

HARMONIZATION DOCUMENT
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FINAL DRAFT
prHD 21.14 S1

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ICS

English version

Cables of rated voltage up to and including 450/750-V and having
thermoplastic insulation
Part 14: Flexible cables (cords), insulated and sheathed with halogen-free
thermoplastic compounds

Câbles avec isolant thermoplastique de
tension assignée au plus égale à
450/750 V
Partie 14: Câbles souples (cordons),
isolés et gainés avec des mélanges
thermoplastiques sans halogène

Leitungen mit thermoplastischer
Isolierhülle für Nennspannungen bis
450/750-V
Teil 14: Flexible Leitungen,
Schlauchleitung mit thermoplastischen
halogenfreien Werkstoffen

This draft Harmonization Document is submitted to CENELEC members for formal vote.
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It has been drawn up by Technical Committee CENELEC TC 20.

If this draft becomes a Harmonization Document, CENELEC members are bound to comply with the
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Document on a national level.

This draft Harmonization Document was established by CENELEC in three official versions (English,
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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 draft European Standard was prepared by the Technical Committee CENELEC TC 20, Electric cables. It is submitted to the formal vote.

The following dates are proposed:

- | | | |
|--|-------|--|
| - latest date by which the existence of the EN has to be announced at national level | (doa) | dor + 6 months |
| - latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement | (dop) | dor + 12 months |
| - latest date by which the national standards conflicting with the EN have to be withdrawn | (dow) | dor + 36 months
(to be confirmed or modified when voting) |

Annexes designated "normative" are part of the body of the standard.
Annexes designated "informative" are given for information only.
In this standard, Annexes A, B, C, D and F are normative and Annex E is informative.

HD 21 was originally adopted by CENELEC on 9 July 1975.

Edition 2 of HD 21 was implemented on 1 January 1984 and at that time, contained 4 parts.

Since 1984 new parts have been published and the original parts revised.

Part 14 has been developed from Vilamoura Notification BT(BE/NOT)5 and introduces a range of flexible cords and cables equivalent to those in Clauses 4 and 5 of HD 21.5 but with halogen-free thermoplastic insulation and sheath. Consequently, and in parallel, the general title of HD 21 has been amended to cover cables with any type of thermoplastic insulation.

HD 21 now has the following parts:

HD 21.1 S4	General requirements
HD 21.2 S3	Test methods
HD 21.3 S3	Non-sheathed cables for fixed wiring
HD 21.4 S2	Sheathed cables for fixed wiring
HD 21.5 S3	Flexible cables (cords)
HD 21.6	(Spare)
HD 21.7 S2	Single core non-sheathed cables for internal wiring for a conductor temperature of 90 °C
HD 21.8 S2	Single core non-sheathed cables for decorative chains
HD 21.9 S2	Single core non-sheathed cables for installation at low temperatures
HD 21.10 S2	Extensible leads
HD 21.11 S1	Cables for luminaires
HD 21.12 S1	Heat-resistant flexible cables (cords)
HD 21.13 S1	Oil resistant PVC sheathed cables with two or more conductors
HD 21.14 S1	Flexible cables (cords), insulated and sheathed with halogen-free thermoplastic compounds

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1.1 Scope

This Part 14 details the particular specifications for flexible cables (cords) of rated voltage up to and including 300/500 V, insulated and sheathed with halogen-free thermoplastic compound and having low emission of smoke and corrosive gases when exposed to fire. These cables are intended for the connection of domestic appliances to the fixed supply.

All cables shall comply with the appropriate requirements given in Part 1 of HD 21 and with the particular requirements of this Part 14.

NOTE 1 The overall dimensions of cables in this part of HD 21 have been calculated in accordance with EN 60719.

NOTE 2 Low emission of smoke is checked in accordance with EN 50268-2. Low emission of corrosive gases is checked as part of the check for absence of halogens (see Annex C).

2 Normative references

HD 21.14 incorporates, by dated or undated reference, provisions from other publications.

These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to HD 21.14 only when incorporated in it by amendment or revision. For undated references, the latest edition of the publication referred to applies.

