

SLOVENSKI STANDARD

oSIST prEN 50122-1:2008

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SIST EN 50122-1:1998

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Railway applications - Fixed installations - Electrical safety, earthing and bonding -- Part 1: Protective provisions against electric shock

Bahnanwendungen - Ortsfeste Anlagen - Elektrische Sicherheit, Erdung und Rückstromführung -- Teil 1: Schutzmaßnahmen gegen elektrischen Schlag

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Applications ferroviaires - Installations fixes - Sécurité électrique, dispositions pour les courants de retour et mise à la terre -- Partie 1: Mesures de protection contres les chocs électriques

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ICS:

13.260	Xæ•ç[Á!^áÁ \dã} ã ~ áæ[{ EÖ^ Á[áÁ æ^ç •ç	Protection against electric shock. Live working
29.120.50	Xæ[çæ\^Á Ái`* æ { ^áç \[ç} æÁ æ ææ	Fuses and other overcurrent protection devices
45.020	Železniška tehnika na splošno	Railway engineering in general

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NORME EUROPÉENNE
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ICS

Will supersede EN 50122-1:1997

English version

**Railway applications -
Fixed installations -
Electrical safety, earthing and bonding -
Part 1: Protective provisions against electric shock**

Applications ferroviaires -
Installations fixes -
Sécurité électrique, dispositions pour les
courants de retour et mise à la terre -
Partie 1: Mesures de protection contre
les chocs électriques

Bahnanwendungen -
Ortsfeste Anlagen -
Elektrische Sicherheit, Erdung und
Rückstromführung -
Teil 1: Schutzmaßnahmen gegen
elektrischen Schlag

This draft European Standard is submitted to CENELEC members for CENELEC enquiry.
Deadline for CENELEC: 2008-09-26.

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

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

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1

Foreword

2 This draft European Standard was prepared by SC 9XC, Electric supply and earthing systems for public
3 transport equipment and ancillary apparatus (Fixed installations), of Technical Committee CENELEC TC 9X,
4 Electrical and electronic applications for railways. It is submitted to the CENELEC enquiry.

5 This document will supersede EN 50122-1:1997.

6 This draft European Standard has been prepared under a mandate given to CENELEC by the European
7 Commission and the European Free Trade Association and covers essential requirements of EC Directives
8 96/48/EC and 2001/16/EC.

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157

158

159 1 Scope

160 This European Standard specifies requirements for the protective provisions relating to electrical safety in
161 fixed installations associated with a.c. and/or d.c. traction systems and to any installations that may be
162 endangered by the traction power supply system.

163 It also applies to all aspects of fixed installations that are necessary to ensure electrical safety during
164 maintenance work within electric traction systems.

165 This European Standard applies to all new lines and to all major revisions to existing lines for the following
166 electric traction systems:

- 167 – railways;
- 168 – guided mass transport systems such as:
 - 169 – tramways,
 - 170 – elevated and underground railways,
 - 171 – mountain railways,
 - 172 – trolleybus systems and
 - 173 – magnetic levitated systems;
 - 174 – material transportation systems.

175 This European Standard does not apply to:

- 176 – mine traction systems in underground mines;
- 177 – cranes, transportable platforms and similar transportation equipment on rails, temporary structures (e.g.
178 exhibition structures) in so far as these are not supplied directly or via transformers from the contact line
179 system and are not endangered by the traction power supply system;
- 180 – suspended cable cars;
- 181 – funicular railways.

182 This European Standard does not specify working rules for maintenance.

183 2 Normative references

184 The following referenced documents are indispensable for the application of this document. For dated
185 references, only the edition cited applies. For undated references, the latest edition of the referenced
186 document (including any amendments) applies.

187 EN 50119:2001, *Railway applications – Fixed installations – Electric traction overhead contact lines*

188 EN 50122-2 ¹⁾, *Railway applications – Fixed installations – Electrical safety, earthing and bonding – Part 2:*
189 *Provisions against the effects of stray currents caused by d.c. traction systems*

190 EN 50122-3 ¹⁾, *Railway applications – Fixed installations – Electrical safety, earthing and bonding – Part 3:*
191 *Mutual interaction of a.c. and d.c. traction systems*

192 EN 50124-1:2001 + A1:2003 + A2:2005, *Railway applications – Insulation coordination – Part 1: Basic*
193 *requirements – Clearances and creepage distances for all electrical and electronic equipment*

194 EN 50153:2002, *Railway applications – Rolling stock – Protective provisions relating to electrical hazards*

1) At draft stage.

