is no longer maintained by the Energy Networks Association (ENA).

The purpose of this consultation is to set out the proposed changes to ERECs P2 and G5 and seek feedback from stakeholders.

## 2. LATEST INDUSTRY STANDARDS

The existing Distribution System Security and Planning Standards (DSSPS) adopted by NIE Networks can be seen in the table below and can be downloaded from the NIE Networks website<sup>2</sup>.

Table 1. Current Standards adopted by NIE Networks

TITLE	NIE Networks Standard
<b>Security of Supply</b>	<b>EREC P2/6</b>
Planning Limits for Voltage Fluctuations	EREC P28
<b>EHV or HV Supplies to Induction Furnaces</b>	<b>EREC P16</b>
Planning Limits for Voltage Unbalance	EREC P29
<b>Limits for Harmonics</b>	<b>EREC G5/4-1</b>
Application of Protective Multiple Earthing to Low Voltage Networks	EREC G12/4

NIE Networks periodically reviews the Standards and considers each standard in turn to identify:

- If an updated equivalent industry standard has been adopted by GB distribution network operators (DNOs) and referenced in the GB Distribution Code;
- If such latest industry standard is relevant to the Northern Ireland distribution network and can therefore be adopted by NIE Networks; and

<sup>2</sup> <https://www.nienetworks.co.uk/distribution-code>

- The implications for stakeholders of changing the NIE Networks standard.

System Security and Planning Standards are reviewed under the auspices of ENA, the membership of which includes NIE Networks and GB DNOs.

EREC P2 and G5 have been revised by the ENA, and P2/7 and G5/5 were adopted by GB DNOs in 2019 and 2020 respectively following public consultations. A further revision was undertaken of P2/8 and has been reviewed and approved in February 2023 by the GB utility regulation authority (Ofgem) following a public consultation and is now the security of supply Qualifying Standard within the GB Distribution Code. Consequently, NIE Networks proposes to also move from EREC P2/6 to EREC P2/8 and from EREC G5/4 to G5/5. A summary of the amendments included in P2/7, P2/8 and G5/5 is given in the next section.

## 3. DETAILED ASSESSMENT OF PROPOSED CHANGES

### 3.1 General

EREC P2, Security of Supply, is a key industry document that sets out the minimum level of supply security that DNOs are obligated to provide to customers, and has served the industry and consumers well for over 40 years. EREC P2 does this by stipulating minimum restoration times for customer supplies to be restored following a planned or unplanned outage on the network. The extent and nature of distribution networks mean that faults occur from time to time. EREC P2 is a vital document used by the Distribution Network Operators to manage the networks at such times.

EREC G5, sets out and defines the best engineering practices on connecting nonlinear equipment to public distribution and transmission networks so as to limit the harmonic disturbance to below immunity levels of equipment. In order to do this, EREC G5 sets out planning limits for harmonic voltage distortion at the different voltages levels as used by public networks in the UK. It also sets out the assessment process under three stages depending on the complexity of the equipment being connected and the voltage level of the connection point.

NIE Networks is now seeking comments from wider industry stakeholders on the proposals highlighted in this consultation paper. The sections below describe the main changes in EREC P2/7, P2/8 and G5/5.

### 3.1 EREC P2/7 Amendments

Issue 6 of P2 is used to cover the following:

- a) Defining the minimum level of security of supply; and
- b) Outlining the contribution to System Security expected from DG connected within a demand group.

This has been updated in Issue 7 (P2/7) by clarifying the intent of P2 as a standard defining the security of supply that is to be achieved. P2 has been amended in Issue 7 to reflect this by removing sections related to the contribution to System Security afforded by DG and other related information (i.e., F-Factor tables). P2/7 details the factors that should be considered to establish the magnitude of the Group Demand to be secured and also the means of securing that demand using a combination of network assets and non-network assets. It does not detail how the DNO should meet the standard. However, guidance on the means of achieving the prescribed security of supply is set out in ENA Engineering Report 130 (EREP 130).

P2/7 which was approved in 2019, represented a major revision to recognise the changes to the load and generation connected to distribution networks since Engineering Recommendation P2/6 was published in 2006. In particular, the changes in Issue 7 recognised that:

- Some demand customers are modifying their electricity consumption in response to market signals; this means that further consideration has to be given to establishing the true demand on the network;
- In addition to providing security of supply from network assets and Distributed Generation (DG), Demand Side Response (DSR) services and Energy Storage (ES) can also contribute to the security of supply; and
- The nature and type of distributed generation connected to the network mean that their contribution to the security of supply is different to that in P2/6.