EN 50265-2-1	Common test methods for cables under fire conditions – Test for resistance to vertical flame propagation for a single insulated conductor or cable – Part 2-1: Procedures – 1 kW pre-mixed flame
EN 50267-2-1	Common test methods for cables under fire conditions – Tests on gases evolved during combustion of material from cables – Part 2-1: Procedures – Determination of the amount of halogen acid gas
EN 50267-2-2	Part 2-2: Procedures – Determination of degree of acidity of gases for materials by measuring pH and conductivity
EN 50268-2	Common test methods for cables under fire conditions – Measurement of smoke density of cables burning under defined conditions – Part 2: Procedure
EN 60684-2	Flexible insulating sleeving – Part 2: Methods of test (IEC 60684-2)
EN 60719	Calculation of the lower and upper limits for the average outer dimensions of cables with circular copper conductors and of rated voltage up to and including 450/750 V (IEC 60719)
EN 60811 Series	Common test methods for insulating and sheathing materials of electric cables (IEC 60811 Series)
HD 21 Series	Cables of rated voltages up to and including 450/750 V and having thermoplastic insulation
HD 22 Series	Cables of rated voltages up to and including 450/750 V and having thermosetting insulation
HD 383	Conductors of insulated cables (IEC 60228 + IEC 60228A, mod.)
HD 605	Electric cables – Additional test methods

3 Insulated and sheathed flexible cords of rated voltage 300/300 V

3.1 Code designation

H03Z1Z1-F for circular cords
H03Z1Z1H2-F for flat cords

3.2 Rated voltage

300/300 V

3.3 Construction

3.3.1 Conductor

Material: plain copper.

Number of conductors: 2, 3 and 4.

The conductors shall comply with the requirements given in HD 383 for class 5 conductors.

3.3.2 Insulation

The insulation shall be thermoplastic compound T1 6, according to Annex A, applied around each conductor.

The insulation thickness shall comply with the specified value given in Table 1, column 2.

The insulation resistance shall be not less than the values given in Table 1, column 6.

3.3.3 Assembly of cores

Circular cord: the cores shall be twisted together.

Flat cord: the cores shall be laid parallel.

The assembly of circular cord shall have a practically circular cross-section.

The assembly of cores may be surrounded by a separator which shall not adhere to the cores.

3.3.4 Sheath

The sheath shall be thermoplastic compound TM 7, according to Annex B, applied around the cores.

The sheath thickness shall comply with the specified value given in Table 1, column 3.

The sheath may fill the spaces between the cores, thus forming a filling, but it shall not adhere to the cores.

3.3.5 Overall dimensions

The mean overall diameter of circular cords, and the mean overall dimensions of flat cords, shall be within the limits given in Table 1, columns 4 and 5.

3.3.6 Outer marking

The cord shall have the marking H03Z1Z1-F (for circular types) or H03Z1Z1H2-F (for flat types) printed or indented or embossed on the outer surface of the cord. The marking, which shall meet the requirements of 3.2 and 3.3 of Part 1, shall be legible.

3.4 Tests

Compliance with the requirements of 3.3 shall be checked by inspection and by the tests given in Table 2.

3.5 Guide to use (informative)

See Annex E.

Table 1 - General data for types H03Z1Z1-F and H03Z1Z1H2-F

1 Number and nominal cross- sectional area of conductors mm ²	2 Thickness of insulation Specified value mm	3 Thickness of sheath Specified value mm	4 Mean overall dimensions		6 Minimum insulation resistance at 70 °C MΩ·km
			Lower limit	Upper limit	
			mm	mm	
2 x 0.5	0.5	0.6	4.6 or 3.0 x 4.9	5.9 or 3.7 x 5.9	0.011
2 x 0.75	0.5	0.6	4.9 or 3.2 x 5.2	6.3 or 3.8 x 6.3	0.010
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 2 - Tests for types H03Z1Z1-F and H03Z1Z1H2-F

1	2	3	4	5
Ref No.	Tests	Category	Test method described in: HD or EN	(Sub)Clause
1	Electrical tests			
1.1	Resistance of conductors	T,S	21.2	2.1
1.2	Voltage test on completed cable at 2 000 V	T,S	21.2	2.2
1.3	Voltage test on cores at 1 500 V	T	21.2	2.3
1.4	Insulation resistance at 70 °C	T,S	21.2	2.4
1.5	Long term resistance of insulation to d.c.	T	21.2	2.5
1.6	Absence of faults on insulation	R	21.2	2.6
1.7	Surface resistance of sheath	T	21.2	2.8
2	Provisions covering constructional and dimensional characteristics			
2.1	Checking of compliance with constructional provisions	T,S	21.1	Inspection and manual tests
2.2	Measurement of thickness of insulation	T,S	21.2	1.9
2.3	Measurement of thickness of sheath	T,S	21.2	1.10
2.4	Measurement of overall dimensions			
2.4.1	Mean value	T,S	21.2	1.11
2.4.2	Ovality	T,S	21.2	1.11
3	Mechanical properties of insulation			
3.1	Tensile test before ageing	T	60811-1-1	9.1
3.2	Tensile test after ageing	T	60811-1-2	8.1.3.1
4	Mechanical properties of sheath			
4.1	Tensile test before ageing	T	60811-1-1	9.2
4.2	Tensile test after ageing	T	60811-1-2	8.1.3.1
5	Compatibility test on cable	T	60811-1-2	8.1.4
6	Pressure test at high temperature			
6.1	Insulation	T	60811-3-1	8.1
6.2	Sheath	T	60811-3-1	8.2
7	Tests at low temperature			
7.1	Bending test for insulation	T	60811-1-4	8.1
7.2	Bending test for sheath	T	60811-1-4	8.2
7.3	Impact test	T	60811-1-4	8.5

