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Edition 2.0 2008-10

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Connectors – Safety requirements and tests

Connecteurs – Exigences de sécurité et essais

IEC 61984:2008

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

CONNECTORS – SAFETY REQUIREMENTS AND TESTS

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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International Standard IEC 61984 has been prepared by subcommittee 48B: Connectors, of IEC technical committee 48: Electromechanical components and mechanical structures for electronic equipment.

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

FDIS	Report on voting
48B/1927/FDIS	48B/1947/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.

This second edition cancels and replaces the first edition published in 2001. This edition constitutes a technical revision.

This edition included the following significant technical changes with respect to the previous edition:

1) Addition in the scope of the statement that this standard may be used as a guide for connectors with rated current higher than 125 A per pole.
2) New definitions added and improvement of existing definitions.
3) In Clause 5, the classification referred to protection against electric shock and that of connector for class II equipment were added.
4) In 6.4 (Protection against electric shock), it is clarified that all parts which are necessary to ensure protection against electric shock shall only be removable by the aid of a tool.
5) Table 2 and Table 3 are added for better readability and connecting methods updated to current status of standardisation.
6) Values for cable clamp testing in Table 6 are adopted according to EN 50262 and no tests are required if metric cable glands according to this standard are used.
7) Tables in 6.19 are deleted and the text refers to IEC 60664.
8) Table 7 (Values for torque for screw-type clamping units) in 7.1.4 of the 2001 edition is deleted and the text refers to the relevant standards.
9) Subclause 7.3.7 of the 2001 edition is modified. Length of the connecting cable and conductor loops are added. Test arrangements for temperature rise test for two-part printed board connectors are fixed.
10) Figure 2 (Device for bending test) transferred from 7.3.8 (Mechanical operation) of the 2001 edition to Clause 7.3.10 (Bending (flexing) test) of the present edition.
11) In Table 10 (Mechanical test group A) test phase A3, the severity or conditions for unenclosed and enclosed connectors are specified.
12) The informative Annex B (Additional information on connector classification) with its Tables B.1 (Scheme of connectors) and B.2 (Help for the classification of connectors) are added for better readability of the standard.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site 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.

The contents of the corrigendum of October 2011 have been included in this copy.

CONNECTORS – SAFETY REQUIREMENTS AND TESTS

1 Scope

This International Standard applies to connectors with rated voltages above 50 V and up to 1000 V a.c. and d.c. 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 voltage up to 50 V, this standard may be used as a guide. In this case, reference is made to IEC 60664-1 for clearance and creepage distances.

This standard may also be used as a guide for connectors with rated current higher than 125 A per pole.

This standard does not apply to connectors in or on equipment where application specific safety requirements for connectors exist.

2 Normative references

The following referenced documents are indispensable for the application 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 60050-581, *International Electrotechnical Vocabulary (IEV) – Chapter 581: Electromechanical components for electronic equipment*

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

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

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

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

IEC 60228: 2004*, Conductors of insulated cables*

IEC 60309-1:1999, *Plugs, socket-outlets and couplers for industrial purposes – Part 1: General requirements*
Amendment 1 (2005)

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

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

IEC 60352-3:1993, *Solderless connections – Part 3: Solderless accessible insulation displacement connections – General requirements, test methods and practical guidance*

IEC 60352-4:1994, *Solderless connections – Part 4: Solderless non-accessible insulation displacement connections – General requirements, test methods and practical guidance*

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

IEC 60352-6, *Solderless connections – Part 6: Insulation piercing connections – General requirements, test methods and practical guidance*

IEC 60352-7, *Solderless connections – Part 7: Spring-clamp connections – General requirements, test methods and practical guidance*

IEC 60364-4-41, *Low-voltage electrical installations – Part 4-41: Protection for safety – Protection against electric shock*

IEC 60417, *Graphical symbols for use on equipment*

IEC 60512 (all parts), *Connectors for electronic equipment – Tests and measurements* [1]

IEC 60512-1-100, *Connectors for electronic equipment – Tests and measurements – Part 1-100: General – Applicable publications*

IEC 60529:1989, *Degrees of protection provided by enclosures (IP Code)*
Amendment 1 (1999)

IEC 60664-1:2007, *Insulation coordination for equipment within low voltage systems – Part 1: Principles, requirements and tests*

IEC 60664-5:2007, *Insulation coordination for equipment within low-voltage systems – Part 5: Comprehensive method for determining clearances and creepage distances equal to or less than 2 mm*

IEC 60760, *Flat, quick-connect terminations*

IEC 60998-2-3:2002, *Connecting devices for low-voltage circuits for household and similar purposes – Part 2-3: Particular requirements for connecting devices as separate entities with insulation-piercing clamping units*

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 mm^2 up to 35 mm^2 (included)*

IEC 60999-2:2003, *Connecting devices – Electrical copper conductors – Safety requirements for screw-type and screwless-type clamping units – Part 2: Particular requirements for conductors above 35 up to 300 mm^2 (included)*

