BRITISH STANDARD

BS EN
50214:2006

Flat polyvinyl chloride sheathed flexible cables

The European Standard EN 50214:2006 has the status of a British Standard

ICS 29.060.20

BSI
British Standards

National foreword

This British Standard was published by BSI. It is the UK implementation of EN 50214:2006. It supersedes BS EN 50214:1998 which is withdrawn.

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

A list of organizations represented on GEL/20/17 can be obtained on request to its secretary.

This British Standard makes reference to HD 308, which is not published directly by BSI but is incorporated into the content of other British Standards. The relevant information on core colours can also be found in BS 7671. Similarly, specific tests and requirements from HD 21.1 can be cross-referenced directly as follows:

HD 21 clause	Requirement	BS cross reference
HD 21.1 s/c 1.3	Common marking	**5.3.3** of BS 6004:2000
HD 21.1 clause 3.1	Indication of origin	**5.3.2** of BS 6004:2000
HD 21.1 clause 3.2	Continuity of mark	**5.3.2** of BS 6004:2000
HD 21.1 clause 3.3	Durability	**5.3.5** of BS 6004:2000

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 cannot confer immunity from legal obligations.

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 50214

November 2006

ICS 29.060.20

Supersedes HD 359 S2:1990 and EN 50214:1997

English version

Flat polyvinyl chloride sheathed flexible cables

Câbles souples méplats gainés en polychlorure de vinyle

Flache PVC-ummantelte Steuerleitungen

This European Standard was approved by CENELEC on 2006-10-01. 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

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Ref. No. EN 50214:2006 E

Foreword

This European Standard was prepared for Technical Committee CENELEC TC 20, Electric cables, with the agreement of CEN TC 10, Lifts, escalators and moving walks.

The text of the draft was submitted to the formal vote and was approved by CENELEC as EN 50214 on 2006-10-01.

This European Standard supersedes EN 50214:1997 and HD 359 S2:1990.

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)	2007-10-01
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2008-01-01

Contents

1 Scope

This European Standard covers the construction, requirements and particular test methods for flat, flexible PVC insulated and PVC sheathed cables, of rated voltage U_o/U 300/500 V, for use in passenger and goods lifts (elevators), and U_o/U 450/750 V for general purposes and for special applications such as hoists and travelling cranes.

Cables of composite construction (for instance, cables with cores of different sizes) are not specified, but conditions are given for the inclusion of telecommunication units into the cables.

NOTE 1 This revision is in accordance with an agreement with CEN TC 10 to specify in the same standard a) flexible cables for lifts as required by EN 81, and b) flexible cable for applications such as hoists and travelling cranes, previously found in HD 359. In accordance with this agreement only those cables in Clauses 5 and 6 are suitable for use with EN 81.

NOTE 2 The limits for the overall diameter of the cables have been calculated in accordance with EN 60719.

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.

EN 81 Series	Safety rules for the construction and installation of lifts
EN 50334	Marking by inscription for the identification of cores of electric cables
EN 50363 Series	Insulating, sheathing and covering materials for low voltage energy cables
EN 50395	Electrical test methods for low voltage energy cables
EN 50396	Non electrical test methods for low voltage energy cables
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 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 450/750V (IEC 60719)
EN 60811 Series	Insulating and sheathing materials of electric and optical cables - Common test methods (IEC 60811 series)
HD 21 Series	Cables of rated voltages up to and including 450/750 V and having thermoplastic insulation
HD 308	Identification of cores in cables and flexible cords
IEC 60227-6	Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V - Part 6: Lift cables and cables for flexible connections

3 Definitions

3.1 Definitions relating to insulating and sheathing materials

3.1.1
type of compound
the category in which a compound is placed according to its properties, and determined by specific tests. The type designation is not directly related to the composition of the compound

3.1.2
polyvinyl chloride compound (PVC)
combinations of materials, of which polyvinyl chloride is the characteristic constituent, suitably selected, proportioned and treated which meet the requirements given in the particular specification

3.2 Definitions relating to the tests

3.2.1
type tests (Symbol T)
tests required to be made before supplying a type of cable covered by this standard on a general commercial basis, in order to demonstrate satisfactory performance characteristics to meet the intended application. These tests are of such a nature that, after they have been made, they need not be repeated unless changes are made in the cable materials, design or type of manufacturing process which might change the performance characteristics

3.2.2
sample tests (Symbol S)
tests made on samples of completed cable, or components taken from a completed cable adequate to verify that the finished product meets the design specifications

3.2.3
routine tests (Symbol R)
tests made on all production cable lengths to demonstrate their integrity

3.3
rated voltage
the rated voltage of a cable is the reference voltage for which the cable is designed, and which serves to define the electrical tests

The rated voltage is expressed by the combination of two values U_o/U, expressed in volts:

U_o being the r.m.s. value between any insulated conductor and "earth" (metal covering of the cable or the surrounding medium);

U being the r.m.s. value between any two phase-conductors of a multicore cable or of a system of single-core cables.

In an alternating current system, the rated voltage of a cable shall be at least equal to the nominal voltage of the system for which it is intended.

This condition applies both to the value U_o and to the value U.

In a direct current system, the nominal voltage between conductors shall be not higher than 1,5 times the rated voltage (U) of the cable, and the nominal voltage between any conductor and earth shall not be higher than 1,5 times the rated voltage (U_o) of the cable.