Table 2 - Tests for types H03Z1Z1-F and H03Z1Z1H2-F (continued)

1	2	3	4	5
Ref No.	Tests	Category	Test method described in: HD or EN	(Sub)Clause
8	Shrinkage test for insulation	T,S	60811-1-3	10
9	Ozone resistance test for insulation and sheath (either method may be used) a) Method A b) Method B	T	60811-2-1 21.2	8 7.3
10	Water Immersion test on sheath	T	21.14	Annex F
11	Mechanical strength on complete cable			
11.1	Flexing test	T	21.2	3.1 and 2.3
12	Tests under fire conditions			
12.1	Test on single vertical cable	T	50265-2-1	-
12.2	Smoke emission	T	50268-2	-
12.3	Assessment of halogens for all non-metallic materials	T, S	21.14	Annex C

4 Insulated and sheathed flexible cords of rated voltage 300/500 V

4.1 Code designation

H05Z1Z1-F for circular cords
H05Z1Z1H2-F for flat cords

4.2 Rated voltage

300/500 V

4.3 Construction

4.3.1 Conductor

Material: plain copper.

Number of conductors: 2, 3, 4 and 5.

The conductors shall comply with the requirements given in HD 383 for class 5 conductors.

4.3.2 Insulation

The insulation shall be thermoplastic compound TI 6, according to Annex A, applied around each conductor.

The insulation thickness shall comply with the specified value given in Table 3, column 2.

The insulation resistance shall be not less than the values given in Table 3, column 6.

4.3.3 Assembly of cores and fillers, if any

Circular cord: the cores and the fillers, if any, shall be twisted together.

Flat cords: the cores shall be laid parallel.

For circular cord having two cores, the space between the cores shall be filled either by separate fillers or by the sheath filling the interstices. For other circular cord, a centre filler may be used. Any filler shall not adhere to the cores.

The assembly of circular cord shall have a practically circular cross-section.

The assembly of cores may be surrounded by a separator, which shall not adhere to the cores.

4.3.4 Sheath

The sheath shall be thermoplastic compound TM 7, according to Annex B, applied around the cores.

The sheath thickness shall comply with the specified value given in Table 3, column 3.

The sheath may fill the spaces between the cores, thus forming a filling, but it shall not adhere to the cores.

4.3.5 Overall dimensions

The mean overall diameter of circular cords and the mean overall dimensions of flat cords shall be within the limits given in Table 3, columns 4 and 5.

4.3.6 Outer marking

The cord shall have the marking H05Z1Z1-F (for circular types) or H05Z1Z1H2-F (for flat types) printed or indented or embossed on the outer surface of the cord. The marking, which shall meet the requirements of 3.2 and 3.3 of Part 1, shall be legible.

4.4 Tests

Compliance with the requirements of 4.3 shall be checked by inspection and by tests given in Table 4.

4.5 Guide to use (informative)

See Annex E.

Table 3 - General data for types H05Z1Z1-F and H05Z1Z1H2-F

1 Number and nominal cross- sectional area of conductors mm ²	2 Thickness of insulation Specified value mm	3 Thickness of sheath Specified value mm	4 Mean overall dimensions		6 Minimum insulation resistance at 70 °C MΩ.km
			Lower limit	Upper limit	
			mm	mm	
2 x 0,75	0,6	0,8	5,7 or 3,7 x 6,0	7,2 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	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	7,5	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	8,3	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

