



BSI Standards Publication

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

Part 2-31: Cables for general applications — Single core non-sheathed cables with thermoplastic PVC insulation

### National foreword

This British Standard is the UK implementation of EN 50525-2-31:2011.

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)	<b>BS 6004:2000</b>
3-41	<b>BS 7211:1998</b>
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*NOTE All British Standards will remain current until they are withdrawn on 31 December 2012. British Standards in bold are only partially superseded, and new editions of BS 6004 and BS 7211 will be introduced on 1 January 2013.*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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### Amendments issued since publication

Date	Text affected
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English version

**Electric cables -  
 Low voltage energy cables of rated voltages up to and including 450/750 V  
 ( $U_0/U$ ) -  
 Part 2-31: Cables for general applications -  
 Single core non-sheathed 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 2-31: Câbles pour applications  
 générales -  
 Conducteurs isolés en PVC  
 thermoplastique

Kabel und Leitungen -  
 Starkstromleitungen mit Nennspannungen  
 bis 450/750 V ( $U_0/U$ ) -  
 Teil 2-31: Starkstromleitungen für  
 allgemeine Anwendungen -  
 Ader- und Verdrahtungsleitungen 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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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 50525-2-31 on 2011-01-17.

This document, which is one of a multipart series, supersedes HD 21.3 S3:1995 + A1:1999 + A2:2008 and HD 21.7 S2:1996 + A1:1999.

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 50525-2-31 applies to non-sheathed single core cables insulated with thermoplastic (PVC) insulation.

The cables are of rated voltages  $U_0/U$  up to and including 450/750 V.

The cables are intended for fixed wiring applications.

NOTE 1 Cables rated 450/750 V may be used at 600/1 000 V when this cable is used in fixed installations with mechanical protection, within switchgear and control gear - see HD 516.

The maximum conductor operating temperatures for the cables in this standard are 70 °C (V types) and 90 °C (V2 types).

NOTE 2 HD 516 contains extensive guidance on the safe use of cables in this standard.

This EN 50525-2-31 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 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 60811-1-4	Insulating and sheathing materials of electric and optical cables - Common test methods - Part 1-4: General application - Tests at low temperature (IEC 60811-1-4:1985 + A1:1993 + corr. May 1986)

## 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 cable**

### **4.1 Cables for fixed wiring – H07V-U and H07V-R**

#### **4.1.1 Construction**

##### **4.1.1.1 Conductor**

The conductor shall be class 1 or class 2, according to EN 60228.

##### **4.1.1.2 Sizes of cable**

The sizes of cable shall be:

- class 1 – 1,5 mm<sup>2</sup> to 10 mm<sup>2</sup>;
- class 2 – 1,5 mm<sup>2</sup> to 1 000 mm<sup>2</sup>.

##### **4.1.1.3 Insulation**

The insulation shall be polyvinyl chloride compound of Type TI 1 to EN 50363-3 applied around the conductor.

##### **4.1.1.4 Marking**

The cable shall be marked with the CENELEC code H07V-U for cables with class 1 conductor, or H07V-R for cables with class 2 conductor. 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.

### **4.2 Cables for fixed wiring – H07V-K**

#### **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 1,5 mm<sup>2</sup> to 240 mm<sup>2</sup>.

##### **4.2.1.3 Insulation**

The insulation shall be polyvinyl chloride compound of Type TI 1 to EN 50363-3 applied around the conductor.

#### **4.2.1.4 Marking**

The cable shall be marked with the CENELEC code H07V-K. 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.

### **4.3 Cables for internal wiring – H05V-U and H05V-R**

#### **4.3.1 Construction**

##### **4.3.1.1 Conductor**

The conductor shall be class 1 or class 2, according to EN 60228.

##### **4.3.1.2 Sizes of cable**

The sizes of cable shall be:

- class 1 – 0,5 mm<sup>2</sup> to 1 mm<sup>2</sup>;
- class 2 – 0,5 mm<sup>2</sup> to 1 mm<sup>2</sup>.

##### **4.3.1.3 Insulation**

The insulation shall be polyvinyl chloride compound of Type TI 1 to EN 50363-3 applied around the conductor.

##### **4.3.1.4 Marking**

The cable shall be marked with the CENELEC code H05V-U for cables with class 1 conductor, or H05V-R for cables with class 2 conductor. The marking shall comply with Clause 6 of EN 50525-1.

#### **4.3.2 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 8.

The dimensions of the cables shall conform to Table B.3 for the relevant size.

### **4.4 Cables for internal wiring – H05V-K**

#### **4.4.1 Construction**

##### **4.4.1.1 Conductor**

The conductor shall be class 5 according to EN 60228.



#### **4.4.1.2 Sizes of cable**

The sizes of cable shall be 0,5 mm<sup>2</sup> to 1 mm<sup>2</sup>.

#### **4.4.1.3 Insulation**

The insulation shall be polyvinyl chloride compound of Type TI 1 to EN 50363-3 applied around the conductor.

