

# Electric cables — Metallic wire and foil sheath constructions of power cables having XLPE insulation for rated voltages from 66 kV ( $U_m = 72.5$ kV) to 132 kV ( $U_m = 145$ kV)

ICS 29.035.01; 29.020; 29.060.01

|                            |
|----------------------------|
| Confirmed<br>December 2011 |
|----------------------------|

# Committees responsible for this British Standard

The preparation of this British Standard was entrusted by Technical Committee GEL/20, Electric cables, to Subcommittee GEL/20/16, Medium/high voltage cables, upon which the following bodies were represented:

British Approvals Service for Cables

British Cables Association

British Plastics Federation

Energy Networks Association

ERA Technology Ltd.

Co-opted members

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 1 November 2005

© BSI 1 November 2005

## Amendments issued since publication

| Amd. No. | Date | Comments |
|----------|------|----------|
|          |      |          |
|          |      |          |
|          |      |          |
|          |      |          |

The following BSI references relate to the work on this British Standard:  
Committee reference GEL/20/16  
Draft for comment DC 03/308252

ISBN 0 580 46817 8

# Contents

|                                                                                         | Page               |
|-----------------------------------------------------------------------------------------|--------------------|
| Committees responsible                                                                  | Inside front cover |
| Foreword                                                                                | ii                 |
| 1 Scope                                                                                 | 1                  |
| 2 Normative references                                                                  | 1                  |
| 3 Construction of metallic wire and foil sheaths                                        | 1                  |
| 4 Routine tests on cables                                                               | 3                  |
| 5 Sample tests on cables                                                                | 3                  |
| 6 Type tests on cables and components                                                   | 4                  |
| Annex A (informative) Guidance on selection of cables                                   | 7                  |
| Annex B (normative) Test for moisture content of water blocking tape                    | 8                  |
| Annex C (normative) Test for peel strength                                              | 8                  |
| Annex D (normative) Test for peel strength of metallic foil sheath to oversheath        | 9                  |
| Annex E (normative) Test for earth fault spiking                                        | 10                 |
| Annex F (normative) Test for thermal cycling                                            | 11                 |
| Annex G (normative) Test for impact                                                     | 11                 |
| Annex H (normative) Test for sidewall pressure                                          | 12                 |
| Annex I (normative) Test for radial water tightness and corrosion penetration           | 13                 |
| Annex J (normative) Short circuit test                                                  | 13                 |
| Bibliography                                                                            | 14                 |
| Figure 1 — Sequence of tests                                                            | 5                  |
| Figure C.1 — Peel strength of metallic foil sheath overlap — Preparation of test sample | 8                  |
| Figure C.2 — Peel strength of metallic foil sheath overlap — Test arrangement           | 9                  |
| Figure D.1 — Peel strength of metallic foil sheath to the oversheath                    | 9                  |
| Figure G.1 — Impact test                                                                | 11                 |
| Figure H.1 — Sidewall pressure test                                                     | 12                 |
| Table A.1 — Details to be agreed between manufacturer and purchaser                     | 7                  |

## Foreword

This British Standard has been prepared by Subcommittee GEL/20/16.

This British Standard should be read in conjunction with BS 7912, which implements the nationally applicable parts of Harmonization Document HD 632 published by the European Committee for Electrotechnical Standardization (CENELEC) in accordance with the decision of the CENELEC Technical Board. The additional tests specified in BS 7970 are to be proposed, under the CENELEC TC20 maintenance procedure, as part of a future Amendment No. 2 to HD 632, Part 5, Section H.

It has been assumed in the preparation of this British Standard that the execution of its provisions will be entrusted to appropriately qualified and experienced people, for whose use it has been produced.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

**Compliance with a British Standard does not of itself confer immunity from legal obligations.**

### Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 14, an inside back cover and a back cover.

The BSI copyright notice displayed in this document indicates when the document was last issued.

## 1 Scope

This British Standard specifies requirements for construction and performance, and gives methods of test, for metallic wire and foil sheath constructions of power cables having XLPE insulation for rated voltages from 66 kV ( $U_m = 72.5$  kV) to 132 kV ( $U_m = 145$  kV). The tests and requirements in this British Standard are additional to the tests and requirements for cables and their accessories specified in BS 7912.

This British Standard is applicable to single-core cables for usual conditions of installation and operation, but not to special cables, such as those designed for submarine applications.

NOTE Guidance on selection of cables is given in Annex A.

## 2 Normative references

The following referenced documents 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.

BS 6360, *Specification for conductors in insulated cables and cords*.

BS 7870-2:1999, *LV and MV polymeric insulated cables for use by distribution and generation utilities — Part 2: Methods of test*.