IEC 61032, *Protection of persons and equipment by enclosures – Probes for verification*

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

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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, *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*

EN 50262:1998, *Cable glands for electrical installations*
Amendment 1 (2001)
Amendment 2 (2004)

3 Terms and 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, as well as 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, modified]

3.2
free connector
connector for attachment to the free end of a wire or cable

[IEV 581-06-12]

3.3
fixed connector
connector for attachment to a rigid surface

[IEV 581-06-10]

3.4
rewirable connector
connector so constructed that the cable or wire can be replaced

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, 2.5, modified]

3.6
enclosed connector
connector for which the protection against electric shock is ensured by the housing of the connector itself

3.7
unenclosed connector
connector with no protection against electric shock

NOTE The protection against electric shock is provided by e.g. the enclosure of the equipment in which the unenclosed connector is deemed to be mounted, in accordance with the applicable product safety standard.

3.8
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.

3.9
connector without breaking capacity
COC
connector which is not deemed to be engaged or disengaged in normal use when live or under load

3.10
connector for class II equipment
connector in which the protection against indirect contact is realised by double or reinforced insulation

NOTE Class II according to IEC 61140.

3.11
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

3.12
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, 2.9, modified]

3.13
cycle of mechanical operation
one insertion and one withdrawal of the connector with his counterpart

3.14
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, 3.1]

3.15
upper limiting temperature
ULT
maximum temperature in the connector as outcome (sum) of the ambient temperature and the temperature rise due to current flow, at which the connector is intended to be still operable.

NOTE 1 At ambient temperature equal to ULT, the available temperature rise due to current flow is zero, thus the current carrying capacity of the connector is zero.

NOTE 2 The ULT of a connector is covered by the climatic category as defined in IEC 60068-1, together with the LLT and the duration of the damp heat test.

3.16
lower limiting temperature
LLT
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 LLT of a connector is covered by the climatic category as defined in IEC 60068-1, together with the ULT and the duration of the damp heat test.

3.17
clearance
shortest distance in air between two conductive parts

[IEC 60664-1:2007, 3.2]

3.18
creepage distance
shortest distance along the surface of the insulating material between two conductive parts

[IEC 60664-1:2007, 3.3]

3.19
overvoltage category
numeral defining a transient overvoltage condition

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

[IEC 60664-1:2007, 3.10]

3.20
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 60664-1:2007, 3.11]

3.21
pollution degree
numeral characterizing the expected pollution of the micro-environment

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

[IEC 60664-1:2007, 3.13]

3.22
rated voltage
value of voltage assigned by the manufacturer to the connector and to which operation and performance characteristics are referred

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

[IEC 60664-1:2007, 3.9, modified]

3.23
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 60664-1:2007, 3.9.1, modified]

3.24
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 60664-1:2007, 3.9.2, modified]

3.25
impulse withstand voltage
highest peak value of impulse voltage of prescribed form and polarity which does not cause breakdown of insulation under specified conditions

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

[IEC 60664-1:2007, 3.8.1, modified]

3.26
r.m.s. withstand voltage (power-frequency withstand voltage)
highest r.m.s. value of a voltage which does not cause breakdown of insulation under specified conditions

[IEC 60664-1:2007, 3.8.2, modified]

3.27
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.

3.28
breaking capacity
value of current which the CBC can make and break under specified conditions

3.29
functional insulation
insulation between conductive parts which is necessary only for the proper functioning of the equipment

[IEC 60664-1:2007, 3.17.1]

3.30
basic insulation
insulation of hazardous-live-parts which provides basic protection

NOTE The concept does not apply to insulation used exclusively for functional purposes.

[IEC 60664-1:2007, 3.17.2]

3.31
internal insulation
part of a basic insulation providing the required clearance and creepage distances inside a conductive housing or enclosure

3.32
supplementary insulation
independent insulation applied in addition to basic insulation for fault protection

[IEC 60664-1:2007, 3.17.3]

3.33
double insulation
insulation comprising both basic insulation and supplementary insulation

[IEC 60664-1:2007, 3.17.4]

3.34
reinforced insulation
insulation of hazardous-live-parts, which provides a degree of protection against electric shock equivalent to double insulation

NOTE Reinforced insulation may comprise several layers which cannot be tested singly as basic insulation or supplementary insulation.

[IEC 60664-1:2007, 3.17.5]

3.35
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

3.36
protective earthing contact
contact for earthing a point or points in a system or in an installation or in equipment for purposes of electrical safety

[IEV 195-01-11, modified]

3.37
degree of protection
the extent of protection provided by an enclosure against access to hazardous parts, against ingress of solid foreign objects and/or against ingress of water and verified by standardized test methods

[IEC 60529:1989, 3.3]

3.38
IP Code
a coding system to indicate the degrees of protection provided by an enclosure against access to hazardous parts, ingress of solid foreign objects, ingress of water and to give additional information in connection with such protection

[IEC 60529:1989, 3.4]