- 195 EN 50163, *Railway applications – Supply voltages of traction systems*
- 196 EN 60529:1991 + A1:2000, *Degrees of protection provided by enclosures (IP Code)* (IEC 60529:1989 +
197 A1:1999)
- 198 EN 60898-1:2003+ A11:2005, *Electrical accessories – Circuit breakers for overcurrent protection for*
199 *household and similar installations – Part 1: Circuit-breakers for a.c. operation* (IEC 60898-1:2002, mod.)
- 200 EN 61140:2002, *Protection against electric shock – Common aspects for installation and equipment*
201 (IEC 61140:2001)
- 202 HD 384.4.41 S2:1996 + A1:2002 ²⁾, *Electrical installations of buildings – Part 4: Protection for safety –*
203 *Chapter 41: Protection against electric shock* (IEC 60364-4-41:1992 + A2:1999, mod.)
- 204 HD 637 S1:1999, *Power installations exceeding 1 kV a.c.*
- 205 IEC 60050-101, *International Electrotechnical Vocabulary – Part 101: Mathematics*
- 206 IEC 60050-111, *International Electrotechnical Vocabulary – Chapter 111: Physics and chemistry*
- 207 IEC 60050-151, *International Electrotechnical Vocabulary – Part 151: Electrical and magnetic devices*
- 208 IEC 60050-191, *International Electrotechnical Vocabulary – Chapter 191: Dependability and quality of service*
- 209 IEC 60050-195, *International Electrotechnical Vocabulary – Part 195: Earthing and protection against electric*
210 *shock*
- 211 IEC 60050-466, *International Electrotechnical Vocabulary – Chapter 466: Overhead lines*
- 212 IEC 60050-811, *International Electrotechnical Vocabulary – Chapter 811: Electric traction*
- 213 IEC 60050-821, *International Electrotechnical Vocabulary – Part 821: Signalling and security apparatus for*
214 *railways*
- 215 IEC 60050-826, *International Electrotechnical Vocabulary – Part 826: Electrical installations* 4-
216 *ISO 3864 (all parts), Graphical symbols – Safety colours and safety signs*

217 **3 Terms and definitions**

218 For the purposes of this document, the following terms and definitions apply.

219 **3.1 Electrical safety and hazards**

220 **3.1.1**

221 **electrical safety**

222 freedom from unacceptable risk of harm caused by electrical systems

223 **3.1.2**

224 **electric shock**

225 pathophysiological effect resulting from an electric current passing through a human or animal body

226 [IEC 60050-826-03-04]

2) Superseded by HD 60364-4-41:2007, *Low-voltage electrical installations -- Part 4-41: Protection for safety - Protection against electric shock* (IEC 60364-4-41:2005, mod.)

3.1.3**(effective) touch voltage (U_{te})**

voltage between conductive parts when touched simultaneously by a person or an animal

NOTE 1 The value of the effective touch voltage can be appreciably influenced by the impedance of the person or the animal in electric contact with these conductive parts.

[IEC 60050-195-05-11]

NOTE 2 The conductive path through the body is conventionally from hand to both feet (horizontal distance of 1 m) or from hand to hand.

3.1.4**prospective touch voltage**

voltage between simultaneously accessible conductive parts when those conductive parts are not being touched by a person or an animal

[IEC 60050-195-05-09]

3.1.5**body voltage (U_b)**

product of the current through the body and the body impedance

3.1.6**standing surface**

any point on a surface where persons may stand or walk about without great effort

3.1.7**protective boarding**

non-conducting barrier to protect persons from coming into contact with the live conductor rail

3.1.8**(electrically) protective obstacle**

part preventing unintentional direct contact, but not preventing direct contact by deliberate action

[IEC 60050-195-06-16]

3.1.9**anti-trespassing guard**

equipment provided to prevent entry to a restricted area, structure or building by an unauthorized person

3.1.10**conductive part**

part which can carry electric current

[IEC 60050-195-01-06]

3.1.11**exposed conductive part**

conductive part of electrical equipment, which can be touched and which is not normally live, but which may become live under fault conditions

NOTE A conductive part of electrical equipment which can only become live under fault conditions through an exposed conductive part is not considered to be an exposed conductive part.

[IEC 60050-826-03-02]

3.1.12**live part**

conductor or conductive part intended to be energized in normal use, by convention. This does not include the running rails and parts connected to them

3.1.13**direct contact**

electric contact of persons or animals with live parts

[IEC 60050-826-12-03]

3.1.14**indirect contact**

electric contact of persons or animals with exposed conductive parts which have become live under fault conditions

[IEC 60050-826-12-04]

3.1.15**neutral conductor (symbol N)**

conductor connected to the neutral point of a system and capable of contributing to the transmission of electrical energy

[IEC 60050-826-01-03]

3.1.16**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

[IEC 60050-826-04-05]

3.1.17**PEN conductor**

earthed conductor combining the functions of both protective conductor and neutral conductor

NOTE The acronym PEN results from the combination of symbols PE for the protective conductor and N for the neutral conductor.

[IEC 60050-826-04-06]

3.1.18**solid-wall design**

any kind of construction made of concrete, steel or other material without any holes or gaps

3.1.19**voltage-limiting device (VLD)**

protective device whose function is to prevent existence of an impermissible high touch voltage

NOTE Two variants of VLD are distinguished:

- VLD-O for operational conditions: protective device against existence of an impermissible high touch voltage coming from rail potential during operation;
- VLD-F for fault conditions: protective device against existence of an impermissible high touch voltage, coming from earth faults or short circuits between the contact line and the return circuit.

