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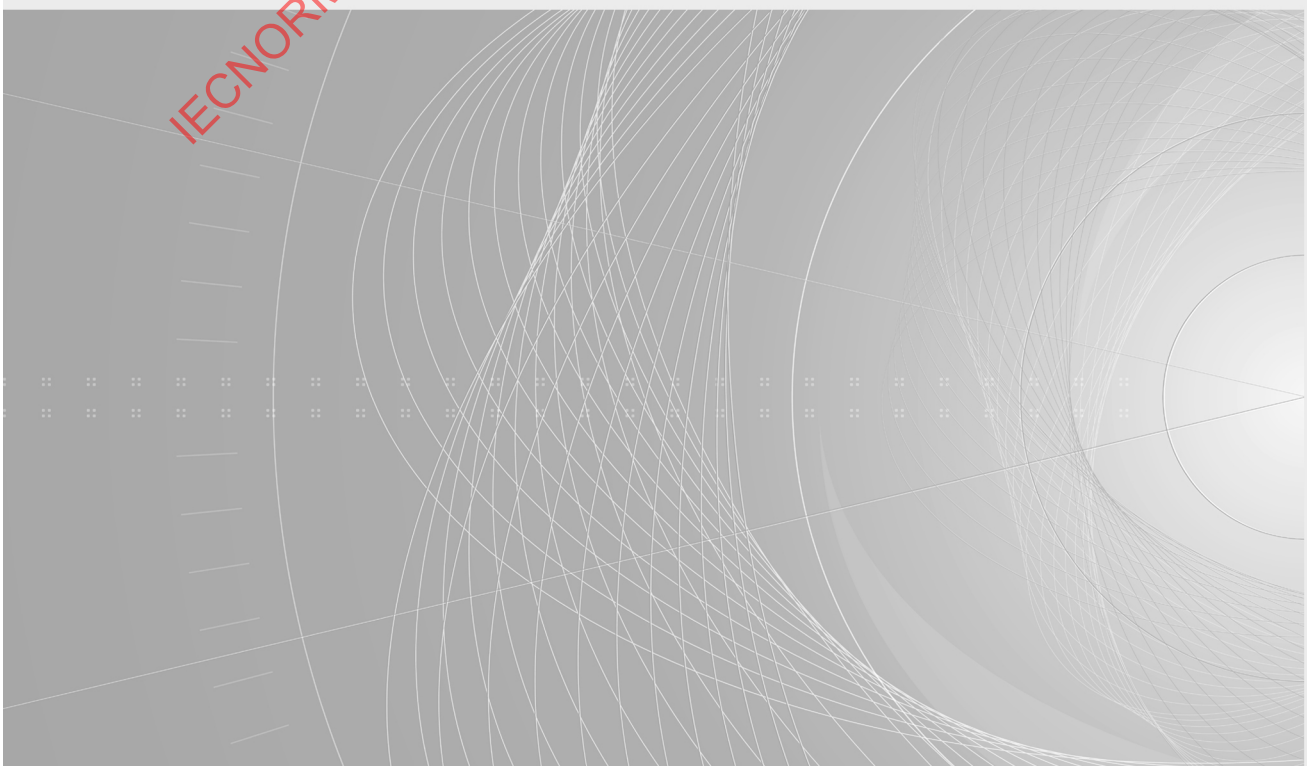
INTERNATIONAL STANDARD

Halogen-free thermoplastic insulated and sheathed flexible cables of rated voltages up to and including 300/300 V – Part 1: General requirements and cables



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Halogen-free thermoplastic insulated and sheathed flexible cables of rated voltages up to and including 300/300 V – Part 1: General requirements and cables

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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HALOGEN-FREE THERMOPLASTIC INSULATED AND SHEATHED FLEXIBLE CABLES OF RATED VOLTAGES UP TO AND INCLUDING 300/300 V –

