

Connecting devices — Electrical copper conductors — Safety requirements for screw-type and screwless-type clamping units —

**Part 1: General requirements and
particular requirements for clamping
units for conductors from 0,2 mm² up to
35 mm² (included)**

The European Standard EN 60999-1:2000 has the status of a
British Standard

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National foreword

This British Standard is the official English language version of EN 60999-1:2000. It is identical with IEC 60999-1:1999. It supersedes BS EN 60999:1993 which is withdrawn.

The UK participation in its preparation was entrusted by Technical Committee PEL/23, Installed electrical accessories, to Subcommittee PEL/23/2, Connecting devices, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
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Summary of pages

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Part 1: General requirements and particular requirements for clamping
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(IEC 60999-1:1999)

Dispositifs de connexion - Conducteurs
électriques en cuivre - Prescriptions de
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et sans vis
Partie 1: Prescriptions générales et
particulières pour les organes de
serrage pour les conducteurs de
0,2 mm² à 35 mm² (inclus)
(CEI 60999-1:1999)

Verbindungsmaterial - Elektrische
Kupferleiter - Sicherheitsanforderungen
für schraub- und schraubenlose
Klemmstellen
Teil 1: Allgemeine Anforderungen und
besondere Anforderungen für
Klemmstellen für Leiter von 0,2 mm² bis
einschließlich 35 mm²
(IEC 60999-1:1999)

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European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
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Foreword

The text of document 23F/108/FDIS, future edition 2 of IEC 60999-1, prepared by SC 23F, Connecting devices, of IEC TC 23, Electrical accessories, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60999-1 on 2000-01-01.

This European Standard supersedes EN 60999-1:1993 and its corrigendum March 1997.

The following dates were fixed:

- latest date by which the EN has to be implemented
at national level by publication of an identical
national standard or by endorsement (dop) 2000-10-01
- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2003-01-01

Annexes designated "normative" are part of the body of the standard.
Annexes designated "informative" are given for information only.
In this standard, annexes B, C and ZA are normative and annex A is informative.
Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60999-1:1999 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 60998-2-3 NOTE: Harmonized as EN 60998-2-3:1993 (not modified).

IEC 60998-2-4 NOTE: Harmonized as EN 60998-2-4:1993 (not modified).

IEC 61210 NOTE: Harmonized as EN 61210:1995 (modified).

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**CONNECTING DEVICES –
ELECTRICAL COPPER CONDUCTORS –
SAFETY REQUIREMENTS FOR SCREW-TYPE AND
SCREWLESS-TYPE CLAMPING UNITS –**

**Part 1: General requirements and particular requirements for clamping
units for conductors from 0,2 mm² up to 35 mm² (included)**

1 Scope

This part of IEC 60999 applies to screw-type and screwless-type clamping units for connecting devices, either as separate entities or as integral parts of equipment, for the connection of electrical copper conductors (complying with IEC 60228), rigid (solid or stranded) and/or flexible, having a cross-sectional area of 0,2 mm² up to and including 35 mm² and equivalent AWG sizes with a rated voltage not exceeding 1 000 V a.c. with a frequency up to and including 1 000 Hz, and 1 500 V d.c.

It applies to clamping units primarily suitable for connecting unprepared conductors.

This standard does not apply to clamping units

- a) for connection by crimping or soldering;
- b) for data and signalling circuits;
- c) for flat quick-connect terminations, insulation-piercing connecting devices and twist-on connecting devices, which are covered by IEC 61210 [3]¹⁾, IEC 60998-2-3 [1] and IEC 60998-2-4 [2] respectively.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 60999. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of IEC 60999 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 60228:1978, *Conductors of insulated cables*

IEC 60228A:1982, *Conductors of insulated cables – First supplement*

IEC 60344:1980, *Guide to the calculation of resistance of plain and coated copper conductors of low-frequency cables and wires*

IEC 61545:1996, *Connecting devices – Devices for the connection of aluminium conductors in clamping units of any material and copper conductors in aluminium bodied clamping units*

¹⁾ Figures in square brackets refer to the bibliography.