311 3.2 Earthing and equipotential bonding

312 3.2.1

313 earth

314 the conductive mass of the earth, whose electric potential at any point is conventionally taken as equal to
315 zero

316 [IEC 60050-826-04-01]

317 3.2.2

318 earthing

319 connection of conductive parts to an appropriate earth electrode

320 3.2.3

321 earth electrode

322 conductive part or a group of conductive parts in intimate contact with and providing an electrical connection
323 with earth

324 [IEC 60050-826-04-02]

325 3.2.4

326 structure earth

327 construction made of metallic parts or construction including interconnected metallic structural parts, which
328 can be used as an earth electrode

329 NOTE Examples are reinforced railway structures such as bridges, viaducts, tunnels, mast foundations and reinforced track bed.

330 3.2.5

331 rail to earth resistance

332 electrical resistance between the running rails and the earth or structure earth

333 3.2.6

334 equipotential bonding

335 electrical connection putting various exposed conductive parts and extraneous conductive parts at a
336 substantially equal potential

337 [IEC 60050-826-04-09]

338 3.2.7

339 main equipotential busbar (MEB)

340 busbar where the equipotential cables terminate

341 3.2.8

342 cross bond

343 any electrical connection intended to connect in parallel the conductors of the return circuit

344 3.2.9

345 rail-to-rail cross bond

346 electrical bond that interconnects the running rails of the same track

347 3.2.10

348 track-to-track cross bond

349 electrical bond that interconnects tracks

350 3.2.11

351 rail joint bond

352 conductor ensuring the electrical continuity of a rail at a joint

353 [IEC 60050-811-35-07]

3.2.12**open connection**

connection of conductive parts to the return circuit by a voltage-limiting device which makes a conductive connection either temporarily or permanently if the limited value of the voltage is exceeded

3.2.13**common building**

building or structure which contains or supports an a.c. railway and a d.c. railway; furthermore where some conductive parts of the structure are within the contact line zone or the current collector zone of the a.c. railway and some conductive parts of the structure are within the contact line zone or the current collector zone of the d.c. railway

NOTE Even the unintended connection of conductive parts of different structures can form a common building, e.g. via reinforcement, wiring, pipes, etc.

3.3 Return circuit**3.3.1****return circuit**

all conductors which form the intended path for the traction return current under operation and fault conditions

EXAMPLE The conductors may be

- running rails,
- return conductor rails,
- return conductors,
- return cables.

3.3.2**track return system**

system in which the running rails of the track form a part of the return circuit for the traction current
[IEC 60050-811-35-02]

3.3.3**return conductor**

conductor paralleling the track return system and connected to the running rails at periodic intervals

3.3.4**return conductor rail – return current rail**

conductor rail used instead of the running rail for the return currents
[IEC 60050-811-34-10]

3.3.5**return cable**

conductor connecting the running rails or other parts of the return circuit to the substation

NOTE Similar to IEC 60050-811-35-04.

3.3.6**traction return current**

sum of the currents returning to the supply source, the substation or regenerative braking vehicles via the return circuit

3.3.7**rail potential (U_{RE})**

voltage occurring between running rails and earth

3.3.8**closed formation**

area where the top of the running rails is at the same level as the surface

3.3.9**open formation**

area where the running rails are laid above the surface

3.3.10**conductance per length**

reciprocal value of the rail to earth resistance per length (S/km)

3.3.11**insulating rail joint**

mechanical rail joint which longitudinally separates the rail electrically

3.3.12**track circuit**

electrical circuit of which the rails of a track section form a part, with usually a source of current connected at one end and a detection device at the other end for detecting whether this track section is clear or occupied by a vehicle

NOTE In a continuous signalling system, the track circuit may be used to transmit information between the ground and the train.

[IEC 60050-821-03-01]

3.3.13**top of rail level (TOR)**

common rail level tangent

3.4 Electric traction system**3.4.1****electric traction system**

railway electrical distribution network used to provide energy for rolling stock

NOTE The system may comprise:

- contact line systems;
- return circuit of electric traction systems;
- running rails of non electric traction systems, which are in the vicinity of, and conductively connected to the running rails of an electric traction system;
- electrical installations, which are supplied from contact lines either directly or via a transformer;
- electrical installations in substations, which are utilized solely for distribution of power directly to the contact line;
- electrical installations of switching stations.

3.4.2**(traction) substation**

installation to supply a contact line system and at which the voltage of a primary supply system, and in certain cases the frequency, is transformed to the voltage and the frequency of the contact line

3.4.3**(traction) switching station**

installation from which electrical energy can be distributed to different feeding sections or from which different feeding sections can be switched on and off or can be interconnected