



SLOVENSKI STANDARD
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Železniške naprave - Stabilne naprave električne vleke - Električna varnost, ozemljitev in povratni tokokrog - 1. del: Zaščitni ukrepi proti električnemu udaru

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

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

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

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Ta slovenski standard je istoveten z: prEN 50122-1

ICS:

| | | |
|--------|--|---|
| 13.260 | Varstvo pred električnim udarom. Delo pod napetostjo | Protection against electric shock. Live working |
| 29.280 | Električna vlečna oprema | Electric traction equipment |

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EUROPEAN STANDARD
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EUROPÄISCHE NORM

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November 2020

ICS 29.280

Will supersede EN 50122-1:2011 and all of its
amendments and corrigenda (if any)

English Version

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

Applications ferroviaires - Installations fixes - Sécurité
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Mesures de protection contre les chocs électriques

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

This draft European Standard is submitted to CENELEC members for enquiry.
Deadline for CENELEC: 2021-02-19.

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

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

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135 **European foreword**

136 This document (prEN 50122-1:2020) has been prepared by CLC/SC 9XC “Electric supply and earthing systems for public transport equipment and ancillary apparatus (Fixed installations)”.

138 This document is currently submitted to the Enquiry.

139 The following dates are proposed:

- latest date by which the existence of this document has to be announced at national level (doa) dor + 6 months
- latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) dor + 12 months
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) dor + 36 months (to be confirmed or modified when voting)

140 This document will supersede EN 50122-1:2011 and all of its amendments and corrigenda (if any).

141 prEN 50122-1:2020 includes the following significant technical changes with respect to EN 50122-1:2011:

142 — some definitions were modified;

143 — the dimensions for protection by clearance were modified, especially there are now voltage dependent differences for high voltage electric traction power supply systems;

144 — methods for the use of obstacles for protection by obstacle were significantly changed.

145 This document has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

146 For the relationship with EU Directive(s) see informative Annex ZZ, which is an integral part of this document.

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149 **1 Scope**

150 This document specifies requirements for the protective provisions relating to electrical safety in fixed installa-
 151 tions associated with AC and/or DC traction systems and to any installations that can be endangered by the
 152 electric traction power supply system. This also includes the requirements which are present at the interface
 153 with the live parts on the outside of the vehicles.

154 It also applies to all aspects of fixed installations that are necessary to ensure electrical safety during mainte-
 155 nance work within electric traction power supply systems.

156 This document applies to all new lines and to all major revisions to existing lines for the following electric
 157 traction power supply systems:

- 158 a) railways;
- 159 b) guided mass transport systems such as
 - 160 1) tramways,
 - 161 2) elevated and underground railways,
 - 162 3) mountain railways,
 - 163 4) trolleybus systems
 - 164 5) electric traction supplies for road vehicles, which use an overhead contact line system, and
 - 165 6) magnetically levitated systems, which use a contact line system;

166 c) material transportation systems.

167 This document does not apply to:

- 168 d) mine traction systems in underground mines,
- 169 e) cranes, transportable platforms and similar transportation equipment on rails, temporary structures (e.g.
 170 exhibition structures) in so far as these are not supplied directly or via transformers from the contact line
 171 system and are not endangered by the electric traction power supply system,
- 172 f) suspended cable cars,
- 173 g) funicular railways.

174 This document does not specify working rules for maintenance.

175 **2 Normative references**

176 The following documents are referred to in the text in such a way that some or all of their content constitutes
 177 requirements of this document. For dated references, only the edition cited applies. For undated references,
 178 the latest edition of the referenced document (including any amendments) applies.

179 EN 50119:2020, *Railway applications - Fixed installations - Electric traction overhead contact lines*

180 EN 50122-2, *Railway applications - Fixed installations - Electrical safety, earthing and the return circuit - Part*
 181 *2: Provisions against the effects of stray currents caused by d.c. traction systems*

182 EN 50124-1:2017, *Railway applications - Insulation coordination - Part 1: Basic requirements - Clearances*
 183 *and creepage distances for all electrical and electronic equipment*