NOTE The operating voltage of a system may permanently exceed the nominal voltage of such a system by 10 %. A cable can be used at a 10 % higher operating voltage than its rated voltage if the latter is at least equal to the nominal voltage of the system.

3.4
freely suspended length
the unsupported allowed length of cable between two fixing points

3.5
strain bearing member (sbm)
metallic or non-metallic high tensile strand or bunch included in the cable construction in order to hold the cable weight

4 Requirements for the construction of cables

4.1 General

Unless otherwise indicated in Clauses 5, 6 or 7 of this EN, the cables shall comply with the general requirements specified in HD 21.1, Clause 5.

4.2 Core identification

Both cables with or without a green-and-yellow core are harmonised. For cables with five cores or fewer, the identification of the remaining cores shall be either by colours, in accordance with a) below, or by numbers in accordance with b) below. For cables with six cores or more only identification by numbers shall be used, except for any green-and-yellow core.

a) Identification by colours

The identification system of HD 308 shall be used.

b) Identification by numbers

Identification by numbers shall be in accordance with EN 50334.

The green-and-yellow core, if any, shall not be identified by a number.

4.3 Telecommunication Units

It shall be permitted to introduce telecommunication units into the cable construction described in Clauses 5 and 6, subject to the following conditions:

1) units shall be chosen from copper pairs or copper coaxial or optical fibres;

NOTE Two pairs may alternatively be included as a quad.

2) units shall have a diameter equal or very close to the diameter of insulated cores;

3) preferably the number of telecommunication units in a cable shall not exceed three;

4) the position of units shall be central and symmetrical;

5) thickness (e_2) of the cable sheath, where measured over telecommunication units, shall comply with the requirements for minimum thickness (see 5.3.5 and 6.3.5) but shall not be taken into account when calculating the mean value;

6) the colour or identification of the outer sheath over units shall not conflict with that of the cores in 4.2. However, no restriction shall be placed on colours used for insulations under an outer sheath.

5 Flat PVC sheathed flexible cables, of rated voltage 300/500 V, for low rise lifts

5.1 Code designation

Without strain bearing members: H05VVH6-F

With strain bearing members: H05VVD3H6-F

5.2 Rated voltage

300/500 V.

5.3 Construction

5.3.1 Conductor

Material: copper

Number of conductors: 4 up to 24

Nominal cross sections: 0,75 mm² and 1 mm²

The conductors shall be in accordance with the requirements of Class 5 given in EN 60228.

5.3.2 Insulation

The insulation shall be PVC compound of type TI 2 to EN 50363-3 applied around each conductor.

The mean value of the thickness of insulation shall be not less than the specified value for each type and size of cable shown in Table 3.

However, the thickness at any place may be less than the specified value provided that the difference does not exceed 0,1 mm + 10 % of the specified value.

Compliance shall be checked by the test given in EN 50396, 4.1.

The insulation resistance at 70 °C shall be not less than the values given in Table 3.

5.3.3 Assembly of cores

The preferred number of cores for the composition of the cables is given in Table 1, according to the nominal cross sectional areas of conductors.

Table 1 – Composition of cables

Nominal cross-sectional area mm^2	Preferred number of cores
0,75	6, 9, 12, 16, 18, 20 and 24
1	4, 5, 6, 9, 12, 16, 18, 20 and 24

The cores shall be laid parallel and covered with the sheath.

The cores shall be grouped, lying closely side by side in groups of 2 to 5 cores.

For cables having the preferred number of cores, given in Table 1, the grouping shall comply with Table 2.

Table 2 – Grouping of cores

Number of cores	6	9	12	16	18	20	24
Number of groups x number of cores in group	2 x 3	3 x 3	3 x 4	4 x 4	2 x 4 + 2 x 5	5 x 4	6 x 4
NOTE A rip-cord may be added inside each core group.							

The green-and-yellow core, if any, shall be placed inside one of the inner core groups, and preferably next to either core number 7 or 8. For cables with fewer than 8 cores, the green-and-yellow core shall be placed as centrally as possible

It shall be possible to separate the cores without damage to the insulation.

5.3.4 Strain bearing member (sbm)

A strain bearing member (or members) either of textile material or of metal may be included in the cable, but shall be separated from the core groups.

NOTE It is permitted to apply a protective surface coating to the sbm.

The sbm shall preferably be located on the edges of the cable in a symmetrical position and shall be easily separable from the cable, without damage to the cores, when separate terminations of the sbm are necessary.

5.3.5 Sheath

The sheath shall be PVC compound of type TM 2 to EN 50363-4-1 applied so as to substantially avoid the formation of cavities. The sheath shall not stick to the cores.

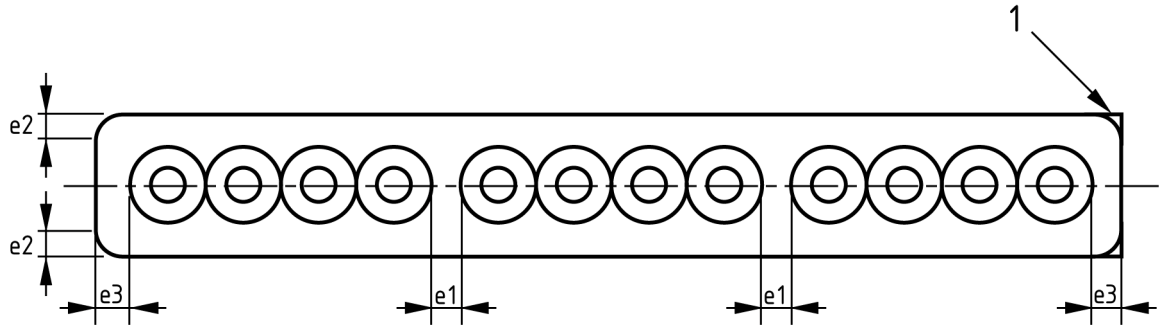
The sheath thickness shall be measured and evaluated generally in accordance with 4.3 of EN 50396, with the following exceptions.