It is worth mentioning that the recommended levels of supply security for each demand class in P2/6 have not been changed in P2/7 (see Table 1 in P2/6).

### 3.2 EREC P2/8 Amendments

Between 2020 and 2022, the ENA P2 Working Group (under the auspices of the Distribution Code Review Panel, DCRP) conducted an assessment on the impact of reducing the security of supply to demand groups between 1MW and 300MW based on study recommendations by Imperial College London and their partners. This review considered the wider societal implications of a reduction in supply security as well as the potential network savings.

The assessment outcomes show that the reduction in supply security to demand groups between 10MW and 300MW is not a viable option as the increased risk of loss of supply had the potential to impact large parts of the networks and large numbers of customers, with little financial savings. Yet, the workgroup considered that it would be reasonable to reduce the security of supply to HV feeders supplying demand between 1MW and 10MW in some limited situations.

The proposed modification in P2/8 is to permit an increase in customer demand that does not need to be restored within 3 hours following a first circuit outage on any HV feeder (supplying the demand of between 1MW and 10MW) where the feeder has a total length not more than 1km, from 1MW to 1.2MW. This represents an increase of 0.2MW in the demand that might not be restored within 3 hours.

Reducing the redundancy of HV feeders would mean power outages experienced by customers would last longer which might not be preferable by customers. Yet, it has been agreed that an increase of 10 minutes in the average time that a customer was off supply would generally be acceptable to consumers, provided that there are some tangible benefits for customers.

The main benefit of reducing the minimum security of supply level is facilitating an increase in network capacity that can be 'released' for normal network configuration, as opposed to it being reserved for use in outage scenarios. In the proposal, up to an 11% increase in customer demand could be accommodated on specified HV feeders without incurring reinforcement costs. Theoretically, this would facilitate the connection of low carbon technology with their associated increase in network demand.

Relaxing the security of supply as proposed would result in a financial saving when the demand on an HV feeder increases above that which would be compliant with the P2/7 minimum level because no reinforcement works would be necessary to either reduce the demand on the HV feeder or to increase the capacity of the transfer circuits.

The ENA P2 Working Group has then developed a revised version of EREC P2 (Issue 8) by amending P2/7 with the inclusion of a note in Table 1 of P2 to indicate that the minimum demand to be restored within three hours can be reduced for specific HV feeders within **Class of Supply B** for HV feeders up to **1km in length**, the demand that shall be restored within 3 hours is **Group Demand** minus **1.2MW**.

Under EREC P2/8, ES is considered as providing a contribution to security of supply, however the demand from such connections (e.g. recharging) is also considered as part of the network group demand. The inclusion of ES demand within the group demand assessment for security of supply modelling is currently under review in GB and any changes to the current assessment process will be reflected in future iterations of EREC P2.

### 3.3 EREP 130 Amendments

In addition to the updates in P2, EREP 130 has also been revised to explain how to assess the security contributions offered by DG, DSR, and ES when making a conformance assessment against the EREC P2/7 security of supply standard.

EREP 130 was revised in Issue 3 (August 2019) to:

- Align EREP 130 with EREC P2/7;
- Provide new guidance on assessing the contribution to security from, and the latent demand associated with, Demand Side Response schemes and Electricity Storage;
- Update the F-factors for assessing contribution to security from DG, using recent data from DG, based on work carried out for ENA by Imperial College London; and
- Differentiate the contribution to security from DG, DSR and ES which is contracted with a DNO and that which is not.

In February 2023, EREP 130 was revised again in Issue 4 to convey that the proposed relaxation in security of supply for Class of Supply B is subject to specific criteria, including that the Group Demand is supplied by a Circuit with a total length less than 1km. Other minor updates were incorporated also to provide further explanations and examples.

Following public consultations on the changes in EREC P2/8 and EREP 130 (Issue 4), the GB utility regulation authority (Ofgem) approved this modification in February 2023.

### 3.4 EREC G5/5 Amendments

EREC G5 underwent a full technical rewrite in 2019 resulting in a significant change in how the document was laid out and the requirements at each assessment Stage. The main reason for the significant changes was to align with international standards which allowed greater distortion at different harmonic levels. This change would also encourage and facilitate the continued connection of modern equipment (inverter-based generation, EV chargers etc.) to the UK electricity networks.

