



BSI Standards Publication

Electric cables — Low voltage energy cables of rated voltages up to and including 450/750 V (U_0/U)

Part 2-11: Cables for general applications — Flexible cables with thermoplastic PVC insulation

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National foreword

This British Standard is the UK implementation of EN 50525-2-11:2011.

In the UK, the BS EN 50525 series of standards contain complex supersession details. The table below best summarizes the relationship between these standards:

Part 1 together with	Supersedes
2-81	BS 638-4:1996
2-41, 2-42	BS 6007: 2006
2-11 (in part), 2-12, 2-21 (in part), 2-71	BS 6500:2000
2-11 (in part), 2-21 (in part), 2-51 (in part), 2-83, 3-21	BS 7919:2001
2-31, 2-51 (in part)	BS 6004:2000
3-41	BS 7211:1998
2-22, 2-72, 2-82, 3-11, 3-31	None

NOTE All British Standards will remain current until they are withdrawn on 31 December 2012. British Standards in bold are only partially superseded, and new editions of BS 6004 and BS 7211 will be introduced on 1 January 2013.

National Annex NA (informative) gives information on the origins and identification of particular cable types.

The UK participation in its preparation was entrusted to Technical Committee GEL/20/17, Electric Cables - Low voltage.

A list of organizations represented on this committee can be obtained on request to its secretary.

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

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Compliance with a British Standard cannot confer immunity from legal obligations.

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Amendments issued since publication

Date	Text affected
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EUROPEAN STANDARD
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Supersedes HD 21.5 S3:1994 (partially) + A1:1999 (partially) + A2:2001 (partially), HD 21.12 S1:1994 + A1:2001

English version

**Electric cables -
 Low voltage energy cables of rated voltages up to and including 450/750 V
 (U_0/U) -
 Part 2-11: Cables for general applications -
 Flexible cables with thermoplastic PVC insulation**

Câbles électriques -
 Câbles d'énergie basse tension de tension
 assignée au plus égale à 450/750 V
 (U_0/U) -
 Partie 2-11: Câbles pour applications
 générales -
 Câbles souples isolés en PVC
 thermoplastique

Kabel und Leitungen -
 Starkstromleitungen mit Nennspannungen
 bis 450/750 V (U_0/U) -
 Teil 2-11: Starkstromleitungen für
 allgemeine Anwendungen -
 Flexible Leitungen mit thermoplastischer
 PVC-Isolierung

This European Standard was approved by CENELEC on 2011-01-17. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

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CENELEC

European Committee for Electrotechnical Standardization
 Comité Européen de Normalisation Electrotechnique
 Europäisches Komitee für Elektrotechnische Normung

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Foreword

This European Standard was prepared by the Technical Committee CENELEC TC 20, Electric cables.

The text of the draft was submitted to the formal vote and was approved by CENELEC as EN 50525-2-11 on 2011-01-17.

This document, which is one of a multipart series, supersedes HD 21.12 S1:1994 + A1:2001 and partially supersedes HD 21.5 S3:1994 + A1:1999 + A2:2001.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN and CENELEC shall not be held responsible for identifying any or all such patent rights.

The following dates were fixed:

- latest date by which the EN has to be implemented
at national level by publication of an identical
national standard or by endorsement (dop) 2012-01-17
 - latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2014-01-17
-

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1 Scope

EN 50525-2-11 applies to thermoplastic (PVC) insulated and PVC sheathed flexible cables.

The cables are of rated voltages U_0/U up to and including 300/500 V.

The cables are intended for the connection of domestic appliances to the fixed supply.

Circular cables and flat cables are included.

The maximum conductor operating temperatures for the cables in this standard are 70 °C (VV types) and 90 °C (V2V2 types).

NOTE HD 516 contains extensive guidance on the safe use of cables in this standard.

This EN 50525-2-11 should be read in conjunction with EN 50525-1, which specifies general requirements.

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.

NOTE One or more references to the standards below are in respect of a specific sub-division of that standard, for instance a clause, a table, a class or a type. Cross-references to these standards are undated and, at all times, the latest version applies.