Measurements for e_1, e_2 and e_3 shall be taken as follows (see Figures 1 and 2):

e_1 the clearance separating groups of cores shall not at any place be less than the value specified in Table 3;

e_2 the thickness on both flat sides shall be measured in each core group at the place where the sheath is thinnest ; the opposite thickness at the same core shall also be measured. The mean value of measurements above shall not be less than that specified in Table 3. The minimum value of e_2 at any place shall not be less than the specified value by more than 0,2 mm + 20 % of the specified value;

e_3 the thickness at the edge and the separation between sbm, if any, and cores shall be measured at both edges of the cable, along the major axis of the cross section. The mean value of measurements above shall not be less than that specified in Table 3. The minimum value of e_3 at any place shall not be less than the specified value by more than 0,2 mm + 20 % of the specified value.



Key

1 Alternative edge shaping

Figure 1 – Cable without strain bearing member

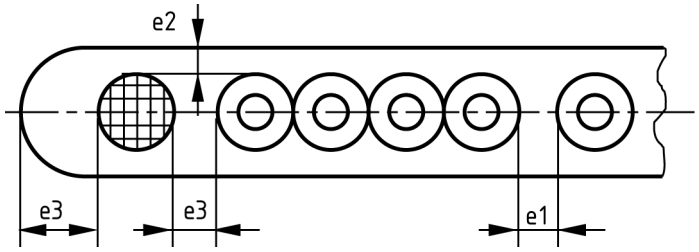


Figure 2 – Cable with strain bearing member

Table 3 – General data

Nominal cross-sectional area of conductors	Maximum diameter of wires in conductor	Thickness of insulation	Thickness of sheath and clearance			Minimum insulation resistance at 70 °C
			e_1 (min)	e_2 (mean)	e_3 (mean)	
mm^2	mm	mm	mm	mm	mm	MΩ.km
0,75	0,21	0,6	0,5	0,8	1,2	0,011
1	0,21	0,6	0,5	0,8	1,2	0,010

5.4 Tests

Compliance with the requirements of 5.3 shall be checked by inspection and by the tests given in Table 6, for cables without sbm, and in Tables 6 and 7 for cables with sbm.

For the requirement of non-adhesion between sheath and core, this shall be carried out by a manual test.

6 Flat PVC sheathed flexible cables, of rated voltage 300/500 V, for high rise, high speed lifts

6.1 Code designation

Without strain bearing members: H05V3V3H6-F

With strain bearing members: H05V3V3D3H6-F

6.2 Rated voltage

300/500 V.

6.3 Construction

6.3.1 Conductor

Material: copper

Number of conductors: 12 up to 24

Nominal cross sections: 0,75 mm² and 1 mm²

The conductors shall be in accordance with the requirements of Class 5 given in EN 60228.

6.3.2 Insulation

The insulation shall be PVC compound of type TI 5 to EN 50363-3 applied around each conductor.

The mean value of the thickness of insulation shall be not less than the specified value for each type and size of cable shown in Table 5.

However, the thickness at any place may be less than the specified value provided that the difference does not exceed 0,1 mm + 10 % of the specified value.

Compliance shall be checked by the test given in EN 50396, 4.1.

The insulation resistance at 70 °C shall be not less than the values given in Table 5.

6.3.3 Assembly of cores

The cores shall be laid parallel and covered with the sheath.

The cores shall be grouped, lying closely side by side in groups of 4 or 5 cores.

The preferred number of cores and composition of the cables are given in Table 4.

Table 4 – Composition of cables

Number of cores	12	16	18	20	24
Number of groups x number of cores in group	3 x 4	4 x 4	2 x 4 + 2 x 5	5 x 4	6 x 4
NOTE A rip-cord may be added inside each core group.					

The green-and-yellow core, if any, shall be placed inside one of the inner core groups, and preferably next to either core number 7 or 8.

It shall be possible to separate the cores without damage to the insulation.

6.3.4 Strain bearing member (sbm)

A strain bearing member, or members, either of textile material or metal may be included in the cable, but shall be separated from the core groups.

NOTE It is permitted to apply a protective surface coating to the sbm.

The use of sbm is compulsory for freely suspended lengths exceeding 45 m. Thus, the value of the freely suspended length for each particular contract shall be declared. The sbm shall preferably be located on the edges of the cable in a symmetrical position and shall be easily separable from the cable, without damage to the cores, when separate terminations of the sbm are necessary.

6.3.5 Sheath

The sheath shall be PVC compound of type TM 4 to EN 50363-4-1, applied so as to substantially avoid the formation of cavities. The sheath shall not stick to the cores.

The sheath thickness shall be measured and evaluated generally in accordance with 4.3 of EN 50396**,** with the following exceptions.

