



BSI Standards Publication

Compression and mechanical connectors for power cables

Part 1-3: Test methods and requirements for compression and mechanical connectors for power cables for rated voltages above 1 kV ($U_m = 1,2$ kV) up to 36 kV ($U_m = 42$ kV) tested on non-insulated conductors

National foreword

This British Standard is the UK implementation of EN IEC 61238-1-3:2019+A11:2019. It is derived from IEC 61238-1-3:2018. Together with BS EN IEC 61238-1-1:2019 and BS EN IEC 61238-1-2:2019, it supersedes BS EN 61238-1:2003, which will be withdrawn on 19 July 2022.

The start and finish of text introduced or altered by amendment is indicated in the text by tags. Tags indicating changes to text carry the number of the CENELEC amendment. For example, text altered by CENELEC amendment A11 is indicated by A11 A11.

The UK participation in its preparation was entrusted to Technical Committee GEL/20/11, Electric Cable accessories.

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

Date	Text affected
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English Version

Compression and mechanical connectors for power cables -
Part 1-3: Test methods and requirements for compression and
mechanical connectors for power cables for rated voltages
above 1 kV ($U_m = 1,2$ kV) up to 36 kV ($U_m = 42$ kV) tested on
non-insulated conductors
(IEC 61238-1-3:2018)

Raccords sertis et à serrage mécanique pour câbles
d'énergie - Partie 1-3: Méthodes et exigences d'essai
relatives aux raccords sertis et à serrage mécanique pour
les câbles d'énergie de tensions assignées supérieures à
1 kV ($U_m = 1,2$ kV) jusqu'à 36 kV ($U_m = 42$ kV) soumis à
essai sur des conducteurs non isolés
(IEC 61238-1-3:2018)

Pressverbinder und Schraubverbinder für Starkstromkabel -
Teil 1-3: Prüfverfahren für und Anforderungen an
Pressverbinder und Schraubverbinder für Starkstromkabel
für Nennspannungen über 1 kV ($U_m = 1,2$ kV) bis zu 36 kV
($U_m = 42$ kV), geprüft an nicht isolierten Leitern
(IEC 61238-1-3:2018)

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European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

European foreword

This document (EN IEC 61238-1-3:2019) consists of the text of IEC 61238-1-3:2018 prepared by IEC/TC 20 "Electric cables".

The following dates are fixed:

- latest date by which this document has to be (dop) 2020-07-19 implemented at national level by publication of an identical national standard or by endorsement
- latest date by which the national standards (dow) 2022-07-19 conflicting with this document have to be withdrawn

This document partially supersedes EN 61238-1:2003 and all of its amendments and corrigenda (if any).

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Endorsement notice

The text of the International Standard IEC 61238-1-3:2018 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 61238-1	NOTE Harmonized as EN 61238-1.
IEC 61238-1-1	NOTE Harmonized as EN IEC 61238-1-1.
IEC 61238-1-2	NOTE Harmonized as EN IEC 61238-1-2.
IEC 62475:2010	NOTE Harmonized as EN 62475:2010 (not modified).

Foreword to amendment A11

This document (EN IEC 61238-1-3:2019/A11:2019) has been prepared by CLC/TC 20 "Electric cables".

The following dates are fixed:

- latest date by which this document has to be (dop) 2020-07-19
implemented at national level by publication of
an identical national standard or by
endorsement
- latest date by which the national standards (dow) 2022-07-19
conflicting with this document have to be
withdrawn

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

Annex ZA

(normative)

Normative references to international publications with their corresponding European publications

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.

NOTE 1 Where 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.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60050-461	-	International Electrotechnical Vocabulary -- Part 461: Electric cables		-
IEC 60228	-	Conductors of insulated cables	EN 60228	-
IEC 60493-1	-	Guide for the statistical analysis of ageing-test data - Part 1: Methods based on mean values of normally distributed test results		-
IEC 60949 + A1	1988 2008	Calculation of thermally permissible short-circuit currents, taking into account non-adiabatic heating effects		-

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**COMPRESSION AND MECHANICAL
CONNECTORS FOR POWER CABLES –****Part 1-3: Test methods and requirements for compression and mechanical
connectors for power cables for rated voltages above 1 kV ($U_m = 1,2$ kV)
up to $\boxed{A_{11}}$ 36 $\boxed{A_{11}}$ kV ($U_m = \boxed{A_{11}}$ 42 $\boxed{A_{11}}$ kV) tested on non-insulated conductors**

FOREWORD

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International Standard IEC 61238-1-3 has been prepared by IEC technical committee 20: Electric cables.

