

Connectors — Safety requirements and tests

The European Standard EN 61984:2001 has the status of a British Standard

ICS 31.220.10

National foreword

This British Standard is the official English language version of EN 61984:2001. It is identical with IEC 61984:2001

The UK participation in its preparation was entrusted by Technical Committee EPL/48, Electrotechnical components for electronic equipment, to Subcommittee EPL/48/2, Connectors for electronic equipment, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

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(IEC 61984:2001)**

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Prescriptions de sécurité et essais
(CEI 61984:2001)

Steckverbinder -
Sicherheitsanforderungen und Prüfungen
(IEC 61984:2001)

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European Committee for Electrotechnical Standardization
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Foreword

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- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2004-10-01

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

Endorsement notice

The text of the International Standard IEC 61984:2001 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 60068-2-20:1979 + A2:1987	NOTE Harmonized as HD 323.2.20 S3:1988 (not modified).
IEC 60417-1:1998	NOTE Harmonized as EN 60417-1:1999 (not modified).
IEC 60423:1993	NOTE Harmonized as EN 60423:1994 (modified).
IEC 60512-11-1:1995	NOTE Harmonized as EN 60512-11-1:1999 (not modified).

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CONNECTORS – SAFETY REQUIREMENTS AND TESTS

1 Scope

This International Standard applies to connectors with rated voltages above 50 V and up to 1 000 V and rated currents up to 125 A per contact, for which either no detail specification (DS) exists or the DS calls up this standard for safety aspects.

For connectors with rated voltages up to 50 V, this standard may be used as a guide. In this case, reference is made to IEC 60664-1 for clearances and creepage distances.

This standard does not apply to connectors in or on equipment where the applicable safety standard for the equipment includes comprehensive safety requirements for those connectors.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard 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 60050(581):1978, *International Electrotechnical Vocabulary (IEV) – Chapter 581: Electromechanical components for electronic equipment*

IEC 60050(826):1982, *International Electrotechnical Vocabulary (IEV) – Chapter 826: Electrical installations of buildings*

IEC 60060-1:1989, *High-voltage test techniques – Part 1: General definitions and test requirements*

IEC 60068-1:1988, *Environmental testing – Part 1: General and guidance*

IEC 60068-2-70:1995, *Environmental testing – Part 2: Tests – Test Xb: Abrasion of marking and letterings caused by rubbing of fingers and hands*

IEC 60112:1979, *Method for determining the comparative and proof tracking indices of solid insulating materials under moist conditions*

IEC 60309-1:1999, *Plugs, socket-outlets and couplers for industrial purposes – Part 1: General requirements*

IEC 60352-1, *Solderless connections – Part 1: Wrapped connections – General requirements, test methods and practical guidance*

IEC 60352-2, *Solderless connections – Part 2: Solderless crimped connections – General requirements, test methods and practical guidance*

IEC 60352-3, *Solderless connections – Part 3: Solderless accessible insulation displacement connections – General requirements, test methods and practical guidance*

IEC 60352-4, *Solderless connections – Part 4: Solderless non-accessible insulation displacement connections – General requirements, test methods and practical guidance*

IEC 60352-5, *Solderless connections – Part 5: Solderless press-in connections – General requirements, test methods and practical guidance*

IEC 60364-4-41:1992, *Electrical installations of buildings – Part 4: Protection for safety – Chapter 41: Protection against electric shock*

IEC 60364-5-54:1980, *Electrical installations of buildings. Part 5: Selection and erection of electrical equipment. Chapter 54: Earthing arrangements and protective conductors*

IEC 60417-2:1998, *Graphical symbols for use on equipment – Part 2: Symbol originals*

IEC 60512 (all parts), *Electromechanical components for electronic equipment* ¹⁾

IEC 60512-1, *Electromechanical components for electronic equipment – Basic testing procedures and measuring methods – Part 1: General*

IEC 60512-11-7:1996, *Electromechanical components for electronic equipment – Basic testing procedures and measuring methods – Part 11: Climatic tests – Section 7: Test 11g: Flowing mixed gas corrosion test*

IEC 60529:1989, *Degrees of protection provided by enclosures (IP Code)*

IEC 60664-1:1992, *Insulation coordination for equipment within low voltage systems – Part 1: Principles, requirements and tests*
Amendment 1 (2000)

IEC 60760:1989, *Flat, quick-connect terminations*

IEC 60884-1:1994, *Plugs and socket-outlets for household and similar purposes – Part 1: General requirements*

IEC 60999-1:1999, *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*

IEC 60999-2:1995, *Connecting devices – Safety requirements for screw-type and screwless-type clamping units for electrical copper conductors – Part 2: Particular requirements for conductors from 35 mm² up to 300 mm²*

IEC 61140:1997, *Protection against electric shock – Common aspects for installation and equipment*

¹⁾ IEC 60512-1-100 gives the list of tests of the IEC 60512 series and the part of IEC 60512 corresponding to each test.

