
Železniške naprave - Železniška vozila - Konektorji, zahteve in preskusne metode

Railway applications - Rolling stock - Electrical connectors, requirements and test methods

Bahnanwendungen - Fahrzeuge - Elektrische Steckverbinder, Bestimmungen und Prüfverfahren

Applications ferroviaires - Matériel roulant - Connecteurs électriques, exigences et méthodes d'essai

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45.060.01	Železniška vozila na splošno	Railway rolling stock in general

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English version

**Railway applications -
Rolling stock -
Electrical connectors, requirements and test methods**

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Bestimmungen und Prüfverfahren

This draft European Standard is submitted to CENELEC members for CENELEC enquiry.
Deadline for CENELEC: 2010-01-08.

It has been drawn up by CLC/SC 9XB.

If this draft becomes a European Standard, 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.

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CENELEC

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

Central Secretariat: Avenue Marnix 17, B - 1000 Brussels

1

Foreword

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

5 This document will supersede CLC/TS 50467:2008.

6 *CLC/SC 9XB Secretary note:*

7 *Technical changes versus CLC/TS 50467:2008 are identified by a yellow background. This background will*
8 *be removed at voting stage.*

9 This draft European Standard has been prepared under Mandate M/334 given to CENELEC by the
10 European Commission and the European Free Trade Association and covers essential requirements of
11 EC Directives 2001/16/EC and 96/48/EC.

12

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SIST EN 50467:2012

<https://standards.itech.ai/catalog/standards/sist/2f53c28a-4cc9-44b7-be6c-3899c56478c6/sist-en-50467-2012>

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99 Introduction

100 This European Standard provides performance requirements and tests for low-voltage electrical connectors
 101 deemed to be installed on board railway rolling stock, either indoors or outdoors. Safety requirements and
 102 tests for electrical connectors are already covered in general by EN 61984:2001. The additional
 103 requirements and testing of specific characteristics demanded by rolling stock applications are set out in this
 104 European Standard. One goal of this European Standard is to avoid retesting of electrical connectors already
 105 in compliance with EN 61984:2001 for those characteristics that have been assessed suitable also for use on
 106 board rolling stock.

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

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

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

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

122 This European Standard does not cover
 123 - *connectors with breaking capacity (CBCs)* as defined in EN 61984:2001, 3.2, because on board rolling
 124 stock connectors are not deemed to be operated (i.e. connected or disconnected) under load or when
 125 live, either by means of procedures or by the presence of interlocks, as required by EN 50153:2002,

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

129 - *non-rewirable connectors* as defined in EN 61984:2001, 3.5,
 130 - *automatic couplers*, due to their additional mechanical complexity and the need for more specific
 131 requirements and testing,
 132 - *inter-vehicle jumpers*, as they are connector and cable assemblies whose characteristics depend on
 133 those of both elements. Inter-vehicle connectors within the limits set in the scope of this European
 134 Standard are therefore covered by the agreed choice of suitable mechanical and environmental
 135 characteristics **as defined by Annex B, and suggested by Annex C.**

1 Scope

This European Standard retains EN 61984:2001 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 1 000 V, rated currents up to 125 V per contact and frequencies below 3 MHz used for indoor and outdoor applications in railway rolling stock.

This European 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 European 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.

EN 50124-1:2001 + A2:2005	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 50264-1:2002 ¹⁾	Railway applications - Railway rolling stock cables having special fire performance - Standard wall - Part 1: General requirements
EN 50264-2-1	Railway applications - Railway rolling stock power and control cables having special fire performance - Part 2-1: Cables with crosslinked elastomeric insulation - Single core cables
EN 50264-2-2	Railway applications - Railway rolling stock power and control cables having special fire performance - Part 2-2: Cables with crosslinked elastomeric insulation - Multicore cables
EN 50264-3-1	Railway applications - Railway rolling stock power and control cables having special fire performance - Part 3-1: Cables with crosslinked elastomeric insulation with reduced dimensions - Single core cables
EN 50264-3-2	Railway applications - Railway rolling stock power and control cables having special fire performance - Part 3-2: Cables with crosslinked elastomeric insulation with reduced dimensions - 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

¹⁾ Will be superseded by EN 50264-1:2008, *Railway applications - Railway rolling stock power and control cables having special fire performance - Part 1: General requirements*, at the date of the latter, i.e. 2011-03-01.