#### **4.4.1.4 Marking**

The cable shall be marked with the CENELEC code H05V-K. The marking shall comply with Clause 6 of EN 50525-1.

#### **4.4.2 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.4 for the relevant size.

### **5 Heat resistant cables (90 °C)**

#### **5.1 Cables for fixed wiring – H07V2-U and H07V2-R**

##### **5.1.1 Construction**

###### **5.1.1.1 Conductor**

The conductor shall be class 1 or class 2, according to EN 60228.

###### **5.1.1.2 Sizes of cable**

The sizes of cable shall be:

- class 1 – 1,5 mm<sup>2</sup> to 10 mm<sup>2</sup>;
- class 2 – 1,5 mm<sup>2</sup> to 35 mm<sup>2</sup>.

###### **5.1.1.3 Insulation**

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

###### **5.1.1.4 Marking**

The cable shall be marked with the CENELEC code H07V2-U for cables with class 1 conductor, or H07V2-R for cables with class 2 conductor. 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 10.

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

## **5.2 Cables for fixed wiring – H07V2-K**

### **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 1,5 mm<sup>2</sup> to 35 mm<sup>2</sup>.

#### **5.2.1.3 Insulation**

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

#### **5.2.1.4 Marking**

The cable shall be marked with the CENELEC code H07V2-K. 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 11.

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

## **5.3 Cables for internal wiring – H05V2-U and H05V2-R**

### **5.3.1 Construction**

#### **5.3.1.1 Conductor**

The conductor shall be class 1 or class 2, according to EN 60228.

#### **5.3.1.2 Sizes of cable**

The sizes of cable shall be:

- class 1 – 0,5 mm<sup>2</sup> to 1 mm<sup>2</sup>;
- class 2 – 0,5 mm<sup>2</sup> to 1 mm<sup>2</sup>.

#### **5.3.1.3 Insulation**

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

#### **5.3.1.4 Marking**

The cable shall be marked with the CENELEC code H05V2-U for cables with class 1 conductor, or H05V2-R for cables with class 2 conductor. 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 12.

The dimensions of the cables shall conform to Table B.3 for the relevant size.

### **5.4 Cables for internal wiring – H05V2-K**

#### **5.4.1 Construction**

##### **5.4.1.1 Conductor**

The conductor shall be class 5 according to EN 60228.

##### **5.4.1.2 Sizes of cable**

The sizes of cable shall be 0,5 mm<sup>2</sup> to 1 mm<sup>2</sup>.

##### **5.4.1.3 Insulation**

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

##### **5.4.1.4 Marking**

The cable shall be marked with the CENELEC code H05V2-K. The marking shall comply with Clause 6 of EN 50525-1.

#### **5.4.2 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 13.

The dimensions of the cables shall conform to Table B.4 for the relevant size.

**Annex A**  
(normative)

**Tests for cables to EN 50525-2-31**

**Table A.1**

1 Ref No.	2 Tests <sup>a</sup>	3 Cate- gory of test	4 Test method described in EN	5 Clause	6 Applicability of test – Subclause						12	13
					7 4.1	8 4.2	9 4.3	10 4.4	11 4.5	12 5.1		
1	<b>Electrical tests<sup>b</sup></b>											
1.1	Resistance of conductors	T, S	50395	5	X	X	X	X	X	X	X	X
1.2.1	Voltage test at 2 500 V	T, S	50395	6	X	X	-	-	X	X	-	X
1.2.2	Voltage test at 2 000 V	T, S	50395	6	-	-	X	-	-	-	X	X
1.3	Insulation resistance - at 70 °C - at 90 °C	T, S	50395	8.1	X	X	X	X	X	X	-	X
1.4	Long term resistance of insulation to d.c.	T	50395	9	-	-	X	X	X	X	X	X
1.5	Absence of faults in insulation	R	50395	10	X	X	X	X	X	X	X	X
2	<b>Constructional and dimensional tests</b>											
2.1	Checking of compliance with constructional provisions	T, S	50525-1	Inspection and manual tests	X	X	X	X	X	X	X	X
2.2	Measurement of thickness of insulation	T, S	50396	4.1	X	X	X	X	X	X	X	X
2.3	Measurement of overall diameter	T, S	50396	4.4	X	X	X	X	X	X	X	X
3	<b>Insulation material tests</b>	T	50363-3 <sup>c</sup>	-	X	X	X	X	X	X	X	X
4	<b>Impact test at - 5 °C</b>	T	60811-1-4	8.5	X	X	X	X	X	X	X	X
5	<b>Test under fire conditions</b>	T	60332-1-2	-	X	X	X	X	X	X	X	X

<sup>a</sup> The order given does not imply a sequence of testing.

<sup>b</sup> Particular test conditions and requirements are given in Table 1 of EN 50525-1.

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

## Annex B (normative)

### General data

NOTE 1 The overall dimensions of cables have been calculated in accordance with EN 60719.

NOTE 2 Cables designated "-U" have class 1 conductors, "-R" have class 2 conductors and "-K" have class 5 conductors.

