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CENELEC

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Foreword

This Draft European Standard was prepared by SC 9XB, Electromechanical material on board of rolling stock, of Technical Committee CENELEC TC 9X, Electrical and electronic applications for railways. It is submitted to CENELEC Enquiry.

Contents

Introduction

This European standard provides performance requirements and tests for low-voltage electrical connectors deemed to be installed on board railway rolling stock, either indoors or outdoors. Safety requirements and tests for electrical connectors are already covered in general by EN 61984. The additional requirements and testing of specific characteristics demanded by rolling stock applications are set out in this European Standard. Connectors complying with EN 61984 may be found suitable for use on board rolling stock by such additional testing. One goal of this European standard is to avoid retesting of electrical connectors already in compliance with EN 61984 for those characteristics that have been assessed suitable also for use on board rolling stock.

Among the additional requirements for use on boar rolling stock, those that can be verified by documentation of tests on the raw materials are distinguished from those to be assessed by tests on the component.

Due to the wide spectrum of existing and future specific rolling stock applications of electrical connectors, this standard does not select any particular geometric configuration of connectors, nor establish any particular values for electrical ratings such as voltage and current, or for any other characteristic. All such details should be selected and agreed between the parties involved (e.g. manufacturer and user) depending on the electrical, mechanical and environmental conditions expected in the intended use. Annexes A and B of this European Standard provide guidance.

Upon agreement between the parties involved, this standard may be used in conjunction with existing connector detail specifications for interchangeability purposes.

Other standards may be developed in future under the umbrella format of this standard, for particular connector designs for applications on board rolling stock, to fix dimensions for interchangeability and to set the additional requirements for specific applications that, due to complexity and variety, are left here to agreement between parties involved.

This standard does not cover:

- *connectors with breaking capacity (CBCs)* as defined in 3.2 of EN 61984, because on board rolling stock connectors are not deemed to be operated (i.e. connected or disconnected) under load or when live, either by means of procedures or by the presence of interlocks, as required by EN 60153.

NOTE For the purpose of this standard connectors on board rolling stock are therefore considered as being always without breaking capacity, therefore where needed for safety reasons, adequate procedures or interlocks (i.e. locking devices that cannot be opened without the aid of a special tool) shall be provided in the end application;

- *non-rewirable connectors* as defined in 3.5 of EN 61984, because they are not used as part of the fixed wiring of the rolling stock.
- *automatic couplers*, due to their additional mechanical complexity and the need for more specific requirements and testing;
- *intervehicle jumpers*, as they are connector and cable assemblies whose characteristics depend on those of both elements. Intervehicle connectors within the limits set in the scope of this standard are therefore covered by the agreed choice of suitable mechanical and environmental characteristics as suggested by Annex B.

1 Scope

This European standard retains EN 61984 as the minimum performance requirements for railway rolling stock electrical connectors.

It identifies additional terms, test methods and performance requirements for single-pole and multipole connectors with rated voltages up to 1000 V, rated currents up to 125 A per contact and frequencies below 3 MHz used for indoor and outdoor applications in railway rolling stock.

This standard identifies the application levels for electrical connectors based on:

- the severity of the service conditions in different rolling stock technologies;
- the intended use of the rolling stock;
- the location of the connector in the rolling stock system.

This standard is not applicable to internal connections of electronic devices such as connectors for printed boards and rack-and-panel connectors.

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.

CLC/TS 45545-5	Railway applications - Fire protection on railway vehicles - Part 5: Firesafety requirements for electrical equipment including that of trolley buses, track guided buses and magnetic levitation vehicles
EN 50124-1:2001 + A1:2003	Railway applications – Insulation coordination – Part 1: Basic requirements – Clearances and creepage distances for all electrical and electronic equipment
EN 50125-1:1999	Railway applications – Environmental conditions for equipment – Part 1: Equipment on board rolling stock
EN 50153:2002	Railway applications – Rolling stock – Protective provisions relating to electrical hazards
EN 50155:2001 + A1:2002	Railway applications – Electronic equipment used on rolling stock
EN 50264-1:2002	Railway applications – Railway rolling stock cables having special fire performance – Standard wall – Part 1: General requirements
EN 50264-2:2002	Railway applications – Railway rolling stock cables having special fire performance – Standard wall – Part 2: Single core cables
EN 50264-3:2002	Railway applications – Railway rolling stock cables having special fire performance – Standard wall – Part 3: Multicore cables
EN 50306-1:2002	Railway applications – Railway rolling stock cables having special fire performance – Thin wall – Part 1: General requirements
EN 50306-2:2002	Railway applications – Railway rolling stock cables having special fire performance – Thin wall – Part 2: Single core cables
EN 50306-3:2002	Railway applications – Railway rolling stock cables having special fire performance – Thin wall – Part 3: Single core and multicore cables (pairs, triples and quads) screened and thin wall sheathed
EN 50306-4:2002	Railway applications – Railway rolling stock cables having special fire performance – Thin wall – Part 4: Multicore and multipair cables standard wall sheathed

