BRITISH STANDARD

BS 7888-3:1998
Incorporating Amendment No. 1 and Corrigendum No.1

LV and MV accessories for power cables with rated voltage from 0.6/1 kV (U_m = 1.2 kV) up to and including 20.8/36 kV (U_m = 42 kV) —

Part 3: Test requirements for LV accessories

(Implementation of HD 623)

ICS 29.120.20

BSI British Standards

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by Technical Committee GEL/20, Electric cables, to Technical Subcommittee GEL/20/11 (formerly GEL/20/7), Cable accessories, upon which the following bodies were represented:

Association of Consulting Engineers

BEAMA Electrical Cable and Conductor Accessory Manufacturers' Association

British Approvals Service for Cables

British Cables Association

Electrical Contractors Association

Electrical Installation Equipment Manufacturers' Association (BEAMA Ltd.)

Electricity Association

ERA Technology Ltd.

Institution of Lighting Engineers

London Underground Ltd.

Railway Industries Association

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Amd. No.	Date	Comments
10017 Corr No. 1	April 1998	Correction of erroneous clause references to BS 7888-2.
13898	2 May 2003	Revisions to Clauses **1**, **2**, **5.1** and **6.1**

Contents

Foreword

BS 7888 was prepared by Technical Subcommittee GEL/20/11. It implements nationally applicable parts of Harmonization Documents HD 623, 628, 629.1 and 629.2 published by the European Committee for Electrotechnical Standardization (CENELEC) in accordance with the decision of the CENELEC Technical Board.

BS 7888 applies to accessories for power cables with rated voltage U_0/U from 0.6/1 kV (U_m = 1.2 kV) up to and including 20.8/36 kV (U_m = 42 kV) and is published as a series of separate parts and sections, as listed in the table in the foreword of BS 7888-1.

BS 7888-3 implements the relevant requirements of HD 623 and is to be read in conjunction with BS 7888-1 and BS 7888-2.

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.

WARNING. The methods of test described in this British Standard do not detail all precautions necessary to meet the requirements of the Health and Safety at Work etc. Act 1974. Attention should be paid to any appropriate safety precautions and the tests should only be performed by authorized personnel.

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 8, an inside back cover and a back cover.

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1 Scope

This British Standard specifies the performance requirements, verified by type testing, for joints, stop ends and outdoor terminations for cables of rated voltage 0.6/1.0 (1.2) kV, as defined in BS 7870-3.

The accessories covered by this British Standard are as follows:

— outdoor terminations for cables with extruded insulation;

— straight joints, branch joints and stop ends for cables with extruded insulation;

— transition joints between cables with extruded insulation and cables with impregnated paper insulation.

Joints, stop ends and outdoor terminations for impregnated paper insulated cables, and accessories for special applications such as submarine cables, ships' cables or hazardous situations (explosive environments, fire-resistant cables or seismic conditions) do not fall within the scope of this British Standard.

2 Normative references

The following referenced documents are indispensible 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 923-1:1990, *Guide on high-voltage testing techniques — Part 1: General.*

BS 7870-3:2001 (all sections), *LV and MV polymeric insulated cables for use by distribution and generation utilities — Part 3: Specification for distribution cables of rated voltage 0.6/1 kV.*

BS 7888-2:1998, *LV and MV accessories for power cables with rated voltage from 0.6/1 kV (U_m = 1.2 kV) up to and including 20.8/36 kV (U_m = 42 kV) — Part 2: Methods of test.*

BS 7933, *Electric cables — Accessories — Material characterization.*

HD 623[1)], *Specification for joints, stop ends and outdoor terminations for distribution cables of rated voltage 0.6/1.0 kV.*

HD 628[1)], *Test methods for accessories for power cables with rated voltage from 3.6 kV/6 kV (U_m 7.2 kV) up to and including 20.8/36 kV (U_m = 42 kV).*

HD 629-1[1)], *Test requirements on accessories for use on power cables of rated voltages from 3.6 kV/6 kV (7.2) kV up to and including 20.8/36 (42) kV — Part 1: Cables with extruded insulation.*

HD 629-2[1)], *Test requirements on accessories for use on power cables of rated voltages from 3.6 kV/6 kV (7.2) kV up to and including 20.8/36 (42) kV — Part 2: Cables with impregnated insulation.*

3 Terms and definitions

For the purposes of this part of BS 7888, the definitions given in Clause **3** of BS 7888-1:1998 apply.