Part 1: General requirements and cables

FOREWORD

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International Standard IEC 63010-1 has been prepared by IEC technical committee 20: Electric cables.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
20/1760/FDIS	20/1773/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 63010 series, published under the general title *Halogen-free thermoplastic insulated and sheathed flexible cables of rated voltages up to and including 300/300 V*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

HALOGEN-FREE THERMOPLASTIC INSULATED AND SHEATHED FLEXIBLE CABLES OF RATED VOLTAGES UP TO AND INCLUDING 300/300 V –

Part 1: General requirements and cables

1 Scope

This part of IEC 63010 applies to cables with insulation and sheaths based on halogen-free thermoplastic compounds for use with small devices and for short connections to desktop electrical appliances where flexibility is of prime importance. These cables have a voltage rating U_0/U up to and including 300/300 V. Maximum operating temperature for the cables in this document is 70 °C.

NOTE 1 For these types of flexible cables the term cord is also used.

NOTE 2 Unlike other cables that are described as “halogen-free” as part of an overall fire performance capability, cables conforming to IEC 63010 have no requirements relating to evolution of smoke.

NOTE 3 Not to be used for fixed installation, extension leads or completed cordsets longer than four meters.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

IEC 60227-2:1997, *Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V - Part 2: Test methods*
IEC 60227-2:1997/AMD1:2003

IEC 60228:2004, *Conductors of insulated cables*

IEC 60332-1-2:2004, *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 60684-2, *Flexible insulating sleeving - Part 2: Methods of test*

IEC 60754-1, *Test on gases evolved during combustion of materials from cables - Part 1: Determination of the halogen acid gas content*

IEC 60754-2, *Test on gases evolved during combustion of materials from cables - Part 2: Determination of acidity (by pH measurement) and conductivity*

IEC 60811-401, *Electric and optical fibre cables - Test methods for non-metallic materials - Part 401: Miscellaneous tests - Thermal ageing methods - Ageing in an air oven*

IEC 60811-501, *Electric and optical fibre cables - Test methods for non-metallic materials - Part 501: Mechanical tests - Tests for determining the mechanical properties of insulating and sheathing compounds*

IEC 60811-502, *Electric and optical fibre cables - Test methods for non-metallic materials - Part 502: Mechanical tests - Shrinkage test for insulations*

IEC 60811-504, *Electric and optical fibre cables - Test methods for non-metallic materials - Part 504: Mechanical tests - Bending tests at low temperature for insulation and sheaths*

IEC 60811-505, *Electric and optical fibre cables - Test methods for non-metallic materials - Part 505: Mechanical tests - Elongation at low temperature for insulations and sheaths*

IEC 60811-506, *Electric and optical fibre cables - Test methods for non-metallic materials - Part 506: Mechanical tests - Impact test at low temperature for insulations and sheaths*

IEC 60811-508, *Electric and optical fibre cables - Test methods for non-metallic materials - Part 508: Mechanical tests - Pressure test at high temperature for insulation and sheaths*

IEC 62440, *Electric cables with a rated voltage not exceeding 450/750 V - Guide to use*

IEC 63010-2:2017, *Halogen-free thermoplastic insulated and sheathed cables of rated voltage up to and including 300/300 V – Part 2: Test methods*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1 Definitions relating to insulating and sheathing materials

3.1.1
halogen-free compound
compound, in which the polymer is a polyolefin or equivalent synthetic polymer not containing halogens, which meets the requirements given in this document

3.1.2
type of compound
category in which a compound is placed according to its properties, as determined by specific tests

Note 1 to entry: The type designation is not directly related to the composition of the compound.

3.2 Definitions relating to the tests

3.2.1
type tests
T
test required to be carried out, before supplying a type of cable covered by this document on a general commercial basis, in order to demonstrate satisfactory performance characteristics to meet the intended application

Note 1 to entry: Type 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 or design, which might change the performance characteristics.