EN 50343:2003	Railway applications – Rolling stock – Rules for installation of cabling
EN 60068-1:1994	Environmental testing – Part 1: General and guidance (IEC 60068-1:1988 + corrigendum Oct. 1988 + A1:1992)
EN 60068-2-32:1993	Basic environmental testing procedures – Part 2: Tests – Test Ed: Free fall (IEC 60068-2-32:1975 + A2:1990)
EN 60068-2-52:1996	Environmental testing – Part 2: Tests – Test Kb: Salt mist, cyclic (sodium chloride solution) (IEC 60068-2-52:1996)
EN 60068-2-70:1996	Environmental testing – Part 2: Tests – Test Xb: Abrasion of marking and letterings caused by rubbing of fingers and hands (IEC 60068-2-70:1995)
EN 60068-2-78:2001	Environmental testing - Part 2-78: Tests - Test Cab: Damp heat, steady state (IEC 60068-2-78:2001)
EN 60077-1:2002	Railway applications – Electrical equipment for rolling stock – Part 1: General service conditions and general rules (IEC 60077-1:1999, mod.)
EN 60077-2:2002	Railway applications – Electrical equipment for rolling stock – Part 2: Electrotechnical components – General rules (IEC 60077-2:1999, mod.)
EN 60309-1:1999	Plugs, socket-outlets and couplers for industrial purposes – Part 1: General requirements (IEC 60309-1:1999)
EN 60352-1:1997	Solderless connections – Part 1: Wrapped connections – General requirements, test methods and practical guidance (IEC 60352-1:1997)
EN 60352-2:1994 + A1:1997 + A2:2002	Solderless connections – Part 2: Solderless crimped connections – General requirements, test methods and practical guidance (IEC 60352-2:1990 + A1:1996 + A2:2002)
EN 60352-3:1994	Solderless connections – Part 3: Solderless accessible insulation displacement connections – General requirements, test methods and practical guidance (IEC 60352-3:1993)
EN 60352-4:1994 + A1:2000	Solderless connections – Part 4: Solderless non-accessible insulation displacement connections – General requirements, test methods and practical guidance (IEC 60352-4:1994 + A1:2000)
EN 60352-5:2001 + A1:2003	Solderless connections – Part 5: Press-in connections – General requirements, test methods and practical guidance (IEC 60352-5:2001 + A1:2003)
EN 60352-7:2002	Solderless connections – Part 7: Spring clamp connections – General requirements, test methods and practical guidance (IEC 60352-7:2002)
EN 60512-1:2001	Connectors for electronic equipment – Tests and measurements – Part 1: General (IEC 60512-1:2001)
EN 60512-1-100:2001	Connectors for electronic equipment – Test and measurements – Part 1-100: General – Applicable publications (IEC 60512-1-100:2001)
EN 60512-1-1:2002	Connectors for electronic equipment – Tests and measurements – Part 1-1: General examination – Test 1a: Visual examination (IEC 60512-1-1:2002)
EN 60512-1-2:2002	Connectors for electronic equipment – Tests and measurements – Part 1-2: General examination – Test 1b: Examination of dimension and mass (IEC 60512-1-2:2002)

