

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE



**Mineral insulated cables and their terminations with a rated voltage not exceeding 750 V –  
Part 1: Cables**

**Câbles à isolant minéral et leurs terminaisons de tension assignée ne dépassant pas 750 V –  
Partie 1: Câbles**

[IEC 60702-1:2002](#)

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## CONTENTS

FOREWORD.....	4
1 Scope.....	6
2 Normative references .....	6
3 Definitions .....	7
4 Voltage designations .....	8
4.1 500 V cable (light duty grade).....	8
4.2 750 V cable (heavy duty grade).....	8
5 Conductors.....	8
6 Insulation .....	8
6.1 Composition .....	8
6.2 Thickness.....	8
7 Metallic sheath .....	8
7.1 Material.....	8
7.2 Sheath thickness.....	9
7.3 Sheath diameter and ovality .....	9
8 Optional outer covering .....	9
8.1 General.....	9
8.2 Material.....	9
8.3 Halogen-free covering.....	9
8.4 Thickness of covering.....	9
9 Marking .....	10
10 General notes on tests .....	10
11 Routine tests .....	11
11.1 General.....	11
11.2 Conductor resistance .....	11
11.3 Insulation resistance .....	11
11.4 Integrity of insulation and copper sheath .....	11
11.5 Spark test on outer covering.....	11
11.6 Diameter and ovality over copper sheath.....	12
12 Sample tests .....	12
12.1 General.....	12
12.2 Voltage test.....	12
12.3 Thickness of outer covering.....	13
12.4 Flame retardance .....	13
12.5 Emission of acidic and corrosive gases .....	13
12.6 Smoke emission .....	13
13 Type tests .....	14
13.1 General.....	14
13.2 Voltage test on completed cable.....	14
13.3 Resistance of copper sheath .....	14
13.4 Thickness of insulation .....	14
13.5 Thickness of copper sheath.....	15
13.6 Bending test.....	15
13.7 Flattening test .....	18
13.8 Fire resistance .....	19

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14	500 V mineral insulated cable (light duty grade) .....	19
14.1	Code designation .....	19
14.2	Rated voltage .....	19
14.3	Construction .....	19
14.4	Dimensions .....	19
14.5	Requirements .....	20
15	750 V mineral insulated cable (heavy duty grade).....	20
15.1	Code designation .....	20
15.2	Rated voltage .....	20
15.3	Construction .....	21
15.4	Dimensions .....	21
15.5	Requirements .....	23
	Bibliography.....	24

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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**MINERAL INSULATED CABLES AND THEIR TERMINATIONS  
WITH A RATED VOLTAGE NOT EXCEEDING 750 V –**

**Part 1: Cables**

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**IEC 60702-1 edition 3.1 contains the third edition (2002-02) [documents 20/490/FDIS and 20/510/RVD] and its amendment 1 (2015-01) [documents 20/1528/FDIS and 20/1556/RVD].**

**In this Redline version, a vertical line in the margin shows where the technical content is modified by amendment 1. Additions and deletions are displayed in red, with deletions being struck through. A separate Final version with all changes accepted is available in this publication.**



International Standard IEC 60702-1 has been prepared by IEC technical committee 20: Electric cables.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 3.

The committee has decided that the contents of the base publication and its amendment will remain unchanged until the stability date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

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# MINERAL INSULATED CABLES AND THEIR TERMINATIONS WITH A RATED VOLTAGE NOT EXCEEDING 750 V –

## Part 1: Cables

### 1 Scope

This standard applies to mineral insulated general wiring cables with copper or copper alloy sheath and copper conductors and with rated voltages of 500 V and 750 V. Provision is made for a corrosion-resistant extruded outer covering over the copper sheath, when required. This outer covering is not specified for the purpose of electrical insulation of the metal sheath.

Requirements for terminations for use with these cables are specified in IEC 60702-2.

The purpose of this standard is to specify mineral insulated cables that are safe and reliable when properly used, to state the manufacturing requirements and characteristics to achieve this, and to specify methods for checking conformity with those requirements.

### 2 Normative references

The following ~~referenced~~ documents, in whole or in part, are normatively referenced in this document and are indispensable for ~~the its~~ 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.

