



# SLOVENSKI STANDARD

## SIST EN 50633:2016

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**Železniške naprave - Stabilne naprave električne vleke - Načela zaščite za sisteme izmeničnih ali enosmernih električnih vlek**

Railway applications - Fixed installations - Protection principles for AC and DC electric traction systems

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EUROPEAN STANDARD

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## Railway applications - Fixed installations - Protection principles for AC and DC electric traction systems

Applications ferroviaires - Installations fixes - Principes de protection pour les réseaux de traction électrique à courant alternatif et à courant continu

Bahnwendungen - Ortsfeste Anlagen - Schutzprinzipien für AC und DC Bahnenergieversorgungssysteme

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<b>Contents</b>		<b>Page</b>
European foreword.....		4
1	Scope .....	5
2	Normative references .....	6
3	Terms and definitions .....	6
4	System to be protected .....	12
4.1	Description .....	12
4.2	Interfaces .....	14
4.2.1	Infeed .....	14
4.2.2	Rolling stock .....	14
4.2.3	Electrical installations fed by the electric traction system .....	15
5	General principles .....	15
5.1	Objectives.....	15
5.2	System requirements .....	16
5.2.1	General .....	16
5.2.2	Protection reliability methods .....	17
5.2.3	Load discrimination .....	19
5.2.4	Speed of protection .....	19
5.2.5	Selectivity .....	20
5.2.6	Economic feasibility.....	20
5.3	Description of the protection system.....	20
5.4	Fault and abnormal conditions .....	21
5.5	Protection concept .....	22
6	Specific requirements of different systems.....	23
6.1	General .....	23
6.2	AC systems .....	23
6.2.1	Power conversion infeed .....	23
6.2.2	Busbar infeed.....	24
6.2.3	Line feeder.....	24
6.2.4	Switching station feeder .....	27
6.2.5	Autotransformer .....	28
6.3	DC systems .....	28
6.3.1	Power conversion infeed .....	28
6.3.2	DC Busbar infeed.....	29
6.3.3	Line feeder.....	30
6.3.4	Switching station feeder .....	30
6.3.5	Frame leakage protection .....	31
6.4	Overview of protection reliability methods.....	31
7	Limitations and residual risks .....	32
8	Conformity assessment.....	34
<b>Annex A (informative) Examples of protection schemes.....</b>		<b>35</b>
A.1	General .....	35
A.2	Description of the structure of the protection scheme examples .....	35
A.3	Protection scheme examples .....	36
<b>Annex B (informative) Example of a Protection Concept for a 25 kV line section .....</b>		<b>39</b>
B.1	Introduction.....	39
B.2	Protection Concept.....	39

B.3	Interfaces.....	40
B.4	Fault Conditions .....	40
B.5	Clearance times .....	40
B.6	Main protection functions .....	40
B.7	Reliability methods .....	40
B.8	Selectivity.....	41
B.9	Grading time requirements .....	41
B.10	Coordination requirements .....	41
B.11	Maintenance requirements.....	41
B.12	Protection device structure.....	41
B.13	Operating sequence .....	43
	Bibliography.....	45

## Figures

Figure 1	— Electric traction system and its interfaces .....	14
Figure 2	— Example of a protection system .....	21
Figure 3	— Example for single protected line sections .....	25
Figure 4	— Example for a grouped protected line section .....	26
Figure 5	— Example for an extended protected section of an additional line feeder of a short section by bridged section insulation.....	27
Figure A.1	— Key for protection scheme, example of protected section 'busbar' .....	35
Figure A.2	— Example of a protection scheme for AC 50 Hz electric traction systems without busbar infeed circuit breaker .....	36
Figure A.3	— Example of a protection scheme for AC 16,7 Hz electric traction systems with busbar infeed circuit breaker.....	37
Figure A.4	— Example of a protection scheme for DC electric traction systems with busbar infeed circuit breaker .....	38
Figure B.1	— System single line diagram.....	39
Figure B.2	— Scheme functional diagram of feeder breakers A1 and A2.....	43
Figure B.3	— Typical scheme sequence diagram – Fault on Feeder A.....	44

## Tables

Table 1	— Overview of reliability methods .....	31
Table 2	— Limitations of protection systems and generic residual risks .....	33

**EN 50633:2016****European foreword**

This document (EN 50633:2016) has been prepared by CLC/SC 9XC “Electric supply and earthing systems for public transport equipment and ancillary apparatus (Fixed installations)” of CLC/TC 9X “Electrical and electronic applications for railways”.