ISO/DIS 1456:—, *Metallic coatings – Electrodeposited coatings of nickel plus chromium and of copper plus nickel plus chromium* ²⁾

ISO 2081:1986, *Metallic coatings – Electroplated coatings of zinc on iron or steel*

ISO 2093:1986, *Electroplated coatings of tin – Specification and test methods*

3 Definitions

For the purpose of this part of IEC 60999, the following definitions apply.

3.1

clamping unit

the part(s) of the terminal necessary for the mechanical clamping and the electrical connection of the conductor(s), including the parts which are necessary to ensure the correct contact pressure

3.2

terminal

the conductive part of one pole, composed of one or more clamping unit(s) and insulation if necessary

3.3

connecting device

a device for the electrical connection of one (or more) conductor(s), comprising one (or more) terminal(s), either fixed to a base or forming an integral part of the equipment

3.4

screw-type clamping unit

a clamping unit for the connection and subsequent disconnection of one conductor or the interconnection and subsequent disconnection of two or more conductors, the connection being made, directly or indirectly, by means of screws or nuts of any kind

3.5

pillar clamping unit

a screw-type clamping unit in which the conductor is inserted into a hole or cavity, where it is clamped under the shank of a screw or screws. The clamping pressure may be applied directly by the shank of the screw or through an intermediate part to which pressure is applied by the shank of the screw

NOTE Examples of pillar clamping units are shown in figure 2.

3.6

screw clamping unit

a screw-type clamping unit in which the conductor is clamped under the head of a screw. The clamping pressure may be applied directly by the head of the screw or through an intermediate part such as a washer, clamping plate or anti-spread device

NOTE Examples of screw clamping units are shown in figure 3.

²⁾ To be published.

3.7

stud clamping unit

a screw-type clamping unit in which the conductor is clamped under a nut. The clamping pressure may be applied directly by a suitably shaped nut or through an intermediate part such as a washer, clamping plate or anti-spread device

NOTE Examples of stud clamping units are shown in figure 3.

3.8

saddle clamping unit

a screw-type clamping unit in which the conductor is clamped under a saddle by means of two or more screws or nuts

NOTE Examples of saddle clamping units are shown in figure 4.

3.9

mantle clamping unit

a screw-type clamping unit in which the conductor is clamped against the base of a slot in a threaded stud by means of a nut, by a suitably shaped washer under the nut, by a central peg if the nut is a cap nut, or by an equally effective means for transmitting the pressure from the nut to the conductor within the slot

NOTE Examples of mantle clamping units are shown in figure 5.

3.10

screwless-type clamping unit

a clamping unit for the connection and subsequent disconnection of one conductor or the interconnection and subsequent disconnection of two or more conductors, the connection being made, directly or indirectly, by means other than screws

3.10.1 universal clamping unit
(for all types of conductors)

3.10.2 non-universal clamping unit
(for certain types of conductors only)

For example:

- push-wire clamping unit (for solid conductors only);
- push-wire clamping unit (for rigid (solid and stranded) conductors only).

NOTE Examples of screwless-type clamping units are shown in figure 6.

3.11

rated connecting capacity of a clamping unit

a value of connectable conductor cross-sectional area stated by the manufacturer and to which certain thermal, mechanical and electrical requirements are referred

3.12

ambient temperature

the temperature of the air surrounding the clamping unit together with its enclosure, if any

3.13

temperature rise

the difference between the temperature of the part under test, together with its enclosure, if any, measured under load according to the test specification and the ambient temperature

3.14

unprepared conductor

a conductor which has been cut and the insulation of which has been removed for insertion into a clamping unit

NOTE A conductor the shape of which is arranged for introduction into a clamping unit or the strands of which are twisted to consolidate the end, is considered to be an unprepared conductor.

3.15

prepared conductor

a conductor the stripped end of which is fitted with an eyelet, a terminal end, a cable lug, etc.

4 General

Clamping units shall be so designed and constructed that, in normal use, their performance is reliable and without danger to the user or the surroundings.

Compliance is checked by carrying out all the tests specified.