IEC 60227-1:~~1993~~, *Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V – Part 1: General requirements* [60702-1:2002](https://standards.iteh.ai/catalog/standards/iec/28c2d7f3-2b64-4e2c-bc67-66244629ec27/iec-60702-1-2002)

IEC 60228:~~1978~~, *Conductors of insulated cables*

~~IEC 60331-21:1999, Tests for electric cables under fire conditions – Circuit integrity – Part 21: Procedures and requirements – Cables of rated voltage up to and including 0,6/1,0 kV~~

~~IEC 60332-1:1993, Tests on electric cables under fire conditions – Part 1: Test on a single vertical insulated wire or cable~~

~~IEC 60702-2:2002, Mineral insulated cables and their terminations with a rated voltage not exceeding 750 V – Part 2: Terminations~~

IEC 60331-1, *Tests for electric cables under fire conditions – Circuit integrity – Part 1: Test method for fire with shock at a temperature of at least 830 °C for cables of rated voltage up to and including 0,6/1,0 kV and with an overall diameter exceeding 20 mm*

IEC 60331-2, *Tests for electric cables under fire conditions – Circuit integrity – Part 2: Test method for fire with shock at a temperature of at least 830 °C for cables of rated voltage up to and including 0,6/1,0 kV and with an overall diameter not exceeding 20 mm*

IEC 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 60754-2:1994, Test on gases evolved during combustion of electric materials from cables – Part 2: Determination of degree of acidity of gases evolved during the combustion of materials taken from electric cables by measuring pH (by pH measurement) and conductivity~~

~~IEC 60811-1-1:1993, Common test methods for insulating and sheathing materials of electric cables and optical cables – Part 1: Methods for general application – Section 1: Measurement of thickness and overall dimensions – Tests for determining the mechanical properties~~

~~IEC 60811-1-4:1985, Common test methods for insulating and sheathing materials of electric cables – Part 1: Methods for general application – Section 4: Tests at low temperature~~

~~IEC 60811-3-1:1985, Common test methods for insulating and sheathing materials of electric cables – Part 3: Methods specific to PVC compounds – Section 1: Pressure test at high temperature – Tests for resistance to cracking~~

~~IEC 60811-202, Electric and optical fibre cables – Test methods for non-metallic materials – Part 202: General tests – Measurement of thickness of non-metallic sheath~~

~~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 60811-509, Electric and optical fibre cables – Test methods for non-metallic materials – Part 509: Mechanical tests – Test for resistance of insulations and sheaths to cracking (heat shock test)~~

~~IEC 61034-2:1997, Measurement of smoke density of cables burning under defined conditions – Part 2: Test procedure and requirements~~

### 3 Definitions

For the purpose of this part of IEC 60702, the following definitions apply.

#### 3.1

##### **nominal value**

value by which a quantity is designated and which is often used in tables

**Note 1 to entry:** Usually, in this standard, nominal values give rise to values to be checked by measurements, taking into account specified tolerances.

#### 3.2

##### **routine tests (symbol R)**

tests made by the manufacturer on each manufactured length of cable to check that the whole of each length meets the specified requirements

#### 3.3

##### **sample tests (symbol S)**

tests made by the manufacturer on samples of completed cable, or components from a completed cable, at a planned frequency, so as to verify that the finished product meets the specified requirements

#### 3.4

##### **type tests (symbol T)**

**T**

tests made before supplying, on a general commercial basis, a type of cable covered by this standard, in order to demonstrate satisfactory performance characteristics to meet the intended application

**Note 1 to entry:** ~~These~~ **Type** tests are such that, after they have been made, they need not be repeated unless changes are made in the cable material, design or manufacturing process which might change the performance characteristics.

## 4 Voltage designations

The rated voltages of the cables considered in this standard are as follows.

### 4.1 500 V cable (light duty grade)

For use where the voltage between conductors and sheath and between conductors does not exceed 500 V r.m.s. or 500 V d.c.

### 4.2 750 V cable (heavy duty grade)

For use where the voltage between conductors and sheath and between conductors does not exceed 750 V r.m.s. or 750 V d.c.

## 5 Conductors

Conductors shall consist of plain annealed copper and shall be of approximately circular cross-section. They shall comply with the requirements given in IEC 60228 for class 1 conductors.

Compliance shall be checked by inspection and by measuring the resistance of each conductor of each complete coil of completed cable and measuring the length of the cable. The measured resistance shall be corrected to 20 °C and to a length of 1 km, in accordance with 11.2.