176	EN 50306-3:2002	Railway applications - Railway rolling stock cables having special fire performance -
177		Thin wall - Part 3: Single core and multicore cables (pairs, triples and quads)
178		screened and thin wall sheathed
179	EN 50306-4:2002	Railway applications - Railway rolling stock cables having special fire performance -
180		Thin wall - Part 4: Multicore and multipair cables standard wall sheathed
181	EN 50382-1:2008	Railway applications - Railway rolling stock high temperature power cables having
182		special fire performance - Part 1: General requirements
183	EN 60068-1:1994	Environmental testing - Part 1: General and guidance
184		(IEC 60068-1:1988 + corrigendum Oct. 1988 + A1:1992)
185	EN 60068-2-70:1996	Environmental testing - Part 2: Tests - Test Xb: Abrasion of markings and letterings
186		caused by rubbing of fingers and hands (IEC 60068-2-70:1995)
187	EN 60309-1:1999	Plugs, socket-outlets and couplers for industrial purposes - Part 1: General
188		requirements (IEC 60309-1:1999)
189	EN 60352-2:2006	Solderless connections - Part 2: Crimped connections - General requirements, test
190		methods and practical guidance (IEC 60352-2:2006)
191	EN 60352-3:1994	Solderless connections - Part 3: Solderless accessible insulation displacement
192		connections - General requirements, test methods and practical guidance
193		(IEC 60352-3:1993)
194	EN 60352-4:1994	Solderless connections - Part 4: Solderless non-accessible insulation
195	+ A1:2000	displacement connections - General requirements, test methods
196		and practical guidance (IEC 60352-4:1994 + A1:2000)
197	EN 60352-5:2001	Solderless connections - Part 5: Press-in connections - General requirements, test
198	+ A1:2003 ²⁾	methods and practical guidance (IEC 60352-5:2001 + A1:2003)
199	EN 60352-6:1997	Solderless connections - Part 6: Insulation piercing connections - General
200		requirements, test methods and practical guidance (IEC 60352-6:1997)
201	EN 60352-7:2002	Solderless connections - Part 7: Spring clamp connections - General requirements,
202		test methods and practical guidance (IEC 60352-7:2002)
203	EN 60512-1:2001	Connectors for electronic equipment - Tests and measurements -
204		Part 1: General (IEC 60512-1:2001)
205	EN 60512-1-1:2002	Connectors for electronic equipment - Tests and measurements -
206		Part 1-1: General examination - Test 1a: Visual examination (IEC 60512-1-1:2002)
207	EN 60512-4-1:2003	Connectors for electronic equipment - Tests and measurements -
208		Part 4-1: Voltage stress tests - Test 4a: Voltage proof (IEC 60512-4-1:2003)
209	EN 60512-5-1:2002	Connectors for electronic equipment - Tests and measurements -
210		Part 5-1: Current-carrying capacity tests - Test 5a: Temperature rise
211		(IEC 60512-5-1:2002)
212	EN 60512-11-6:2002	Connectors for electronic equipment - Tests and measurements -
213		Part 11-6: Climatic tests - Test 11f: Corrosion, salt mist (IEC 60512-11-6:2002)
214	EN 60512-11-7:2003	Connectors for electronic equipment - Tests and measurements -
215		Part 11- 7: Climatic tests - Test 11g: Flowing mixed gas corrosion test
216		(IEC 60512-11-7:2003)
217	EN 60512-19-3:1997	Electromechanical components for electronic equipment - Basic testing procedures
218		and measuring methods - Part 19: Chemical resistance tests - Section 3: Test 19c -
219		Fluid resistance (IEC 60512-19-3:1997)
220	EN 60512-23-3:2001	Electromechanical components for electronic equipment - Basic testing procedures
221		and measuring methods - Part 23-3: Test 23c: Shielding effectiveness of
222		connectors and accessories (IEC 60512-23-3:2000)

²⁾ Will be superseded by EN 60352-5:2008, *Solderless connections – Part 5: Press-in connections – General requirements, test methods and practical guidance* (IEC 60352-5:2008) at the date of the latter, i.e. 2011-02-01.