5 General notes on tests

5.1 *Tests according to this standard are intended to be type tests. They are carried out as tests of the product standard which shall be specified by the relevant technical committee.*

5.2 *Unless otherwise specified, the specimens are tested in the condition in which they are delivered and installed as in normal use. Tests are made at an ambient temperature of (20 ± 5) °C.*

5.3 *The tests of clause 9 are carried out in the order of the subclauses.*

5.4 *Unless otherwise stated, three specimens are submitted to all the tests and the requirements are satisfied if all the tests are met. If only one of the specimens does not satisfy a test due to an assembly or manufacturing fault, that test and any preceding ones which may have influenced the results of the test shall be repeated and also the tests which follow shall be made in the required sequence on another full set of specimens, all of which shall comply with the requirements.*

NOTE The applicant may submit, together with the number of specimens specified in 5.4, the additional set of specimens which may be wanted, should one specimen fail. The testing station will then, without further request, test additional specimens and will reject only if a further failure occurs. If the additional set of specimens is not submitted at the same time, the failure of one specimen will entail rejection.

6 Main characteristics

The standard rated connecting capacities of a clamping unit are:

0,2 mm², 0,34 mm², 0,5 mm², 0,75 mm², 1 mm², 1,5 mm², 2,5 mm², 4 mm², 6 mm², 10 mm², 16 mm², 25 mm², and 35 mm².

NOTE For the time being, in some countries, the designation by wire gauges (e.g. AWG in USA and Canada) may be used instead of the cross-sectional areas expressed in square millimetres. For the approximate relationship between square millimetres and AWG, see annex A.

7 Connection of conductors

7.1 In general, clamping units are suitable to accept one conductor only. Certain types may also be used for two or more conductors of the same or of different nominal cross-sectional areas or compositions.

Clamping units shall accept unprepared conductors.

NOTE Screw-type clamping units are not suitable for the connection of flexible conductors with soldered ends.

7.2 Each clamping unit, if not stated otherwise in the relevant product standard, shall, in addition to its rated connecting capacity, accept at least the two successive smaller cross-sectional areas (e.g. a clamping unit having the rated connecting capacity of 1 mm² shall clamp reliably a conductor of the same type of 0,5 mm², 0,75 mm² and 1 mm²).

7.3 The theoretical diameter of the largest conductor and the relationship between the rated connecting capacity and connectable conductors are given in table 1.

Table 1 – Relationship between rated connecting capacity and diameter of conductors

Rated connecting capacity	Theoretical diameter of the largest conductor							Connectable conductor	
	Metric			AWG				Rigid	Flexible
	Rigid		Flexible	Rigid		Flexible			
					b)	b)	c)		
	Solid	Stranded			Solid	Class B Stranded	Classes I, K, M Stranded		
mm ²	mm	mm	mm	Gauge	mm	mm	mm		
0,2	0,51	0,53	0,61	24	0,54	0,61	0,64		
0,34	0,63	0,66	0,8	22	0,68	0,71	0,80		
0,5	0,9	1,1	1,1	20	0,85	0,97	1,02		
0,75	1,0	1,2	1,3	18	1,07	1,23	1,28		
1,0	1,2	1,4	1,5	–	–	–	–		
1,5	1,5	1,7	1,8	16	1,35	1,55	1,60		
2,5	1,9	2,2	2,3 ^{a)}	14	1,71	1,95	2,08		
4,0	2,4	2,7	2,9 ^{a)}	12	2,15	2,45	2,70		
6,0	2,9	3,3	3,9 ^{a)}	10	2,72	3,09	3,36		
10,0	3,7	4,2	5,1	8	3,43	3,89	4,32		
16,0	4,6	5,3	6,3	6	4,32	4,91	5,73		
25,0	–	6,6	7,8	4	5,45	6,18	7,26		
35	–	7,9	9,2	2	6,87	7,78	9,02		
NOTE Diameters of the largest rigid and flexible conductors are based on table 1 of IEC 60228A and on IEC 60344 and, for AWG conductors, on ASTM B172-71 [4], ICEA Publication S-19-81 [5], ICEA Publication S-66-524 [6] and ICEA Publication S-66-516 [7].									
a) Dimensions for class 5 flexible conductors only, according to IEC 60228A.									
b) Nominal diameter +5 %.									
c) Largest diameter for any of the three classes I, K, M +5 %.									