

BS EN 60702-3:2016



BSI Standards Publication

# Mineral insulated cables and their terminations with a rated voltage not exceeding 750 V

Part 3: Guidance for use

### **National foreword**

This British Standard is the UK implementation of EN 60702-3:2016. It is identical to IEC 60702-3:2016. It supersedes BS 6207-3:2001 which will be withdrawn on 18 May 2019.

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

A list of organizations represented on this committee can be obtained on request to its secretary.

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### **Amendments/corrigenda issued since publication**

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EUROPEAN STANDARD

**EN 60702-3**

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EUROPÄISCHE NORM

June 2016

ICS 29.060.20

English Version

**Mineral insulated cables and their terminations with a rated voltage not exceeding 750 V - Part 3: Guidance for use (IEC 60702-3:2016)**

Câbles à isolant minéral et leurs terminaisons de tension assignée ne dépassant pas 750 V - Partie 3: Guide d'utilisation  
(IEC 60702-3:2016)

Mineralisierte Leitungen mit einer Bemessungsspannung bis 750 V - Teil 3: Anwendungsrichtlinie  
(IEC 60702-3:2016)

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## **European foreword**

The text of document 20/1618/FDIS, future edition 1 of IEC 60702-3, prepared by IEC/TC 20 "Electric cables" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 60702-3:2016.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2017-02-18
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In the official version, for Bibliography, the following note has to be added for the standard indicated:

IEC 60702-1	NOTE	Harmonized as EN 60702-1.
IEC 60702-2	NOTE	Harmonized as EN 60702-2.
IEC 60364-5-52	NOTE	Harmonized as HD 60364-5-52.

## Annex ZA (normative)

### Normative references to international publications with their corresponding European publications

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NOTE 1 When an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: [www.cenelec.eu](http://www.cenelec.eu).

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60364-1	-	Low-voltage electrical installations -- Part 1: Fundamental principles, assessment of general characteristics, definitions	HD 60364-1	-

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**MINERAL INSULATED CABLES AND THEIR TERMINATIONS  
WITH A RATED VOLTAGE NOT EXCEEDING 750 V –****Part 3: Guidance for use**

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International Standard IEC 60702-3 has been prepared by IEC technical committee 20: Electric cables.

This first edition of IEC 60702-3 is based on CENELEC HD 586.3.

The text of this standard is based on the following documents:

FDIS	Report on voting
20/1618/FDIS	20/1623/RVD

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

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

A list of all parts in the IEC 60702 series, published under the general title *Mineral insulated cables and their terminations with a rated voltage not exceeding 750 V*, can be found on the IEC website.

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

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



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

## Part 3: Guidance for use

### 1 Scope

This part of IEC 60702 provides guidance for the safe use of mineral insulated cables and their terminations with a rated voltage not exceeding 750 V which are specified in IEC 60702-1 and IEC 60702-2.

### 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60364-1, *Low-voltage electrical installations – Part 1: Fundamental principles, assessment of general characteristics, definitions*

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60364-1 apply.

### 4 Safety

#### 4.1 Fundamental considerations

**4.1.1** Safety of a cable means that the product does not present an unacceptable risk of danger to life or property whilst being used in its intended manner.

**4.1.2** Unless otherwise stated, cables shall not be used for any other purpose than the transmission and distribution of electricity.

**4.1.3** The test methods, test parameters and requirements described in IEC 60702-1 and IEC 60702-2 are only provided for the purpose of checking design with respect to safety and quality assurance. They shall not be regarded as providing guidance as to whether the cables are suitable for service under conditions equivalent to the test conditions.

#### 4.2 General

**4.2.1** All conductors and cables shall be selected so as to be suitable for the voltages and currents likely to occur under all conditions which are or shall have been anticipated in the equipment or installation in which they are used.

**4.2.2** Cables shall be constructed, installed, protected, used and maintained so as to prevent danger so far as it is reasonably practical.