Table 4 -Tests for types H05Z1Z1-F and H05Z1Z1H2-F

1	2	3	4	5
Ref No.	Tests	Category	Test method described in:	
			HD or EN	(Sub)Clause
1	Electrical tests			
1.1	Resistance of conductors	T,S	21.2	2.1
1.2	Voltage test on completed cable at 2 000 V	T,S	21.2	2.2
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	21.2	2.3
1.3.2	- at 2 000 V exceeding 0,6 mm	T	21.2	2.3
1.4	Insulation resistance at 70 °C	T,S	21.2	2.4
1.5	Long term resistance of insulation to d.c.	T	21.2	2.5
1.6	Absence of faults on insulation	R	21.2	2.6
1.7	Surface resistance of sheath	T	21.2	2.8
2	Provisions covering constructional and dimensional characteristics			
2.1	Checking of compliance with constructional provisions	T,S	21.1	Inspection and manual tests
2.2	Measurement of thickness of insulation	T,S	21.2	1.9
2.3	Measurement of thickness of sheath	T,S	21.2	1.10
2.4	Measurement of overall dimensions			
2.4.1	Mean value	T,S	21.2	1.11
2.4.2	Ovality	T,S	21.2	1.11
3	Mechanical properties of insulation			
3.1	Tensile test before ageing	T	60811-1-1	9.1
3.2	Tensile test after ageing	T	60811-1-2	8.1.3.1
4	Mechanical properties of sheath			
4.1	Tensile test before ageing	T	60811-1-1	9.2
4.2	Tensile test after ageing	T	60811-1-2	8.1.3.1
5	Compatibility test on cable	T	60811-1-2	8.1.4
6	Pressure test at high temperature			
6.1	Insulation	T	60811-3-1	8.1
6.2	Sheath	T	60811-3-1	8.2

Table 4 - Tests for types H05Z1Z1-F and H05Z1Z1H2-F (continued)

1	2	3	4	5
Ref No.	Tests	Category	Test method described in: HD or EN	(Sub)Clause
7	Tests at low temperature			
7.1	Bending test for insulation	T	60811-1-4	8.1
7.2	Bending test for sheath ^{a)}	T	60811-1-4	8.2
7.3	Elongation test for sheath ^{b)}	T	60811-1-4	8.4
7.4	Impact test	T	60811-1-4	8.5
8	Shrinkage test for insulation	T,S	60811-1-3	10
9	Ozone resistance test for insulation and sheath (either method may be used)	T		
	a) Method A		60811-2-1	8
	b) Method B		21.2	7.3
10	Water immersion test on sheath	T	21.14	Annex F
11	Mechanical strength on complete cable			
11.1	Flexing test ^{c)}	T	21.2	3.1 and 2.3
12	Tests under fire conditions			
12.1	Test on single vertical cable	T	50265-2-1	-
12.2	Smoke emission	T	50268-2	-
12.3	Assessment of halogens for all non-metallic materials	T,S	21.14	Annex C
^{a)} Only applicable to cables having mean overall diameters up to and including 12.5 mm. ^{b)} Only applicable if the mean overall outer diameter of the cable exceeds 12.5 mm. ^{c)} Not applicable to cables having conductors greater than 2.5 mm ² .				

Annex A
(normative)

(This will be incorporated into EN 50363-7 ¹⁾.)

Table A.1 - Requirements for the non-electrical tests for thermoplastic insulation TI 6

1	2	3	4	5	6
Ref No.	Test	Unit	Test method described in EN.60811 ¹⁾ Section	(Sub)Clause	Thermoplastic insulation TI 6 requirements
	Maximum rated conductor temperature	°C			70
	Maximum temperature for short circuit conditions	°C			160
1	Mechanical properties				
1.1	Properties before ageing		1-1	9.1	
1.1.1	Values to be obtained for the tensile strength: - median, min.	N/mm ²			7.5
1.1.2	Values to be obtained for the elongation at break: - median, min.	%			150
1.2	Properties after ageing in air oven		1-2	8.1	
1.2.1	Ageing conditions: - temperature - duration of treatment	°C h			80 ± 2 7 x 24
1.2.2	Value to be obtained for the tensile strength: - median, min. - variation ^{b)} , max.	N/mm ² %			± 20
1.2.3	Values to be obtained for the elongation at break: - median, min. - variation ^{b)} , max.	% %			± 20
2	Shrinkage test for insulation		1-3	10	
2.1	Test conditions: - sample length: - temperature - duration	mm °C h			200 100 ± 2 1
2.2	Result to be obtained: - shrinkage, max.	%			4
3	Compatibility test on cable				
3.1	Ageing conditions: - temperature - duration of treatment	°C h	1-2	8.1.4	80 ± 2 7 x 24

¹⁾ At draft stage.

