



Report for Initial Review of ENA Engineering Recommendation P25

for
Energy Networks Association

Confidential to Client

*Contract Reference: ENA_ENA112
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1. Executive Summary

Threepwood Consulting Limited has conducted an initial review of ENA Engineering Recommendation P25 Issue 1: *The Short-Circuit Characteristics of Public Electricity Suppliers' Low Voltage Distribution Networks and the Co-ordination of Overcurrent Protective Devices on 230V Single Phase Supplies up to 100As*, to determine the requirements for subsequent revision.

Since the document was published in 1996, a number of the references in the document, have been revised or superseded. Much of the technical content of ER P25 is still relevant and no major errors were identified. The document appears to have served the industry well since it was published. This initial review has identified that a minor revision of the document is required to update the document against current Standards and practice.

Feedback from Member Companies has confirmed that ER P25 remains relevant and is required. The Member Companies have highlighted a number of clarifications and confirmations that are required during the revision including the following points.

- Address inconsistencies of consumer protection device ratings with ER P25 PSCC declared values.
- Clarify the underlying calculation assumptions used in ER P25.

The content in ER P25 is very similar to ENA Engineering Recommendation P26, which provides guidance on the estimation of PSCC for 415 V three-phase supplies. It is recommended that a revision of ER P25 and ER P26 are undertaken together, with a view to amalgamating the documents.

The main recommendation of this initial review is that P25 be subjected to a "Minor Revision". This revision should be undertaken by a small revision team under the auspices of the Distribution Code Review Panel (DCRP) since P25 is a Distribution Code (DCode) Annex 1 Qualifying Standard.

2. Introduction

The Energy Networks Association (ENA) has commissioned Threepwood Consulting Limited (Threepwood Consulting) to conduct an initial review of a number of engineering documents due for revision as part of the 201 Programme. The purpose of this initial review is to determine the requirements for subsequent revision of the documents.

This report relates to the initial review of ENA Engineering Recommendation P25 Issue 1 (subsequently referred to as 'P25').

The findings and recommendations from the initial review of this document are presented in this short form report.

3. Overview of Document

P25 was published in 1996 to provide guidance, as required by the Electricity Regulations 1988 (now ESQCR 2002), on the estimation of maximum prospective short circuit current (PSCC) at the supply terminals. P25 is therefore the appropriate source document when Network Operators are declaring the value of the PSCC to consumers.

The document content is very similar to that of ENA Engineering Recommendation P26 (ER P26), which provides guidance on the estimation of PSCC for 415 V three-phase supplies. ER P26 has been recommended for revision as described in a separate report titled: *Threepwood Report_ENA_ENA112_ER P26_v1*.

P25 is referenced in the Distribution Code (DCode) as technical guidance under Clause DPC 4.3.2 'Design Principles' and Clause DPC 6.5.1 'Fault Level'. P25 is also a DCode Annex 1 Qualifying Standard, and its revision will fall under the governance of the Distribution Code Review Panel (DCRP).

The details in P25, for example, estimation of PSCC for different service cable lengths and types, are most relevant to those involved in the design and installation of consumer supply arrangements.

4. Review of Technical References

4.1 General

Since the document was published in 1996, many of the references in the document have been subject to amendment or replacement.

4.2 Standards

4.2.1 International Standards

IEC Standards are not referenced in P25 and this review recommends that IEC 60909-0, *Short-circuit currents in three-phase a.c. systems - Part 0: Calculation of currents*, may be relevant. This Standard is recommended for consideration during revision of ER P26.

4.2.2 BSI Standards

P25 includes a small number of BS and BS EN Standards in clauses which have all been subject to amendments, as discussed below.