3.2.2
sample tests
S
test carried out 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 test
R
test carried out by the manufacturer on each manufactured length of cable to check that each length meets the specified requirements

4 Code designation

IEC 63010 IEC 111 for circular cables and IEC 63010 IEC 111f for flat cables.

5 Rated voltage

The rated voltage of a cable is the reference voltage for which the cable is designed.

The rated voltage in an alternating current system is expressed by the combination of two values U_0/U, expressed in volts, where:

a) U_0 is the r.m.s. value between any insulated conductor and “earth” (metal covering of the cable or the surrounding medium);

b) U is 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 or cord shall be at least equal to the nominal voltage of the system for which it is intended. This condition applies to the values of both U_0 and U.

The maximum permanent operating voltage of the system (AC or DC) is stated in Table 1.

Table 1 – Examples of maximum permitted voltages against rated voltage of cable

Rated voltage of cable U_0/U	Maximum permanent permitted operating voltage of the system		
	AC	DC	
	Conductor-earth	Conductor-earth	Conductor-conductor
V	U_0 max (V)	V	V
300/300	320	410	410

6 Marking

6.1 Indication of origin and cable identification and cable type

Cables shall be provided with an indication by the manufacturer, which shall be either an identification thread or a repetitive marking of the manufacturer's name or trademark.

The cables shall be marked IEC 63010 IEC 111 for circular cables and IEC 63010 IEC 111f for flat cables.

Marking may be executed by printing or by reproduction in relief on, or in, the insulation or sheath.

6.2 Continuity of marks

Each specified mark shall be regarded as continuous if the distance between the end of the mark and the beginning of the next identical mark does not exceed:

– 550 mm if the marking is on the outer sheath of the cable;
– 275 mm if the marking is on the insulation or on a tape within the sheathed cable.

6.3 Durability

Printed markings shall be durable. Compliance with this requirement shall be checked by carrying out the test given in 1.8 of IEC 60227-2:1997.

6.4 Legibility

All markings shall be legible.

The colours of the identification threads shall be easy to recognize or easily made recognizable, if necessary, by cleaning with petrol or another suitable solvent.

7 Core identification

7.1 General requirements

Each core shall be identified with colours. Identification of the cores of a cable shall be achieved by the use of coloured insulation or other suitable method.

Each core of a cable shall have only one colour, except the core identified by a combination of the colours green and yellow.

The colours green and yellow, when not in combination, shall not be used for any multicore cable.

The colours red and white should preferably be avoided.

7.2 Colour scheme

The preferred colour scheme:

–	two-core cable:	no preferred colour scheme;
–	three-core cable:	either green-and-yellow, blue, and brown; or
		brown, black, grey
–	four-core cable:	either green-and-yellow, brown, black, and grey; or
		blue, brown, black, grey.

The colours shall be clearly identifiable and durable. Durability shall be checked by carrying out the test given in 1.8 of IEC 60227-2:1997.

7.3 Colour combination green-and-yellow

The distribution of the colours for the green-and-yellow-coloured core shall comply with the following condition: for every 15 mm length of core, one of these colours shall cover at least 30 % and not more than 70 % of the surface of the core, the other colour covering the remainder.

It is understood that the colours green and yellow, when they are combined as specified above, are recognized exclusively as a means of identification of the core intended for use as earth connection or similar protection, and that the colour blue is intended for the identification of the core intended to be connected to neutral.

8 General requirements for the construction of cables

8.1 Conductors

8.1.1 Material

The conductors shall consist of annealed copper. The wires may be plain or tinned.

The conductor shall comply with Class 5 according to IEC 60228.

8.1.2 Construction

The maximum diameters of the wires of flexible conductors shall be in accordance with Class 5 specified in IEC 60228.

8.1.3 Check on construction

Compliance with the requirements of 8.1.1 and 8.1.2, including the requirements of IEC 60228, shall be checked by inspection and by measurement.

8.1.4 Electrical resistance

The resistance of each conductor at 20 °C shall be in accordance with the requirements of IEC 60228 for the given class of the conductor.