Table A.1 - Requirements for the non-electrical tests for thermoplastic insulation TI 6 (continued)

1	2	3	4	5	6
Ref No.	Test	Unit	Test method described in EN 60811 ^{a)}		Thermoplastic insulation TI 6 requirements
			Section	(Sub)Clause	
	Maximum rated conductor temperature	°C			70
	Maximum temperature for short circuit conditions	°C			160
3.2	Mechanical properties after ageing				
3.2.1	Values to be obtained for tensile strength - variation ^{b)} , max.	%			± 20
3.2.2	Values to be obtained for elongation at break - variation ^{b)} , max.	%			± 20
4	Pressure test at high temperature		3-1	8.1	
4.1	Test conditions:				
	- force exerted by the blade	N	3-1	8.1.4	c)
	- duration of heating under load	h	3-1	8.1.5	c)
	- temperature	°C			80 ± 2
4.2	Result to be obtained: - median of the depth of indentation, max.	%			50
5	Bending test at low temperature		1-4	8.1	
5.1	Test conditions:				
	- temperature	°C			-15 ± 2
	- period of application of low temperature	h	1-4	8.1.4 & 8.1.5	
5.2	Result to be obtained				No crack
6	Impact test at low temperature		1-4	8.5	
6.1	Test conditions:				
	- temperature	°C			-15 ± 2
	- period of application of low temperature	h		8.5.5	c)
	- mass of hammer	g		8.5.4	c)
6.2	Result to be obtained			8.5.6	No crack

Table A.1 - Requirements for the non-electrical tests for thermoplastic insulation TI 6 (continued)

1	2	3	4	5	6
Ref No.	Test	Unit	Test method described in EN 60811 ^{a)}		Thermoplastic insulation TI 6 requirements
			Section	(Sub)Clause	
	Maximum rated conductor temperature	°C			70
	Maximum temperature for short circuit conditions	°C			160
7	Ozone resistance test				
7.1	Method A - test temperature - duration - ozone concentration (by volume)	°C h %	2-1	8.	25 ± 2 24 0,025 to 0,030
7.2	Method B - test temperature - duration - ozone concentration (by volume)	°C h %	HD 21.2	7.3	40 ± 2 72 (200 ± 50) x 10 ⁻⁶
7.3	Result to be obtained				No crack
8	(Spare)				
9	Assessment of halogens				
9.1	- pH (minimum)		EN 50267-2-2		4,3
9.2	- conductivity (maximum)	µS/mm	EN 50267-2-2		10
9.3	- amount of halogen acid gases				
	• HCl and HBr (maximum)	%	EN 50267-2-1		0,5
	• HF (maximum) ^{d)}	%	EN 60684-2, subclause 45.2		0,1
<p>^{a)} Unless otherwise stated.</p> <p>^{b)} Variation: difference between the median value after ageing and the median without ageing expressed as a percentage of the latter.</p> <p>^{c)} See test method referred to in columns 4 and 5.</p> <p>^{d)} This test need not be performed if a negative result is obtained for fluorone in the test to Annex D.</p>					

Annex B
(normative)

(This will be incorporated into EN⁵⁰³⁶³⁻⁸ 1).)

Table B.1 - Requirements for the non-electrical tests for thermoplastic sheath TM 7

1	2	3	4	5	6
Ref No.	Test	Unit	Test method described in EN ⁵⁰⁸¹¹ ¹⁾		Thermoplastic sheath TM 7 requirements
			Section	(Sub) Clause	
1	Mechanical properties				
1.1	Properties before ageing		1-1	9.2	
1.1.1	Values to be obtained for the tensile strength: - median, min.	N/mm ²			7.5
1.1.2	Values to be obtained for the elongation at break: - median, min.	%			150
1.2	Properties after ageing in air oven		1-2	8.1	
1.2.1	Ageing conditions: - temperature - duration of treatment	°C h			80 ± 2 7 x 24
1.2.2	Value to be obtained for the tensile strength: - median, min. - variation ^{b)} max.	N/mm ² %			- ± 20
1.2.3	Values to be obtained for the elongation at break: - median, min. - variation ^{b)} max.	% %			- ± 20
2	Compatibility test on cable				
2.1	Ageing conditions - temperature - duration of treatment	°C h	1-2	8.1.4	80 ± 2 7 x 24
2.2	Mechanical properties after ageing				
2.2.1	Values to be obtained for tensile strength - variation ^{b)} max.	%			± 20
2.2.2	Values to be obtained for elongation at break - variation ^{b)} max.	%			± 20

¹⁾ At draft stage.