**4.2.3** The limiting temperature conditions under which mineral insulated cables and terminations can reasonably be expected to operate safely under normal circumstances are given in Table 1.

These conditions are those which are considered capable of ensuring a reasonable length of life in service. It has been accepted as reasonable by experience and use of the cable and terminations in the particular installations.

**Table 1 – Limiting temperature conditions**

Temperature condition	Limit value
Maximum continuous sheath operating temperature, exposed to touch or in contact with combustible material:	
bare copper sheath	70 °C
covered copper sheath	70 °C
Maximum continuous sheath operating temperature, not exposed to touch, and not in contact with combustible material:	
bare copper sheath and 105 °C seals	105 °C
bare copper sheath and 250 °C seals	250 °C
Maximum conductor temperature under fault conditions, exposed to touch or in contact with combustible material:	
bare or covered sheath	160 °C <sup>a</sup>
Maximum conductor temperature under fault conditions, not exposed to touch, and not in contact with combustible material	
bare copper sheath	250 °C <sup>a</sup>
Minimum installation temperature:	
bare copper sheath	b
covered copper sheath	c
Minimum continuous operating temperature	
bare copper sheath	b
covered copper sheath	c
<sup>a</sup> Seals shall be suitable for this temperature rating up to 5 s. <sup>b</sup> For all practical circumstances, unlimited with respect to cable performance. <sup>c</sup> Seek advice from the manufacturer for the particular covering material.	

**4.2.4** Cables shall be selected so that they are suitable for the operating conditions and equipment classification.

Examples of operating conditions are:

- a) voltage;
- b) overcurrent;
- c) protective measures;
- d) grouping of cables;
- e) method of installation;
- f) accessibility.

**4.2.5** Cables shall be selected so that they are suitable for any external influences which may exist.

Examples of external influences are:

- a) ambient temperature;
- b) presence of rain, steam or accumulation of water;
- c) presence of corrosive, flammable, chemical or polluting substances;

- d) mechanical stresses (such as through holes or sharp edges in metal work);
- e) fauna (such as rodents);
- f) flora (such as mould);
- g) radiation (such as sunlight).

NOTE In respect of item g) it is known that colour is important, a black covering giving a higher degree of protection.

### 4.3 Support and fixing

Cables shall be supported adequately. Recommended maximum values for spacing for surface installations are given in Table 2. For inaccessible positions the weight of the cable between supports shall be taken into account and the advice of the cable manufacturer obtained.

**Table 2 – Recommended fixing distances**

Overall diameter of cable ( <i>D</i> ) (mm)	Maximum spacing of supports	
	Horizontal (m)	Vertical (m)
$D \leq 9$	0,6	0,8
$9 < D \leq 15$	0,9	1,2
$15 < D \leq 20$	1,5	2,0
$D > 20$	2,25	3,0

## 5 Limiting conditions

### 5.1 General

The influences of all factors as outlined in 5.2 to 5.9 shall be considered in combination, rather than separately.

### 5.2 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.

### 5.3 Current carrying capacity

**5.3.1** The cross-sectional area of every conductor shall be such that its current carrying capacity is not less than the maximum sustained current that is required to flow through it in normal use.

For the purposes of this standard, the limiting temperature to which the current carrying capacity is related shall not exceed that appropriate to the maximum cable termination operating temperature, the cable covering material, if any, or any material in contact with the cable.

**5.3.2** The current carrying capacities of cables for fixed wiring meet the requirements of IEC 60364-5-52.

The values given have been determined such that the limiting temperatures given in Table 1 will not be exceeded under particular defined conditions where the cables are continuously loaded.

For current ratings for other installation conditions the cable manufacturer shall be consulted.

**5.3.3** In the case of soft soldered conductor joints or connections the limiting temperature for the conductor under short circuit conditions is 160 °C. This limitation shall be taken into account for selecting and operating cables.