Measurements for e_1, e_2 and e_3 shall be taken as follows (see Figures 1 and 2):

e_1 the clearance separating groups of cores shall not at any place be less than the value specified in Table 5;

e_2 the thickness on both flat sides shall be measured in each core group at the place where the sheath is thinnest; the opposite thickness at the same core shall also be measured. The mean value of measurements above shall not be less than that specified in Table 5. The minimum value of e_2 at any place shall not be less than the specified value by more than 0,2 mm + 20 % of the specified value;

e_3 the thickness at the edge and the separation between sbm, if any, and cores shall be measured at both edges of the cable, along the major axis of the cross section. The mean value of measurements above shall not be less than that specified in Table 5. The minimum value of e_3 at any place shall not be less than the specified value by more than 0,2 mm + 20 % of the specified value.

Table 5 – General data

Number of conductors	Nominal cross-section of conductor	Maximum diameter of wires	Nominal thickness of insulation	Thickness of sheath and clearances			Cable overall dimensions [a]			Minimum insulation resistance at 70 °C
				e_1	e_2	e_3	Width		Thickness	
				(min)	(mean)	(mean)	min.	max.	max.	
	mm^2	mm	mm	mm	mm	mm	mm	mm	mm	MΩ.km
12	0,75	0,21	0,6	0,5	0,8	1,2	29,4	34,5	4,50	0,011
16	0,75	0,21	0,6	0,5	0,8	1,2	38,8	45,5	4,50	0,011
18	0,75	0,21	0,6	0,5	0,8	1,2	43,3	51,0	4,50	0,011
20	0,75	0,21	0,6	0,5	0,8	1,2	48,3	57,0	4,50	0,011
24	0,75	0,21	0,6	0,5	0,8	1,2	57,7	68,0	4,50	0,011
12	1	0,21	0,6	0,5	0,8	1,2	31,0	36,0	4,65	0,010
16	1	0,21	0,6	0,5	0,8	1,2	41,0	47,0	4,65	0,010
18	1	0,21	0,6	0,5	0,8	1,2	45,8	53,0	4,65	0,010
20	1	0,21	0,6	0,5	0,8	1,2	51,1	59,0	4,65	0,010
24	1	0,21	0,6	0,5	0,8	1,2	61,1	70,0	4,65	0,010

[a] Cables with sbm or telecom units may have different overall dimensions.

6.4 Tests

Compliance with the requirements of 6.3 shall be checked by inspection and by the tests given in Table 6, for cables without sbm, and in Tables 6 and 7 for cables with sbm.

Adherence between cores and sheath shall be checked according to A.10 and Table 6.

Table 6 – List of applicable tests

1	2	3	4	5	6
Ref. No.	**Tests**	**Category of test**		**Test Method described in**	
		Cables to Clause 5	**Cables to Clause 6**	**EN**	**Clause**
1	**Electrical Tests**				
1.1	Resistance of conductors	T, S	T, S	50395	5
1.2	Voltage test on completed cable at 2 000 V	T, S	T, S	50395	6
1.3	Voltage test on cores at 1 500 V	T	T	50395	7
1.4	Insulation resistance at 70 °C	T, S	T, S	50395	8.1
1.5	Long term resistance of insulation to direct current	T	T	50395	9
1.6	Absence of faults on insulation	R	R	50395	10
2	**Constructional and dimensional characteristics**				
2.1	Compliance with constructional provisions	T, S	-	50214	5.3 Inspection and manual test
		-	T, S	50214	6.3 Inspection and manual test
2.2	Measurement of insulation thickness	T, S	T, S	50396	4.1
2.3	Measurement of sheath thickness	T, S	-	50214	5.3.5
		-	T, S	50214	6.3.5
3	**Mechanical properties of insulation**				
3.1	Tensile test before and after ageing	T	T	60811-1-1	9.1
3.2	Loss of mass test	T	T	60811-3-2	8
4	**Mechanical properties of sheath**				
4.1	Tensile test before and after ageing	T	T	60811-1-1	9.2
4.2	Loss of mass test	T	T	60811-3-2	8
5	**Pressure test at high temperature**				
5.1	Insulation	T	T	60811-3-1	8.1
5.2	Sheath	T	T	60811-3-1	8.2 [a]

Table 6 – List of applicable tests (continued)

1	2	3	4	5	6
Ref. No.	**Tests**	**Category of test**		**Test Method described in**	
		Cables to Clause 5	**Cables to Clause 6**	**EN**	**Clause**
6	**Bending and impact test at low temperature**				
6.1	Bending test for insulation			60811-1-4	8.1
	-15 °C	T	-		
	-30 °C	-	T		
6.2	Bending test for sheath	T	[b]	60811-1-4	8.2
6.3	Elongation test for insulation	T	[b]	60811-1-4	8.3
6.4	Elongation test for sheath			60811-1-4	8.4
	-15 °C	T	-		
	-30 °C	-	T		
6.5	Impact test for insulation			60811-1-4	8.5
	-15 °C	T	-		
	-30 °C	-	T		
6.6	Impact test for sheath			50214	A.3
	-15 °C	T	-		
	-30 °C	-	T		
6.7	Unrolling test at low temperature	-	T	50214	A.4
7	**Heat shock test**				
7.1	Insulation	T	T	60811-3-1	9
7.2	Sheath	T	T	50214	A.5
8	**Mechanical properties of complete cables**				
8.1	Static flexibility test	T	T	50214	A.6
8.2	Flexing test	-	T	50214	A.7
8.3	Adherence test between cores and sheath	-	T	50214	A.10
9	**Test under fire conditions**	T	T	60332-1-2	-

[a] Hot Pressure test on the sheath of the flat cables should be done on strips of sheath removed from the larger flat surface. The sample being wrapped around a mandrel having diameter equal to the minor outer dimension minus twice the sheath thickness (e_2).