IEC 61210:1993, *Connecting devices – Flat quick-connect terminations for electrical copper conductors – Safety requirements*

ISO 6988:1985, *Metallic and other non organic coatings – Sulfur dioxide test with general condensation of moisture*

3 Definitions

For the purpose of this International Standard, definitions from IEC 60050(581), IEC 60050(826), IEC 60309-1, IEC 60664-1, IEC 60999-1 and IEC 61140, together with the following, apply.

3.1

connector

component which terminates conductors for the purpose of providing connection to and disconnection from a suitable mating component

[IEV 581-06-01]

3.2

connector with breaking capacity (CBC)

connector specially designed to be engaged or disengaged in normal use when live or under load

NOTE 1 In this standard, the term "live" is used if contacts are under an applied voltage, but not necessarily carrying current.

The term "load" is used if a current is flowing through the contacts.

NOTE 2 In this standard, CBC is used only if requirements refer to connectors with a specified breaking capacity.

3.3

free connector

connector for attachment to the free end of a wire or cable

[IEV 581-06-12]

3.4

fixed connector

connector for attachment to a rigid surface

[IEV 581-06-10]

3.5

non-rewirable connector

connector so constructed that the cable cannot be separated from the connector without making it permanently useless

[IEC 60309-1, definition 2.5 modified]

3.6

connector for class II equipment

device in which the protection against indirect contact is realised by double or reinforced insulation

NOTE Class II according to IEC 61140.

3.7

intended use

application conditions of connectors which are included within the permissible rated values and environmental conditions and characteristics assigned by the detail specification (DS) or the manufacturer

3.8

interlock

device, either electrical or mechanical, which prevents the contacts of a connector from becoming live before it is in proper engagement with its counterpart, and which either prevents the connector from being withdrawn while its contacts are live or makes the contacts dead before separation

[IEC 60309-1, definition 2.9 modified]

3.9

cycle of mechanical operation

one insertion and one withdrawal of the connector halves

3.10

clamping unit

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

[IEC 60999-1, definition 3.1]

3.11

upper limiting temperature

maximum temperature of a connector as defined by the climatic category assigned by the manufacturer, in which the connector is intended to operate

NOTE The abbreviation ULT is often used.

3.12

lower limiting temperature

minimum temperature of a connector as defined by the climatic category assigned by the manufacturer in which a connector is intended to operate

NOTE The abbreviation LLT is often used.

3.13

clearance

the shortest distance in air between two conductive parts

[IEC 60664-1, definition 1.3.2]

3.14

creepage distance

shortest distance along the surface of the insulating material between two conductive parts

[IEC 60664-1, definition 1.3.3]

3.15

overvoltage category

numeral defining a transient overvoltage condition

NOTE Overvoltage categories I, II, III and IV are used.

[IEC 60664-1, definition 1.3.10]

3.16

pollution

any addition of foreign matter, solid, liquid, or gaseous, that can result in a reduction of electric strength or surface resistivity of the insulation

[IEC 60664-1, definition 1.3.11]

3.17

pollution degree

numeral characterizing the expected pollution of the micro-environment

NOTE Pollution degrees 1, 2, 3 and 4 are used.

[IEC 60664-1, definition 1.3.13]

3.18

rated voltage

value of voltage assigned by the manufacturer to the connector and to which operation and performance characteristics are referred

[IEC 60664-1, definition 1.3.9 modified]

NOTE A connector may have more than one rated voltage value.

3.18.1

rated insulation voltage

r.m.s. withstand voltage value assigned by the manufacturer to the connector, characterising the specified (long term) withstand capability of its insulation

NOTE The rated insulation voltage is not necessarily equal to the rated voltage, which is primarily related to functional performance.

[IEC 60664-1, definition 1.3.9.1 modified]

3.18.2

rated impulse voltage

impulse withstand voltage value assigned by the manufacturer to the connector, characterising the specified withstand capability of its insulation against transient overvoltages

[IEC 60664-1, definition 1.3.9.2 modified]

3.18.3

impulse withstand voltage

highest peak value of impulse voltage, of prescribed form and polarity which does not cause breakdown of the insulation under specified conditions

[IEC 60664-1, definition 1.3.8.1]

NOTE The impulse withstand voltage is equal to or higher than the rated impulse voltage.

3.18.4

r.m.s. withstand voltage (power-frequency withstand voltage)

highest r.m.s. value of a voltage which does not cause breakdown of the insulation under specified conditions

[IEC 60664-1, definition 1.3.8.2]

3.19

rated current

current value assigned by the manufacturer, which the connector can carry continuously (without interruption) and simultaneously through all its contacts wired with the largest specified conductor, preferably at an ambient temperature of 40 °C, without the upper limiting temperature being exceeded

NOTE If other ambient temperature values are used for the definition of the rated current, the manufacturer should state in the technical documentation the ambient temperature on which the rating is based, with reference, if appropriate, to the derating curve defined in IEC 60512, test 5b.

