

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

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British Standard

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National foreword

This British Standard has been prepared under the direction of the Power Electrical Engineering Standards Policy Committee and is the English language version of EN 60999:1993 *Connecting devices. Safety requirements for screw-type and screwless-type clamping units for electrical copper conductors*, published by the European Committee for Electrotechnical Standardization (CENELEC). It was derived by CENELEC from IEC 999:1990 published by the International Electrotechnical Commission (IEC).

The CENELEC common modifications have been implemented at the appropriate places in the text and are indicated by a side line in the margin. Parts of the original IEC text that have been modified by CENELEC have been quoted in National annex NA.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the EN title page, pages 2 to 22, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

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Descriptors: Low voltage equipment, home electrical installations, connecting equipment, screwless type clamping units, screw-type clamping units, characteristics, tests

English version

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

(IEC 999:1990, modified)

Dispositifs de connexion
Prescriptions de sécurité pour organes de
serrage à vis et sans vis pour conducteurs
électriques en cuivre
(CEI 999:1990, modifiée)

Verbindungsmaterial
Sicherheitsanforderungen für
Schraubklemmstellen und schraublose
Klemmstellen für elektrische Kupferleiter
(IEC 999:1990, modifiziert)

This European Standard was approved by CENELEC on 9 March 1993. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

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

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Foreword

The CENELEC questionnaire procedure, performed for finding out whether or not the International Standard IEC 999:1990 could be accepted without textual changes, has shown that some common modifications were necessary for the acceptance as a European Standard.

The reference document, together with the common modifications prepared by the CENELEC Reporting Secretariat SR 23F, was submitted to the CENELEC members for formal vote in August 1992.

The text of the draft was approved by CENELEC on 9 March 1993. The following dates were fixed:

- latest date of publication of an identical national standard (dop) 1994-03-01
- latest date of withdrawal of conflicting standards (dow) 1994-03-01

For products which have complied with the relevant national standard before 1994-03-01 as shown by the manufacturer or by a certification body, this previous standard may continue to apply for production until 1999-03-01.

Appendices and CENELEC annexes designated “normative” are part of the body of the standard. In this standard, Appendix B and Appendix C and Annex ZA are normative. Where reference is made to other international or harmonized standards, the edition of that standard quoted in Annex ZA is applicable.

NOTE In this document, the following print types are used:

- requirements proper: in roman type;
- *test specifications: in italic type;*
- explanatory matter: in smaller roman type.

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1 Scope

This standard 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 HD 383), rigid (solid or stranded) and/or flexible, having a cross-sectional area of 0.5 mm^2 up to and including 35 mm^2 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, for which separate parts are under consideration.
- d) designed to receive prepared conductors (soldering, eyelet, lug etc.) nor to terminals designed to be assembled together with apparatus being subjected to strong vibrations.

2 Definitions

2.1 Clamping unit denotes 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.

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

2.3 Connecting device denotes 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.

2.4 Screw-type clamping unit denotes 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.

2.5 Pillar clamping unit denotes 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.

Examples of pillar clamping units are given in Figure 2.

2.6 Screw clamping unit denotes 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.

Examples of screw clamping units are given in Figure 3.

2.7 Stud clamping unit denotes 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.

Examples of stud clamping units are given in Figure 3.

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

Examples of saddle clamping units are given in Figure 4.

2.9 Mantle clamping unit denotes 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.

Examples of mantle clamping units are given in Figure 5.

2.10 Screwless-type clamping unit denotes 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.

2.10.1 Universal clamping unit (for all types of conductors).

2.10.2 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).

Examples of screwless-type clamping units are given in Figure 6.

2.11 Rated connecting capacity denotes the cross-sectional area of the largest rigid conductor that can be connected, as stated by the manufacturer of the clamping unit.

- 2.12 Ambient temperature** denotes the temperature of the air surrounding the clamping unit together with its enclosure, if any.
- 2.13 Temperature rise** denotes 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.
- 2.14 Unprepared conductor** denotes a conductor which has been cut and the insulation of which has been removed for insertion into a clamping unit.
- 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.
- 2.15 Prepared conductor** denotes a conductor the stripped end of which is fitted with an eyelet, a terminal end, a cable lug, etc.

3 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.

4 General notes on tests

- 4.1** Tests according to this standard are intended to be type tests. They are carried out as tests of the product standard to be specified by the relevant Technical Committee.
- 4.2** 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 $(20 \pm 5)^\circ\text{C}$.
- 4.3** The tests of Clause 8 are carried out in the order of the sub-clauses.
- 4.4** Unless otherwise specified, a set consisting of a minimum of three specimens is subjected to all the tests.
- 4.5** Clamping units are deemed not to comply with this standard if more than one sample fails one of the tests. If one sample fails in a test, that test and the preceding ones which may have influenced the results of that test are repeated on another set of three samples, all of which shall then comply with the repeated tests.
- 4.6** A supplementary set of three samples, which may be necessary for the repetition of a test, may be supplied at the same time as the first set.

Sub-clauses 4.5 and 4.6 are under revision by Technical Committee No. 23 as the present text is unacceptable to some countries.

5 Main characteristics

The standard rated connecting capacities of a clamping unit are: 0.5 mm^2 , 0.75 mm^2 , 1 mm^2 , 1.5 mm^2 , 2.5 mm^2 , 4 mm^2 , 6 mm^2 , 10 mm^2 , 16 mm^2 , 25 mm^2 , and 35 mm^2 .