223	EN 60512-23-4:2001	Connectors for electronic equipment - Tests and measurements -
224		Part 23-4: Screening and filtering tests - Test 23d: Transmission line reflections in
225		the time domain (IEC 60512-23-4:2001)
226	EN 60529:1991	Degrees of protection provided by enclosures (IP Code)
227	+ A1:2000	(IEC 60529:1989 + A1:1999)
228	EN 60664-1:2007	Insulation coordination for equipment within low-voltage systems -
229		Part 1: Principles, requirements and tests (IEC 60664-1:2007)
230	EN 60999-1:2000	Connecting devices - Electrical copper conductors - Safety requirements for screw-
231		type and screwless-type clamping units - Part 1: General requirements and
232		particular requirements for clamping units for conductors from 0,2 mm ² up to
233		35 mm ² (included) (IEC 60999-1:1999)
234	EN 60999-2:2003	Connecting devices - Electrical copper conductors - Safety requirements for screw-
235		type and screwless-type clamping units - Part 2: Particular requirements for
236		clamping units for conductors above 35 mm ² up to 300 mm ² (included)
237		(IEC 60999-2:2003)
238	EN 61210:1995	Connecting devices - Flat quick-connect terminations for electrical copper
239		conductors - Safety requirements (IEC 61210:1993, mod.)
240	EN 61373:1999	Railway applications - Rolling stock equipment - Shock and vibration tests
241		(IEC 61373:1999)
242	EN 61984:2001 ³⁾	Connectors - Safety requirements and tests (IEC 61984:2001)
243	EN ISO 4892-2:1999 ⁴⁾	Plastics – Methods of exposure to laboratory light sources – Xenon arc sources
244		(ISO 4892-2:1994)
245		
246	HD 588.1 S1:1991	High-voltage test techniques - Part 1: General definitions and test requirements
247		(IEC 60060-1:1989 + corrigendum Mar. 1990 + corrigendum Mar. 1992)
248	IEC 60050-581:1978	International Electrotechnical Vocabulary (IEV) – Chapter 581: Electromechanical
249	+ A1:1998 ⁵⁾	components for electronic equipment
250	IEC 60050-811	International Electrotechnical Vocabulary (IEV) – Chapter 811: Electric traction
251	IEC 60050-826	International Electrotechnical Vocabulary (IEV) – Part 826: Electrical installations
252	IEC 60417-2 ⁶⁾	Graphical symbols for use on equipment
253	IEC 60760	Flat, quick-connect terminations
254	IEC 60536:1976 ⁷⁾	Classification of electrical and electronic equipment with regard to protection
255		against electric shock
256	ISO 1431-1:2004	Rubber, vulcanized or thermoplastic – Resistance to ozone cracking –
257		Part 1: Static and dynamic strain testing

³⁾ Will be superseded by EN 61984:2009, *Connectors - Safety requirements and tests* (IEC 61984:2008) at the end of the latter, i.e. 2012-06-01.

⁴⁾ Superseded by EN ISO 4892-2:2006, *Plastics – Methods of exposure to laboratory light sources – Part 2: Xenon-arc lamps* (ISO 4892-2:2006).

⁵⁾ Superseded by IEC 60050-581:2008, *International Electrotechnical Vocabulary – Part 581: Electromechanical components for electronic equipment*.

⁶⁾ Superseded by IEC 60417-DB, *Graphical symbols for use on equipment*.

⁷⁾ Superseded by IEC 61140:1997, *Protection against electric shock – Common aspects for installation and equipment* (harmonized as EN 61140:2001). IEC 61140:1997 is superseded by IEC 61140:2001, *Protection against electric shock – Common aspects for installation and equipment*, which is harmonized as EN 61140:2002).

258 3 Terms and definitions

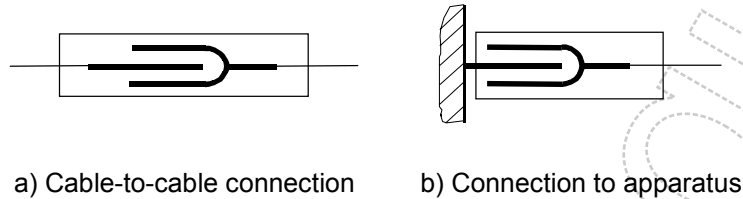
259 For the purposes of this document, the terms and definitions given in IEC 60050-581:1978 and the following
260 apply.

261 3.1

262 **connection**

263 two mated connectors or contacts

264 EXAMPLES See Figure 1.



265 **Figure 1 – Typical examples of connections**

266 3.2

267 **connector**

268 component which terminates conductors for the purpose of providing connection to and disconnection from a
269 suitable mating component, and which are not intended to be connected and disconnected under electrical
270 load

271 [IEV 581-06-01, mod.]