This first edition, together with IEC 61238-1-1 and IEC 61238-1-2, cancels and replaces IEC 61238-1:2003.

This edition includes the following significant technical changes with respect to IEC 61238-1:2003:

- a) The scope has been widened to cover connectors for conductors from 10 mm² down to 2,5 mm² and has been limited to 1 200 mm² for connectors for copper and aluminium conductors because test experience and applications are rare for conductors of larger cross-sectional areas.

- b) A new mechanical class has been introduced to satisfy the demand for connectors subjected to higher mechanical forces than those specified in Class 1 for conductors of larger cross-sectional areas.
- c) For the electrical test, a maximum elevated heating current has been set in order to avoid unrealistic current densities during the test which may change the properties of tested connectors.
- d) For the short-circuit test, the method of calculation and requirements have been updated.
- e) For the mechanical test, the methods and requirements have been updated.
- f) A proposal for an electrical test on cable terminal lugs for application in separable connectors has been introduced.

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

FDIS	Report on voting
20/1790/FDIS	20/1805/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 61238 series, published under the general title *Compression and mechanical connectors for power cables*, 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.

INTRODUCTION

The IEC 61238 series has been divided into the following parts:

- Part 1-1: Test methods and requirements for compression and mechanical connectors for power cables for rated voltages up to 1 kV ($U_m = 1,2$ kV) tested on non-insulated conductors
- Part 1-2: Test methods and requirements for insulation piercing connectors for power cables for rated voltages up to 1 kV ($U_m = 1,2$ kV) tested on insulated conductors
- Part 1-3: Test methods and requirements for compression and mechanical connectors for power cables for rated voltages above 1 kV ($U_m = 1,2$ kV) up to 30 kV ($U_m = 36$ kV) tested on non-insulated conductors

A11 EN IEC 61238-1-3:2019 and its A11:2019 (adopting and modifying IEC 61238-1-3:2018-05), deals with type tests for compression and mechanical connectors for use on copper or aluminium conductors of power cables for rated voltages above 1 kV ($U_m = 1,2$ kV) up to 36 kV ($U_m = 42$ kV). **A11**

When a design of connector meets the requirements of this document, then it is expected that in service:

- a) the resistance of the connection will remain stable within specified limits;
- b) the temperature of the connector will be of the same order or less than that of the conductor during current heating;
- c) if the intended use demands it, application of short-circuit currents will not affect a) and b);
- d) independently from the electrical performance, conforming axial tensile strength will ensure an acceptable mechanical performance for the connections to the cable conductors.

It should be stressed that, although the object of the electrical and mechanical tests specified in this document is to prove the suitability of connectors for most operating conditions, they do not necessarily apply to situations where a connector may be raised to a high temperature by virtue of connection to a highly rated plant, to corrosive conditions, or where the connector is subjected to external mechanical stresses such as excessive vibration, shock and large displacement after installation. In these instances, the tests in this document may need to be supplemented by special tests agreed between supplier and purchaser.

This document does not invalidate existing approvals of products achieved on the basis of national standards and specifications and/or the demonstration of satisfactory service performance. However, products approved according to such national standards or specifications cannot directly claim approval to this document.

Once successfully completed, these tests are not repeated unless changes are made in material, manufacturing process and design which might adversely change the connector performance characteristics.

COMPRESSION AND MECHANICAL CONNECTORS FOR POWER CABLES –

Part 1-3: Test methods and requirements for compression and mechanical connectors for power cables for rated voltages above 1 kV ($U_m = 1,2$ kV) up to $\overline{A_{11}}$ 36 $\overline{A_{11}}$ kV ($U_m = \overline{A_{11}}$ 42 $\overline{A_{11}}$ kV) tested on non-insulated conductors

1 Scope

This part of IEC 61238 applies to compression and mechanical connectors for power cables for rated voltages above 1 kV ($U_m = 1,2$ kV) up to $\overline{A_{11}}$ 36 $\overline{A_{11}}$ kV ($U_m = \overline{A_{11}}$ 42 $\overline{A_{11}}$ kV), for example buried cables or cables installed in buildings, having

- a) conductors complying with IEC 60228 having nominal cross-sectional areas between 2,5 mm² and 1 200 mm² for copper and between 16 mm² and 1 200 mm² for aluminium, excluding Milliken conductors;
- b) a maximum continuous conductor temperature not exceeding 90 °C.

