



Technical Specification 09-2

Issue 6 2016

Specification for the supply, delivery & installation of power cables with operating voltages in the range 11 kV to 400 kV and associated auxiliary cables

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Issue 5 published, 2010.

Amendments since publication

Issue	Date	Amendment
Issue 6	February 2016	<p>Minor revision of Issue 5: (i) to expand scope of document to cover 11 kV and 20 kV cables (ii) to reflect changes made to the standards referenced (iii) to update requirements, as necessary, to meet latest practice and (iv) to add requirements for cable oversheath testing. The technical intent of the document remains unchanged.</p> <p><i>NOTE: To avoid confusion due to the re-numbering of existing clauses and addition of new clauses, the Clause numbering below refers to this revised version, Issue 6. The Clause numbers of Issue 5 are given in brackets, where relevant, for cross referencing.</i></p> <p>This issue includes the following principal technical changes.</p> <p>Title: Amended to refer to 11 kV to 400 kV cables to reflect the expanded scope of the document.</p> <p>Foreword:</p> <p>(i) Wording added to reflect the expanded scope of the document.</p> <p>(ii) Reference to the EA document “General Conditions of Contract for the Supply, Delivery and Installation of Electric Cables” deleted. This is a legacy document from the EA and is no longer available from the ENA.</p> <p>Clause 3 (Issue 5, Appendix A): References updated, deleted or added as relevant.</p> <p>Clause 4 (Issue 5, Definitions): Terms and definitions updated, as relevant.</p> <p>Clause 7.2.12 (Issue 5, Clause 3.2.12): Reference to withdrawn “Engineering Recommendation G17” updated to “HSE publication ‘Avoiding danger from underground services’”. Technical requirements unchanged.</p>