EN 60512-1-4:1997	Electromechanical components for electronic equipment - Basic testing procedures and measuring methods – Part 1: General – Section 4: Test 1d: Contact protection effectiveness (scoop-proof) (IEC 60512-1-4:1997)
EN 60512-2-2:2003	Connectors for electronic equipment – Tests and measurements – Part 2-2: Electrical continuity and contact resistance tests – Test 2b: Contact resistance – Specified test current method (IEC 60512-2-2:2003)
EN 60512-2-5:2003	Connectors for electronic equipment – Tests and measurements – Part 2-5: Electrical continuity and contact resistance tests – Test 2e: Contact disturbance (IEC 60512-2-5:2003)
EN 60512-3-1:2002	Connectors for electronic equipment – Tests and measurements – Part 3-1: Insulation tests – Test 3a: Insulation resistance (IEC 60512-3-1:2002)
EN 60512-4-1:2003	Connectors for electronic equipment – Tests and measurements – Part 4-1: Voltage stress tests – Test 4a: Voltage proof (IEC 60512-4-1:2003)
EN 60512-5-1:2002	Connectors for electronic equipment – Tests and measurements – Part 5-1: Current-carrying capacity tests – Test 5a: Temperature rise (IEC 60512-5-1:2002)
EN 60512-5-2:2002	Connectors for electronic equipment – Tests and measurements – Part 5-2: Current-carrying capacity tests – Test 5b: Current-temperature derating (IEC 60512-5-2:2002)
EN 60512-11-2:2002	Connectors for electronic equipment – Tests and measurements – Part 11-2: Climatic tests – Test 11b: Combined/sequential cold, low air pressure and damp heat (IEC 60512-11-2:2002)
EN 60512-11-3:2002	Connectors for electronic equipment – Tests and measurements – Part 11-3: Test 11c: Damp heat, steady state (IEC 60512-11-3:2002)
EN 60512-11-4:2002	Connectors for electronic equipment – Tests and measurements – Part 11-4: Test 11d: Rapid change of temperatures (IEC 60512-11-4:2002)
EN 60512-11-6:2002	Connectors for electronic equipment – Tests and measurements – Part 11-6: Climatic tests – Test 11f: Corrosion, salt mist (IEC 60512-11-6:2002)
EN 60512-11-7:2003	Connectors for electronic equipment – Tests and measurements – Part 11-7: Climatic tests – Test 11g: Flowing mixed gas corrosion test (IEC 60512-11-7:2003)
EN 60512-11-9:2002	Connectors for electronic equipment – Tests and measurements – Part 11-9: Climatic tests – Test 11i: Dry heat (IEC 60512-11-9:2002)
EN 60512-11-10:2002	Connectors for electronic equipment – Tests and measurements – Part 11-10: Climatic tests – Test 11j: Cold (IEC 60512-11-10:2002)
EN 60512-13-1:1997	Electromechanical components for electronic equipment – Basic testing procedures and measuring methods – Part 13: Mechanical operating tests – Section 1: Test 13a: Engaging and separating forces (IEC 60512-13-1:1996)
EN 60512-13-5 [1)]	Connectors for electronic equipment - Tests and measurements -- Part 13-5: Test 13e: Polarizing and keying method (IEC 60512-13-5)
EN 60512-19-3:1997	Electromechanical components for electronic equipment – Basic testing procedures and measuring methods – Part 19: Chemical resistance tests – Section 3: Test 19c: Fluid resistance (IEC 60512-19-3:1997)

1) At draft stage.

EN 60512-23-3:2001	Electromechanical components for electronic equipment – Basic testing procedures and measuring methods – Part 23-3: Test 23c: Shielding effectiveness of connectors and accessories (IEC 60512-23-3:2000)
EN 60512-23-7:2005	Connectors for electronic equipment – Tests and measurements – Part 23-7: Screening and filtering tests – Test 23g: Effective transfer impedance of connectors (IEC 60512-23-7:2005)
EN 60529:1991 + A1:2000	Degrees of protection provided by enclosures (IP Code) (IEC 60529:1989 + A1:1999)
EN 60664-1:2003	Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests (IEC 60664-1:1992 + A1:2000 + A2:2002)
EN 60999-1:2000	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 60999-1:1999)
EN 60999-2:2003	Connecting devices – Electrical copper conductors – Safety requirements for screw-type and screwless-type clamping units – Part 2: Particular requirements for clamping units for conductors above 35 mm^2 up to 300 mm^2 (included) (IEC 60999-2:2003)
EN 61373:1999	Railway applications – Rolling stock equipment – Shock and vibration tests (IEC 61373:1999)
EN 61984:2001	Connectors – Safety requirements and tests (IEC 61984:2001)
EN ISO 4892-2:1999	Plastics – Methods of exposure to laboratory light sources – Xenon-arc sources (ISO 4892-2:1994)
EN ISO 6988:1994	Metallic and other non organic coatings – Sulphur dioxide test with general condensation of moisture (ISO 6988:1985)
IEC 60050-581 + A1:1998	International Electrotechnical Vocabulary. Electromechanical components for electronic equipment
IEC 60417-2 Database	Graphical symbols for use on equipment
IEC 60512-5:1992	Electromechanical components for electronic equipment; basic testing procedures and measuring methods – Part 5: Impact tests (free components), static load tests (fixed components), endurance tests and overload tests
IEC 60512-6:1984	Electromechanical components for electronic equipment; basic testing procedures and measuring methods – Part 6: Climatic tests and soldering tests
IEC 60512-7:1993	Electromechanical components for electronic equipment; basic testing procedures and measuring methods – Part 7: Mechanical operating tests and sealing tests
IEC 60512-8:1993	Electromechanical components for electronic equipment; basic testing procedures and measuring methods – Part 8: Connector tests (mechanical) and mechanical tests on contacts and terminations
IEC 60512-9:1992	Electromechanical components for electronic equipment; basic testing procedures and measuring methods – Part 9: Miscellaneous tests
IEC 60512-15-1-1)	Connectors for electronic equipment - tests and measurements - Part 15-1:Connector tests (mechanical) - Test 15a: Contact retention in insert

1) At draft stage.