- 184 EN 50153:2014,¹ *Railway applications – Rolling stock – Protective provisions relating to electrical hazards*
- 185 EN 50163:2004,² *Railway applications – Supply voltages of traction systems*
- 186 EN 50522:2010, *Earthing of power installations exceeding 1 kV a.c.*
- 187 EN 60529:1991³, *Degrees of protection provided by enclosures (IP code) (IEC 60529:1989)*
- 188 EN 60898-1:2019, *Electrical accessories - Circuit-breakers for overcurrent protection for household and similar*
- 189 *installations - Part 1: Circuit-breakers for a.c. operation (IEC 60898-1:2016)*
- 190 EN 61140:2016, *Protection against electric shock - Common aspects for installation and equipment*
- 191 *(IEC 61140:2016)*
- 192 EN 61936-1:2010,⁴ *Power installations exceeding 1 kV a.c. – Part 1: Common rules (IEC 61936-1:2010)*
- 193 EN 62305 (series), *Protection against lightning (IEC 62305 series)*
- 194 HD 60364 series, *Low-voltage electrical installations (HD 60364 series)*
- 195 HD 60364-4-41:2017,⁵ *Low-voltage electrical installations – Part 4-41: Protection for safety – Protection*
- 196 *against electric shock (IEC 60364-4-41:2005, modified)*
- 197 ISO 3864-1:2011, *Graphical symbols — Safety colours and safety signs — Part 1: Design principles for safety*
- 198 *signs and safety markings*
- 199 ISO 7010:2019, *Graphical symbols — Safety colours and safety signs — Registered safety signs*

200 **3 Terms and definitions** (standards.iteh.ai)

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

202 ISO and IEC maintain terminological databases for use in standardization at the following addresses:

203 — ISO Online browsing platform: available at <https://www.iso.org/obp>

204 — IEC Electropedia: available at <http://www.electropedia.org/>

205 **3.1 Electrical safety and hazards**

206 **3.1.1**

207 **electrical safety**

208 freedom from unacceptable risk of harm caused by electrical systems

209 **3.1.2**

210 **electric shock**

211 physiological effect resulting from an electric current passing through a human or animal body

212 [SOURCE: IEC 60050-195:1998, 195-01-04]

¹ As impacted by EN 50153:2014/A1:2017.

² As impacted by EN 50163:2004/AC:2013.

³ As impacted by EN 60529:1991/A1:2000 and EN 60529:1991/A2:2013.

⁴ As impacted by 61936-1:2010/AC:2011, 61936-1:2010:2013 and 61936-1:2010/A1:2014.

⁵ As impacted by HD 60364-4-41:2017/A11:2017 and HD 60364-4-41:2017/A12:2019.

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- 213 **3.1.3**
 214 **(effective) touch voltage**
 215 U_{te}
 216 voltage between conductive parts when touched simultaneously by a human or livestock
- 217 Note 1 to entry: The value of the effective touch voltage can be appreciably influenced by the impedance of the person
 218 or the animal in electric contact with these conductive parts.
- 219 Note 2 to entry: The conductive path through the body is conventionally from hand to both feet (horizontal distance of
 220 1 m) or from hand to hand.
- 221 [SOURCE: IEC 60050-195:1998, 195-05-11, modified – “a person or an animal” has been replaced by “a hu-
 222 man or livestock”. The Note 2 to entry has been added]
- 223 **3.1.4**
 224 **prospective touch voltage**
 225 voltage between simultaneously accessible conductive parts when those conductive parts are not being
 226 touched by a human or livestock
- 227 [SOURCE: IEC 60050-195:1998, 195-05-09, modified - “a person or an animal” has been replaced by “a hu-
 228 man or livestock”.]
- 229 **3.1.5**
 230 **body voltage**
 231 U_b
 232 product of the current through the body and the body impedance
- 233 **3.1.6**
 234 **accessible area**
 235 any point where persons may stand or walk even by help
- 236 **3.1.7**
 237 **standing surface**
 238 any point on a surface where persons may have easy and intentional access and stand or walk about without
 239 great effort
- 240 **3.1.8**
 241 **protective boarding**
 242 non-conducting barrier to protect persons from coming into direct contact with a live conductor rail
- 243 **3.1.9**
 244 **(electrically) protective obstacle**
 245 part preventing unintentional direct contact, but not preventing direct contact by deliberate action
- 246 [SOURCE: IEC 60050-195:1998, 195-06-16]
- 247 **3.1.10**
 248 **(electrically) protective barrier**
 249 part providing protection against direct contact from any usual direction of access
- 250 [SOURCE: IEC 60050-195:1998, 195-06-15]
- 251 **3.1.11**
 252 **anti-trespassing guard**
 253 equipment provided to deter entry to a restricted area, structure or building by an unauthorized person
- 254 **3.1.12**
 255 **conductive part**
 256 part which can carry electric current
- 257 [SOURCE: IEC 60050-195:1998, 195-01-06]