In summary the main changes between G5/4 and G5/5 are:

- Planning and compatibility limits have been revised (note that voltage total harmonic distortion (THD) has remained the same);
- Defined voltage ranges adapted to align with typical voltages in use in the UK;
- Planning and compatibility levels have been extended to 5kHz (100<sup>th</sup> harmonic). Note measurement and assessment of harmonics above 2.5kHz (50<sup>th</sup>) are at the Network Operators (NO) discretion;

- Clearly defined interharmonics in line with IEC 61000-34-30, 61000-4-7 and 61000-2-2;
- Revised limit for voltage notches (depth and duration);
- Three stages of assessment have been updated. Stage 1 for LV, Stage 2 for connections that fail Stage 1 and below 33kV, Stage 3 for any other connection;
- Stage 1 has been completely revised and is designed for LV connections. 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;
- Stage 2 has been completely revised; it is designed for connection at voltages below 33 kV and for those that have failed Stage 1. It has also been designed as a linear process, such that assessments are applied in substages;
- A new section has been added 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;
- Stage 3 has been completely revised; it is designed for connections at and above 33 kV and for those that have failed Stage 2. The connection process has been clearly outlined;
- In Stage 3, the harmonic limits are based on the apportionment of the harmonic headroom. This is a significant difference between G5 Issue 5 and Issue 4;
- Defining the minimum requirement and format for harmonic specification that the NO has to issue to a new user;
- 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.

### 3.5 EREC P16 Removal from the Standards

EREC P16 (EHV or HV Supplies to Induction Furnaces) is no longer maintained by the ENA and is not considered for updating.

Detail considered within this document is now covered in other ENA Engineering Recommendations namely P28 and G5, hence P16 is now obsolete. As such, it is proposed to remove reference to this document from the DSSPS list to avoid confusion to customers considering the potential connection of induction furnaces to the distribution network at HV or EHV.

## 4. CONSULTATION QUESTIONS

1. Do you agree with the content and approach contained in EREC P2 and EREP 130, or do you have any alternatives to propose?
2. Do you have any objections to the proposal for NIE Networks to move from EREC P2/6 to P2/8?
3. Do you have any comments regarding relaxing the security of supply in EREC P2/8 by not to restore 1.2MW (increased from 1MW) of customer demand (Class of Supply B – between 1MW and 8MW) following an outage for HV feeders up to 1km in length?
4. Do you have any objections to the proposal for NIE Networks to move from EREC G5/4 to G5/5?
5. Do you have any objections to the proposal for NIE Networks to remove EREC P16 from the Standards?
6. Do you have any other relevant comments?

## 5. CONSULTATION PACK

The Consultation Pack can be found [here](#).

The Consultation Pack includes:

- This Consultation Paper.
- Engineering Recommendation P2 Issue 8 (With amendment to Table 1<sup>3</sup> to align with the specific requirements of Northern Ireland).
- EREP 130 Issue 4.
- Engineering Recommendation G5 Issue 5.
- Response Proforma.

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<sup>3</sup> Table 1 sets out the levels of security required for distribution networks classified in ranges of Group Demand.

## 6. NEXT STEPS

Stakeholders are invited to express a view on the proposed changes in ERECs P2 and G5 and any other aspect of this paper. Responses to this consultation should be sent to NIE Networks by 17:00 on Friday, 16<sup>th</sup> February 2024 on the pro-forma provided expressly for the purpose (pro-forma can be found in the Consultation Pack), or via any other convenient means and should be addressed to:

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During the consultation period, should any stakeholder have any specific queries on any aspect of this document, or on the proposed changes to the standards, they should contact Ahmed Mohamed (EREC P2) or Richard Derby (EREC G5) at the address set out above.

NIE Networks intends to collate all responses received to this consultation as part of its report to the Utility Regulator. Following the end of this consultation period NIE Networks will, in accordance with its Distribution Licence send a report on the outcome of its review to the Regulator detailing;

- The proposed revisions to the Distribution System Security and Planning Standards which NIE Networks proposes to make; and
- Any written representations or objections from any stakeholders (including any proposals for revisions to the document that were not accepted in the course of the review) arising during the consultation process and subsequently maintained.

Following the end of the consultation period and the discussions to be held with the Regulator, revisions to ERECs P2 and G5 will be finalised and published on the NIE Networks website once approval has been received by the Regulator.