- **BS 1361:1986**, *Specification for cartridge fuses for a.c. circuits in domestic and similar premises*. This standard has been withdrawn and superseded by **BS HD 60269-3**, *Low-voltage fuses. Supplementary requirements for fuses for use by unskilled persons (fuses mainly for household and similar applications). Examples of standardized systems of fuses A to F*. This standard is current but is subject to amendment via a draft for public comment, dated July 2015. It is proposed that this draft is reviewed when revising P25.
- **BS 7657:1993**, *Specification for fuses (cut-outs), ancillary terminal blocks and interconnecting units up to 100 A rating, for power supplies to buildings*. This Standard has been withdrawn and replaced by **BS 7657:2010**, *Specification for cut-out assemblies up to 100 A rating, for power supply to buildings*. The revised Standard constitutes a full revision and has been written as a performance based document and is less prescriptive. It includes more stringent heat and fire performance requirements for insulating materials and extended temperature-rise testing. It is proposed that this Standard is closely reviewed when revising P25.
- **BS 7671**, *Requirements for Electrical Installations. IET Wiring Regulations*. This Standard has been subject to a number of revisions (2001 and 2008) since P25 was published. The latest revision of the Standard was published in 2008 and is subject to Amendment 3, published in July 2015. The updates to this Standard have included major amendments and it will be necessary to review the appropriate clauses closely when revising P25.

- **BS EN 60439-3:1991 + A1:1994**, *Low-voltage switchgear and controlgear assemblies. Particular requirements for low-voltage switchgear and controlgear assemblies intended to be installed in places where unskilled persons have access to their use. Distribution boards*. This Standard has been withdrawn and superseded by **BS EN 61439-3**, *Low-voltage switchgear and controlgear assemblies. Distribution boards intended to be operated by ordinary persons (DBO)*. The updates within BS EN 61439-3 are technical but the details of the 'conditional testing' (specifically referred to in P25) are not believed to have changed. Indeed, P25 is referenced by BS EN 61439-3 in Annex ZB, regarding the PSCC declared value in the UK. It is proposed that Annex ZB of BS EN 61439-3 is carefully reviewed during the revision of P25.

4.3 CIGRÉ Documents

P25 does not currently reference any CIGRÉ publications and this review has not identified any CIGRÉ publications that are relevant to the revision of P25.

4.4 ENA Engineering Documents

The current version of P25 makes no reference to any other ENA document. It is proposed that any revision of P25 should include reference to the following Engineering Documents.

- **ENA EREC G81 Part 1**, *Framework for design and planning, materials specification and installation and record for Greenfield low voltage housing estate installations and associated, new, HV/LV distribution substations. Part 1: Design and Planning*. It is proposed that the EREC G81 Part 1 is added as an appropriate reference in P25. Indeed, P25 is referred to in Clause 6.14 of EREC G81 Part 1.
- **ENA ER P26**, *The estimation of the maximum prospective short-circuit current for three phase 415V supplies*. This document has a close relationship and very similar scope to P25; and it is proposed that ER P26 is combined with P25 during the revision work (refer to *Threepwood Report_ENA_ENA112_ER P26_v1*).
- **ENA ER P23**, *Consumers earth fault protection for compliance with the IEE Wiring Regulations for Electrical Installations*. This document was last published in 1991 but has been subject to recent review by the ENA Earthing Co-ordination Group (ECG). It would be pertinent to review ER P23 and liaise with the ENA ECG whilst revising P25.
- **ENA ER G74**, *Procedure to meet the requirements of IEC 909 for the calculation of short-circuit currents in three-phase AC power systems*. ER G74 is currently under revision and it is recommended in the review report for ER P26 (refer to *Threepwood Report_ENA_ENA112_ER P26_v1*), that the work on ER G74 will have high significance for short-circuit considerations on three-phase systems. Indeed, the revision team for G74 should be advised to consider the impact of LV distributed generation on the PSCC value at LV busbars.

5. Legislation

P25 makes reference to the Electricity Supply Regulations, 1988. These Regulations were replaced by the Electricity Safety, Quality and Continuity Regulations (ESQCR) 2002 (as amended).