IEC 60512-15-2 [1)]	Connectors for electronic equipment - tests and measurements - Part 15-2: Connector tests (mechanical) - Test 15b: Insert retention in housing (axial)
IEC 60512-15-3 [1)]	Connectors for electronic equipment – Tests and measurements – Part 15-3: Connector tests (mechanical) - Test 15c: Insert retention in housing (torsional)
ISO 1431-1:1989	Rubber, vulcanised or thermoplastic – Resistance to ozone cracking – Part 1: Static strain test

3 Definitions

For the purpose of this standard, the definitions given in IEC 60050-581 and the following apply.

3.1
connection
two mated connectors or contacts
EXAMPLES: see Figure 1

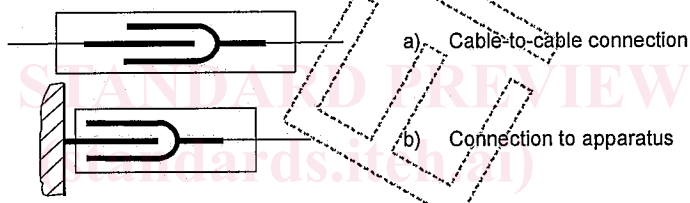


Figure 1 – Typical examples of connections

3.2
connector [IEV 60050 (581) 06-01, modified]
component which terminates conductors for the purpose of providing connection to and disconnection from a suitable mating component, and which are not intended to be connected and disconnected under electrical load

3.3
free connector [IEV 60050 (581) 06-12]
connector for attachment to the free end of a wire or cable

3.4
fixed connector [IEV 60050 (581) 06-10]
connector for attachment to a rigid surface

3.5
enclosed connector
connector where protection against electric shock is provided by enclosures

3.6
unenclosed connector
connector where 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

3.7
inter-vehicle connector
a connector deemed to be assembled with proper cable to form a cable assembly for inter-vehicle electrical connection

3.8
contact
conductive element in a connector (including means for cable termination) that mates with a corresponding element to provide an electrical path

3.9
male contact
contact (including means for cable termination) designed for electrical engagement on its outer surface and to enter a female contact, thus forming an electrical connection

EXAMPLES tab, pin, blade

3.10
female contact
contact (including means for cable termination) designed for electrical engagement on its inner surface, and to accept entry of a male contact, thus forming an electrical connection

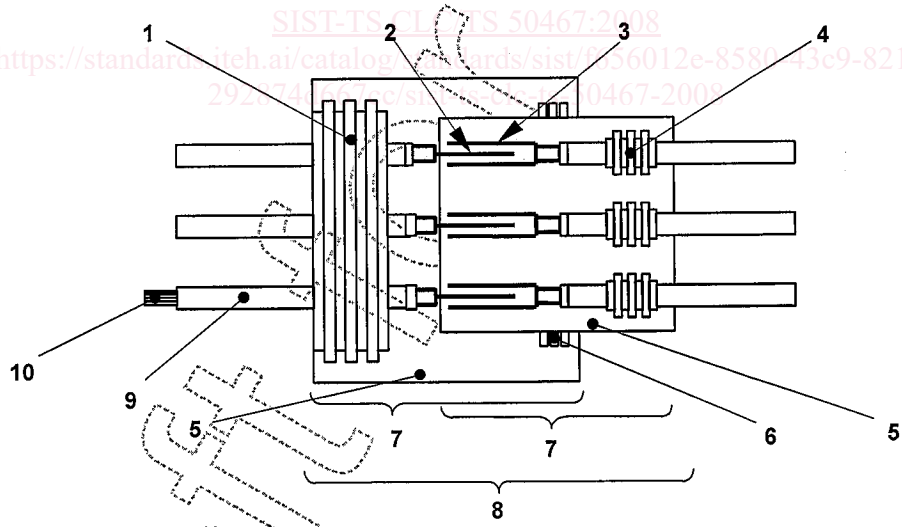
EXAMPLES receptacle, sleeve

3.11
cable termination
any joining of cable to contact

EXAMPLES crimp, insulation displacement, soldering, screwing

3.12
multipole connector
a connector with more than one contact

EXAMPLE: see Figure 2



Key

1	Multiple cable seal	6	Housing seal
2	Male contact	7	Multipole connector
3	Female contact	8	Multipole connection
4	Single cable seal	9	Cable
5	Housing	10	Conductor

Figure 2 – Multipole connectors