Compliance shall be checked by carrying out the test given in 2.1 of IEC 60227-2:1997 and Annex A of IEC 60228:2004.

8.1.5 Sizes of cable

The sizes of cable shall be:

a) circular cable: 0,5 mm^2 to 1,0 mm^2 – 2-, 3- and 4-core

b) flat cable: 0,5 mm^2 and 0,75 mm^2 – 2-core only.

8.2 Insulation

8.2.1 Material

The insulation shall be a halogen-free compound of type HF/D.

Insulation resistance shall be in accordance with Table 4.

The test requirements for these compounds are specified in Table 2.

8.2.2 Application to the conductor

The insulation shall be so applied that it fits closely on the conductor. However, it shall be possible to remove the insulation without damaging the insulation, the conductor, or the tin coating, if any.

It is permitted to place a separator between the conductor and the insulation.

Compliance shall be checked by inspection and by a manual test.

8.2.3 Thickness

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 B.1. The thickness at any point 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 carrying out the test given in 1.9 of IEC 60227-2:1997.

8.2.4 Mechanical properties

The insulation shall have adequate mechanical properties within the temperature limits to which it may be exposed in normal use.

Compliance shall be checked by carrying out the tests specified in Table 2.

The applicable test methods and the results to be obtained are specified in Table 2.

Table 2 – Requirements for halogen-free thermoplastic insulating compound

1	2	3	4	5	
Reference No.	**Test**	**Unit**	**Type of component**	**Test method described in**	
			HF/D	**IEC**	**Clause/ subclause**
1	**Tensile strength and elongation at break**			60811-501	
1.1	Properties in the state as delivered				
1.1.1	Values to be obtained for the tensile strength:				
	– median, min.	N/mm^2	7,0		
1.1.2	Values to be obtained for the elongation at break:				
	– median, min.	%	150		
1.2	Properties after ageing in air oven			60811-401 and 60811-501	
1.2.1	Ageing conditions: – temperature – duration of treatment	 °C h	 80 ± 2 7 × 24		
1.2.2	Values to be obtained for the tensile strength: – median, min. – variation [a], max.	 N/mm^2 %	 - ±20		
1.2.3	Values to be obtained for the elongation at break: – median, min. – variation [a], max.	 % %	 - ±20		
2	**Shrinkage test**			60811-502	
2.1	Test conditions:				
	– distance L between marks	mm	200		
	– temperature	°C	100 ± 2		
	– duration of treatment	h	1		
2.2	Results to be obtained:				
	– shrinkage, max	%	4		
3	**Pressure test at high temperature**			60811-508	
3.1	Test conditions:				
	– force exercised by the blade	See IEC 60811-508			
	– duration of heating under load	See IEC 60811-508			
	– temperature	°C	80 ± 2		
3.2	Results to be obtained:				
	– median of the depth of penetration, max.	%	50		
4	**Bending test at low temperature**			60811-504	
4.1	Test conditions:				
	– temperature [b]	°C	−25 ± 2		
	– period of application of low temperature			60811-504	
4.2	Results to be obtained		No cracks		
5	**Assessment of halogens**			63010-1	Annex A
5.1	– pH, min		4,3		

1	2	3	4	5	
Reference No.	Test	Unit	Type of component	Test method described in	
			HF/D	IEC	Clause/ subclause
5.2	– conductivity, max.	µS/mm	10		
5.3	Amount of halogen acid gas				
	– HCl and HBr, max.	%	0,5		
	– HF, max.[c)]	%	0,1		

a) Variation: difference between the median value after ageing and the median value without ageing, expressed as a percentage of the latter.

b) Due to climatic conditions, national standards may require a lower test temperature to be used.

c) This test need not be performed if a negative result is obtained for fluorine in the test in 5.3 of IEC 63010-2:2017.

8.3 Filler (optional)

8.3.1 Material

Fillers, when used, shall be halogen-free and composed of one of the following or of any combination of the following:

– compound; or
– natural or synthetic textiles; or
– paper.