BS 7912:2001, *Power cables with XLPE insulation and metallic sheath, and their accessories, for rated voltages from 66 kV ( $U_m = 72.5$  kV) to 132 kV ( $U_m = 145$  kV) — Requirements and test methods*.

BS EN 60811-1-3:1995, *Insulating and sheathing materials of electric cables — Common test methods — Part 1-3: General application — Methods for determining the density — Water absorption tests — Shrinkage test*.

## 3 Construction of metallic wire and foil sheaths

### 3.1 Metallic wires

A layer of metallic wires shall be applied over the semi-conducting insulation screen in a single helical layer. The wires shall be spaced with an average gap not greater than 4 mm and no gap shall exceed 8 mm.

An equalizing metallic tape shall be applied.

### 3.2 Water blocking tape

Semi-conducting water blocking/cushioning tape(s) shall be applied above and below the metallic wires.

### 3.3 Metallic foil sheath

A continuous metallic foil sheath shall be longitudinally applied over the water blocking tapes with a minimum overlap of 7 mm. Joins in the foil shall have the same electrical performance as a continuous piece of foil. The metallic foil overlap shall be sealed to prevent ingress of moisture.

The metallic foil sheath shall be either plain or corrugated foil bonded to the oversheath.

The thickness and the material of the metallic foil sheath shall be as agreed between the manufacturer and the purchaser.

NOTE 1 An energy absorbing bedding layer may be applied under the metallic foil sheath by agreement between the manufacturer and the purchaser.

NOTE 2 Other designs, e.g. using a longitudinally-welded, thick metallic foil sheath, may be used and tested in accordance with this British Standard by agreement between the manufacturer and the purchaser. Additional or alternative testing might be necessary.

### 3.4 Earth fault capability

The earth fault capability in current (kA) and duration (seconds) shall be as specified by the purchaser.

The cross-sectional area, approximate number and approximate diameter of the metallic wires shall be as specified by the manufacturer.

3.5 Oversheath

The oversheath shall be an extruded layer of black medium density polyethylene (MDPE) conforming to the requirements specified for ST 3 or ST 7 as given in BS 7912:2001, Table 5, unless otherwise agreed (see Note).

NOTE Alternative materials to ST 3 and ST 7 may be provided by agreement between the manufacturer and the purchaser.

The thickness of the oversheath shall be as agreed between the manufacturer and the purchaser.

An outer semi-conducting coating shall be applied to serve as an electrode for a voltage test on the oversheath.

3.6 Marking of cables

3.6.1 External marking

The external surface of all cables shall be legibly marked with the following elements.

| Element                                                                                                                            | Example of marking                 |
|------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|
| a) Electric cable                                                                                                                  | ELECTRIC CABLE                     |
| b) Voltage designation                                                                                                             | 66 000 V or 110 000 V or 132 000 V |
| c) British Standard number <sup>1)</sup>                                                                                           | BS 7970                            |
| d) Manufacturer's identification                                                                                                   | XYZ                                |
| e) The number of cores, type and nominal area of conductor, e.g.<br>single core cable with<br>300 mm <sup>2</sup> copper conductor | 1 × 300                            |

The marking of elements a) to d) shall be by embossing or indenting on the oversheath.

The marking of element e) shall be by embossing, indenting or printing on the oversheath.

Elements a), b) and c) shall appear on two or more primary lines along the axis of the cable, approximately equally spaced around the circumference of the cable.

Elements d) and e) shall appear on at least one line.

NOTE Elements d) and e) may be on one of the primary lines or a secondary line or lines and need not be on the same line.

The letters and figures shall consist of upright block characters. The characters shall have a height of not less than 3 mm.

The distance between the end of one element of marking and the beginning of the next identical element of marking shall be not greater than 550 mm for elements a), b) and c), and not greater than 1 100 mm for elements d) and e).

3.6.2 Identification of year and month of manufacture

A means of identifying the year and month of manufacture of the cable shall be provided throughout the length of the cable by marking on the surface of the cable.

The marking shall be by embossing or indenting on the oversheath. The characters shall have a height of not less than 3 mm and the distance between the end of one element of marking and the beginning of the next identical element of marking shall be not greater than 1 100 mm.

3.6.3 Mark of an approval organisation

If the mark of an approval organization is used it shall be provided throughout the length of the cable.

<sup>1)</sup> Marking BS 7970:2005 on or in relation to a product represents a manufacturer's declaration of conformity, i.e. a claim by or on behalf of the manufacturer that the product meets the requirements of the standard. The accuracy of the claim is solely the claimant's responsibility. Such a declaration is not to be confused with third-party certification of conformity.