[1)] Referred to in the foreword only.

4 Operating conditions

4.1 General

The service operating conditions of accessories shall be compatible with the service operating conditions of the cable.

4.2 Rated voltage

The rated voltage of the joints, stop ends and outdoor terminations shall be $U_0/U(U_m)$ = 0.6/1.0 (1.2) kV, where:

U_0 is the rated power frequency voltage between phase conductor and earth or metallic screen for which the cable accessory is designed;

U is the rated power frequency voltage between phase conductors for which the cable accessory is designed;

U_m is the maximum value of the "highest system voltage" between phase conductors for which the accessory may be used.

4.3 Current rating

The continuous current rating of a joint or outdoor termination shall be in accordance with the appropriate cable(s) specified in BS 7870-3, and shall be suitable for continuous duty and operation under short-circuit conditions at the temperatures specified in Table 1.

Table 1 — Maximum rated conductor temperatures

Rating	Insulation type	
	Extruded solid dielectric	Impregnated paper
Continuous	[a]	80 °C
Short-circuit	[a]	160 °C

[a] For cables with extruded insulation, the maximum rated temperatures for continuous duty and short-circuit duty are given in the particular section of BS 7870-3.

5 Requirements

5.1 General

Accessories within the scope of this British Standard shall be type tested in accordance with Clause **6** for conformity to the requirements given in **5.2**, **5.3**, **5.4**, **5.5**, **5.6**, **5.7** and **5.8**.

The publication of this standard does not invalidate existing approvals. However, products approved to such earlier standards or specifications shall not claim approval to this standard unless specifically tested to it.

5.2 Water penetration

Joints and stop ends shall be tested in accordance with Clauses **5**, **9**, **15** and **16** of BS 7888-2:1998 for their ability to withstand a head of water.

5.3 A.C. voltage withstand

There shall be no breakdown.

5.4 Thermal cycling

The cores shall withstand an a.c. voltage of 4 kV for 1 min when tested in accordance with Clause **5** of BS 7888-2:1998 while the accessory is still immersed in water after the load cycling test.

The insulation resistance, measured in accordance with Clause **15** of BS 7888-2:1998 after completion of the voltage test and while still immersed in water, shall be a minimum of 50 MΩ.

5.5 Impact at ambient temperature

The cores shall withstand an a.c. voltage of 4 kV for 1 min when tested in accordance with Clause **5** of BS 7888-2:1998 after the impact.

The insulation resistance, measured in accordance with Clause **15** of BS 7888-2:1998 after completion of the voltage test, shall be a minimum of 50 MΩ.

5.6 Insulation resistance

The insulation resistance shall be a minimum of 50 MΩ prior to and after immersion in water.

5.7 Immersion

The cores shall withstand an a.c. voltage of 4 kV for 1 min when tested in accordance with Clause **5** of BS 7888-2:1998 without breakdown.

The insulation resistance, measured in accordance with Clause **15** of BS 7888-2:1998 after completion of the voltage test, shall be a minimum of 50 MΩ.

5.8 Examination

When examined in accordance with Clause **17** of BS 7888-2:1998, the accessory sample shall not show any of the following:

a) cracking of filling media and/or tape or tubing components;

b) a moisture path bridging a primary seal;

c) active corrosion, such as would, in time, lead to failure of the joint.

6 Type testing

6.1 General

Written reports on type tests that establish conformity to this standard shall be made available by the manufacturer. The major details of the test arrangements shall be given in the test report, including, for example, size of conductors, model and type of connector, minimum clearance between joint and shell.

The test reports shall be signed by a representative of the body performing the tests.

NOTE This may be either the manufacturer or a recognized certification body.

The profile of properties of the materials used for the main components of the accessory shall be identified in accordance with the appropriate part of BS 7933.

If, during a test, there is a failure in a portion of cable that is outside any part of an accessory, the test shall be declared void without discrediting the accessory. Tests may be repeated using a new accessory (in which case the test shall be repeated in its entirety) or, alternatively, the defective cable shall be repaired (in which case the testing shall continue from the point of failure).