Table B.1 - Requirements for the non-electrical tests for thermoplastic sheath TM 7 (continued)

1	2	3	4	5	6
Ref No.	Test	Unit	Test method described in EN 60811 ^{a)}		Thermoplastic sheath TM 7 requirements
			Section	(Sub) Clause	
3	Pressure test at high temperature		3-1	8.2	
3.1	Test conditions:				
	- force exerted by the blade	N	3-1	8.2.4	c)
	- duration of heating under load	h	3-1	8.2.5	c)
	- temperature	°C			80 ± 2
3.2	Result to be obtained:				
	- median of the depth of indentation, max.	%			50
4	Bending test at low temperature		1-1	8.2	
4.1	Test conditions:				
	- temperature	°C			-15 ± 2
	- period of application of low temperature	h	1-1	8.2.3	
4.2	Result to be obtained				No crack
5	Elongation test at low temperature		1-1	8.4	
5.1	Test conditions:				
	- temperature	°C			-15 ± 2
	- period of application of low temperature	h		8.4.4 & 8.4.5	
5.2	Result to be obtained:				
	- elongation without break, min.	%			30
6	Impact test at low temperature:				
6.1	Test conditions:				
	- temperature	°C			-15 ± 2
	- period of application of low temperature	h		8.5.5	c)
	- mass of hammer	g		8.5.4	c)
6.2	Result to be obtained			8.5.6	No crack

Table B.1 - Requirements for the non-electrical tests for thermoplastic sheath TM 7 (continued)

1	2	3	4	5	6
Ref No.	Test	Unit	Test method described in EN 60811 ^{a)}		Thermoplastic sheath TM 7 requirements
			Section	(Sub) Clause	
7	Ozone resistance test				
7.1	Method A - test temperature - duration - ozone concentration (by volume)	°C h %	2-1	8	25 ± 2 24 0,025 to 0,030
7.2	Method B - test temperature - test duration - ozone concentration (by volume)	°C h %	HD 21.2	7.3	40 ± 2 72 (200 ± 50) × 10 ⁻⁴
7.3	Result to be obtained				No crack
8	Water Immersion test		HD 21.14	Annex F	
8.1	Test conditions: - temperature - duration	°C h			70 ± 2 168
8.2	Mechanical properties after immersion				
8.2.1	Values to be obtained for tensile strength - variation ^{b)} , max.	%			± 30
8.2.2	Values to be obtained for elongation at break - variation ^{b)} , max.	%			± 35
9	Assessment of halogens				
9.1	- pH (minimum)		EN 50267-2-2		4,3
9.2	- conductivity (maximum)	µS/mm	EN 50267-2-2		10
9.3	- amount of halogen acid gas - HCl and HBr (maximum)	%	EN 50267-2-1		0,5
	- HF (maximum) ^{c)}	%	EN 60684-2, subclause 45.2		0,1

^{a)} Unless otherwise stated.

^{b)} Variation: difference between the median value after ageing and the median without ageing expressed as a percentage of the latter.

^{c)} See test method referred to in columns 4 and 5.

^{d)} This test need not be performed if a negative result is obtained for fluorene in the test to Annex D.

Annex C
(normative)
Requirements for halogens

C.1 Requirements for extruded material

The insulation and sheath shall meet the following requirements:

a) Type test

The material shall be tested to all the tests in Table C.1.

Table C.1

	Test method	Measurement	Requirements
1	EN 50267-2-2	pH and conductivity	pH \geq 4,3 and conductivity \leq 10 μ S/mm
2	EN 50267-2-1	Chlorine and bromine content expressed as HCl	\leq 0,5 %
3a	HD 21.14 Annex D	Halogen: Fluorine	If negative: stop test; no further test needed. Accept material. If positive: do test according to 3b.
3b	EN 60684-2	Fluorine content	\leq 0,1 %

b) Sample test

The material shall be tested to the sequential test programme in Table C.2

Table C.2

	Test method	Measurement	Result	Outcome
Stage 0	HD 21.14 Annex D	Halogen: Fluorine, Chlorine and Bromine		If negative: stop test; no further test needed. Accept material.
				If positive: continue with stage 1.
Stage 1	EN 50267-2-2	pH	< 4,3	Reject material.
			≥ 4,3	Evaluate conductivity.
		Conductivity	≤ 2.5 μS/mm	Accept material. No further testing needed.
		Conductivity	> 10 μS/mm	Reject material.
		Conductivity (s)	>2,5 μS/mm but ≤ 10 μS/mm	Test to EN 50267-2-1.
Stage 2	EN 50267-2-1	Chlorine and bromine Content expressed as HCl	> 0.5 %	Reject material.
			≤ 0.5 %	Test to EN 60684-2.
Stage 3	EN 60684-2	Fluorine content	> 0.1 %	Reject material.
			≤ 0.1 %	Accept material.