When a compound is used as filler, there shall be no harmful interactions between its constituents and the insulation and/or the sheath. Compliance with this requirement shall be checked according to the ageing procedure for pieces of completed cable test given in IEC 60811-401.

8.3.2 Application

The fillers shall fill the spaces between the cores giving the assembly a practically circular shape. The fillers shall not adhere to the cores. The assembly of cores and fillers may be held together by halogen-free (according to Annex A) film or tape.

8.4 Assembly

The cores shall be assembled as follow:

a) circular cable: the cores shall be twisted together;
b) flat cable: the cores shall be laid parallel.

A halogen-free tape may be applied around the core assembly before application of the sheath.

8.5 Sheath

8.5.1 Material

The sheath shall be halogen-free thermoplastic compound of type HF/SH1.

The test requirements for this compound are specified in Table 3.

8.5.2 Application

The sheath shall be extruded in a single layer on the assembly of cores and fillers.

The sheath shall not adhere to the cores. A separator, consisting of a film or tape, may be placed under the sheath.

In certain cases the sheath may penetrate into the spaces between the cores, thus forming a filling.

8.5.3 Thickness

The mean value of the thickness shall not be less than the specified value for each type and size of cable shown in Table B.1.

However, the thickness at any place may be less than the specified value provided that the difference does not exceed 0,1 mm + 15 % of the specified value, unless otherwise specified.

Compliance shall be checked by carrying out the test given in 1.10 of IEC 60227-2:1997 and IEC 60227-2:1997/AMD1:2003.

8.5.4 Mechanical properties

The sheath shall have adequate mechanical properties within the temperature limits to which it may be exposed in normal use.

Compliance shall be checked by carrying out the tests specified in Table 3.

Table 3 – Requirements for halogen-free thermoplastic sheathing compounds

1	2	3	4	5	
Reference No.	**Test**	**Unit**	**Type of compound**	**Test method described in**	
			HF/ SH1	**IEC**	**clause/ subclause**
1	**Tensile strength and elongation at break**			60811-501	
1.1	Properties in the state as delivered				
1.1.1	Values to be obtained for the tensile strength:				
	– median, min.	N/mm^2	7,0		
1.1.2	Values to be obtained for the elongation at break				
	– median, min.	%	150		
1.2	Properties after ageing in the air oven			60811-401	
1.2.1	Ageing conditions:				
	– temperature	°C	80 ± 2		
	– duration of treatment	h	7 × 24		
1.2.2	Values to be obtained for the tensile strength:				
	– median, min.	N/mm^2	-		
	– variation[a)], max.	%	±20		
1.2.3	Values to be obtained for the elongation at break:				
	– median, min.	%	-		
	– variation[a)], max.	%	±20		
2	**Pressure test at high temperature**			60811-508	
2.1	Test conditions:				
	– temperature	°C	80 ± 2		
2.2	Results to be obtained:	%	50		
3	**Bending test at low temperature**				
3.1	Test conditions:			60811-504	
	– temperature[b)]	°C	−25 ± 2		
	– period of application of low temperature	h		60811-504	
3.2	Results to be obtained		No cracks		
4	**Water immersion**			63010-2:2017	5.2.1
4.1	Test conditions:				
	– temperature	°C	70 ± 2		
	– duration	h	7 × 24		
4.2	Mechanical properties after immersion				
4.2.1	Values to be obtained for the tensile strength:				
	– variation max.	%	± 30		
4.2.2	Values to be obtained for the elongation at break:				
	– variation max.	%	± 35		
5	**Assessment of halogens**			63010-1	Annex A
5.1	– pH, min		4,3		
5.2	– conductivity, max.	µS/mm	10		

1	2	3	4	5	
Reference No.	**Test**	**Unit**	**Type of compound**	**Test method described in**	
			HF/ SH1	**IEC**	**clause/ subclause**
5.3	– Amount of halogen acid gas:				
	– HCl and HBr, max.	%	0,5		
	– HF, max.[c)]	%	0,1		

a) Variation: difference between the median value after ageing and the median value without ageing, expressed as a percentage of the latter.

b) Due to climatic conditions, national standards may require the use of a lower test temperature.

c) This test need not be performed if a negative result is obtained for fluorine in the test in 5.3 of IEC 63010-2:2017.