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- 258 **3.1.13**
 259 **exposed conductive part**
 260 conductive part of equipment which can be touched and which is not normally live, but which can become live
 261 when basic insulation fails
- 262 Note 1 to entry: A conductive part of electrical equipment, which can become live only through contact with an exposed-
 263 conductive-part which has become live, is not considered to be an exposed-conductive-part itself.
- 264 [SOURCE: IEC 60050-195:1998, 195-06-20, modified - The Note 1 to entry has been added]
- 265 **3.1.14**
 266 **live part**
 267 conductor or conductive part intended to be energized in normal use
- 268 Note 1 to entry: This concept does not necessarily imply a risk of electric shock.
- 269 Note 2 to entry: By convention, this does not include the running rails and parts connected to them.
- 270 [SOURCE: IEC 60050-811:2017, 811-36-23]
- 271 **3.1.15**
 272 **direct contact**
 273 electric contact of persons or animals with live parts
- 274 [SOURCE: IEC 60050-826:2004, 826-12-03]
- 275 **3.1.16**
 276 **indirect contact**
 277 electric contact of persons or animals with exposed conductive parts which have become live under fault con-
 278 ditions
- 279 [SOURCE: IEC 60050-826:2004, 826-12-04]
- 280 **3.1.17**
 281 **neutral conductor**
 282 conductor electrically connected to the neutral point and capable of contributing to the distribution of electric
 283 energy
- 284 [SOURCE: IEC 60050-826:2004, 826-14-07]
- 285 **3.1.18**
 286 **protective conductor**
 287 **PE identification**
 288 **PE**
 289 conductor provided for purposes of safety, for example protection against electric shock
- 290 Note 1 to entry: In an electrical installation, the conductor identified PE is normally also considered as protective earth-
 291 ing conductor.
- 292 [SOURCE: IEC 60050-826:2004, 826-13-22]
- 293 **3.1.19**
 294 **PEN conductor**
 295 conductor combining the functions of both a protective earthing conductor and a neutral conductor
- 296 [SOURCE: IEC 60050-826:2004, 826-13-25]
- 297 **3.1.20**
 298 **solid-wall design**
 299 any kind of construction made of concrete, steel or other material without any holes or gaps

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- 300 **3.1.21**
 301 **voltage-limiting device**
 302 **VLD**
 303 protective device whose function is to prevent existence of an impermissible high touch voltage
- 304 [SOURCE: IEC 60050-811:2017, 811-29-41, modified – abbreviation “VLD” added]
- 305 **3.2 Earthing and equipotential bonding**
- 306 **3.2.1**
 307 **earth**
 308 conductive mass of the earth, whose electric potential at any point is conventionally taken as equal to zero
- 309 **3.2.2**
 310 **earthing**
 311 connection of conductive parts to an appropriate earth electrode
- 312 **3.2.3**
 313 **earth electrode**
 314 conductive part, which may be embedded in a specific conductive medium, e.g. concrete or coke, in electric
 315 contact with the earth
- 316 [SOURCE: IEC 60050-195:1998, 195-02-01, modified – earth without capital]
- 317 **3.2.4**
 318 **structure earth**
 319 construction made of metallic parts or construction including interconnected metallic structural parts, which
 320 can be used as an earth electrode
- 321 Note 1 to entry: Examples are reinforced railway structures such as bridges, viaducts, tunnels, mast foundations and
 322 reinforced track bed.
- 323 **3.2.5**
 324 **rail to earth resistance**
 325 electrical resistance between the running rails and the earth or structure earth
- 326 **3.2.6**
 327 **equipotential bonding**
 328 provision of electric connections between conductive parts, intended to achieve equipotentiality
- 329 [SOURCE: IEC 60050-195:1998, 195-01-10]
- 330 **3.2.7**
 331 **main equipotential busbar**
 332 **MEB**
 333 busbar where the equipotential conductors terminate
- 334 **3.2.8**
 335 **cross bond**
 336 any electrical connection intended to connect two or more conductors of the return circuit in parallel
- 337 **3.2.9**
 338 **rail-to-rail cross bond**
 339 electrical bond that interconnects the running rails of the same track
- 340 **3.2.10**
 341 **track-to-track cross bond**
 342 electrical bond that interconnects tracks

343 **3.2.11**
 344 **rail joint bond**
 345 conductor ensuring the electrical continuity of rails at a joint

346 [SOURCE: IEC 60050-811:2017, 811-35-07]

347 **3.2.12**
 348 **open connection**
 349 connection of conductive parts to the return circuit by a voltage-limiting device which makes a conductive
 350 connection either temporary or permanent if the limited value of the voltage is exceeded

351 **3.2.13**
 352 **common building**
 353 building or structure which contains or supports an AC railway and a DC railway; furthermore where some
 354 conductive parts of the structure are within the contact line zone or the current collector zone of the AC railway
 355 and some conductive parts of the structure are within the contact line zone or the current collector zone of the
 356 DC railway

357 Note 1 to entry: Even the unintended connection of conductive parts of different structures can form a common build-
 358 ing, e.g. via reinforcement, wiring, pipes, etc.

359 **3.3 Return circuit**

360 **3.3.1**
 361 **extended return circuit**
 362 that part of the traction power supply circuit which leads the current back from the loads such as vehicles or
 363 other equipment to the source, characterised by tripping of the circuit breaker in case of contact with a live part

364 EXAMPLE The conductors may be:

- 365 — running rails,
- 366 — return conductor rails,
- 367 — return conductors,
- 368 — return cables;
- 369 — BT return conductors.