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	<p>Clause 7.2.14 (Issue 5, Clause 3.2.15), Table 1: Entries added for 11 kV and 20 kV cables.</p> <p>Clause 7.2.15 (Issue 5, Clause 3.2.15): Requirements for cable spacing extended to include 11 kV and 20 kV cables, where the minimum spacing to be 300 mm.</p> <p>Clause 7.2.17 (Issue 5, Clause 3.2.17): Additional requirement that unless otherwise specified, the cable bend radius to be not less than 20 times the overall diameter of the cable except at joints or terminations or when using a former, where 15 x is acceptable. Requirement to exceed values specified in ENA ER C61, restricted to apply to 33 kV and above cables.</p> <p>Clause 7.2.18 (Issue 5, Clause 3.2.18): Added reference to “BS EN 61537” for additional guidance on methods of calculation of cleat spacing.</p> <p>Clause 7.2.24 (Issue 5, Clause 3.2.24): Added requirement that the latest updates to the guidance from Defra on biosecurity guidance to staff visiting farms should be consulted.</p> <p>Clause 7.2.25 (Issue 5, Clause 3.2.25): Added reference to “ENA EREC G80” for additional guidance on access to LRT sites.</p> <p>Clause 7.2.33 (Issue 5, Clause 3.2.33): Reference to “Chapter 8 of the Traffic Signs Regulations” updated to “Traffic Signs Manual Chapter 8 Road works and temporary situations”. Technical requirements unchanged.</p> <p>Clause 7.10 (Issue 5, Clause 3.10): Title amended to ‘Provision of cable and/or duct bedding’.</p> <p>Clause 7.11 (Issue 5, Clause 3.11):</p> <ul style="list-style-type: none"> (i) Paragraph 4: Requirement that ‘metallic pipes be effectively earthed’ enhanced to require that the earth to be via an exothermic weld. (ii) Paragraph 5: Table of recommended duct sizes deleted. Text amended to refer to ENA TS 12-24 because the duct dimensions have been revised. Technical intent unchanged. (iii) Paragraph 8: Requirement for the radius of bends in ducts “shall be as large as reasonably practical” quantified by adding “and generally shall have radii of at least 20 times inside diameter”. <p>Clause 7.15 (Issue 5, Clause 3.15): Requirements added that ‘cables be fixed at intervals’ enhanced to require that cables be fixed at regular intervals and that the cleats to meet the requirements of BS EN 61914.</p> <p>Clause 7.16 (Issue 5, Clause 3.16):</p> <ul style="list-style-type: none"> (i) Paragraph 2: Requirement added for support of 11 and 20 kV joint bays. Reference to withdrawn “BS 7263 Part 1” updated to “BS EN 1339”. (ii) Paragraph 5: Requirement added to require that precautions be taken to remove the mechanical thrust in the cable circuit prior to the cables entering the joint. (iii) Paragraph 8: Reference to withdrawn “BS 1485” updated to “BS EN 10223-2”. <p>Technical requirements unchanged using the updated standards.</p> <p>Clause 7.18 (Issue 5, Clause 3.18): Paragraph added that cables having an insulated oversheath to be subject to oversheath tests prior to commencing the installation, where required by the Purchaser.</p> <p>Clause 7.18.1: Requirement added that in cold weather, cables to be maintained at a temperature above 0°C, and preferably higher, for a minimum of 24 hours before laying or otherwise bending. Arrangements to be made to deliver the cable to site with protection from the cold and to install as quickly as possible.</p>
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		<p>Clause 7.18.3: Title amended to 'Position of auxiliary/pilot cables'. Optional consideration added that auxiliary/pilot cables containing metallic conductors or sheaths may be laid with a transposition at the mid-point of the route so that approximately 50% of the route the pilot cable is run on one side of the cable circuit and 50% on the opposite side of the cable circuit.</p> <p>Clause 7.18.4 (Issue 5, Clause 3.18.4): Paragraph added that cables having an insulated oversheath to be subject to oversheath tests after blinding, where required by the Purchaser.</p> <p>Clause 7.18.5 (Issue 5, Clause 3.18.5): Requirement that protective tiles to conform to the impact test requirements of BS 2484, extended to apply to tiles made from materials other than reinforced concrete.</p> <p>Clause 7.18.8 (Issue 5, Clause 3.18.8):</p> <ul style="list-style-type: none">(i) Requirement added that joints and terminations be fully supported for their complete length, with this support having a thermal resistivity of at least equal to that of the bedding and blinding used in the trench.(ii) Paragraph added that cables having an insulated oversheath to be subject to oversheath tests after jointing but prior to being connected to the existing network, where required by the Purchaser. <p>Clause 7.18.10: Oversheath testing. New Clause. Added to provide requirements for oversheath testing of cables during installation.</p> <p>Clause 7.18.11 (Issue 5, Clause 3.18.10): Sentence added that where the new cable has an insulated oversheath, to confirm that any oversheath faults identified by the site tests have been located, repaired and satisfactory re-test results obtained.</p> <p>Clause 7.19.1 (Issue 5, Clause 3.19.1):</p> <ul style="list-style-type: none">(i) Paragraph 4: Reference to withdrawn "BS 4000" updated to "BS EN ISO 216".(ii) Paragraph 4: References to withdrawn "BS 4884" and "BS 5070" updated to "BS EN 82079". <p>Technical requirements unchanged using the updated standards.</p> <p>Clause 7.19.2: Entry for cable and accessories data sheets augmented by requiring this information to include: positive sequence resistance, positive sequence reactance, positive sequence susceptance, zero sequence resistance, zero sequence reactance, zero sequence susceptance & phase charging current.</p> <p>Bibliography: Clause added and references to "ENA TS 09-6" and "ENA ER G87" included, moved from "Normative references" Clause because not explicitly referenced in the document.</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 Technical Specification (TS) 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 (ENFG). The approved abbreviated title of this engineering document is “ENA TS 09-2”.

This document replaces and supersedes Technical Specification 09-2 Issue 5 2010.

This Technical Specification has been issued for use by ENA Member Companies. It may be incorporated without modification into Enquiry Documents issued by Purchasers for the supply, delivery and installation of the relevant types of cables on distribution systems owned and operated by ENA Member Companies.

The use of this Technical Specification in conjunction with model forms of contract, or where conditions outside the scope of the Specification apply, should not be undertaken without additional professional advice.

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

This document forms a code of practice describing installation methods which the industry has found to be effective and to which Tenderers and Contractors are expected to refer in drawing up their plans.

Flexibility is incorporated which enables Purchasers, Tenderers and Contractors to propose and adopt solutions which may not conform to contemporary industry norms.

2 Scope

This Technical Specification is applicable to the supply, delivery and installation of electricity power cables in the voltage range 11 kV to 400 kV inclusive and the associated auxiliary/pilot cables which are intended to operate on the electricity supply systems owned and operated by ENA Member Companies. To enhance performance and longevity of the works, this specification requires that the works are designed and built with maintenance requirements in mind.

This Technical Specification is not intended to cover major works of civil engineering construction such as cofferdams, pits, shafts, tunnels, dewatering, use of compressed air, piling and large formwork, which are occasionally associated with cable installations. It is recommended that such works should be the subject of a separate specification.