EN 50363-3	Insulating, sheathing and covering materials for low voltage energy cables – Part 3: PVC insulating compounds
EN 50363-4-1	Insulating, sheathing and covering materials for low voltage energy cables – Part 4-1: PVC sheathing compounds
EN 50395	Electrical test methods for low voltage energy cables
EN 50396	Non electrical test methods for low voltage energy cables
EN 50525-1	Electric cables – Low voltage energy cables of rated voltages up to and including 450/750 V (U_0/U) – Part 1: General requirements
EN 60228	Conductors of insulated cables (IEC 60228)
EN 60332-1-2	Tests on electric and optical fibre cables under fire conditions – Part 1-2: Test for vertical flame propagation for a single insulated wire or cable – Procedure for 1 kW pre-mixed flame (IEC 60332-1-2)
EN 60811-1-2	Insulating and sheathing materials of electric and optical cables – Common test methods – Part 1-2: General application – Thermal ageing methods (IEC 60811-1-2)
EN 60811-1-4	Insulating and sheathing materials of electric and optical cables – Common test methods – Part 1-4: General application – Tests at low temperature (IEC 60811-1-4)
EN ISO 6892-1 2009	Metallic materials – Tensile testing – Part 1: Method of test at room temperature (ISO 6892-1:2009)

3 Terms and definitions

For the purposes of this document the terms and definitions given in Clause 3 of EN 50525-1 apply.

4 General purpose cables

4.1 Light duty cables – H03VV-F and H03VVH2-F

4.1.1 Construction

4.1.1.1 Conductor

The conductor shall be class 5, according to EN 60228.

4.1.1.2 Sizes of cable

The sizes of cable shall be:

- circular cables – 0,5 mm² and 0,75 mm² – 2, 3 and 4 core;
- flat cables – 0,5 mm² and 0,75 mm² – 2 core only.

4.1.1.3 Insulation

The insulation shall be polyvinyl chloride compound of Type TI 2 to EN 50363-3.

4.1.1.4 Assembly

The cables shall be assembled as follows:

- circular cables: the cores shall be twisted together;
- flat cables: the cores shall be laid parallel.

NOTE A tape may be applied around the core assembly before application of the sheath.

4.1.1.5 Sheath

The sheath shall be polyvinyl chloride compound of Type TM 2 to EN 50363-4-1.

The sheath shall fill the spaces between the cores, thus forming a filling.

4.1.1.6 Marking

The cable shall be marked with the CENELEC code H03VV-F for circular cables, or H03VVH2-F for flat cables. The marking shall comply with Clause 6 of EN 50525-1.

4.1.2 Requirements

Each cable shall comply with the appropriate requirements given in EN 50525-1, and the particular requirements of this Part.

Testing shall be in accordance with Annex A, and the relevant tests indicated in column 6.

The dimensions of the cables shall conform to Table B.1 for the relevant size.

The requirements to be met for the compatibility test shall be as given in Annex C.

4.2 Ordinary duty cables – H05VV-F and H05VVH2-F

4.2.1 Construction

4.2.1.1 Conductor

The conductor shall be class 5, according to EN 60228.

4.2.1.2 Sizes of cable

The sizes of cable shall be:

- circular cables – 0,75 mm² to 4 mm² – 2, 3, 4 and 5 core;
- flat cables – 0,75 mm² to 1,5 mm² – 2 core only.

4.2.1.3 Insulation

The insulation shall be polyvinyl chloride compound of Type TI 2 to EN 50363-3.

4.2.1.4 Assembly

The cables shall be assembled as follows:

- circular cable: the cores, and the fillers if any, shall be twisted together;
- flat cable: the cores shall be laid parallel.

For circular cable having two cores, the space between the cores shall be filled either by separate fillers or by the sheath filling the interstices.

NOTE 1 For circular cables with three, four or five cores, a centre filler may be used.

NOTE 2 A tape may be applied around the core assembly before application of the sheath.

4.2.1.5 Sheath

The sheath shall be polyvinyl chloride compound of Type TM 2 to EN 50363-4-1.

The sheath shall fill the spaces between the cores, thus forming a filling.

4.2.1.6 Marking

The cable shall be marked with the CENELEC code H05VV-F for circular cables, or H05VVH2-F for flat cables. The marking shall comply with Clause 6 of EN 50525-1.

4.2.2 Requirements

Each cable shall comply with the appropriate requirements given in EN 50525-1, and the particular requirements of this Part.

Testing shall be in accordance with Annex A, and the relevant tests indicated in column 7.

The dimensions of the cables shall conform to Table B.2 for the relevant size.

The requirements to be met for the compatibility test shall be as given in Annex C.

5 Heat resistant cables (90 °C)

5.1 Light duty cables – H03V2V2-F and H03V2V2H2-F

5.1.1 Construction

5.1.1.1 Conductor

The conductor shall be class 5, according to EN 60228.

5.1.1.2 Sizes of cable

The sizes of cable shall be:

- circular cables – 0,5 mm² and 0,75 mm² – 2, 3 and 4 core;
- flat cables – 0,5 mm² and 0,75 mm² – 2 core only.

