

SLOVENSKI STANDARD

SIST EN 50122-1:1998

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Železniške naprave – Stabilne naprave električne vleke – 1. del: Zaščitni ukrepi glede električne varnosti in ozemljitev

Railway applications - Fixed installations -- Part 1: Protective provisions relating to electrical safety and earthing

Bahnanwendungen - Ortsfeste Anlagen -- Teil 1: Schutzmaßnahmen in bezug auf elektrische Sicherheit und Erdung

Applications ferroviaires - Installations fixes -- Partie 1: Mesures de protection relatives à la sécurité électrique et à la mise à la terre

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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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Descriptors: Railway fixed equipment, safety, accident prevention, earthing, safety measures, safety devices, protection against live parts, protection against electric shocks

English version

Railway applications - Fixed installations
Part 1: Protective provisions relating to electrical safety and earthing

Applications ferroviaires
Installations fixes
Partie 1: Mesures de protection
relatives à la sécurité électrique
et à la mise à la terre

Bahnanwendungen - Ortsfeste Anlagen
Teil 1: Schutzmaßnahmen in Bezug auf
elektrische Sicherheit und Erdung

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CENELEC

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

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Foreword

This European Standard was prepared by SC 9XC, Electrical supply and earthing systems the Technical Committee CENELEC TC 9X, Electrical and electronic applications for railways.

The text of the draft was submitted to the Unique Acceptance Procedure and was approved by CENELEC as EN 50122-1 on 1996-10-01.

The following dates were fixed:

- latest date by which the EN has to be implemented
at national level by publication of an identical
national standard or by endorsement (dop) 1997-12-01
- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 1997-12-01

Annexes designated "normative" are part of the body of the standard.

Annexes designated "informative" are given for information only.

In this standard, annexes B, E and G are normative and annexes A, C, D, F and H are informative.

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1 Scope

This standard specifies requirements for the protective provisions relating to electrical safety in fixed installations associated with a.c.- and d.c.-traction systems and to any installations that may be endangered by the traction power supply system.

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

Note: Other provisions may be required to protect work sites for maintenance purposes which are not included in this standard.

This standard applies to all new lines and to all major revisions to existing lines for the following electric traction systems:

- railways;
- guided mass transport systems such as:
Tramways, elevated and underground railways, mountain railways, trolleybus systems and magnetic levitated systems;
- material transportation systems

This standard does not apply to:

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

2 Normative references

This European Standard incorporates by dated and undated reference provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 50122-2*)	Railway applications - Fixed installations -- Part 2: Protective provisions against the effects of stray currents caused by d.c. traction systems
EN 50124-1*)	Railway applications - Insulation co- ordination -- Part 1: Basic requirements - Clearances and creepage distances
EN 50153	Railway applications - Rolling stock - Protective provisions relating to electrical hazards
EN 50163	Railway applications - Supply voltages of traction systems
EN 50179*)	Power installations exceeding 1 kV a.c.
EN 60529	Degrees of protection provided by enclosures (IP Code) (IEC 529)
HD 384.4.41	Electrical installations of buildings -- Part 4: Protection for safety Chapter 41: Protection against electric shock (IEC 364-4-41, modified)
HD 384.4.47	Electrical installations of buildings -- Part 4: Protection for safety Chapter 47: Application of protective measures for safety Section 471: Measures of protection against electric shock (IEC 364-4-47, modified)
HD 366	Classification of electrical and electronic equipment with regard to protection against electric shock
IEC 479-1	Effects of current passing through the human body Part 1: General aspects
ISO 3864	Safety colours and safety signs

*) In preparation

3 Definitions

For the purposes of this standard, the following definitions apply:

3.1 electric traction system

A 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 power plants and substations, which are utilized solely for generation and distribution of power directly to the contact line;
- electrical installations of switching stations.

3.2 Traction power supply systems

3.2.1 (traction) substation

An installation the main function of which is 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.

3.2.2 (traction) switching station

An 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.

3.2.3 feeding section

A section of the traction power supply system which may be isolated from other sections or feeders of the system by means of switching devices.

3.2.4 feeder

An electrical connection between the contact line and a substation or a switching station.

3.2.5 feeding point

A point at which the feeders or line feeders are connected to the contact line.

3.3 Contact line systems

3.3.1 contact line

[IEC 50 811-33-01]

A conductor system for supplying electric energy to vehicles through current-collecting equipment.

3.3.2 overhead contact line system

A system consisting of the following:

- all overhead wiring, including the catenary, the contact wire and the return wire, the earth wire, the lightning protection wire, the line feeder and the reinforcing feeder mounted on the supports;
- overhead conductor rails;
- the foundations, supporting structures and any components supporting, registering, terminating or insulating the conductors;
- equipment mounted on the supports for switching, detecting or protecting.

3.3.3 overhead contact line

A contact line placed above or beside the roof of the vehicles and supplying vehicles with electric energy through roof-mounted current collection equipment.

NOTE: The reinforcing feeder is not included.

3.3.4 overhead line

[IEC 50 466-01-01]

An electric line whose conductors are supported above ground, generally by means of insulators and appropriate supports.