[b] Optional for cables passing test 6.7.

Table 7 – List of additional applicable tests for cables with strain bearing member(s)

1	2	3	4	5	6
Ref. No.	**Tests**	**Category of test**		**Test Method described in**	
		Cables to Clause 5	**Cables to Clause 6**	**EN**	**Clause**
1	Tensile strength for cable with sbm	T	T	50214	A.8
2.	Adherence test on sbm	T	T	50214	A.9

7 Flat PVC sheathed flexible cable of rated voltage 450/750 V

7.1 Code designation

Without strain bearing members: H07VVH6-F

With strain bearing members: H07VVD3H6-F

7.2 Rated voltage

450/750 V.

7.3 Construction

Cables of composite construction (for instance cables with cores of different sizes) are not specified.

7.3.1 Conductor

Material: copper

Number of conductors: 3 up to 12

Nominal cross sections: 1,5 mm² to 25 mm²

The conductors shall be in accordance with the requirements of Class 5 given in EN 60228.

7.3.2 Insulation

The insulation shall be PVC compound of type TI 2 to EN 50363-3 applied around each conductor.

The mean value of the thickness of insulation shall be not less than the specified value for each type and size of cable shown in Table 10.

However, the thickness at any place may be less than the specified value provided that the difference does not exceed 0,1 mm + 10 % of the specified value.

Compliance shall be checked by the test given in EN 50396, 4.1.

The insulation resistance at 70 °C shall be not less than the values given in Table 10.

7.3.3 Assembly of cores

The preferred number of cores for the composition of the cables is given in Table 8, according to the nominal cross-sectional areas of conductors.

Table 8 – Composition of cables

Nominal cross-sectional area mm²	**Preferred number of cores**
1,5 and 2,5	3, 4, 5, 6, 9 and 12
4, 6, 10, 16 and 25	4 and 5

The cores shall be laid parallel and covered with the sheath.

The cores shall be grouped, lying closely side by side in groups of 2 to 5 cores.

For cables having the preferred number of cores, as given in Table 8, the grouping shall comply with Table 9.

Table 9 – Grouping of cores

Number of cores	6	9	12
Number of groups x number of cores in group	2 x 3	3 x 3	3 x 4

A tearing thread may be added inside each core group. It shall be possible to separate the cores without damage to the insulation.

7.3.4 Strain bearing member (sbm)

A strain bearing member, or members, either of textile material or of metal may be included in the cable, but shall be separated from the core groups.

NOTE It is permitted to apply a protective surface coating to the sbm.

The sbm shall preferably be located on the edges of the cable in a symmetrical position and shall be easily separable from the cable, without damage to the cores, when separate terminations of the sbm are necessary.

7.3.5 Sheath

The sheath shall be PVC compound of type TM 2 to EN 50363-4-1, applied so as to substantially avoid the formation of cavities. The sheath shall not stick to the cores.

The sheath thickness shall be measured and evaluated generally in accordance with 4.3 of EN 50396**,** with the following exceptions.

Measurements for e_1, e_2 and e_3 shall be taken as follows (see Figures 1 and 2):

e_1 the clearance separating groups of cores shall not at any place be less than the value specified in Table 10;

e_2 the thickness on both flat sides shall be measured in each core group at the place where the sheath is thinnest; the opposite thickness at the same core shall also be measured. The mean value of measurements above shall not be less than that specified in Table 10. The minimum value of e_2 at any place shall not be less than the specified value by more than 0,2 mm + 20 % of the specified value;

e_3 the thickness at the edge and the separation between sbm, if any, and cores shall be measured at both edges of the cable, along the major axis of the cross section. The mean value of measurements above shall not be less than that specified in Table 10. The minimum value of e_3 at any place shall not be less than the specified value by more than 0,2 mm + 20 % of the specified value.

Table 10 – General data

Nominal cross-sectional area of conductors	Maximum diameter of wires in conductor	Thickness of insulation	Thickness of sheath and clearance			Minimum Insulation Resistance at 70 °C
			e_1 (min)	e_2 (mean)	e_3 (mean)	
mm^2	mm	mm	mm	mm	mm	MΩ.km
1,5	0,26	0,7	1,0	1,0	1,5	0,010
2,5	0,26	0,8	1,5	1,0	1,8	0,009 0
4	0,31	0,8	1,5	1,2	1,8	0,007 0
6	0,31	0,8	1,5	1,2	1,8	0,006 0
10	0,41	1,0	1,5	1,4	1,8	0,005 6
16	0,41	1,0	1,5	1,5	2,0	0,005 2
25	0,41	1,2	n/a [a]	1,6	2,0	0,005 0
[a] Not applicable; these 4 and 5 core cables are not separated into groups.						

7.4 Tests

Compliance with the requirements of 7.3 shall be checked by inspection and by the tests given in Table 11.

For the requirement of non adhesion between sheath and core, this shall be carried out by a manual test.