8.6 Tests on completed cables

8.6.1 Electrical properties

The cables shall have adequate dielectric strength and insulation resistance.

Compliance shall be checked by carrying out the tests specified in Table 4.

The test methods and the results to be obtained are specified in Table 4.

Table 4 – Tests for cable types 111 and 111f

1	2	3	4	5	6	7
Ref No.	**Tests** [a]	**Category of test**	**Unit**	**Requirements**	**Test method described in**	
					IEC	**Subclause**
1	**Electrical tests** [b]					
1.1	**Resistance of conductors**	T, S			60227-2	2.1
1.1.1	Results to be obtained		Ω/km	IEC 60228		
1.2	**Voltage test on completed cable at 2 000 V**	T, S			60227-2	2.2
1.2.1	Test conditions:					
	– minimum sample length		m	10		
	– minimum period of water immersion		h	1		
	– temperature of the water		°C	20 ± 5		
	– duration of voltage application		min.	5		
1.2.2	Results to be obtained:			No breakdown		
1.3	**Voltage test on cores at 1500 V**	T, S			63010-2:2017	5.1.4
1.3.1	Test conditions:					
	– minimum sample length		m	5		
	– minimum period of water immersion		h	1		
	– temperature of the water		°C	20 ± 5		
	– duration of voltage application		min.	5		
1.3.2	Results to be obtained:			No breakdown		
1.4	**Measurement of insulation resistance**	T, S			60227-2	2.4
1.4.1	Test conditions:					
	– minimum sample length		m	5		
	– minimum period of hot water immersion		h	2		
	– temperature of the water		°C	70 ± 2		
	– previous voltage application (see 1.2 & 1.3 in this table)				63010-1	Annex B
1.4.2	Results to be obtained:			Table B.1		
1.5	**Long term resistance of insulation to DC**	T			63010-2:2017	5.1.1
1.5.1	Test conditions:					
	– minimum sample length		m	5		
	– temperature		°C	60 ± 5		
	– period of immersion		h	240		
1.5.2	Results to be obtained			No breakdown and no signs of damage		
1.6	**Absence of faults in insulation**	R			63010-2:2017	5.1.2
1.6.1	Results to be obtained			No fault shall be detected		
1.7	**Surface resistance of sheath**	T			63010-2:2017	5.1.3
1.7.1	Test conditions:					
	– voltage applied, DC		V	100 to 500		
	– duration of test		min	1		
1.7.2	Results to be obtained		Ω	$\geq 10^9$		

1	2	3	4	5	6	7
Ref No.	**Tests [a]**	**Category of test**	**Unit**	**Requirements**	**Test method described in**	
					IEC	**Subclause**
2	**Constructional and dimensional tests**					
2.1	**Conductor**	T, S			63010-1	8.1.3
2.1.1	Maximum wire diameter		mm	6.1 of IEC 60228		
2.1.2	Checking of continuity of tin (when applicable)			No visible gaps		
2.2	**Measurement of thickness of insulation**	T, S			60227-2	1.9
	Results to be obtained:			8.2.3 of this document		
2.3	**Measurement of thickness of sheath**	T, S			60227-2	1.10
	Results to be obtained:			8.5.3 of this document		
2.4	**Measurement of overall dimensions**					
2.4.1	Mean value	T, S		Table B.1 of this document	60227-2	1.10.2
2.4.2	Ovality (not applicable to flat cables)	T, S			60227-2	1.11
3	**Insulation material tests**	T		Table 2 of this document		
4	**Sheath material tests**	T		Table 3 of this document		
5	**Compatibility test**	T		Annex C	60811-401	
6	**Cold impact test**	T			60811-506	
6.1	Test conditions:					
	– temperature		°C	−15		
6.2	Results to be obtained			No cracks		
7	**Mechanical strength of completed cable**					
	Flexing test followed, after immersion in water, by a voltage test at 1500 V on cores	T		8.6.3.1 of this document	60227-2	3.1
8	**Tests under fire conditions**					
8.1	Test on single vertical cable	T		IEC 60332-1-2:2004, Annex A	60332-1-2	-
9	**Assessment of halogens for all non-metallic materials**	T, S		Annex A of this document	63010-1	Annex A