NOTE: Certain overhead lines may also be constructed with insulated conductors.

3.3.5 catenary

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A longitudinal wire supporting the contact wire or wires either directly or indirectly.

3.3.6 contact wire

[IEC 50 811-33-15]

The electric conductor of an overhead contact line with which the current collectors make contact.

3.3.7 lightning protection wire

An earthed wire fitted above the overhead contact line to protect it against lightning.

3.3.8 Overhead contact line zone and pantograph zone

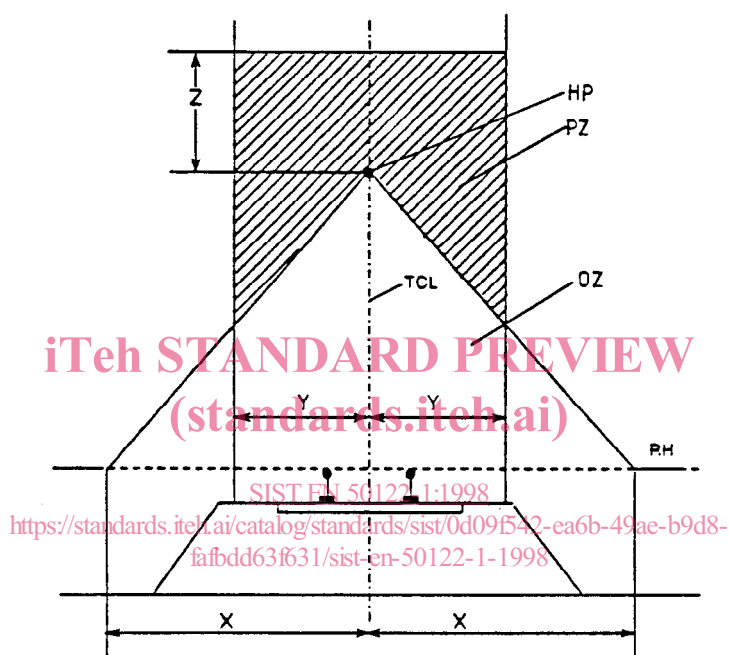
The zone whose limits are not exceeded in general, by a broken overhead contact line or a pantograph which is energized, in the event of dewirement or by broken fragments.

Structures and equipment may come accidentally in contact with a live broken overhead contact line or with live parts of a broken or dewired pantograph. Figure 1 defines the zone inside which such contact is considered to be probable. The parameters x , y , z shall be defined by national safety regulations. The point HP is the position of the highest conductor of the overhead contact line under all operational conditions considered in the centre of the track. The limits of the overhead contact line zone below the rail head are extended vertically downwards until the earth surface is reached. These limits, however, need not be extended beyond the upper surface of the deck when the railway runs over a bridge.

In the case of out of running overhead contact lines the overhead contact line zone shall be extended accordingly.

For conductor rail systems not mounted in the overhead position, no contact line zone is defined, while the limits of the pantograph zone shall be stipulated according to each specific case.

NOTE: The pantograph may be live because of dewirement or breakage as a result of being connected with other live pantographs or because electrical braking is in effect. The breaking of feeders or line feeders, which are not mechanically strained by current collectors, is not taken into consideration because the probability of a break is too small.



RH	Rail head
HP	Highest point of the overhead contact line
OZ	Overhead contact line zone
PZ	Pantograph zone
TCL	Track centre line

Figure 1: Overhead contact line zone and pantograph zone

NOTE: The stagger has been taken into consideration within the dimension of "y".

3.3.9 earth wire

A wire connecting supports collectively to earth or to running rails to protect people and installations in case of insulation fault and which may also be used as a return conductor.

3.3.10 line feeder

An overhead conductor supported on the same structure as the overhead contact line to supply successive feeding points.

3.3.11 reinforcing feeder

An overhead conductor mounted on the same structure as the overhead contact line, and directly connected to it at frequent intervals, in order to increase the effective cross-sectional area.

3.3.12 supports (in electric traction)

[IEC 50 811-33-19]

Those parts which support the conductors and the associated insulators of an overhead contact line.

3.3.13 mast (in electric traction)

A mainly vertical structure to provide for support, tensioning and registration of the overhead contact line.

3.3.14 stagger

The displacement of the contact wire to opposite sides of the track centre at successive supports to avoid localized wear of the pantograph wearing strips.

3.3.15 section insulator

[IEC 50 811-36-15]

A sectioning point formed by insulators inserted in a continuous run of a contact line, with skids or similar devices to maintain continuous current collection.

3.3.16 conductor rail

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A rigid metallic section or rail mounted on insulators located near the running rails, with which the shoe gear makes contact.

3.3.17 overhead conductor rail

A rigid metallic section mounted with insulators on a structure forming an overhead contact line.

3.3.18 out of running overhead contact line

An overhead contact line, when it abandon the track centre line in order to reach a termination point on a mast or a structure and when it is not intended to be directly used for current collection.

3.4 Return current circuits**3.4.1 return circuit**

All conductors which form the intended path for the traction return current and the current under fault conditions.