This document is not applicable to connectors for overhead line conductors nor to connectors with a sliding contact.

The object of this document is to define the type test methods and requirements which apply to compression and mechanical connectors for power cables with copper or aluminium conductors. The reference method is to perform the tests on unused conductors.

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 60050-461, *International Electrotechnical Vocabulary – Part 461: Electric cables* (available at <http://www.electropedia.org>)

IEC 60228, *Conductors of insulated cables*

IEC 60493-1, *Guide for the statistical analysis of ageing test data – Part 1: Methods based on mean values of normally distributed test results*

IEC 60949:1988, *Calculation of thermally permissible short-circuit currents, taking into account non-adiabatic heating effects*
IEC 60949:1988/AMD1:2008

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-461 and the following 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

connector

<of cables> device for connecting a conductor to an equipment terminal or for connecting two or more conductors to each other

[SOURCE: IEC 60050-461:2008, 461-17-03, modified – the definition has been revised.]

3.2

through connector

device for connecting two consecutive lengths of conductor together

[SOURCE: IEC 60050-461:2008, 461-17-04, modified – the term "joint ferrule" has been deleted and the definition revised.]

3.3

branch connector

device for connecting a branch conductor to a main conductor at an intermediate point on the latter

[SOURCE: IEC 60050-461:2008, 461-17-05, modified – the term "branch ferrule" has been deleted and in the definition "metallic" has been deleted.]

3.4

termination

device fitted to the end of a cable conductor to ensure electrical connection with other parts of the system

[SOURCE: IEC 60050-461:2008, 461-10-01, modified – "conductor" has been added and "and to maintain insulation up to the point of connection" has been deleted.]

3.5

terminal lug

device to connect a cable conductor to other electrical equipment

[SOURCE: IEC 60050-461:2008, 461-17-01, modified – "metallic" has been deleted.]

3.6

palm

<of terminal lug> part of a terminal lug used to make the connection to electrical equipment

[SOURCE: IEC 60050-461:2008, 461-17-07]

3.7

barrel

<of terminal lug, of connector> part of a device into which the conductor to be connected is introduced

[SOURCE: IEC 60050-461:2008, 461-17-06]

3.8

reference conductor

length of unjointed bare conductor or conductor with the insulation removed, which is included in the test loop and which enables the reference temperature and reference resistance to be determined

3.9

equalizer

arrangement used in the test loop to ensure a point of equipotential and uniform current distribution in a stranded conductor

3.10

compression jointing

method of securing a connector to a conductor by using a special tool to produce permanent deformation of the connector and the conductor

3.11

mechanical jointing

method of securing a connector to a conductor, for example by means of a bolt or screw acting on the latter or by alternative methods

3.12

median connector

connector which during the first heat cycle records the third highest temperature of the six connectors in the test loop

3.13

conductor

<of a cable> part of a cable which has the specific function of carrying current

[SOURCE: IEC 60050-461:2008, 461-01-01]

3.14

family of connectors

group of connectors of a manufacturer to be considered of the same design criteria, the same material characteristic and the same installation procedure

4 Symbols

A	nominal cross-sectional area of the conductor
D	change in the resistance factor of the connector
I	direct current flowing through a connection during resistance measurement
I_{RMS}	equivalent RMS short-circuit current
I_{N}	alternating current necessary to maintain the reference conductor at its equilibrium temperature
I_{r}	direct current flowing through the reference conductor/conductors during resistance measurement
k	connector resistance factor: ratio of the resistance of a connector to that of the resistance of the equivalent length of the reference conductor
k_0	initial connector resistance factor: ratio of the resistance of a connector to that of the resistance of the equivalent length of the reference conductor at cycle no. 0
$l_{\text{a}}, l_{\text{b}}, l_{\text{j}}$	lengths of each connector assembly associated with the measurement positions in the test set-up after installation
l_{r}	length of the reference conductor between measurement positions
R	measured resistance value of connector/conductor installation under an electrical test corrected to 20 °C
R_{r}	measured resistance value of the reference conductor corrected to 20 °C
R_{j}	length related calculated resistance value of a connector under an electrical test corrected to 20 °C