Table 11 – List of applicable tests

1	2	3	4	5
Ref. No	Tests	Category of test	Test Method described in	
			EN	Clause
1	**Electrical Tests**			
1.1	Resistance of conductors	T, S	50395	5
1.2	Voltage test on completed cable at 2 500 V	T, S	50395	6
1.3	Voltage test on cores at 2 500 V	T	50395	7
1.4	Insulation resistance at 70 °C	T, S	50395	8.1
1.5	Long term resistance of insulation to direct current	T	50395	9
1.6	Absence of faults on insulation	R	50395	10
2	**Constructional and dimensional characteristics**			
2.1	Compliance with constructional provisions	T, S	50214	7.3 inspection and manual
2.2	Measurement of insulation thickness	T, S	50396	4.1
2.3	Measurement of sheath thickness	T, S	50214	7.3.5
3	**Mechanical properties of insulation**			
3.1	Tensile test before and after ageing	T	60811-1-1	9.1
3.2	Loss of mass test	T	60811-3-2	8
4	**Mechanical properties of sheath**			
4.1	Tensile test before and after ageing	T	60811-1-1	9.2
4.2	Loss of mass test	T	60811-3-2	8

Table 11 – List of applicable tests (continued)

1	2	3	4	5
Ref. No	Tests	Category of test	Test Method described in	
			EN	Clause
5	**Pressure test at high temperature**			
5.1	Insulation	T	60811-3-1	8.1
5.2	Sheath	T	60811-3-1	8.2 [a]
6	**Bending and impact test at low temperature**			
6.1	Bending test for insulation at –15 °C	T	60811-1-4	8.1
6.2	Bending test for sheath	T	60811-1-4	8.2
6.3	Elongation test for insulation	T	60811-1-4	8.3
6.4	Elongation test for sheath at –15 °C	T	60811-1-4	8.4
6.5	Impact test for insulation at –15 °C	T	60811-1-4	8.5
6.6	Impact test for sheath at –15 °C	T	60811-1-4	8.5 [b]
7	**Heat shock test**			
7.1	Insulation	T	60811-3-1	9.1
7.2	Sheath	T	60811-3-1	9.2 [c]
8	**Mechanical properties of complete cables**			
8.1	Static flexibility test	T	50214	A.6
9	**Test under fire conditions**	T	60332-1-2	-

[a] Hot pressure test on the sheath of the flat cables should be done on strips of sheath removed from the larger flat surface. The sample being wrapped around a mandrel having diameter equal to the minor outer dimension minus twice the sheath thickness (e_2).

[b] The values of the mass of the hammer, specified in 8.5.4 of EN 60811-1-4 shall be chosen by reference to the minor dimensions of the cable instead of the overall diameter.

[c] This test shall be carried out on a strip of the sheath (9.2.2 d)).

8 Test methods

The test methods shall be as given in Annex A.

9 Marking

9.1 General

Cables shall be marked in accordance with HD 21.1, Clause 3, as appropriate.

9.2 Common Marking

The application of the common marking is not mandatory. However, where it is applied, it shall be in accordance with 1.3 of HD 21.1.

10 Guide to use

A guide for use for cables to this European Standard is given in Annex B.

Annex A
(normative)

Test methods

A.1 General

The tests and test methods are those specified in EN 50395 and EN 50396 which also cross refer to EN 60811, subject to the following modifications and/or additions.

A.2 Pressure test at high temperature on sheath

(EN 60811-3-1, 8.2, together with IEC 60227-6, 3.4.1).

This test shall be done on strips of sheath removed from the larger flat surface. The sample shall be wrapped around a mandrel having diameter equal to the minor outer dimension minus twice the sheath thickness (e_2).

A.3 Impact test at low temperature for sheath

(EN 60811-1-4, 8.5)

The values of the mass of the hammer, specified in 8.5.4 of EN 60811-1-4, shall be chosen by reference to the minor dimensions of the cable instead of the overall diameter.

A.4 Unrolling test at low temperature

A sample with a length of (2,00 ± 0,05) m shall be wound at room temperature, so as to form an annular coil with an inner diameter of 200 mm.

The coil of cable shall be tied and put into a cold room for at least six hours at the specified temperature of (–20 ± 1) °C.

The coil shall be brought out of the cold room and within five seconds it shall be hung vertically by its outer end and untied to allow it to unroll freely under its own weight.

60 s after untying, the coil must have unrolled so that the inner end of the cable coil is clearly free from the remainder.

A.5 Heat shock test for sheath

(EN 60811-3-1, 9.2)

This test shall be carried out on a strip of the sheath (9.2.2 d).

A.6 Static flexibility test

(EN 50396, 6.1)

This test shall be applied to all cables. The test method shall be as given in 6.1 of EN 50396 with the following particular requirements:

Before the test, the cable shall be conditioned at (20 ± 5) °C for 24 h in a vertical position.

The sample shall be mounted in the one clamp with the flat side towards the other clamp.

The mean of the two values of L', as measured between two plumb lines, shall not exceed 0,7 m.

NOTE If the results of the test are unfavourable, the sample shall be pre-conditioned by winding it twice on and off a reel with a diameter approximately 20 times the lower dimension of the cable with a flat side against the reel. In this case, the sample shall be turned each time through 180°. After this pre-conditioning, the sample shall be subjected to the test described above and shall meet the specified requirements.

A.7 Flexing test

This test shall be carried out with the same procedure and apparatus as described in EN 50396, 6.2, except for the following modifications:

1) pulleys with flat grooves and appropriate guides shall be used;

2) the weights shall be 10 times the weight of 1 m length of the flat cable;

3) diameter of pulleys shall be between 25 and 30 times the specified maximum overall thickness of the flat cable;

4) each conductor shall be loaded with a current of 0,1 A (a metallic sbm shall be considered as a conductor for this purpose);

5) an a.c. voltage of (400 ± 40) V rms shall be applied between all even conductors connected together and all odd conductors connected together. The green and yellow conductor, if any, is included in this count;

6) the number of flexing cycles is 30 000 (60 000 single strokes).