**Table B.1 — Cables with rigid conductor (450/750 V)**

1 Nominal cross-sectional area of conductors <sup>a</sup> mm <sup>2</sup>	2 Class of conductor (EN 60228)	3 Thickness of insulation Specified value mm	4 Mean overall diameter		6 Minimum insulation resistance at rated temperature MΩ.km
			Lower limit mm	Upper limit mm	
			1,5	1	
2,5	1	0,8	3,2	3,9	0,010
4	1	0,8	3,6	4,4	0,008 7
6	1	0,8	4,1	5,0	0,007 4
10	1	1,0	5,3	6,4	0,007 2
1,5	2	0,7	2,7	3,3	0,010
2,5	2	0,8	3,3	4,0	0,009 9
4	2	0,8	3,8	4,6	0,008 2
6	2	0,8	4,3	5,2	0,007 0
10	2	1,0	5,6	6,7	0,006 7
16	2	1,0	6,4	7,8	0,005 6
25	2	1,2	8,1	9,7	0,005 3
35	2	1,2	9,0	10,9	0,004 6
50	2	1,4	10,6	12,8	0,004 6
70	2	1,4	12,1	14,6	0,004 0
95	2	1,6	14,1	17,1	0,003 9
120	2	1,6	15,6	18,8	0,003 5
150	2	1,8	17,3	20,9	0,003 5
185	2	2,0	19,3	23,3	0,003 5
240	2	2,2	22,0	26,6	0,003 4
300	2	2,4	24,5	29,6	0,003 3
400	2	2,6	27,5	33,2	0,003 1
500	2	2,8	30,5	36,9	0,003 0
630	2	2,8	34,0	41,1	0,002 7
800	2	2,8	37,8	45,7	0,002 4
1 000	2	3,0	42,1	51,0	0,002 3

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

**Table B.2 — Cables with flexible conductor (450/750 V)**

1	2	3	4	5
Nominal cross-sectional area of conductors <sup>a</sup> (Class 5) mm <sup>2</sup>	Thickness of insulation Specified value mm	Mean overall diameter		Minimum insulation resistance at rated temperature MΩ.km
		Lower limit mm	Upper limit mm	
1,5	0,7	2,8	3,4	0,010
2,5	0,8	3,4	4,1	0,009 5
4	0,8	3,9	4,8	0,007 8
6	0,8	4,4	5,3	0,006 8
10	1,0	5,7	6,8	0,006 5
16	1,0	6,7	8,1	0,005 3
25	1,2	8,4	10,2	0,005 0
35	1,2	9,7	11,7	0,004 3
50	1,4	11,5	13,9	0,004 2
70	1,4	13,2	16,0	0,003 6
95	1,6	15,1	18,2	0,003 6
120	1,6	16,7	20,2	0,003 2
150	1,8	18,6	22,5	0,003 2
185	2,0	20,6	24,9	0,003 2
240	2,2	23,5	28,4	0,003 1

<sup>a</sup> 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.

**Table B.3 — Cables with rigid conductor (300/500 V)**

1	2	3	4	5	6
Nominal cross-sectional area of conductor mm <sup>2</sup>	Class of conductor (EN 60228)	Thickness of insulation Specified value mm	Mean overall diameter		Minimum insulation resistance at rated temperature MΩ.km
			Lower limit mm	Upper limit mm	
0,5	1	0,6	1,9	2,3	0,014
0,75	1	0,6	2,1	2,5	0,013
1	1	0,6	2,2	2,7	0,011
0,5	2	0,6	2,0	2,4	0,014
0,75	2	0,6	2,2	2,6	0,012
1	2	0,6	2,3	2,8	0,011

**Table B.4 — Cables with flexible conductors (300/500 V)**

1	2	3	4	5
Nominal cross-sectional area of conductors (Class 5) mm <sup>2</sup>	Thickness of insulation Specified value mm	Mean overall diameter		Minimum insulation resistance at rated temperature MΩ.km
		Lower limit mm	Upper limit mm	
0,5	0,6	2,1	2,5	0,013
0,75	0,6	2,2	2,7	0,011
1	0,6	2,4	2,8	0,010

## **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 (IEC 60719) |
| 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 50525-2-31:

- the identification of the particular cable types from BS 6004 that are now included in BS EN 50525-2-31;
- the location of the cables within BS EN 50525-2-31;
- 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 50525-2-31	Cable type – Coding	
Number	Table		United Kingdom (if applicable)	CENELEC
BS 6004	4a)	4.1	6491X	H07V-U
			6491X	H07V-R
BS 6004	4b)	4.2	6491X	H07V-K
BS 6004	5	4.3	2491X	H05V-U
			2491X	H05V-R
		4.4	2491X	H05V-K
BS 6004	11a)	5.1	6491X HR	H07V2-U
			6491X HR	H07V2-R
BS 6004	11b)	5.2	6491X HR	H07V2-K
BS 6004	12	5.3	2491X HR	H05V2-U
			2491X HR	H05V2-R
		5.4	2491X HR	H05V2-K





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