272 3.3

273 **free connector**

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

275 [IEV 581-06-12]

276 3.4

277 **fixed connector**

278 connector for attachment to a rigid surface

279 [IEV 581-06-10]

280 3.5

281 **enclosed connector**

282 connector where protection against electric shock is provided by its enclosures

283 3.6

284 **unenclosed connector**

285 connector where protection against electric shock is provided by the enclosure of the equipment, in which the
286 connector is mounted, in accordance with the applicable product safety standard

287 3.7

288 **inter-vehicle connector**

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

291 3.8

292 **contact**

293 conductive element in a connector (including means for cable termination) that mates with a corresponding
294 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**

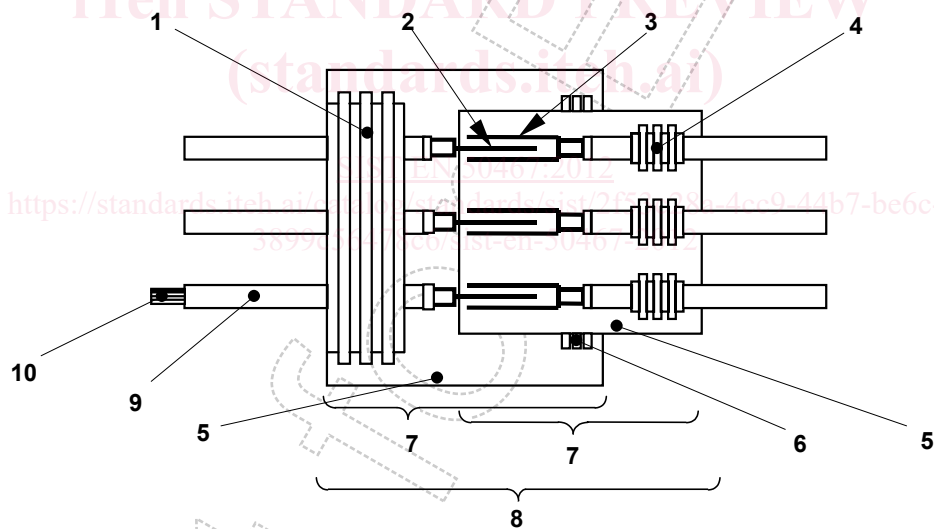
any joining of cable to contact

EXAMPLES Crimp, insulation displacement, screwing, spring clamp.

3.12**multipole connector**

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

3.13**connector coding**

device, either visual, or mechanical or sensitive, or a combinations of these, preventing connection of connectors from the same family and having the same number of contacts but with different coding

- 319 **3.14**
320 **intended use**
321 application conditions of connectors which are included within the permissible rated values and
322 environmental conditions and characteristic assigned by the manufacturer's specification
- 323 **3.15**
324 **interlock**
325 device, either electrical or mechanical, which prevents the contacts of a connector from becoming live before
326 it is in proper engagement with its counterpart, and which either prevents the connector from being
327 withdrawn while its contacts are live or makes the contacts dead before separation
328 [EN 60309-1:1999, 2.9, mod.]
- 329 **3.16**
330 **cycle of mechanical operation** (mating cycles)
331 one insertion and one withdrawal of the connector halves
332 [EN 61984:2001, 3.9]
- 333 **3.17**
334 **clamping unit**
335 part(s) of the terminal necessary for the mechanical clamping and the electrical connection of the
336 conductor(s), including the parts which are necessary to ensure the correct contact pressure
337 [EN 60999-1:2000, 2.1]
- 338 **3.18**
339 **upper limiting temperature**
340 maximum permissible temperature of a connector assigned by the manufacturer at which the connector may
341 still be operated. It takes into consideration the temperature rise due to heating of the contacts by current
342 flow plus the ambient temperature
- 343 **3.19**
344 **lower limiting temperature**
345 minimum permissible temperature of a connector assigned by the manufacturer at which the connector may
346 still be operated
- 347 **3.20**
348 **clearance**
349 shortest distance in air between two conductive parts
350 [EN 60664-1:2007, 1.3.2]
- 351 **3.21**
352 **creepage distance**
353 shortest distance along the surface of the insulating material between two conductive parts
354 [EN 60664-1:2007, 1.3.3]
- 355 **3.22**
356 **over voltage category**
357 numeral defining a transient over voltage condition
358 [EN 60664-1:2007, 1.3.10]
- 359 **3.23**
360 **pollution**
361 any addition of foreign matter, solid, liquid, or gaseous (ionised gases), that can result in a reduction of
362 electrical strength or specific surface resistivity of the insulation
363 [EN 60664-1:2007, 1.3.11]