The following dates are fixed:

- latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2017–04–18
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2019–04–18

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## 1 Scope

This European Standard applies to the electrical protection system, provided for AC and DC electric traction systems. It:

- establishes railway specific protection principles;
- describes the railway specific protection system functionality;
- specifies minimum functional requirements and informative examples of their application;
- establishes limitations of the protection system and the acceptability of residual risks;
- specifies principles for conformity assessment.

It applies to:

- railways;
- guided mass transport systems, such as tramways, elevated and underground railways, mountain railways, trolleybus systems, and magnetically levitated systems which use a contact line system.

This European Standard may also be applied to electrified road traffic with a contact line, such as truck-trolley systems.

This European Standard applies to new electric traction systems and may be applied to changes of existing systems.

It does not apply to:

- underground mine traction systems;
- 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;
- magnetic levitated systems (without a contact line system);
- railways with an inductive power supply without contact system;
- railways with a buried contact system that is required to be energized only below the train to ensure safety.

This European Standard does not cover:

- technical requirements for products, e.g. protection devices;
- rules for maintenance of protection systems.

**EN 50633:2016****2 Normative references**

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 50122-1:2011, *Railway applications — Fixed installations — Electrical safety, earthing and the return circuit — Part 1: Protective provisions against electric shock*

EN 50122-3, *Railway applications — Fixed installations — Electrical safety, earthing and the return — Part 3: Mutual Interaction of a.c. and d.c. traction systems*

EN 50123-1, *Railway applications — Fixed installations — D.C. switchgear — Part 1: General*

EN 50123-7-1, *Railway applications — Fixed installations — D.C. switchgear — Part 7-1: Measurement, control and protection devices for specific use in d.c. traction systems — Application guide*

EN 50153, *Railway applications — Rolling stock — Protective provisions relating to electrical hazards*

EN 50327, *Railway applications — Fixed installations — Harmonisation of the rated values for converter groups and tests on converter groups*

EN 50388:2012, *Railway Applications — Power supply and rolling stock — Technical criteria for the coordination between power supply (substation) and rolling stock to achieve interoperability*

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

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

NOTE When possible, the following definitions have been taken from the relevant chapters of the International Electrotechnical Vocabulary (IEV), IEC 60050. In such cases, the appropriate IEV reference is given.

**3.1****contact line system**

support network for supplying electrical energy from substations to electrically powered traction units, which covers overhead contact line systems and conductor rail systems, and whose electrical limits are the feeding point and the contact point to the current collector

Note 1 to entry: The mechanical system may comprise:

- the contact line;
- structures and foundations;
- supports and any components supporting or registering the conductors;
- head and cross spans;
- tensioning devices;
- along-track feeders, reinforcing feeders, and other lines like earth wires and return conductors as far as they are supported from contact line system structures;
- any other equipment necessary for operating the contact line;
- conductors connected permanently to the contact line for supply of other electrical equipment such as lights, signal operation, point control and point heating.



[SOURCE: EN 50119:2009, 3.1.1, modified — The former sentence that began with "The electrical limits are..." was attached to the definition with the pronoun "whose".]

### 3.2

#### **electric traction system**

railway electrical distribution network used to provide energy for rolling stock

Note 1 to entry: The system may comprise:

- contact line systems;
- return circuit of electric traction systems;
- electrical installations in substations, which are utilized solely for distribution of power directly to the contact line;
- electrical installations of switching stations.