ESQCR Regulation 28 requires the electricity supplier to state the maximum PSCC at the supply terminals; this aligns with the existing statement in paragraph 4 (referencing the Electricity Supply Regulations 1988) of the Clause 1 in P25. The ESQCR also require that pre-1937 cut-out designs are removed - it may be appropriate to mention this in the revised version of P25.

This review has not identified any other legislative references which may be relevant to P25.

6. Review of Document Structure and Content

Although the document is well structured, alignment with the new ENA Standards template and associated ENA Engineering Recommendation governing the rules for structure, drafting and presentation of ENA engineering documents (ER G0) will be required. A number of new clauses are proposed for the revision.

- Foreword - to provide reader guidance and publishing information background on the document.
- Normative reference - to capture the references currently detailed in Appendix A.
- Terms and definitions - to capture the definitions currently detailed in Appendix A and some acronyms used in the document. Relevant acronyms used in the document include: PSCC, HV, LV, pf.
- Bibliography - to capture any references which may be of an informative nature for the reader, for example, the IET *On-Site Guide*.

It is proposed that out-of-date terms used in P25 are replaced as follows.

- Replace 'PES' with 'Network Operator (NO)'.
- Replace 'London Electricity Area' with 'UKPN London Power Network'.

7. Review of Technical Relevance

7.1 General

Nominated ENA Standard Representatives from a number of Member Companies were invited to provide feedback on the technical relevance of P25, in particular what changes, if any, are required to meet their business processes and applications currently and in the medium term (i.e. 1 - 5 years). The responses are captured in Appendix A. In addition to their feedback, a number of comments were raised as discussed in the following paragraphs.

1. Users of P25
Network Operators do not see themselves as direct users of this document. P25 may be referred to during consumer queries. Network Operators use the values declared in P25 in their documents but may not directly reference P25.
The predominant users of P25 are assumed to be domestic supply designers and electricians - when complying with BS 7671 and/or NICEIC guidance. However, anecdotal evidence suggests that P25 is not being applied appropriately and 6 kA MCBs are fitted in most consumer installations. Given that P25 specifies the PSCC at the service tee off to be a maximum of 16 kA, and many service cables are not long (fault current attenuation is low), there may be consumers with inadequately rated protection equipment.
2. Relationship of P25 and ENA ER P26
The scope and content of P25 and P26 include considerable overlap and an amalgamation of the two documents should be considered.
3. P25 Clause 4 and Table 1
Confirm the assumptions used in the determination of the PSCC at the service tee off position i.e. what typical length of LV main distributor is assumed?
Table 1 should be updated with a wider range of service cables.

4. Voltage base in P25
Has the PSCC value been calculated on a 230 V base or a 240 V base on a 230 V system?
5. Application of P25
Is P25 applicable to new builds or existing properties?
6. Protection device selection
The guidance provided in Clause 6 should be reviewed - is this guidance required?
7. P25 PSCC value
The value of PSCC in P25 should be confirmed as still relevant and accurate.

Considering the issue raised in item 1 in further detail (installation of 6 kA rated MCBs), a brief review of literature from a UK supplier of electrical equipment uncovered the following: 'a domestic MCB would normally have a 6KA fault level, whereas one used in an industrial application may need a unit with a 10KA fault capability'. This statement would indicate that product ratings are not consistent with the requirements of P25 PSCC values. It is proposed that a manufacturer/supplier is consulted during the revision of P25. Close attention to the details for Clause 6 will be necessary.

Considering the issue raised in item 7 in further detail (accuracy of PSCC value), it is not stated in P25 whether the maximum PSCC value takes account of distributed generation. Given the increase and penetration of distributed generation on LV networks, it would certainly be appropriate to ascertain the impact of such generation to fault currents. This issue is of higher significance for ER P26, which considers the short-circuit current at the LV substation busbars. It is recommended that any revision of ER P26 which considers the impact of LV distributed generation, should also consider the impact for P25.