## 6 Insulation

### 6.1 Composition

The insulation shall consist of compressed powdered mineral or minerals which shall form a compact body. The electrical properties of the insulation shall be such that the completed cable shall meet the test requirements of this standard.

### 6.2 Thickness

The nominal thickness of insulation between conductors and between each conductor and the sheath shall be as given in tables 7 and 10.

When measured in accordance with 13.4, the minimum thickness shall be not less than 80 % of the nominal value minus 0,1 mm.

## 7 Metallic sheath

### 7.1 Material

The sheath shall be of plain annealed copper or copper alloy. The resistance of the sheath, measured and corrected to 20 °C in accordance with 13.3, shall comply with the values in tables 9 and 12.

## 7.2 Sheath thickness

The mean thickness of the sheath shall be not less than the nominal thickness specified in tables 8 and 11. The thickness at any point may, however, be less than the nominal value, provided that the difference does not exceed 10 % of the nominal value.

Compliance shall be checked by the test in 13.5.

## 7.3 Sheath diameter and ovality

When measured in accordance with 11.6, the diameter measurements shall be within  $\pm 0,05$  mm of the value specified in tables 7 and 10.

## 8 Optional outer covering

### 8.1 General

Where deemed necessary because of corrosive environments, cable identification or aesthetic appeal, an extruded outer covering may be applied. Application shall be such that the cable complies with the spark test specified in 11.5 and with the flame retardance test specified in 12.4. The covering may be of any colour appropriate for the country of use. The material shall meet the requirements of 8.2 and 8.3, as appropriate.

NOTE By agreement between the manufacturer and purchaser, outer coverings of alternative materials and thicknesses may be applied.

### 8.2 Material

The material of the outer covering shall comply with the following requirements.

#### 8.2.1 Low temperature impact

When samples of cable with outer covering are tested in accordance with ~~8.5 of IEC 60811-1-4~~ IEC 60811-506, at a temperature of  $(-15 \pm 2)$  °C, the samples shall not crack.

#### 8.2.2 Heat shock test

When samples of cable with outer covering are tested in accordance with ~~9.2 of IEC 60811-3-1~~ IEC 60811-509, at a temperature of  $(150 \pm 3)$  °C, the samples shall not crack.

### 8.3 Halogen-free covering

Halogen-free covering shall meet the requirements given in 8.2, and be such that the completed cable will meet the fire performance tests of 12.4, 12.5 and 12.6.

### 8.4 Thickness of covering

When measured in accordance with 12.3, the mean value of the thickness of the outer covering shall be not less than the nominal value given in table 1. The thickness at any point may, however, be less than the nominal value, provided that the difference does not exceed  $0,1$  mm + 15 % of the specified nominal value.

**Table 1 – Thickness of covering**

Diameter over copper sheath <sup>1)</sup> mm		Nominal thickness of covering mm
Above	Up to and including	
–	7	0,65
7	15	0,75
15	20	1,00
20	–	1,25

<sup>1)</sup> As given in tables 7 and 10.

## 9 Marking

Every cable shall be identified with the rated voltage and a means of identifying the manufacturer. Marking shall comply with the requirements of IEC 60227-1 except that, for cables without an outer covering, the information may be marked on a label attached to each length of cable.

**Table 2 – Schedule of tests**

Test	Clause	Category <sup>1)</sup>
Conductor resistance	5	R
Insulation:		
Insulation resistance	11.3	R
Thickness	13.4	T
Copper sheath:		
Sheath resistance	13.3	T
Thickness	13.5	T
Integrity of sheath	11.4	R
Diameter and ovality	11.6	R
Outer covering:		
Material properties	8.2	S
Thickness	12.3	S
Spark test	11.5	R
Acidic and corrosive gases	12.5	S
Voltage test (1 min)	12.2	S
Voltage test (15 min)	13.2	T
Bending test	13.6	T
Flattening test	13.7	T
Flame retardance test	12.4	S
Smoke emission test	12.6	S
Fire resistance test	13.8	T

<sup>1)</sup> R = routine test; S = sample test; T = type test

## 10 General notes on tests

Unless otherwise specified, tests shall be made at an ambient temperature of (20 ± 15) °C.