6.2 Range of approval

6.2.1 *General*

Conformity to this British Standard shall be established for an accessory for a particular cable type (either copper or aluminium conductors) by successful testing in accordance with the appropriate test sequences given in Table 3, Table 4 and Table 5.

Where conformity is established for accessories for two different cables sizes, accessories of any intermediate size are deemed also to conform. Where conformity is established for one size only, no other size is deemed to conform.

6.2.2 *Insulation and sheathing*

Conformity to this British Standard established by successful testing of a particular type of cable insulation is deemed to extend to other types of insulation in accordance with Table 2.

Table 2 — Summary of approvals for different cable insulations

Cable insulation tested	Range of approval
XLPE	XLPE, EPR, PVC
EPR	EPR, PVC
PVC	PVC

NOTE It should be noted that adhesion between the cable insulation and the accessory's filling compound is critical for the performance of some joint designs.

Conformity established for a cable with one type of sheathing material shall not be extended to an otherwise identical cable that incorporates a different sheathing material.

6.2.3 *Joints and stop ends*

Where, for a given range of cable sizes, branch joints have been successfully tested in accordance with this British Standard, straight joints and stop ends for the same range of cable sizes may be deemed to conform if it can be shown that the construction is similar and the seals are of the same type and not inferior to those of the branch joints tested.

6.2.4 *Transition joints*

Where a transition joint has been successfully tested in accordance with this British Standard, a similar design of transition joint suitable for an alternative type of extruded insulation cable shall be deemed to conform if the following conditions are met.

— The impregnated paper-insulated cable side of the joint shall be identical in design.

— Conformity of the alternative extruded insulation cable shall have been established in a straight or branch joint, as relevant, and satisfactory performance of the moisture seals shall have been established by examination in accordance with Clause **17** of BS 7888-2:1998.

6.3 Test samples

The number of samples required for each test sequence shall be in accordance with Table 6.

Cables used for testing shall conform to BS 7870-3 and shall be identified in the test report in respect of:

— rated voltage;

— material, shape and cross-section of conductors;

— details of construction (insulation and sheath, number of cores, water blocking etc.);

— principal dimensions of cable.

The connecting components used in a joint or termination shall conform to the appropriate specification.

Accessories to be tested shall be correctly identified in respect of:

— name of manufacturer;

— type, designation, manufacturing date or date code;

— minimum and maximum cable cross-section, material and shape of conductor;

— smallest and largest cable diameter;

— rated voltage;

— installation instructions.

Accessories shall be assembled in the manner specified in the manufacturer's instructions, using exclusively the grade and quantity of materials supplied. A joint which is designed for crossed cores shall be so assembled.

Accessories shall be dry and clean, but neither the cable nor the accessories shall be subjected to any form of conditioning which may modify the electrical, thermal or mechanical performance of the test assemblies.

Relevant details regarding the test installation shall be recorded for future reference, e.g. to ensure repeatability of the test regime, if necessary.

6.4 Sequence of tests

The test sequence shall be in the order given in Table 3, Table 4 and Table 5, as appropriate for the accessory being tested.

6.5 Test conditions

Tests shall be made at an ambient temperature within the range (20 ± 15) °C, unless otherwise stated in the details for a particular test.

6.6 Frequency and waveform of power frequency test voltages

The requirements for the a.c. test voltage shall be in accordance with Clause **16** of BS 923-1:1990.

Table 3 — Test sequence for joints for extruded insulation cables, transition joints between extruded insulation cables and impregnated paper insulated cables

Test	Test clause number[a]	Samples	Test criterion
		A1 and B1	
A.C. voltage withstand (in air)	**5**	x	4 kV for 1 min
Insulation resistance (in air)	**15**	x	50 MΩ minimum
Impact at ambient temperature	**14**	x	Insulation resistance remains 50 MΩ minimum
A.C. voltage withstand (immersed)	**5**	x	4 kV for 1 min
Insulation resistance (immersed)	**15**	x	50 MΩ minimum
Thermal cycling in air	**9**	x	63 cycles
Thermal cycling in water (oversheath damage)	**9**	x	63 cycles
A.C. voltage withstand (immersed)	**5**	x	4 kV for 1 min
Insulation resistance (immersed)	**15**	x	50 MΩ minimum
Examination	**17**	x	Record condition

[a] See BS 7888:Part 2:1998.