**5.3.4** Defined conditions include the method of installation of the cables used. These conditions shall be taken into account when determining the current carrying capacity of a cable.

Correction factors for quoted current carrying capacities are available for particular conditions such as:

- a) ambient temperature;
- b) cable grouping;
- c) type of overcurrent protection;
- d) presence of thermal insulation.

**5.3.5** If cables are operated for prolonged periods at temperatures above those given in Table 1, the cable terminations, covering or surrounding material may be damaged.

**5.3.6** The selection of the cross-sectional area of any conductor shall not be based on current carrying capacity alone; account shall be taken of the influence of the requirements for:

- a) electric shock;
- b) thermal effects;
- c) overload and short circuit currents;
- d) voltage drop;
- e) mechanical strength.

## **5.4 Thermal effects**

**5.4.1** The limiting temperatures of cables are given in Table 1. These values shall not be exceeded by any combination of the heating effect of the current in the conductors and the ambient conditions. In particular the following conditions shall be taken into account:

- a) Cables in free air shall not be installed in a way that the natural air convection is impeded. When cables are covered or embedded in thermal insulation or when the heat dissipation is impeded by other means, it is essential that the corresponding reduction of the current carrying capacity shall be observed.
- b) The temperature of cable sheaths can be significantly higher than the ambient temperatures, where the cables are subjected to radiation, e.g. solar or infra-red. Where these situations cannot be avoided their effect shall be taken into account in assessing the current carrying capacity or the temperature of the cable relative to the limiting conditions.
- c) The temperatures occurring within equipment, appliances, luminaires and at their terminals shall be taken into account when selecting the types of termination to be used.

**5.4.2** Cables shall be selected, located and installed so that their intended heat dissipation is not inhibited and they do not present a fire hazard to adjacent materials.

**5.4.3** In the event of a fire, cables can contribute to the fire load and propagate fire along their length. This hazard may be eliminated by using bare copper sheathed mineral insulated cable. Where covered mineral cables are used, the amount of combustible material is small and the hazard may be reduced by selecting a covering material with reduced flame propagation characteristics.

Where a particular hazard exists or is likely to exist in the presence of explosive or flammable atmospheres, specific regulations apply. It is essential that the requirements of these regulations shall be taken into account in selecting the current carrying capacity and the type of cable termination to be used.

**5.4.4** When the cable is installed 'not exposed to touch' and the current is such that the cable sheath exceeds 70 °C, the cable shall be bare copper and shall be located or guarded so as to prevent contact of persons or animals and it shall not be in contact with combustible material.

NOTE When installed in such conditions, cables need not be derated when used in groups.

**5.4.5** Cable terminations shall be selected such that they are operated within the temperature limits specified by the manufacturer.

## **5.5 Mechanical stress**

### **5.5.1 General**

In assessing risks of mechanical damage to cables, mechanical strains likely to be imposed during the normal process of installation shall be taken into account.

### **5.5.2 Tension**

The tension applied to a cable shall not exceed 50 N/mm<sup>2</sup> per conductor, subject to a maximum of 1 000 N unless otherwise agreed by the cable manufacturer.

### **5.5.3 Bending**

The internal radius of every bend in a cable shall not cause damage to the cable.

- a) The internal radius of every bend shall not be less than 6 times the cable diameter; this will allow bends to be straightened and repositioned. Bends with a smaller radius may be permitted provided that the bend is a once only bend which is not reworked; such bends shall not be less than 3 times the cable diameter.
- b) Cables which are installed vertically, without intermediate support, which are inaccessible and unlikely to be disturbed, shall be supported at the top of the run such that the internal radius of the resulting bend is not less than 6 times the cable diameter.

### **5.5.4 Compression**

Whilst mineral insulated cables possess significant resistance to compression and deformation, the installation and use of the cable shall not be designed to make use of these characteristics.

