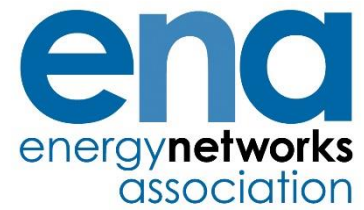


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Engineering Recommendation C55

Issue 5 2014

Insulated sheath power cable systems

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Issue 4 published 1989

Amendments since publication

Issue	Date	Amendment
Amendment 1	1995	Amendments to ensure conformance with Clause 11 of the Utilities Supply and Works Contracts Regulations 1992. Updating of several British Standards and CEGB/ESI/EA Standards and deletion of references to 'Engineering Equipment Approvals Lists'.
Issue 5	2014	<p>Major revision of Issue 4 + A1 to reflect the cable technology change from paper insulation to polymeric (XLPE) insulation at all voltages and the consequent changes to technical standards. The purpose and intent of EREC C55 remains unchanged and the principles and methods of sheath bonding and earthing are unaltered.</p> <p>The structure of the document has been extensively revised to improve clarity and logical flow. The body of the EREC is now divided in four main clauses covering definition and technical requirements for systems, design and technical requirements for system components (items), sheath bonding arrangements and test requirements.</p> <p>This issue includes the following principal technical changes.</p> <p>Foreword: Updated statement regarding conformance with the Utilities Contracts Regulations.</p> <p>Clause 1 Scope: Statement added to clarify that "sheath" includes metallic screens comprising wires or tapes or both.</p> <p>Clause 2 Normative references: Several standards titles removed from the list:-</p> <ul style="list-style-type: none">BS 6346 (withdrawn by BSI);BS 6480 (withdrawn by BSI) (not cited in text);Normative reference IEC 60502-1 (1 kV cables with extruded insulation) added in place of BS 6346. <p>Reference to ENA EREC C48 (withdrawn) deleted.</p>

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	<p>Clause 3: Terms and definitions: Reference to IEC 60050 (Electrotechnical vocabulary) updated:- Definition of “bonding lead” added; Definition of “engineer” added; Definition of “indirect earthing” modified to remove non-definition content; Definition of “sheath” modified to improve clarity; Definition of “sheath voltage limiter (SVL)” added.</p> <p>Clause 4.1 (previously 1.5): Added requirement for calculations of induced voltage to additionally meet the requirements of CIGRE Technical Brochure 283.</p> <p>Clause 4.4 (previously 1.6): Removed reference to PVC insulation and BS 6346. Added referral to clauses on bonding leads.</p> <p>Clause 5.1.6 (previously 8.8.6): Note added regarding the standard use of ZnO SVLs.</p> <p>Clause 5.2 Bonding leads (previously 1.9): Deleted reference to PVC insulation and BS 6346. Added reference to IEC 60502-1 (allowing insulations including PVC and XLPE). Deleted paragraph “Subject to.....” (allowing use of polyethylene insulation). Added functional requirements for external surface of bonding leads to be coated or extruded from suitably conductive materials for sheath voltage testing.</p> <p>Clause 5.5.1 Terminations other than into metalclad equipment. (previously 3.1): Reference to EREC C48 (withdrawn) deleted.</p> <p>Clause 7.3.2 Internal insulation of link housings (previously 4.3): EREC C28 replaced by IEC 60230 (impulse test procedure).</p> <p>Clause 7.2 Bonding leads (previously 4.4): Replaced BS 6346 with IEC 60229. Added IEC 60228 for conductor resistances. Removed resistance figures and spark test requirement from Table 4 (previously Table 2B).</p> <p>New Annex A: Design guide for SVL selection added.</p> <p>Bibliography: New Bibliography added. Several standards transferred from Normative References that were not cited in the text.</p> <p>Standards added to Bibliography, mostly relating to polymeric insulated cables but including IEC 60055 (33 kV paper cables – alternative to BS 6480).</p> <p>All figures re-drawn to improve clarity.</p> <p>Tables 5 and 6 rearranged and augmented with information from previous Table 1. Emphasis placed on fault rating rather than traditional associated system voltage. Removed reference to graphite coating. delete the rows that specify conductor construction. Deleted the dimensional restrictions (i.e. min and max dimensions) for insulation. Removed reference to PVC.</p> <p>Details of all other technical, general and editorial amendments are included in the associated Document Amendment Summary for this Issue (available on request from the Operations Directorate of ENA).</p>
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Foreword

This Engineering Recommendation (EREC) is published by the Energy Networks Association (ENA) and comes into effect from the date of publication. It has been prepared under the authority of the ENA Engineering Policy and Standards Manager and has been approved for publication by the ENA Electricity Networks and Futures Group. The approved abbreviated title of this engineering document is “EREC C55”, which replaces the previously used abbreviation “ER C55”.