Table 4 — Test sequence for stop ends on extruded insulation cables

Test	Test clause number[a]	Samples	Test criterion
		C1	
A.C. voltage withstand (in air)	**5**	x	4 kV for 1 min
Insulation resistance (in air)	**15**	x	50 MΩ minimum
Impact at ambient temperature	**14**	x	Insulation resistance remains 50 MΩ minimum
A.C. voltage withstand (immersed)	**5**	x	4 kV for 1 min
Insulation resistance (immersed)	**15**	x	50 MΩ minimum
Immersion test	**16**	x	Nominal water depth 1m[b]
A.C. voltage withstand (immersed)	**5**	x	4 kV for 1 min
Insulation resistance (immersed)	**15**	x	50 MΩ minimum
Examination	**17**	x	Record condition

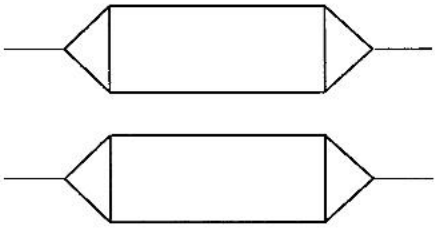
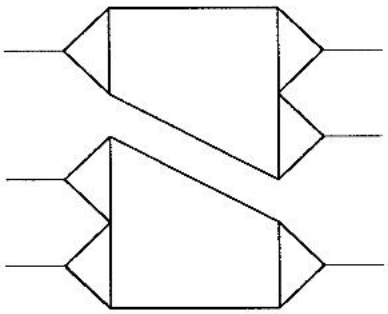
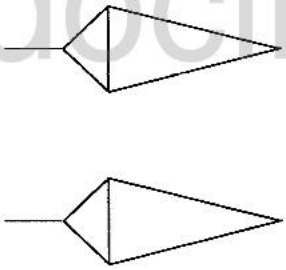
[a] See BS 7888-2:1998.
[b] Equivalent pressure up to a maximum of 0.5 bar where a pressure vessel is used.

Table 5 — Test sequence for outdoor terminations on extruded insulation cables

Test	Test clause number[a]	Samples	Test criterion
		D1	
A.C. voltage withstand (in air)	**5**	x	4 kV for 1 min
Insulation resistance (in air)	**15**	x	50 MΩ minimum
Thermal cycling in air	**9**	x	63 cycles
Thermal cycling (crutch immersed)	**9**	x	63 cycles
A.C. voltage withstand (crutch immersed)	**5**	x	4 kV for 1 min
Insulation resistance (crutch immersed)	**15**	x	50 MΩ minimum
Examination	**17**	x	Record condition

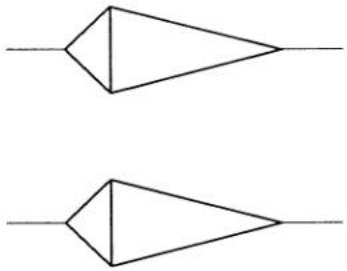
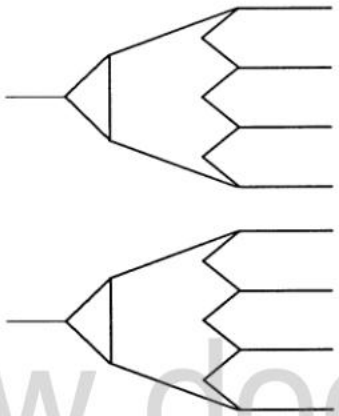
[a] See BS 7888-2:1998.

Table 6 — Number of test samples and conductor size

Sequence	Tests	Symbol	Number of samples and conductor size[a]
Straight joint			
A1	General test sequence		Two samples: one sample smallest conductor size one sample largest conductor size
Branch joint			
B1	General test sequence		Two samples: one sample smallest main conductor size with smallest branch size one sample largest main conductor size with smallest branch size
Stop end			
C1	General test sequence		Two samples: one sample smallest conductor size one sample largest conductor size

[a] Copper or aluminium.

Table 6 — Number of test samples and conductor size (*concluded*)

Sequence	Tests	Symbol	Number of samples and conductor size[a]
Outdoor termination			
D1	General test sequence		Two samples: one sample smallest conductor size one sample largest conductor size
or			
D1	General test sequence		Two samples: one sample smallest conductor size one sample largest conductor size
[a] Copper or aluminium.			

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