5.1.1.3 Insulation

The insulation shall be polyvinyl chloride compound of Type TI 3 to EN 50363-3.

5.1.1.4 Assembly

The cables shall be assembled as follows:

- circular cable: the cores shall be twisted together;
- flat cable: the cores shall be laid parallel.

NOTE A tape may be applied around the core assembly before application of the sheath.

5.1.1.5 Sheath

The sheath shall be polyvinyl chloride compound of Type TM 3 to EN 50363-4-1.

The sheath shall fill the spaces between the cores, thus forming a filling.

5.1.1.6 Marking

The cable shall be marked with the CENELEC code H03V2V2-F for circular cables, or H03V2V2H2-F for flat cables. The marking shall comply with Clause 6 of EN 50525-1.

5.1.2 Requirements

Each cable shall comply with the appropriate requirements given in EN 50525-1, and the particular requirements of this Part.

Testing shall be in accordance with Annex A, and the relevant tests indicated in column 8.

The dimensions of the cables shall conform to Table B.1 for the relevant size.

The requirements to be met for the compatibility test shall be as given in Annex C.

5.2 Ordinary duty cables – H05V2V2-F and H05V2V2H2-F

5.2.1 Construction

5.2.1.1 Conductor

The conductor shall be class 5, according to EN 60228.

5.2.1.2 Sizes of cable

The sizes of cable shall be:

- circular cables – 0,75 mm² to 4 mm² – 2, 3, 4 and 5 core;
- flat cables – 0,75 mm² to 1,5 mm² – 2 core only.

5.2.1.3 Insulation

The insulation shall be polyvinyl chloride compound of Type TI 3 to EN 50363-3.

5.2.1.4 Assembly

The cables shall be assembled as follows:

- circular cable: the cores, and the fillers if any, shall be twisted together;
- flat cable: the cores shall be laid parallel.

For circular cable having two cores, the space between the cores shall be filled either by separate fillers or by the sheath filling the interstices.

NOTE 1 For circular cables with three, four or five cores, a centre filler may be used.

NOTE 2 A tape may be applied around the core assembly before application of the sheath.

5.2.1.5 Sheath

The sheath shall be polyvinyl chloride compound of Type TM 3 to EN 50363-4-1.

The sheath shall fill the spaces between the cores, thus forming a filling.

5.2.1.6 Marking

The cable shall be marked with the CENELEC code H05V2V2-F for circular cables, or H05V2V2H2-F for flat cables. The marking shall comply with Clause 6 of EN 50525-1.

5.2.2 Requirements

Each cable shall comply with the appropriate requirements given in EN 50525-1, and the particular requirements of this Part.

Testing shall be in accordance with Annex A, and the relevant tests indicated in column 9.

The dimensions of the cables shall conform to Table B.2 for the relevant size.

The requirements to be met for the compatibility test shall be as given in Annex C.

5.3 Ordinary duty cables with a strain-bearing member – H05V2V2D3-F

5.3.1 Construction

5.3.1.1 Conductor

The conductor shall be class 5, according to EN 60228.

5.3.1.2 Sizes of cable

The sizes of cable shall be 0,75 mm² with two, three or four cores.

5.3.1.3 Insulation

The insulation shall be polyvinyl chloride compound of Type TI 3 to EN 50363-3.

5.3.1.4 Strain-bearing member

The strain-bearing member shall consist of a steel rope of seven strands, each of 0,25 mm diameter. The individual wires (strands) shall be zinc coated. The strain-bearing member shall be covered with an anti-corrosion layer applied by extrusion. The breaking load of the strain-bearing member shall be ≥ 250 N.

5.3.1.5 Assembly

The cables shall be assembled by stranding the cores, together with dummy cores as shown, around the strain-bearing member as follows:

- 2 core cable – 2 insulated cores + 2 dummy cores;
- 3 core cable – 3 insulated cores + 1 dummy core;
- 4 core cable – 4 insulated cores.

The dummy cores should not adhere to the insulated cores, and it shall be possible to remove them without damage to the insulation.

NOTE A tape may be applied around the core assembly before application of the sheath.

5.3.1.6 Sheath

The sheath shall be polyvinyl chloride compound of Type TM 3 to EN 50363-4-1.

The sheath shall fill the spaces between the cores, thus forming a filling.

5.3.1.7 Marking

The cable shall be marked with the CENELEC code H05V2V2D3-F. The marking shall comply with Clause 6 of EN 50525-1.

5.3.2 Requirements

Each cable shall comply with the appropriate requirements given in EN 50525-1, and the particular requirements of this Part.

Testing shall be in accordance with Annex A, and the relevant tests indicated in column 10.

The dimensions of the cables shall conform to Table B.2 for the relevant size.