During the test with 30 000 cycles, i.e. 60 000 single movements, neither interruption of the current, short circuit between the conductors nor short circuit between the cables and pulleys (the flexing apparatus) shall occur.

After the required number of cycles the sheath of the cable, if any, shall be removed. The cores shall then withstand the voltage test carried out in accordance with EN 50395, Clause 7.

In the case of a cable with strain bearing member (sbm), after completion of the test, there shall be no short circuit between the sbm and an adjacent core, and the tensile strength of the sbm shall still be higher than 75 % of the initial value specified in Clause A.8 below.

A.8 Tensile strength for cable with strain bearing member (sbm)

The tensile strength at break of each sbm shall be higher than the following specified value:

$$f = \frac{weight\ \ of\ \ freely\ \ suspended\ \ length}{number\ \ of\ \ sbm} \times 4$$

The elongation under a load half the value of f above shall be less than 2 % (initial distance between mark: 1 000 mm).

The test shall be carried out with a tensile strength machine at an elongation speed of (50 ± 10) mm/min.

NOTE See definition of the freely suspended length in 3.4.

A.9 Adherence test on sbm

Two testing methods can be applied according to the type of support. For both methods a tensile strength machine (dynamometer) capable of using a clamping device for flat cables shall be used.

A.9.1 Method 1 (for cable supported only by the sbm)

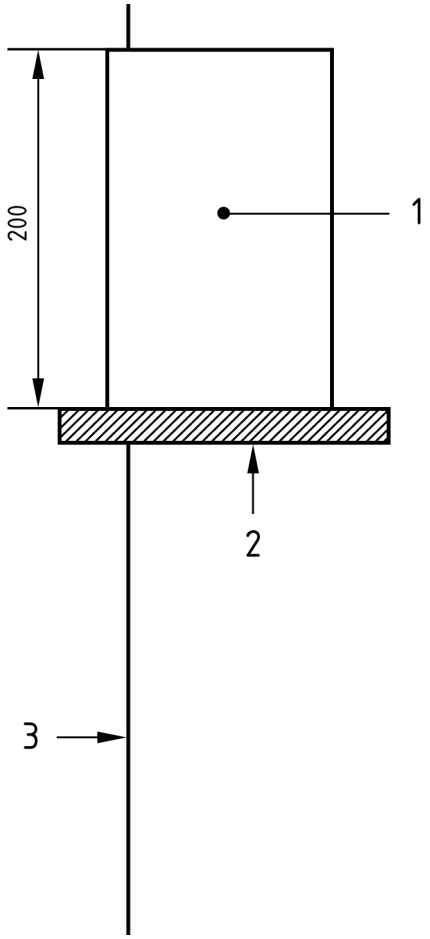
A sample of the complete cable 1 m long shall be weighed.

Coverings and cores shall be removed in order to leave only 200 mm of cable and the sbm (Figure A.1).

The stripped part of the sbm shall be inserted through the hole of a steel device properly designed to be tightened in the clamp of a tensile strength machine (Figure A.1).

Then, a force shall be applied between the free end of the stripped sbm and the steel device until the sbm slides out of the cable, the cable being maintained in a vertical position.

The sliding force of each sbm must be higher than the weight of 1 m of complete cable.



Dimensions in millimetres

Key

1 Flat cable
2 Steel device (fixed support)
3 Stripped s.b.m.

Figure A.1 - Adherence test for strain bearing member (method 1)

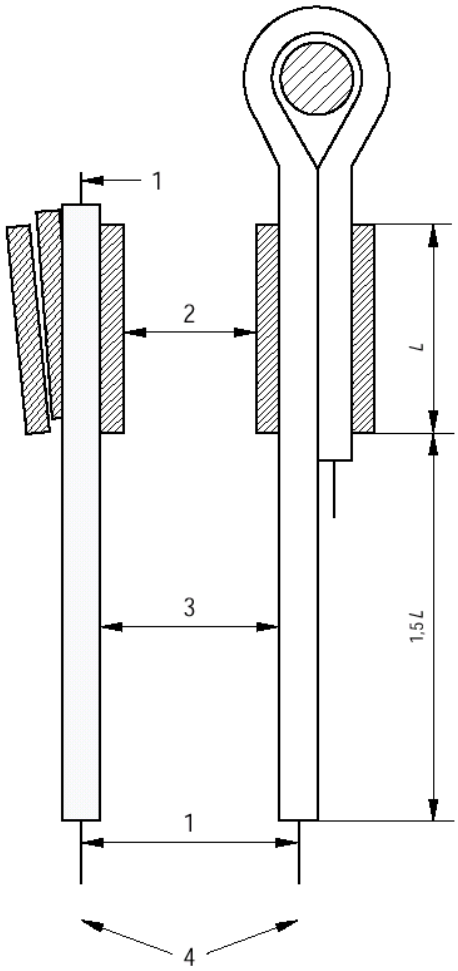
A.9.2 Method 2 (when clamping is applied to the complete cable)

The test shall be carried out with the clamping device designed by the manufacturer, or with a similar device taking into consideration the same design parameters after agreement between customer and manufacturer. Examples are shown in Figure A.2.

All coverings and cores shall be removed beyond a distance from the clamping device which is 1,5 times the length of the clamping device.

