
Železniške naprave – Stabilne naprave električne vleke – 2. del: Zaščitni ukrepi proti učinkom blodečih tokov, ki jih povzročajo enosmerni vlečni sistemi

Railway applications - Fixed installations -- Part 2: Protective provisions against the effects of stray currents caused by d.c. traction systems

Bahnanwendungen - Ortsfeste Anlagen -- Teil 2: Schutzmaßnahmen gegen die Auswirkungen von Streuströmen, verursacht durch Gleichstrombahnen

Applications ferroviaires - Installations fixes -- Partie 2: Mesures de protection contre les effets des courants vagabonds issus de la traction électrique à courant continu

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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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Descriptors: Railway fixed equipment, electric traction, direct current, safety, safety measures, corrosion prevention, stray current corrosion, cathodic protection

English version

**Railway applications - Fixed installations
 Part 2: Protective provisions against the effects of
 stray currents caused by d.c. traction systems**

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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, Electric supply and earthing systems for public transport equipment and ancillary apparatus (fixed installations), of Technical Committee CENELEC TC 9X, Electrical and electronic applications for railways.

The text of the draft was submitted to the formal vote and was approved by CENELEC as EN 50122-2 on 1998-04-01.

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) 1999-03-01
- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 1999-03-01

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1 Scope

This standard specifies requirements for protective provisions against the effects of stray currents which result from the operation of d.c. traction systems.

As experience for several decades has not shown evident corrosion effects from a.c. traction systems and actual investigations are not completed, this standard only deals with stray currents flowing from a d.c. traction system.

This standard applies to all metallic fixed installations which form part of the traction system, and also to any other unrelated metallic components located in any position in the earth, which may carry stray currents resulting from the operation of the railway system.

This standard applies to all new electrification of a d.c. railway system. The principles may also be applied to existing electrified systems where it is necessary to consider the effects of stray currents.

The range of application includes:

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

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This standard does not apply to:

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

2 Normative references

This European Standard incorporates by dated or undated references, 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 50122-1	Railway applications - Fixed installations Part 1: Protective provisions relating to electrical safety and earthing
EN 50162*)	Protection against corrosion by stray currents from d.c. current systems

3 Definitions

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

3.1 stray current

A current which follows paths other than the intended paths.

3.2 stray current zone

Zone in which currents may be exchanged between a d.c. traction system and metallic structures or earth.

NOTE: Such a stray current zone may extend over a distance of a few kilometres.

3.3 corrosion

[BS 7361]

The chemical or electrochemical reaction of a metal with its environment, resulting in its progressive degradation or destruction.

NOTE: This standard is concerned with corrosion by electrochemical reaction.

3.4 cathodic protection

A method to protect a metal from corrosive attack by causing a direct current to flow from its electrolytic environment into the entire metal surface.

3.4.1 polarized electric drainage

[BS 7361]

A form of drainage of stray currents in which the connection between a protected structure and a traction system includes a unidirectional device or devices such as rectifier or a relay and contactor.

NOTE: Also referred to as "polarized drainage".

*) At present under preparation.

3.4.2 forced drainage

[BS 7361]

A form of drainage in which the connection between a protected structure and a traction system includes an independent source of direct current.

3.4.3 impressed current installation

A rectifier or other d.c. supplying direct current to a protected structure in order to achieve the necessary protection potential.

3.5 protection potential

[BS 7361]

The more negative level to which the potential of a metallic structure, with respect to a specified reference electrode in an electrolytic environment, has to be depressed in order to effect cathodic protection of the structure.

3.6 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.

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3.7 track return system

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

3.8 return conductor

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

3.9 return conductor rail

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

3.10 return cable

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

3.11 return cable busbar

A busbar in substations at which return cables terminate.

3.12 d.c. (traction) substation

An installation the main function of which is to supply a contact line system, at which the voltage of a primary supply system, and in certain cases the frequency, is converted to the voltage of the contact line.

3.13 traction return current

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

3.14 rail joint bond

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

3.15 insulated rail joint

A mechanical rail joint which longitudinally separates the rail electrically.

3.16 rail-to-rail cross bond

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

3.17 track-to-track cross bond

An electrical bond that interconnects tracks.

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3.18 earth

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[IEC 50 826-04-01]

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

3.19 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.

3.20 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.

3.21 structure earth

The electrical interconnection of the reinforcing rods of structures, and in the case of other modes of construction, the conductive interconnection of the metallic parts. Examples are reinforced railway structures such as bridges, viaducts and reinforced trackbed.

3.22 rail to earth resistance

The electrical resistance between the running rails and the earth.

NOTE 1: For d.c. traction systems in tunnels the measurement is made between the running rails and tunnel earth.

NOTE 2: In this standard the rail to earth resistance refers to a single-track installation, unless otherwise explicitly specified.

3.23 conductance per unit length

The reciprocal value of the rail to earth resistance per unit of length.

NOTE: In this standard the conductance per unit length refers to a single-track installation, unless otherwise explicitly specified.

3.24 equipotential bonding

[IEC 50 826-04-09]

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

3.25 equipotential bonding conductor

[IEC 50 826-04-10]

A protective conductor for ensuring equipotential bonding.

3.26 rail potential

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.

3.27 (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.

3.28 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 1 m to a touchable part).

3.29 closed formation

The top of the running rails is at the same level as the surface.

3.30 open formation

The running rails are laid above the surface.

3.31 railway authority

The person or organization who owns or is responsible for the overall management of the relevant railway infrastructure.

3.32 validation

The process of demonstrating by test and analysis that the system under consideration meets in all respects the specification for that system.

3.33 verification

The process of determining for each phase of the safety lifecycle that the output meets in all respects the objectives and requirements set for the specific phase, for example, forward traceability from the requirements specification through each stage of the design documentation to the final design.

NOTE: Verification may include testing.

3.34 earthing

The connection of conductive parts to an appropriate earth electrode.

3.35 open traction system earthing

The connection of conductive parts to the track return system or the track return system to 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.

4 General

4.1 d.c. traction systems may cause stray currents which could adversely affect both the railway concerned and / or outside interests. In order to determine the extent of the problem an assessment study shall be carried out in co-operation with the affected parties. The outcome of this action will assist at the design stage to establish the optimum range of solutions for any identifiable effects. Any provisions adopted to control the effects of stray currents shall be subjected to validation and verification according to the provisions of this standard. If no specific effect / remedy is determined consideration shall be given to the establishment of a regime of periodical checks.

All connections to the track return systems shall be approved by the railway authority.

Protective provisions against electric shock shall take precedence over provisions against the effects of stray currents. See EN 50122-1.

NOTE: The major effects of stray currents can be:

- corrosion and subsequent damage of metallic structure where stray currents leave the metallic structures;
- the risk of overheating, arcing and fire and subsequent danger to equipment and persons not necessarily within the railway authority's area of responsibility;
- influence on non-immunized signalling and communication systems;
- influence on unrelated cathodic protection installations;
- influence on unrelated a.c. and d.c. power supply systems.