NOTE: The conductors may be for example:

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

3.4.2 track return system

A system in which the running rails form a part of the return circuit.

3.4.3 return conductor

Conductor which parallels the track and which is connected to the running rails at periodic intervals.

3.4.4 return conductor rail

A conductor rail used instead of the running rails for the traction return current.

3.4.5 return cable

An insulated conductor forming part of the return circuit and connecting the rest of the return circuit to the substation.

3.4.6 rail joint bond

A conductor ensuring the electrical continuity of a rail at a joint.

3.4.7 insulated rail joint

A mechanical rail joint which longitudinally separates the rail electrically.

3.4.8 rail-to-rail cross bond

An electrical bond that interconnects the running rails of the same track.

3.4.9 track-to-track cross bond

An electrical bond that interconnects tracks.

3.4.10 track circuit

[IEC 50 821-03-01]

An 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.

3.4.11 impedance bond

An apparatus used on electric traction systems, usually at the ends of a double-rail track circuit, and designed to ensure the passage of the traction return current notwithstanding the presence of insulated rail joints.

3.5 Earthing and bonding

3.5.1 earth

[IEC 50 826-04-01]

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

3.5.2 earth electrode

[IEC 50 826-04-02]

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

3.5.3 traction system earth

The running rail, when it is utilized as a return circuit and is connected to earth intentionally. It includes all conductive parts connected thereto.

3.5.4 tunnel earth

The electrical interconnection of the reinforcing rods of reinforced concrete tunnels and in the case of other modes of construction the conductive interconnection of the metallic parts of the tunnel.

NOTE: In the case of single-phase a.c. traction systems, the tunnel earth is connected to the running rails and thus forms part of the traction system earth which may be supplemented by external earth connections.

3.5.5 traction system earthing

Connection between conductive parts and the traction system earth.

3.5.6 direct traction system earthing

The direct connection between conductive parts and the traction system earth.

NOTE: Earthing via impedance bonds, required by reason of track circuits considerations, is considered to be direct earthing.

3.5.7 open traction system earthing

The connection of conductive parts to the traction system earth by a voltage-limiting device or by circuit-breakers, which make a conductive connection either temporarily or permanently if the limited value of the voltage is exceeded.

3.5.8 protective conductor (symbol PE)

[IEC 50 826-04-05]

A 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.

3.5.9 PEN conductor

[IEC 50 826-04-06]

An 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.

3.5.10 neutral conductor (symbol N) [IEC 50 826-01-03]

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

3.5.11 equipotential bonding [IEC 50 826-04-09]

Electrical connection putting various exposed conductive parts and extraneous conductive parts at a substantially equal potential.

3.5.12 equipotential bonding conductor [IEC 50 826-04-10]

A protective conductor for ensuring equipotential bonding.

3.6 Voltages and electrical circuits

3.6.1 nominal voltage

Voltage by which an installation or part of an installation is designated.

NOTE: The voltage of the contact line may differ from the nominal voltage by a quantity within permitted tolerances given in EN 50163.

3.6.2 rail potential

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The voltage occurring under operating conditions when the running rails are utilized for carrying the traction return current or under fault conditions between running rails and earth.

3.6.3 accessible voltage

That part of the rail potential under operating conditions which can be bridged by persons, the conductive path being conventionally from hand to both feet through the body or from hand to hand (horizontal distance of 1m to a touchable part).

3.6.4 (effective) touch voltage

Voltage under fault conditions between parts when touched simultaneously .

NOTE : The value of the effective touch voltage may be appreciably influenced by the impedance of the person in contact with these parts.

3.6.5 traction return current

The sum of the currents returning to the supply source (substation or regenerative braking vehicles).

3.6.6 stray current

A current which follows paths other than the intended paths.

3.6.7 short- circuit

[IEV 195-04-21]*)

Accidental or intentional conductive path between two or more points in a circuit forcing the voltages between these points to be relatively low.

NOTE: Any such conductive path whether between conductors or between a conductor and earth is regarded as a short- circuit.

3.6.8 short- circuit current

[IEV 195-05-18]*)

The electric current flowing through the short- circuit.

3.6.9 fault condition

A non intended condition of the apparatus or equipment.

3.6.10 rail to earth resistance

The electrical resistance between the running rails and the earth.

NOTE: For d.c. traction systems in tunnels the measurement is made between the running rails and tunnel earth.

3.6.11 conductance per unit length

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

3.7 Current collection

[IEC 50 811-32]

3.7.1 current collector

[IEC 50 811-32-01]

Equipment fitted to the vehicle and intended to collect current from a contact wire or conductor rail.

3.7.2 pantograph

[IEC 50 811-32-02]

Apparatus for collecting current from one or more contact wires or overhead conductor rails, formed of a hinged device designed to allow vertical movement of the pantograph head.

3.7.3 trolley

[IEC 50 811-32-08]

Apparatus for collecting current from a contact wire by means of a grooved wheel or contact slipper mounted on a pole which is movable in any direction.

3.7.4 shoe gear

[IEC 50 811-32-19]

An assembly of parts for collecting current from a conductor rail.

*) in preparation