[a] The order given does not imply a sequence of testing.

[b] Particular test conditions and requirements are given in Table 3.

8.6.2 Overall dimensions

The mean overall dimensions of the cables shall be within the limits specified in Annex B.

The difference between any two values of the overall diameter of sheathed cables of the same cross-section (ovality) shall not exceed 15 % of the upper limit specified for the mean overall diameter.

Compliance shall be checked by the tests given in 1.11 of IEC 60227-2:1997 and IEC 60227-2:1997/AMD1:2003.

8.6.3 Mechanical strength of flexible cables

The flexible cables shall be capable of withstanding bending and other mechanical stresses occurring in normal use.

The test shall be carried out in accordance with 3.1 of IEC 60227-2:1997.

During the test with 30 000 cycles, i.e. 60 000 single movements, no interruption of the current, no short-circuit between the conductors and no short-circuit between the cables and pulleys (the flexible apparatus) shall occur.

After the required number of cycles, the sheath of a sheathed cable shall be examined under normal or corrected vision. There shall be no point at which any underlying component of the cable (for instance inner sheath, tapes, insulated cores) shall be visible through a break in the sheath. The sheath of the cable shall then be removed.

The cores from the cable without its sheath shall then withstand the voltage test carried out in accordance with 2.3 of IEC 60227-2:1997, but with a test voltage not exceeding 1 500 V.

8.6.4 Tests under fire conditions

All the cables shall comply with the test specified in IEC 60332-1-2 as well as the requirements as given in Annex A of IEC 60332-1-2.

8.6.5 Compatibility of materials

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

Annex A
(normative)

Assessment of halogens

A.1 Requirements for extruded material

A.1.1 Type test

The material shall be tested according to the sequential test programme in Table A.1.

Table A.1 – Type test for extruded material for the assessment of halogens

Stage	Test method	Measurement	Requirements
1	IEC 60754-2	pH and conductivity	pH ≥ 4,3 and conductivity ≤ 10 µS/mm
2	IEC 60754-1	Chlorine and bromine content expressed as HCl	≤ 0,5 %
3a	5.3 of IEC 63010-2:2017	Halogen: fluorine	If negative: stop test; no further test needed. Accept material.
			If positive: do test according to 3b.
3b	IEC 60684-2	Fluorine content	≤ 0,1 %

A.1.2 Sample test

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

Table A.2 – Sample test for extruded material for the assessment of halogens

Stage	Test method	Measurement	Result	Outcome
1	5.3 of IEC 63010-2:2017	Halogen: fluorine, chlorine and bromine	Negative	Accept material No further test needed
			Positive	Go to stage 2
2	IEC 60754-2	pH	< 4,3	Reject material
			≥ 4,3	Evaluate conductivity
		Conductivity	≤ 2,5 µS/mm	Accept material No further testing needed
			> 10 µS/mm	Reject material
			>2,5 µS/mm but ≤ 10 µS/mm	Go to stage 3
3	IEC 60754-1	Chlorine and bromine Content expressed as HCl	> 0,5 %	Reject material
			≤ 0,5 %	Go to stage 4
4	IEC 60684-2	Fluorine content	> 0,1 %	Reject material
			≤ 0,1 %	Accept material