The requirements to be met for the compatibility test shall be as given in Annex C.

Annex A
(normative)

Tests for cables to EN 50525-2-11

Table A.1

1	2	3	4	5	6	7	8	9	10
Ref No.	Tests ^a	Category of test	Test method described in		Applicability of test Subclause				
			EN	Clause	4.1	4.2	5.1	5.2	5.3
					H03VV	H05VV	H03V2V2	H05V2V2	H05V2V2D3
1	Electrical tests ^b								
1.1	Resistance of conductors	T, S	50395	5	X	X	X	X	X
1.2	Voltage test on completed cable at 2 000 V	T, S	50395	6	X	X	X	X	X
1.3	Voltage test on cores according to specified insulation thickness:								
1.3.1	- at 1 500 V up to and including 0,6 mm	T	50395	7	X	X	X	X	X
1.3.2	- at 2 000 V above 0,6 mm	T	50395	7	-	X	-	X	-
1.4	Insulation resistance:								
1.4.1	- at 70 °C	T, S	50395	8.1	X	X	-	-	-
1.4.2	- at 90 °C	T, S	50395	8.1	-	-	X	X	X
1.5	Long term resistance of insulation to d.c.	T	50395	9	X	X	X	X	X
1.6	Absence of faults in insulation	R	50395	10	X	X	X	X	X
2	Constructional and dimensional tests								
2.1	Checking of compliance with constructional provisions	T, S	50525-1	Inspection and manual tests	X	X	X	X	X
2.2	Measurement of thickness of insulation	T, S	50396	4.1	X	X	X	X	X
2.3	Measurement of thickness of sheath	T, S	50396	4.2/4.3	X	X	X	X	X
2.4	Measurement of overall dimensions								
2.4.1	- Mean value	T, S	50396	4.4.1	X	X	X	X	X
2.4.2	- Ovality	T, S	50396	4.4.2	X	X	X	X	X
3	Insulation material tests	T	50363-3 ^c	-	X	X	X	X	X
4	Sheath material tests	T	50363-4-1 ^c	-	X	X	X	X	X
5	Compatibility test	T	60811-1-2	8.1.4	X	X	X	X	X
6	Impact test at - 5 °C	T	60811-1-4	8.5	X	X	X	X	X
7	Mechanical strength of completed cable								
	Flexing test followed, after immersion in water, by a voltage test at 2 000 V on cores	T	50396 50395	6.2 7	X X	X ^d	X	X ^d	-
8	Mechanical strength of strain-bearing member	T	EN ISO 6892-1 ^e	-	-	-	-	-	X
9	Test under fire conditions	T	60332-1-2	-	X	X	X	X	X

^a The order given does not imply a sequence of testing.

^b Particular test conditions and requirements are given in Table 1 of EN 50525-1.

^c This EN includes all the test methods and requirements for the material. Material to be tested is taken from the finished cable.

^d Not applicable to cables having conductors greater than 2,5 mm².

^e The test shall be carried out with a tensile strength machine using a separation rate of (50 ± 10) mm/min.

Annex B
(normative)

General data

NOTE The overall dimensions of cables have been calculated in accordance with EN 60719.

Table B.1 – Cables rated at 300/300 V

1	2	3	4	5	6
Number and nominal cross-sectional area of conductors mm ²	Thickness of insulation Specified value mm	Thickness of sheath Specified value mm	Mean overall dimensions		Minimum insulation resistance at rated temperature MΩ.km
			Lower limit mm	Upper limit mm	
2 x 0,5	0,5	0,6	4,6	5,9	0,011
2 x 0,75	0,5	0,6	or 3,0 x 4,9	or 3,7 x 5,9	0,010
			4,9 or 3,2 x 5,2	6,3 or 3,8 x 6,3	
3 x 0,5	0,5	0,6	4,9	6,3	0,011
3 x 0,75	0,5	0,6	5,2	6,7	0,010
4 x 0,5	0,5	0,6	5,4	6,9	0,011
4 x 0,75	0,5	0,6	5,7	7,3	0,010