3 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 EN 1339:2003, *Concrete paving flags. Requirements and test methods*

BS EN 60721, *Classification of environmental conditions*

BS EN 61082-1:2015, *Preparation of documents used in electrotechnology. Rules*

BS EN 61537:2007, *Cable management. Cable tray systems and cable ladder systems*

BS EN 61914:2009, *Cable cleats for electrical installations*

BS EN 82079-1:2012, *Preparation of instructions for use. Structuring, content and presentation. General principles and detailed requirements*

BS EN 10223-2:2012, *Steel wire and wire products for fencing and netting. Hexagonal steel wire netting for agricultural, insulation and fencing purposes*

BS 2484, *Specification for straight concrete and clayware cable covers*¹

BS EN ISO 216:2007, *Writing paper and certain classes of printed matter. Trimmed sizes. A and B series, and indication of machine direction*

BS 3408:1992, *Specification for tarpaulins*

¹ Standard has been withdrawn but remains available.

BS 6031:2009, *Code of Practice for Earthworks*

BS 8002:2015, *Code of Practice for earth retaining structures*

Other publications

[N1] Water Resources Act 1991 (and amendments)

[N2] Land Drainage Act 1991 (and amendments)

[N3] HSE Publication, *Avoiding danger from underground services*

[N4] New Roads and Street Works Act (NRSWA) 1991

[N5] HAUC Specification for the Reinstatement of Openings in Highways: Highways & Utilities Committee Code of Practice

[N6] Department for Environment Food & Rural Affairs (DEFRA), Guidance document: Controlling disease in farm animals at <https://www.gov.uk/controlling-disease-in-farm-animals>

[N7] Department for Transport, Traffic Signs Manual, Chapter 8 Road works and temporary situations

[N8] The Groundwater (England and Wales) Regulations 2009 (SI 2009/2902)

[N9] Electricity Safety, Quality and Continuity Regulations (ESQCR) 2002 (SI 2002/2665) (and amendments)

[N10] Control of Substances Hazardous to Health Regulations (COSHH)

[N11] ENA ACE 19, *Induced voltages in auxiliary cables*²

[N12] ENA ACE 64, *Thermo-mechanical performance of super-tension cables and accessories*³

[N13] ENA TS 12-24, *Plastic ducts for buried electric cables*

[N14] ENA TS 41-24, *Guidelines for the design, installation, testing and maintenance of main earthing systems in substations*

[N15] ENA TS 97-1, *Special backfill materials for cable installation*

[N16] ENA TS PO5, *Protection of telecommunication lines from power lines*

[N17] ENA EREC C55, *Insulated sheath power cable systems*

[N18] ENA ER C61, *Installation bending radii of 33 kV and higher voltage cables*²

[N19] ENA ER C97, *Code of Practice on the marking of high voltage cable routes*

[N20] ENA ER G29, *Farm hygiene: precautions to prevent spread of animal and poultry diseases*²

² These documents have been withdrawn and are no longer maintained. The documents are archived and available to ENA Member Company's upon request.

³ This document is no longer maintained but remains available for purchase.

[N21] ENA EREC G56, *Arrangements for access by ENA Member Company Staff to Network Rail Infrastructure*

[N22] ENA G57, *Cable laying in agricultural land*

[N23] ENA ER G64, *Safety in cable ways*

[N24] ENA EREC G80, *Recommendations for the safe working of utilities' staff and other parties near light rapid transit systems*

[N25] ENA ER S2, *Limitation of fire risk in substations*

[N26] ENA ER S5, *Earthing installations in substations²*

[N27] ENA ER S34, *A guide for assessing the rise of earth potential at substation sites*

[N28] Holtum W (1975) "*The installation of metal sheathed cables on spaced supports*"
Proceedings IEE, Part A 102, 729-742

4 Terms and definitions

For the purposes of this document and for the purposes of drawing up a Contract, the following terms and definitions apply.

4.1

assessment and assessed

assessment of, or as assessed by the Engineer

4.2

auxiliary/pilot cable

cable installed for the purposes of protection and control

4.3

bedding

process of providing a layer of selected sand or other assessed material in a trench prior to installing a cable

4.4

bending radius, minimum

minimum permissible dimension of the radius of a bend in a cable

4.5

blinding

process of surrounding cables in trenches with selected sand, stabilised backfill or other assessed material

4.6

bond pulling

process of installing a cable with the aid of a wire rope attached at close intervals to the entire length

4.7

bondwire

wire rope used for bond pulling