The sliding force of the sbm inside the cable must be higher than the following specified value:

$$f = \frac{weight\ \ of\ \ freely\ \ suspended\ \ length}{number\ \ of\ \ sbm} \times 2$$



Key

1 Stripped s.b.m.
2 Clamping device (proprietary)
3 Flat cable
4 Load

Figure A.2 - Adherence test for strain bearing member (method 2, showing two examples of clamping device)

A.10 Adherence test between cores and sheath (for cables according to Clause 6)

The test shall be carried out on a cable sample of 250 mm.

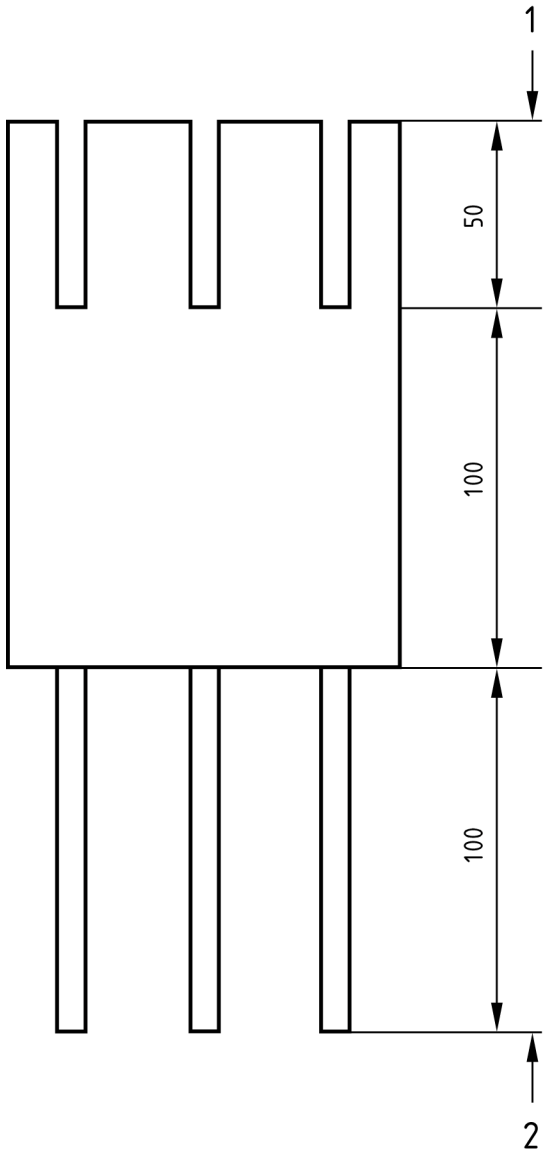
The coverings and cores shall be removed over 100 mm to keep only one core in each core group (bottom of sample).

At the opposite end of the sample the cores to be tested shall be carefully cut out over 50 mm (top of sample) (Figure A.3).

The top 50 mm shall be clamped in a tensile strength machine and a force shall be applied, in turn, to each of the cores to be tested until the core slides out of the cable.

The sliding force on each core shall be more than 3 N.

NOTE Higher values for the sliding force may be requested in connection with special mounting and/or operating conditions.



Dimensions in millimetres

Key

1 Top

2 Bottom

Figure A.3 - Adherence between cores and sheath

Annex B
(informative)

Guide to use

B.1 Cables to Clause 5

The designs of cables included in Clause 5 of this European Standard are not recommended for use outdoors or at ambient temperatures below 0 °C or above 40 °C.

They are recommended for installations where the freely suspended length does not exceed 35 m and the speed of travel does not exceed 1,6 m/s.

Care should be taken to uncoil and hang the cable in such a manner as to avoid twisting or kinking.

Care should be taken to ensure that nothing can prevent the cable from moving freely during service.

B.2 Cables to Clause 6

Cables covered by Clause 6 of this European Standard are recommended for use under lift cabins either indoors or outdoors.

In the latter case however exposure to rain, snow or direct sunlight should be avoided.

Cables are suitable for ambient temperatures between –15 °C to +40 °C.

It is recommended that the use of cable without sbm be limited to lift installations where the maximum speed does not exceed 4,0 m/s. At speeds above 4,0 m/s and up to and including 6,3 m/s it is recommended that cables with sbm should be used.

The cables are not recommended for use at speeds above 6,3 m/s.

NOTE Advice on the selection of cables for use at speeds above 6,3 m/s should be sought from the manufacturer.

In accordance with 6.3.4 it should be noted that cables with sbm are compulsory where the freely suspended cable lengths exceed 45 m.

The above recommended limitations in travelling speed, as well as limitations regarding travelling acceleration, should be (re)considered for particular local conditions, e.g. low ambient temperature.

When the cable is intended to follow without guidance the movements of a lift cabin or a similar device it is recommended that appropriate side clearance be allowed all along the cable course.

It is recommended that only clamping devices and other equipment specifically designed for the particular cable are used. Care should be taken to uncoil and hang the cable in such a manner as to avoid twisting or kinking.

B.3 Cables to Clause 7

The designs of cables included in this clause of the European Standard are not recommended for use outdoors or at ambient temperatures below 0 °C or above 40 °C, or for lifts to EN 81.

They are recommended for installations where the freely suspended length does not exceed 35 m and the speed of travel does not exceed 1,6 m/s.

Care should be taken to uncoil and hang the cable in such a manner as to avoid twisting or kinking.

Care should be taken to ensure that nothing can prevent the cable from moving freely during service.

_____

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