## **5.6 Compatibility**

**5.6.1** The possibility of interference between adjacent circuits either mechanical or electrical shall be avoided. The solid copper sheath of mineral insulated cables provides an electrical screen. To maximise the screening effect, brass cable glands shall be used to provide a complete 360° connection to the apparatus.

**5.6.2** The effects of heat dissipating from the cables, or the chemical/physical effect of materials used in their construction, on materials adjacent to which they are installed, for example construction materials, decorative materials, cable enclosures and supports, shall be considered.

**5.6.3** The interaction of adjacent materials with the materials used in the construction of cables shall be taken into account.

**5.6.4** The effects on cables of transient overvoltages, which may be generated during the switching of inductive loads, shall be considered. When such transient voltages are likely to be in excess of the rated voltage, action shall be taken to limit their magnitude.

**5.6.5** IEC 60702-1 and IEC 60702-2 are intended to ensure that cables and terminations are compatible. However, it is recommended that installers confirm compatibility.

## **5.7 Dynamic stresses**

The possibility of damage to cables and their supports due to disruptive effects of the electro-mechanical forces caused by any current which the cables may have to carry in service, including short circuit currents, shall be taken into account.

## **5.8 Flexing**

Cable shall not be installed in situations where it is subjected to repetitive flexing, but may be bent occasionally in use.

## **5.9 Corrosion protection and direct burial**

Covered cables may be buried directly in the ground. Where cables are used in atmospheres corrosive to copper, a suitable outer covering shall be provided as recommended by the manufacturer.

## **6 Installation**

Cable and terminations shall be selected, installed and commissioned by a competent person. The installation shall comply with the requirements given in IEC 60364-1.

Cables shall be arranged correctly to reduce induced current in metal sheath when wiring.

Measures shall be taken to reduce or avoid eddy current loss when cables are through threading board and installed in electrical boxes or electrical cabinets.

Moisture shall be removed when terminations are made. Cables shall not be installed immediately after being cut and measures shall be taken to prevent moisture ingress.

Cables shall be well protected to avoid electric spark burning damage. Copper sheath of cables shall not be used as earthing electrode of electric welding machine.

Checks shall be made on assembling of terminations and joints as well as cable insulation before and after the installation.

## **7 Initial and periodic verification**

Cables shall be inspected periodically and every time it is suspected that a cable has been damaged. If a cable shows visible damage, it shall be electrically tested. If found to be electrically faulty, the cable shall be either repaired, through suitable devices and by skilled persons, or replaced.

Damage to the outer covering is not critical to the continued satisfactory operation of the cable, but may be repaired or tidied up for aesthetic reasons.

## **8 Packaging, storage and handling/transportation**

### **8.1 Packaging**

Cables within the scope of this standard will normally be delivered to the user either on drums, reels, in coils or as cut lengths in non-tangle packaged units. They will normally be labelled to identify the manufacturer, the cable type, size and length.

Terminations within the scope of this standard will normally be delivered to the user in sealed bags or boxes. The boxes or bags will normally contain a complete kit of components sufficient to assemble one or more gland, seal or complete termination.

### **8.2 Storage/transportation**

Cables and terminations shall be stored in such a manner as to prevent any form of damage.

During storage and transportation, measures shall be taken to keep cables and terminations protected against moisture, water ingress or immersion and corrosion. Terminations especially shall be stored in a dry location.

During transportation, measures shall be taken to prevent mechanical damages.

### **8.3 Handling**

If the temperature falls below the minimum recommended installation temperature given in Table 1 care shall be taken to minimise any mechanical stress applied to any covering, in particular bending, impact or shock.

## Bibliography

IEC 60702-1, *Mineral insulated cables and their terminations with a rated voltage not exceeding 750 V – Part 1: Cables*

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

IEC 60364-5-52, *Low-voltage electrical installations – Part 5-52: Selection and erection of electrical equipment – Wiring systems*

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