370 **3.3.2**
 371 **return circuit**
 372 that subset of the extended return circuit where the direct contact is permissible during both operational and
 373 fault conditions

374 Note 1 to entry: The earthed phase of a three-phase electric traction power supply system can be considered as a
 375 return circuit.

376 **3.3.3**
 377 **track return system**
 378 system in which the running rails of the track form a part of the return circuit for the traction current

379 [SOURCE: IEC 60050-811:2017, 811-35-02]

380 **3.3.4**
 381 **return conductor**
 382 conductor paralleling the track return system and connected to the running rails at periodic intervals

383 [SOURCE: IEC 60050-811:2017, 811-35-13]

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- 384 **3.3.5**
 385 **return conductor rail**
 386 **return current rail**
 387 conductor rail used instead of the running rails for the return traction currents
- 388 [SOURCE: IEC 60050-811:2017, 811-34-10]
- 389 **3.3.6**
 390 **booster transformer return conductor**
 391 **BT return conductor**
 392 insulated set of return conductors which is necessary for the functionality of a booster transformer system
- 393 **3.3.7**
 394 **return cable**
 395 conductor connecting the running rails or other parts of the return circuit to the substation
- 396 [SOURCE: IEC 60050-811:2017, 811-35-04, modified – “return current rail” has been replaced by “other parts
 397 of the return circuit”]
- 398 **3.3.8**
 399 **traction return current**
 400 sum of the currents returning to the supply source, the substation or regenerative braking vehicles
- 401 Note 1 to entry: This can also include load fed from the electric traction power supply systems for example point heat-
 402 ing, auxiliary supplies.
- 403 **3.3.9**
 404 **rail potential**
 405 U_{RE}
 406 voltage occurring between running rails and earth
- 407 **3.3.10**
 408 **closed formation**
 409 area where the top of the running rails is at the same level as the surrounding surface
- 410 **3.3.11**
 411 **open formation**
 412 area where the running rails are laid above the surrounding surface
- 413 **3.3.12**
 414 **conductance per length**
 415 G'_{RE}
 416 reciprocal value of the rail to earth resistance per length (S/km)
- 417 **3.3.13**
 418 **insulated rail joint**
 419 mechanical rail joint which longitudinally separates the rail electrically
- 420 [SOURCE IEC 60050-811:2017, 811-35-11, modified – “longitudinally” has been added]
- 421 **3.3.14**
 422 **track circuit**
 423 electrical circuit of which the rails of a track section form a part, with usually a source of current connected at
 424 one end and a detection device at the other end for detecting whether this track section is clear or occupied
 425 by a vehicle
- 426 Note 1 to entry: In a continuous signalling system, the track circuit can be used to transmit information between the
 427 ground and the train.
- 428 [SOURCE: IEC 60050-821:2017, 821-03-01]

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429 **3.3.15**
 430 **top of rail level**
 431 **TOR**
 432 common rail level tangent

433 **3.4 Electric traction power supply system**

434 **3.4.1**
 435 **electric traction power supply system**
 436 railway electrical distribution network used to provide energy for rolling stock

437 Note 1 to entry: The system may comprise:

438 — contact line systems;

439 — return circuit of electric traction systems;

440 — running rails of non-electrified tracks, which are in the vicinity of, and conductively connected to the running
 441 rails of an electric traction system;

442 — electrical installations, which are supplied from contact lines either directly or via a transformer;

443 — electrical installations in power plants in substations, which are utilized solely for distribution of power directly
 444 to the contact line;

445 — electrical installations of switching stations.

446 **3.4.2**
 447 **traction substation**
 448 **substation**

449 substation the main function of which is to supply an electric traction power supply system

450 Note 1 to entry: The synonym substation is used only when the context is clear.

451 Note 2 to entry: It includes equipment for protection and switching-off.

452 [SOURCE: IEC 60050-811:2017, 811-36-02, modified – the specific use “<in electric traction>” in the headline
 453 has been removed; the term “electric traction system” has been replaced by “electric traction power supply
 454 system”. The Note 2 to entry has been added.]

455 **3.4.3**
 456 **switching station**
 457 **traction switching station**

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

460 [SOURCE: IEC 60050-811:2017, 811-36-22]

461 **3.4.4**
 462 **feeding section**

463 electrical section of the route fed by individual track feeder circuit-breakers within the area supplied by one or
 464 more substations

465 [SOURCE: IEC 60050-811:2017, 811-36-25]

466 **3.4.5**
 467 **fault condition**

468 non-intended condition caused by short-circuit; the time duration of which is terminated by the correct function
 469 of the protection devices and circuit breakers

470 Note 1 to entry: For the relevant fault duration, the correct operation of protection devices and circuit breakers is taken
 471 into account.

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