C.2 Requirements for non-extruded materials

Type and sample test

The materials shall meet the following requirements:

4.4 If the combined mass of all non-extruded materials (including separator tapes and fillers) is ≤ 5 % wt/wt of the total combustible material in the cable, the test to EN 50267-2-2 (Table C.1, No 1) shall be carried out on each component of materials. Each component shall meet the requirements for pH and conductivity of ≥ 4,3 and ≤ 10 μS/mm, respectively:

A layer comprising a number of tapes of the same material shall be regarded as one component and similarly, a number of cable fillers of the same material shall be regarded as one component.

If the combined mass of separator tapes and fillers is > 5 % wt/wt of the total combustible materials, then each of the components shall meet the requirements for extruded material according to Table C.1.

For the test according to 3a of Table C.1, the sample may be prepared from all tapes. If the result is positive, it must be repeated on each component.

Annex D

(normative)

Determination of halogens - Elemental test.

Warning

Owing to its potentially hazardous nature, the fusion operation should be carried out in a fume cupboard, using a safety screen.

D.1 Equipment

Bunsen burner
3 small/medium soda glass test tubes (approximately 50 mm-x-10 mm)
Test tube holder
Evaporating basin/mortar
Wire gauze;
Funnel
Filter paper

D.2 Materials

Unknown sample
Sodium metal
Dilute nitric acid (5 %)
Aqueous silver nitrate (5 %)
Dilute ammonia (10 %)
Freshly made up zirconium-alizarin red S reagent
Glacial acetic acid
Acid/pH indicator papers

D.3 Procedure

D.3.1 Sodium fusion

Place 200 mg - 250 mg. of the sample into the bottom of a small soda glass test tube. Add 10 ml of distilled/de-ionized water to the evaporating basin and place this in the fume cupboard behind the safety screen. Whilst holding the test tube firmly with the test tube holder at an angle of 45° - 60° to the vertical, introduce a piece of freshly cut, clean sodium (about the size of a small pea) (200 mg - 250 mg) into the mouth of the test tube without allowing it to come into contact with the sample. With the safety screen in place, heat the sodium gently until it melts and runs down on to the sample (there may be a vigorous reaction when the molten sodium reaches the sample if halogens are present). Heat the tube gently for about 1 min, then more strongly until the lower 20 mm of the tube glows red hot. Plunge the red hot tube into the water in the evaporating basin, immediately placing the gauze on top. (The gauze prevents any loss of material when the tube shatters on contact with the water.) Allow any unreacted sodium to react before grinding up the solution and glass. Filter, and separate the filtrate into two equal portions.

D.3.2 Chlorine and Bromine

To the first portion of the filtrate, add sufficient nitric acid to make the solution acidic. Boil this solution until its total volume has been reduced by half (this is to remove any HCN or H₂S, if present, which would interfere with the test). Add 1 ml silver nitrate solution; a white or yellowish-white precipitate indicates the presence of halogen (Cl, Br) in the original sample. (If the liquor is decanted, and the precipitate is white and readily soluble in dilute ammonia, then chloride is present.)

D.3.3 Fluorine

To the second portion of the filtrate, acidify with glacial acetic acid. Boil this solution until its total volume has been reduced by half. Add 2 to 3 drops freshly prepared zirconium lake reagent (equal volumes of: a) Alizarin solution: 0,05 g Alizarin Red-S in 50 ml distilled water, b) Zirconium solution: 0,05 g zirconium nitrate in 10 ml concentrated HCl diluted with 50 ml distilled water); Heat at 40°C for 1 h. The presence of fluoride is indicated by the red/pink colouration being bleached to yellow.

Annex E
(informative)

Proposed amendment to HD 516 S2

(This informative annex will be incorporated into the next amendment to HD 516 S2.)