[SOURCE: EN 50122-1:2011, 3.4.1, modified — Running rails of non-electrified lines in the vicinity of, and conductively connected to the running rails of an electric traction system, and electrical installations which are supplied from contact lines either directly or via a transformer have been excluded from Note 1 to entry.]

### 3.3

#### **(traction) substation**

substation the main function of which is to supply a traction system

[SOURCE: IEC 60050-811:1991, 811-36-02]

### 3.4

#### **(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

[SOURCE: IEC 60050-811:2015 (CDV), 811-36-22]

### 3.5

#### **feeding section**

electrical section of the route fed by individual track feeder circuit-breakers within the area supplied by the substation

[SOURCE: EN 50119:2009, 3.3.2]

### 3.6

#### **electrical safety**

freedom from unacceptable risk of harm caused by electrical hazards

[SOURCE: EN 50122-1:2011, 3.1.1]

### 3.7

#### **electric shock**

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

[SOURCE: IEC 60050-826:2004, 826-12-01]

**EN 50633:2016****3.8****return circuit**

all conductors which form the intended path for the traction return current

EXAMPLE The conductors may be:

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

[SOURCE: EN 50122-1:2011, 3.3.1]

**3.9****switchgear**

switching devices and their combination with associated control, measuring, protective and regulating equipment, also assemblies of such devices and equipment with associated interconnections, accessories, enclosures and supporting structures, intended in principle for use in connection with generation, transmission, distribution and conversion of electric energy

[SOURCE: IEC 60050-441:2000, 441-11-02]

**3.10****protection operating time**

interval of time between the fault inception and the instant of initiation of the opening operation of a switching device, e.g. circuit breaker

Note 1 to entry: This time includes measurement, communication and protection device operation.

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**3.11****opening time** (of a mechanical switching device)

interval of time between the specified instant of initiation of the opening operation and the instant when the arcing contacts have separated in all poles

Note 1 to entry: The instant of initiation of the opening operation, i.e. the application of the opening command (e.g. energizing the release, etc.), is given in the relevant specifications.

[SOURCE: IEC 60050-441:2000, 441-17-36]

**3.12****break-time**

interval of time between the beginning of the opening time of a mechanical switching device (or the pre-arcing time of a fuse) and the end of the arcing time

[SOURCE: IEC 60050-441:2000, 441-17-39]

**3.13****fault clearance time**

time interval between the fault inception and the fault clearance

Note 1 to entry: This time is the longest fault current interruption time of the associated circuit-breaker(s) for elimination of fault current on the faulty item of plant.

Note 2 to entry: Fault clearance time is the total of the protection operating time, the (mechanical) opening time and the arc extinction time. The latter two are included in break-time, IEC 60050-441-17-39.

[SOURCE: IEC 60050-448:1995, 448-13-15]

**3.14****(effective) touch voltage** $U_{te}$ 

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

Note 1 to entry: 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.

[SOURCE: IEC 60050-195:1998, 195-05-11]

**3.15****fault condition**

non intended condition caused by short-circuit, whilst the time duration is terminated by the correct function of the protection devices and circuit breakers

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

[SOURCE: EN 50122-1:2011, 3.4.5, modified — "Whilst" was added so as to link the sentence "The time duration..." with the rest of the definition.]

**3.16****low resistance fault**

fault condition where the resistance of the fault is sufficiently low that the fault current is of a similar magnitude to that which would flow if the fault resistance were zero

Note 1 to entry: The resistance of the fault is typically dominated by the resistance of the power arc.

Note 2 to entry: In this definition, resistance will be understood as also being impedance for AC fault currents.

**3.17****high resistance fault**

fault condition where the resistance of the fault is sufficiently high that the fault current is of a substantially different magnitude to that which would flow with a low resistance fault

Note 1 to entry: In this definition, resistance will be understood as also being impedance for AC fault currents.