3.20

breaking capacity

value of current which the CBC can make and break under specified conditions

3.21

functional insulation

insulation between conductive parts which is necessary only for the proper functioning of the equipment

[IEC 60664-1, definition 1.3.17.1]

3.22

basic insulation

insulation applied to live parts to provide basic protection against electric shock

NOTE Basic insulation does not necessarily include insulation used exclusively for functional purposes (see 3.10.1 of IEC 61140).

[IEC 60664-1, definition 1.3.17.2]

3.23

supplementary insulation

independent insulation applied in addition to basic insulation, in order to provide protection against electric shock in the event of a failure of basic insulation (see 3.10.2 of IEC 61140)

[IEC 60664-1, definition 1.3.17.3]

3.24

double insulation

insulation comprising both basic insulation and supplementary insulation (see 3.10.3 of IEC 61140)

[IEC 60664-1, definition 1.3.17.4]

3.25

reinforced insulation

single insulation system applied to live parts, which provides a degree of protection against electric shock equivalent to double insulation under the conditions specified in the relevant IEC standard (see 3.10.4 of IEC 61140)

NOTE A single insulation system does not imply that the insulation must be a homogeneous piece. It may comprise several layers which cannot be tested singly as basic or supplementary insulation.

[IEC 60664-1, definition 1.3.17.5]

3.26

internal insulation

part of basic insulation providing the required clearance and creepage distances inside a conductive housing or enclosure

3.27

protective conductor (symbol PE)

conductor required by some measures for protection against electric shock for electrically connecting any of the following parts:

- exposed conductive parts,
- extraneous conductive parts,

- main earthing terminal,
- earth electrode,
- earthed point of the source or artificial neutral

[IEV 826-04-05]

4 Technical information (electrical ratings)

For connectors according to this standard, no particular values have been specified for electrical ratings such as voltage, current and breaking capacity. Values shall be specified in compliance with mechanical and environmental conditions given in the detail specification or in the manufacturer's specification.

5 Classification

5.1 General

In order to apply the relevant test requirements, connectors shall be classified by the manufacturer's specification or the detail specification (DS), if any, according to their intended use and characteristics, as set out below.

5.2 Existence of an enclosure (see 7.2.1.1 of IEC 60884-1)

- unenclosed connector (no protection against electric shock is required)
- enclosed connector (protection against electric shock is required)

NOTE For an unenclosed connector, the protection against electric shock is provided by the enclosure of the equipment in which the connector is mounted, in accordance with the applicable product safety standard.

5.3 Style of connector

- a) Fixed connector
- b) Free connector

5.4 Additional characteristics

- a) Connector with protective earthing contact.
- b) Connector with cable clamp.
- c) Connector without breaking capacity,
 - 1) with protection against electric shock for hand back safety, when mated;
 - 2) with protection against electric shock for finger safety, when mated.
- d) CBC with protection against electric shock for finger safety, both in mated and unmated condition.
- e) Degree of protection of a connector.
- f) Connector for class II equipment.
- g) Connector with interlock.
- h) Non-rewirable connector.
- i) Rewirable connector.
- j) Terminations and connection methods.

6 Constructional requirements and performance

6.1 General

Connectors shall be so designed and dimensioned that they can withstand the electrical, mechanical, thermal and corrosive stresses which occur in their intended use and present no danger to the user or the environment.

Compliance with these requirements is verified by the specified tests of this standard.

6.2 Marking and identification

6.2.1 Identification

Connectors shall be identified and characterised by the following markings:

- a) manufacturer's name, trademark or mark of origin;
- b) type identification;
- c) rated current in amperes (A);
- d) rated voltages or rated insulation voltages between line to earth and line to line in volts (V);
- e) rated impulse voltage in kilovolts (kV), if specified;
- f) pollution degree;
- g) degree of protection by enclosure according to IEC 60529, if applicable;
- h) range of temperature;
- i) type of terminals;
- j) connectable conductors;
- k) reference to this standard or to the DS, if applicable.

6.2.2 Marking

The marking shall be indelible and easily legible.

The minimum marking on the connector shall be that of item a) of 6.2.1.

Markings a) and b) of 6.2.1 shall be found on the smallest unit of packaging.

All other markings of 6.2.1 shall be given in the technical documentation or catalogue of the manufacturer; for the rated values, follow the examples given hereinafter.

Examples of markings for rated current, rated voltages, rated impulse voltage and pollution degree:

a) Example 1

Marking of a connector with rated current 16 A, rated voltage 400 V, rated impulse voltage 6 kV and pollution degree 3, 2 and 1 for use in any system, preferably unearthed or delta-earthed systems:

16 / 400 / 6 / 3 or 16A 400V 6kV 3