(i) Add to Table 2A columns for HD 21.14 as below:

Standard	HD 21.14		HD 21.14	
	3		4	
Clause numbers	H03Z1Z1		H05Z1Z1	
Designation	H03Z1Z1		H05Z1Z1	
Cross section shape	Circ	Flat	Circ	Flat
Conductor type	F	F	F	F
1 Duty ^{a)}				
1.1 Extra light	+	+	+	+
1.2 Light	+	+	+	+
1.3 Ordinary	-	-	+	+
1.4 Heavy	-	-	-	-
2 Presence of water				
2.1 Condition AD1 ^{b)}	+	+	+	+
2.2 Condition AD2 ^{b)}	-	-	+	+
2.3 Condition AD6 ^{b)}	-	-	-	-
3 Corrosive or polluting substances				
3.1 Condition AF3 ^{b)}	-	-	+	+
4 Impact				
4.1 Condition AG2 ^{b)}	-	-	-	-
5 Vibrations				
5.1 Condition AH3 ^{b)}	-	-	-	-
6 Flora				
6.1 Condition AK2 ^{b)}	-	-	-	-
7 Fauna				
7.1 Condition AL2 ^{b)}	-	-	-	-
8 Outdoor use ^{c)}				
8.1 Temporary ^{d)}	-	-	+	+
8.2 Permanent ^{d)}	-	-	-	-
9 Frequent flexing	+	+	+	+
10 Frequent torsion	+	-	+	-
^{a)} See Annex B for definitions. ^{b)} See Annex C for definitions. ^{c)} Only for the relevant duty classification given in line 1 "Duty". ^{d)} See Annex A for definitions. NOTE "+" Acceptable application. "-" Not suitable.				

(ii) Add to the supplement to Table 2A the following:

1 Part No.	2 Recommended use	3 Comments
Part 14 Clause 3 H03Z1Z1-F or H03Z1Z1H2-F Halogen-free thermoplastic insulated and sheathed flexible cords of rated voltage 300/300 V	<p>Where cords having a low level of emission of smoke and corrosive gases are required in the case of fire or of burning.</p> <p>In domestic premises, kitchens, offices; for light duties, for light portable appliances (e.g. radio sets, table and standard lamps, office machines).</p> <p>For "H03Z1Z1-F and H03Z1Z1H2-F" with cross-section 0,75 mm², the same "Recommended use" and "Comments" as for "H05Z1Z1-F and H05Z1Z1H2-F" below are applicable.</p> <p>Where extra flexibility is required and provided there is no particular danger of mechanical damage, these light cords may be used.</p> <p>If cords are subject to frequent flexing and/or torsion, circular cords are recommended instead of flat ones.</p>	<p>Maximum cord operating temperature is: 60 °C.</p> <p><u>Unsuitable</u> for cooking and space heating appliances.</p> <p><u>Unsuitable</u> for use in elevated temperature zones in luminaires.</p> <p><u>Unsuitable</u> for outdoor use, in industrial (*) or agricultural buildings or for non domestic portable tools.</p> <p>Not recommended for the cabling of fixed installations.</p>
Part 14 Clause 4 H05Z1Z1-F or H05Z1Z1H2-F Halogen-free thermoplastic insulated and sheathed flexible cords of rated voltage 300/500 V	<p>Where cords having a low level of emission of smoke and corrosive gases are required in the case of fire or of burning.</p> <p>In domestic premises, kitchens, offices; for household appliances, including in damp premises; for medium duties (e.g. washing machines spin dryers and refrigerators).</p>	<p>Maximum cord operating temperature is: 60 °C.</p> <p>May be used for cooking and heating appliances, providing that there is no risk of contact with hot parts and is not subject to radiation.</p> <p><u>Unsuitable</u> for use in elevated temperature zones in luminaires.</p> <p><u>Unsuitable</u> for permanent outdoor use, in industrial (*) or agricultural buildings or for non domestic portable tools.</p> <p>Not recommended for the cabling of fixed installations.</p>

Annex F
(normative)

Water immersion test on sheath

F.1 General

This test is to demonstrate the effect of water on the mechanical properties of sheath by determining the tensile strength and elongation at break of the sheathing materials in the unconditioned state as manufactured and in the conditioned state after immersion in water.

The tensile tests on the conditioned and unconditioned test pieces shall be made in immediate succession.

F.2 Sampling and preparation of test pieces

Prepare test pieces in accordance with the procedure described in 9.2 of EN 60811-1-1.

F.3 Procedure

Immerse the dumb-bell test pieces in de-ionized water for the time and at the temperature given in the relevant standard for the cable sheathing material. Following this immersion, allow the test pieces to cool to a temperature of (20 ± 5) °C before removing them from the water. Dry the test pieces with absorbent paper and within 60 min of drying measure both the tensile strength and the elongation at break in accordance with the procedure described in 9.2 of EN 60811-1-1.

F.4 Evaluation of results

Calculate the tensile strength and the elongation at break in accordance with the procedure described in 9.2 of EN 60811-1-1.