**3.18****abnormal operating condition**

condition where the system is operated beyond its intended capabilities such that damage or reduced life expectancy can be anticipated

**3.19****short-circuit**

accidental or intentional conductive path between two or more conductive parts forcing the electric potential differences between these conductive parts to be equal to or close to zero

[SOURCE: IEC 60050-195:1998, 195-04-11]

**3.20****current collector**

equipment fitted to a vehicle and intended to collect current from a contact wire or conductor rail

[SOURCE: IEC 60050-811:2015 (CDV), 811-32-01]

**EN 50633:2016****3.21****protection**

provisions for detecting faults or other abnormal operating conditions in a power system, for enabling fault clearance, for terminating abnormal operating conditions, and for initiating signals or indications

Note 1 to entry: The term “protection” is a generic term for protection equipment or protection systems.

Note 2 to entry: The term “protection” may be used to describe the protection of a complete power system or the protection of individual plant items in a power system e.g. transformer protection, line protection, generator protection.

Note 3 to entry: Protection does not include items of power system plant provided, for example, to limit overvoltages on the power system. However, it includes items provided to control the power system voltage or frequency deviations such as automatic reactor switching, load-shedding, etc.

[SOURCE: IEC 60050-448:1995, 448-11-01, modified — Abnormal condition becomes abnormal operating conditions.]

**3.22****protection system**

arrangement of one or more protection equipments, and other devices intended to perform one or more specified protection functions

Note 1 to entry: A protection system includes one or more protection equipment, intelligent electronic devices (IED), instrument transformer(s), wiring, tripping circuit(s), auxiliary supply(s) and, where provided, communication system(s). Depending upon the principle(s) of the protection system, it may include one end or all ends of the protected section and, possibly, automatic reclosing equipment.

Note 2 to entry: The circuit-breaker(s) are excluded.

Note 3 to entry: The circuit-breaker protection functions are included, e.g. direct over-current or falling voltage release of dc-circuit-breaker(s).

[SOURCE: IEC 60050-448:1995, 448-11-04, modified – Note 3 to entry has been added.]

**3.23****protection equipment**

equipment incorporating one or more protection relays and, if necessary, logic elements intended to perform one or more specified protection functions

Note 1 to entry: A protection equipment is part of a protection system.

[SOURCE: IEC 60050-448:1995, 448-11-03]

**3.24****protection relay**

measuring relay which, either solely or in combination with other relays, is a constituent of a protection equipment

[SOURCE IEC 60050-448:1995, 448-11-02]

**3.25****protected section**

part of a power system network, or circuit within a network, to which specified protection has been applied

Note 1 to entry: The protected section normally originates from a point of automatic disconnection to at least the next point of automatic disconnection or the end of the circuit.

Note 2 to entry: An electric traction system is a form of power system network.

[SOURCE: IEC 60050-448:1995, 448-11-05, modified — The Notes to entry were added.]

**3.26****selectivity (of protection)**

ability of a protection to identify the faulty section and/or phase(s) of a power system

[SOURCE: IEC 60050-448:1995, 448-11-06]

**3.27****reliability of protection**

probability that a protection can perform a required function under given conditions for a given time interval

[SOURCE: IEC 60050-448:1995, 448-12-05]

**3.28****redundancy**

in an item, existence of more than one means for performing a required function

[SOURCE: IEC 60050-448:1995, 448-12-08]

**3.29****sensitivity (of protection)**

minimum operating level (e.g. current, voltage, frequency, temperature) in a process that can be detected for the purpose of protection

EXAMPLE Sensitivity of a protection system can be expressed by minimum fault current or maximum fault impedance coverage.

**3.30****main protection**

protection expected to have priority in initiating fault clearance or an action to terminate an abnormal condition in a power system

[SOURCE: IEC 60050-448:1995, 448-11-13]

**3.31****backup protection**

protection which is intended to operate when a system fault is not cleared, or abnormal condition not detected, in the required time because of failure or inability of other protection to operate or failure of the appropriate circuit-breaker(s) to trip

[SOURCE: IEC 60050-448:1995, 448-11-14]

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