6 Connection of conductors

- 6.1** 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.
- 6.2** Each clamping unit, if not otherwise stated 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 mm^2 shall clamp reliably a conductor of the same type of 0.5 mm^2 , 0.75 mm^2 or 1 mm^2).
- 6.3** The relationship between the rated connecting capacity of clamping units and connectable conductors as well as data on the diameters of conductors are given in Table I.

Table I — Rated connecting capacity and connectable conductors

Rated connecting capacity	Connectable conductors and their theoretical diameters				
	Metric				
	Rigid			Flexible	
		solid	stranded		
mm^2	mm^2	$\varnothing\text{mm}$	$\varnothing\text{mm}$	mm^2	$\varnothing\text{mm}$
0.5	0.5	0.9	1.1	0.5	1.1
0.75	0.75	1.0	1.2	0.75	1.3
1.0	1.0	1.2	1.4	1.0	1.5
1.5	1.5	1.5	1.7	1.5	1.8
2.5	2.5	1.9	2.2	2.5	2.3 ^a
4.0	4.0	2.4	2.7	4.0	2.9 ^a
6.0	6.0	2.9	3.3	4.0	2.9 ^a
10.0	10.0	3.7	4.2	6.0	3.9
16.0	16.0	4.6	5.3	10.0	5.1
25.0	25.0	—	6.6	16.0	6.3
35.0	35.0	—	7.9	25.0	7.8

^a Dimensions for Class 5 flexible conductors only, according to HD 383.

Diameters of the largest rigid and flexible conductors are based on Table I of IEC Publication 228A.

- 6.4** Screw-type clamping units, unless otherwise specified by the manufacturer, shall accept rigid and flexible conductors as indicated in Table I, in which case no markings are necessary.

If a screw-type clamping unit according to the manufacturer's specification can accept only one type of conductor (e.g. rigid or flexible), this shall be either clearly marked on the end product, for connecting purposes, by the letter "r" or "f", or indicated on the smallest package unit or in technical information and/or catalogues.

Compliance is checked by inspection and by the tests of Sub-clauses 8.1 and 8.6.

6.5 Screwless-type clamping units, unless otherwise specified by the manufacturer, shall accept rigid and flexible conductors as indicated in Table I, in which case no markings are necessary.

If a screwless-type clamping unit according to the manufacturer's specification can accept only solid conductors, this shall be either clearly marked on the end product, for connecting purposes, by the letter "s" or "sol", or indicated on the smallest package unit or in technical information and/or catalogues.

If a screwless-type clamping unit according to the manufacturer's specification can accept only rigid (solid and stranded) conductors, this shall be either clearly marked on the end product, for connecting purposes, by the letter "r", or indicated on the smallest package unit or in technical information and/or catalogues.

See Sub-clause 2.10.

Compliance is checked by inspection and by the test of Sub-clause 8.1.

6.6 On screwless-type clamping units, the connection or disconnection of conductors shall be made as follows:

- on universal clamping units by the use of a general purpose tool or a convenient device, integral with the clamping unit to open it for the insertion or withdrawal of the conductors;
- on push-wire clamping units by simple insertion. For the disconnection of the conductors an operation other than a pull on the conductor shall be necessary.

The use of a general purpose tool or of a convenient device, integral with the clamping unit is allowed in order to "open" it and to assist the insertion or the withdrawal of the conductor.

Compliance is checked by inspection and by the test of Sub-clause 8.3.

7 Constructional requirements

7.1 Parts of terminals mainly intended for carrying current, shall be of:

- copper, or

- an alloy containing at least 58 % copper for parts that are worked cold or at least 50 % copper for other parts, or

- other metal with surface protection offering a resistance to corrosion not less than that of copper and having mechanical properties at least equivalent.

Compliance is checked by inspection and by the relevant test specified in the relevant product standard (the test of HD 323 is recommended).

7.2 Clamping units shall be so designed and constructed that contact pressure shall not be transmitted via insulating material other than ceramic or pure mica, unless there is sufficient resiliency in the metallic parts to compensate for any possible shrinkage or yielding of the insulating material.

The possibility of using material other than metal as compensation for any possible deformation, for example shrinkage, is under consideration.

Compliance is checked by tests under consideration, such as a test for the efficiency of resiliency.

7.3 Earthing clamping units shall be such that there is no risk of corrosion resulting from contact between these parts and the copper of the earthing conductor, or any other metal that is in contact with these parts.

The body of the earthing clamping unit shall be of brass or other metal no less resistant to corrosion, unless it is a part of the metal frame or enclosure; in this case the screw or nut shall be of brass or another metal no less resistant to corrosion.

If the body of the earthing clamping unit is a part of a frame or enclosure of aluminium or an aluminium alloy, precautions shall be taken to avoid the risk of corrosion resulting from contact between copper and aluminium or its alloys.

Precautions shall be taken to ensure that the surface of the metal frame or enclosure is clean when the conductor is clamped against it.

Compliance is checked by inspection.

Plated steel withstanding the corrosion test is considered as a metal no less resistant to corrosion than brass.

A test for checking the resistance to corrosion is under consideration.

7.4 Screws and nuts for clamping the conductor shall not serve to fix any other component, although they may hold the clamping unit in place or prevent it from turning.

Compliance is checked by inspection.

Screws shall not be of metal which is soft or liable to creep, such as zinc or aluminium.