In addition to those Member Companies who provided comment, a publication by ENWL: Electrolink 2 (January 2011), *ESTIMATION OF PROSPECTIVE SHORT CIRCUIT CURRENT (PSCC)*, was reviewed. This publication includes all relevant information from P25 and is a clear declaration of PSCC value in accordance with P25.

7.2 Low Carbon Network Funded Projects

This review report has not identified any Low Carbon Network Funded (LCNF) projects which have a sole impact on P25. However, a number of LCNF projects, relating to fault level considerations for networks, were identified in the review of ER P26 (refer to *Threepwood Report_ENA_ENA112_ER P26_v1*).

8. Conclusions

The content of P25 is still very relevant and the document is a required reference for Network Operators when declaring the maximum PSCC value at consumer supply points, in accordance with Regulation 28 of ESQCR.

A number of references in P25 have been subject to amendments since the document was published. A selection of Member Companies were requested to provide feedback on the document during this review and the following points were raised, warranting consideration during a revision of P25.

- Address inconsistencies of consumer protection device ratings with P25 PSCC declared values.
- Clarify the underlying calculation assumptions used in P25 (base voltage, LV distribution main details, transformer size etc.)

The content of P25 is very similar to ER P26, which considers the PSCC value for three-phase supplies connected at the LV busbar or LV main. A revision of P25 should be co-ordinated with a revision of ER P26 and it would be sensible to amalgamate the two documents. A review of ER P26 (refer to *Threepwood Report_ENA_ENA112_ER P26_v1*) recommends that the impact of LV distributed generation should be considered for PSCC declared values. This would require consideration of fault level calculations based on relevant Standards. Any work to validate the PSCC values in ER P26, should include a review of P25 PSCC values.

Although P25 is well structured, it should be aligned with the new ENA Standards template and reformatted following the rules for structure, drafting and presentation of ENA engineering documents (ER G0).

9. Recommendations

The main recommendation is that P25 is subject to a “Minor Revision”, on account that the document requires mainly editorial amendment and addressing the points raised by Member Companies. In addition, the revision work should include minor amendments relating to revisions of the Standards and Legislation referenced.

It is recommended that P25 is amalgamated with ER P26, as described in review report *Threepwood Report_ENA_ENA112_ER P26_v1* - that report recommends ER P26 is subjected to a “Major revision”.

The validation of PSCC values recommended for ER P26 - to confirm the impact of LV distributed generation on fault levels - should also take account of P25 PSCC values.

It is recommended that the revision of P25 is undertaken alongside the revision of ER P26 and overseen by a small Revision Team consisting of the following members.

- One representative from Threepwood Consulting Ltd, who will act as the ENA Co-ordinator and Chief Author for changes to the document.
- A minimum of three representatives from Member Companies who are nominated as the primary reviewers, and will have primary responsibility for overseeing the document as it is revised.
- A representative from a manufacturer of electrical distribution equipment for household consumer supplies.

The first stage of any revision should involve drafting the Terms of Reference (ToR) of the Revision Team for approval by the DCRP.

Appendix A: Technical Relevance

Summary of Feedback from ENA Member Company Standard Representatives

		SPN	NIE	NPGRID	NGRID	SSE	UKPN	WPD	ENW	COMMENTS
Q1	Do you use this engineering document to support your current business processes / practices?	NO RESPONSE	NONE	IN PART	NA	NONE	IN PART	NONE	NONE	See Clause 7.1
Q2	Does this engineering document meet your engineering requirements in its current format?	NO RESPONSE	NONE	IN FULL	NA	NONE	IN FULL	NONE	NONE	See Clause 7.1
Q3	Are there any significant errors or omissions in this engineering document that you believe should be addressed in the next revision?	NO RESPONSE	NONE	NO	NA	NONE	NO	NONE	NONE	See Clause 7.1
Q4	What is the extent of review you believe is required for the revision of this engineering document?	NO RESPONSE	NONE	Minor Revision	NA	NONE	Minor Revision	NONE	NONE	See Clause 7.1