Table B.2 – Cables rated at 300/500 V

1	2	3	4	5	6
Number and nominal cross-sectional area of conductors ^a mm ²	Thickness of insulation Specified value mm	Thickness of sheath Specified value mm	Mean overall dimensions		Minimum insulation resistance at rated temperature MΩ.km
			Lower limit mm	Upper limit mm	
2 x 0,75	0,6	0,8	5,7 ^b or 3,7 x 6,0	7,2 ^b or 4,5 x 7,2	0,011
2 x 1	0,6	0,8	5,9 or 3,9 x 6,2	7,5 or 4,7 x 7,5	0,010
2 x 1,5	0,7	0,8	6,8 or 4,2 x 7,0	8,6 or 5,2 x 8,6	0,010
2 x 2,5	0,8	1,0	8,4	10,6	0,009 5
2 x 4	0,8	1,1	9,7	12,1	0,007 8
3 x 0,75	0,6	0,8	6,0 ^b	7,6 ^b	0,011
3 x 1	0,6	0,8	6,3	8,0	0,010
3 x 1,5	0,7	0,9	7,4	9,4	0,010
3 x 2,5	0,8	1,1	9,2	11,4	0,009 5
3 x 4	0,8	1,2	10,5	13,1	0,007 8
4 x 0,75	0,6	0,8	6,6 ^b	8,3 ^b	0,011
4 x 1	0,6	0,9	7,1	9,0	0,010
4 x 1,5	0,7	1,0	8,4	10,5	0,010
4 x 2,5	0,8	1,1	10,1	12,5	0,009 5
4 x 4	0,8	1,2	11,5	14,3	0,007 8
5 x 0,75	0,6	0,9	7,4	9,3	0,011
5 x 1	0,6	0,9	7,8	9,8	0,010
5 x 1,5	0,7	1,1	9,3	11,6	0,010
5 x 2,5	0,8	1,2	11,2	13,9	0,009 5
5 x 4	0,8	1,4	13,0	16,1	0,007 8

^a Not all cable types are specified in all the sizes given here. See the specific clause of the standard, and also Clause 1 of EN 50525-1.

^b For cables with a strain-bearing member (H05V2V2D3-F) the lower limit is 7,1 mm and the upper limit is 9,0 mm.

Annex C (normative)

Requirements for compatibility test

C.1 Test conditions

The sample shall be aged in accordance with the designated test method, and for the following periods:

- a) cables with a 70 °C temperature rating – 7 days at (80 ± 2) °C;
- b) cables with a 90 °C temperature rating – 14 days at (100 ± 2) °C.

C.2 Requirements

At the conclusion of the ageing period the insulation and sheath shall meet the requirements given in Table C.1 below.

Table C.1

Parameter		Units	Insulation TI 2	Sheath TM 2	Insulation TI 3	Sheath TM 3
Tensile strength	- median, min.	N/mm ²	10,0	10,0	15,0	10,0
	- variation ^a , max.	%	± 20	± 20	± 25	± 25
Elongation at break	- median, min.	%	150	150	150	150
	- variation ^a , max.	%	± 20	± 20	± 25	± 25
^a The variation is the difference between the respective values obtained prior to and after heat treatment, expressed as a percentage of the former.						

Annex D (normative)

Special national conditions

Special national condition: National characteristic or practice that cannot be changed even over a long period, e.g. climatic conditions, electrical earthing conditions.

NOTE If it affects harmonization, it forms part of the European Standard.

For the countries in which the relevant special national conditions apply these provisions are normative, for other countries they are informative.

Clause Special national condition

Table B.2 **Ireland, United Kingdom**

Add:

2 x 1,25	0,7	0,8	6,3	8,0	0,010
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3 x 1,25	0,7	0,9	6,9	8,7	0,010
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NOTE This cable is intended for use on appliances fitted with 13 A plugs conforming to BS 1363-1 or I.S 401.

Bibliography

- EN 60719 Calculation of the lower and upper limits for the average outer dimensions of cables with circular copper conductors and of rated voltages up to and including 450/750 V
- HD 516 Guide to use of low voltage harmonized cables

National Annex (informative) Origins and identification of the particular cable types

As an aid to users, the table below shows, in respect of BS EN 50525-2-11:

- the identification of the particular cable types from BS 6500 and BS 7919 that are now included in BS EN 50525-2-11;
- the location of the cables within BS EN 50525-2-11;
- any applicable United Kingdom and CENELEC cable codings (see also National Informative Annex B to BS EN 50525-1).

Pre-existing BS		Clause in BS EN 50525-2-11	Cable type – Coding	
Number	Table		United Kingdom (if applicable)	CENELEC
BS 6500	26	4.1	2182/3/4Y	H03VV-F
			2192Y	H03VVH2-F
BS 6500	27	4.2	3182/3/4/5Y	H05VV-F
			3192Y	H05VVH2-F
BS 6500	28	5.1	–	H03V2V2-F
			–	H03V2V2H2-F
BS 6500	29	5.2	–	H05V2V2-F
			–	H05V2V2H2-F
BS 7919	40	4.2	3182/3/4/5Y	H05VV-F
BS 7919	41	5.2	–	H05V2V2-F

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