This issue supersedes Issue 4 published 1989 and its Amendment 1 published 1995. The document has been revised in conjunction with the ENA Cable and Accessories Panel. The revision includes updating of normative Standards and addition of Standards relating to cables with extruded insulation. The technical intent of the EREC and its specified methods and practices remain unchanged.

The layout of the main text of the document has been restructured to improve clarity and logical flow.

This EREC meets the requirements of the Utilities Contracts Regulations 2006 [N2] as amended.

Where the term “shall” or “must” is used in this document it means the provision is mandatory. Where the term “should” is used in this document it means the provision is a recommendation. The term “may” is used to express permission.

NOTE: Commentary, explanation and general informative material is presented in smaller type, and does not constitute a normative element.

1 Scope

This EREC covers the bonding and earthing of insulated sheath power cable systems for three-phase a.c. operation at 33 kV and above. These systems relate to cables in which the metallic sheath is covered with an insulating oversheath. Metallic joint sleeves and base metalwork of sealing ends are similarly insulated from earth in order to protect them from corrosion and/or the voltages imposed upon them by reason of the adoption of a specially bonded system. For the purposes of this EREC the term “sheath” is deemed to include extruded metallic coverings and metallic screens comprising wires, tapes or both.

2 Normative references

The following referenced documents, in whole or part, are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

Standards publications

BS 3621, *Thief resistant lock assembly. Key egress*

IEC 60050-461 ed 2.0, *International Electrotechnical Vocabulary – Part 461: Electric cables*

IEC 60230, *Impulse tests on cables and their accessories*

IEC 60502-1, *Power cables with extruded insulation and their accessories for rated voltages from 1 kV ($U_m = 1,2$ kV) up to 30 kV ($U_m = 36$ kV) – Part 1: Cables for rated voltages of 1 kV ($U_m = 1,2$ kV) and 3 kV ($U_m = 3,6$ kV)*

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

Other publications

[N1] ‘Electra’ No. 28, May 1973, *The design of specially bonded cable systems, (Part I)*

[N2] Utilities Contracts Regulations 2006 (S.I. 2006 No.6) and amendment, the Utilities Contracts (Amendment) Regulations 2009 (S.I. 2009 No. 3100)

[N3] CIGRE Technical Brochure 283, *Special bonding of high voltage power cables*, Working Group B1.18, October 2005

[N4] ENA TS 09-3, *33 kV impregnated paper insulated oil-filled and gas-pressure type power cable systems*

[N5] ENA TS 09-4, *66 kV and 132 kV impregnated paper insulated oil-filled and gas-pressure type power cable systems*

[N6] ENA TS 09-5, *275 kV and 400 kV impregnated paper insulated, oil-filled and gas-compression type power cable systems*

[N7] ENA TS 50-9, *Equipment for work on cable under induced voltage conditions*

[N8] ENA TS 50-18, *Application of ancillary electrical equipment*

[N9] ENA EREC C66, *Type approval testing procedure: protective boxes for use with buried accessories employed on 33 kV to 400 kV insulated sheath power cable (and for sheath sectionalising insulation embodied in such accessories)*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

The terms used in this document are generally as given in IEC 60050-461 ed 2.0, *International Electrotechnical Vocabulary – Part 461: Electric cables*, supplemented by those given in Appendix A of 'Electra' No. 28 [N1]. Definitions in Clauses 3.1 to 3.7 are specific to this document.

3.1

bonding lead

insulated stranded single or concentric conductor forming the connection between the metallic sheath/screen of a cable and a link in a link housing or link box

3.2

direct earthing

earthing of the cable sheath at a termination by the shortest path, taking into account the practical site conditions and the need to accommodate link housings and current transformers (CTs), etc

3.3

engineer

technically qualified person nominated by and representing an ENA member company

3.4

indirect earthing

earthing of the cable sheath at a termination in such a manner as to reduce or eliminate sheath circulating currents which would otherwise be produced

3.5

link housing or link box

lockable, earthed, metallic enclosure constructed to accommodate sheath sectionalising links, earth connecting links, and associated sheath voltage limiters (SVLs) where appropriate

3.6

sheath

metallic covering surrounding the cable core(s) comprising a continuous extruded layer or tapes or wires or a combination thereof

3.7

sheath voltage limiter (SVL)

device connected to a sheath or sheaths of specially bonded cables intended to limit sheath voltages during system transients