SLOVENSKI STANDARD
SIST EN 50153:2003

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SIST EN 50153:1998

Ģelezniġke naprave ï Vozna sredstva ï Zaġ ļitni ukrepi proti nevarnostim elektriļ ne napetosti

Railway applications - Rolling stock - Protective provisions relating to electrical hazards

Bahnanwendungen - Fahrzeuge - Schutzmaßnahmen in Bezug auf elektrische Gefahren

Applications ferroviaires - Matériel roulant - Mesures de protection vis-à-vis des dangers d'origine électrique

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13.260	Varstvo pred elektriļ nim udarom. Delo pod napetostjo	Protection against electric shock. Live working
45.060.01	Železniška vozila na splošno	Railway rolling stock in general

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EUROPEAN STANDARD

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Railway applications - Rolling stock - Protective provisions relating to electrical hazards

Applications ferroviaires - Matériel roulant - Mesures de protection vis-à-vis des dangers d'origine électrique

Bahnanwendungen - Fahrzeuge - Schutzmaßnahmen in Bezug auf elektrische Gefahren

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Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

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CENELEC

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

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Foreword

This European Standard was prepared by SC 9XB, Electromechanical material on board of rolling stock, of Technical Committee CENELEC TC 9X, Electrical and electronic applications for railways.

This European Standard represents the second edition of the standard and is technically based on the International Standard IEC 61991 which is the adaptation of EN 50153:1996 into IEC format. IEC 61991 was submitted successfully to a parallel vote in 1999. The European references, special national conditions and A-deviations have been restored in this European Standard.

The text of the draft was submitted to the Unique Acceptance Procedure and was approved by CENELEC as EN 50153 on 2002-05-01.

This European Standard supersedes EN 50153:1996.

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) 2003-05-01

- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2005-05-01

Annexes designated “normative” are part of the body of the standard.
Annexes designated “informative” are given for information only.
In this standard, annexes A and B are normative and annex C is informative.

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Introduction

It is generally accepted that safety depends on human factors, based on the normal behaviour of the operators involved, as well as upon technical factors.

For these reasons, this European Standard, in several instances, leaves a choice to the contracting parties between two alternatives. These alternatives consist either in the provision of operating rules, regulations and procedures, or in the application of technical measures such as mechanical or electrical *interlocking devices*.

A list of the cases for which the contracting parties (e.g. user and manufacturer) should reach agreement before signing the contract is included in annex B.

1 Scope

This European Standard offers a set of rules that are applied in the design and manufacture of electrical installations and equipment to be used on rolling stock so as to protect the persons from *electric shocks*.

The methods used to satisfy the rules may differ, in accordance with the procedures and practices of the operating organization.

This European Standard is applicable to vehicles of rail transport systems, road vehicles powered by an external supply (e.g. trolley buses), magnetic levitated vehicles and to the electrical equipment installed in these vehicles.

This European Standard does not apply to

- mine railways in underground mines,
- crane installations, moving platforms and similar transport systems on rails,
- funicular railways,
- temporary constructions.

Testing of vehicles against the requirements of this European Standard is not included. For this, refer to EN 50215.

2 Normative references

This European Standard incorporates, by dated or undated references, provisions from other publications. These normative references are cited at the appropriate place 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 (including amendments).

EN 50122-1	1997	Railway applications - Fixed installations Part 1: Protective provisions relating to electrical safety and earthing
EN 50124-1	2001	Railway applications - Insulation coordination Part 1: Basic requirements - Clearances and creepage distances for all electrical and electronic equipment
EN 50126	1999	Railway applications - The specification and demonstration of Reliability, Availability, Maintainability and Safety (RAMS)

EN 50163	1995	Railway applications - Supply voltages of traction systems
EN 50215	1999	Railway applications - Testing of rolling stock after completion of construction and before entry into service
EN 60439	Series	Low-voltage switchgear and controlgear assemblies (IEC 60439 series, modified)
EN 60529 + corr. May	1991 1993	Degrees of protection provided by enclosures (IP code) (IEC 60529:1989)
EN 61310-1	1995	Safety of machinery - Indication, marking and actuation Part 1: Requirements for visual, auditory and tactile signals (IEC 61310-1:1995)
HD 366 S1	1977	Classification of electrical and electronic equipment with regard to protection against electric shock (IEC 60536: 1976)
HD 384	Series	Electrical installations of buildings (IEC 60364 series, modified)
HD 384.4.41 S2	1996	Electrical installations of buildings Part 4: Protection for safety Chapter 41: Protection against electric shock (IEC 60364-4-41:1992, modified)
IEC 60050-191	1990	International Electrotechnical Vocabulary (IEV) Chapter 191: Dependability and quality of service
IEC 60050-441	1984	Chapter 441: Switchgear, controlgear and fuses
IEC 60050-811	1991	Chapter 811: Electric traction
IEC 60050-826	1982	Electrical installations of buildings (harmonized as HD 384.2)
IEC 60479-1	1994	Effects of current on human beings and livestock Part 1: General aspects

3 Definitions

For the purpose of this European Standard, the following definitions apply. For more information relating to definitions of parts of the fixed installations, refer to EN 50122-1 from which these definitions are derived.

NOTE In order to avoid risks of misunderstanding, definitions used in the text are written in italics.

3.1 Definitions concerning persons

3.1.1
skilled person
a person who can judge the work assigned to him and recognize possible dangers on the basis of his professional training, knowledge and experience and of his knowledge of the relevant requirements [IEV 826-09-01]

3.1.2
instructed person
a person adequately advised or supervised by *skilled persons* to enable him or her to avoid dangers and to prevent risks which electricity may create [IEV 826-09-02]

3.1.3
ordinary person
a person who is neither a *skilled person* nor an *instructed person* [IEV 826-09-03]

3.2 Other definitions

3.2.1
closed electrical operating area
any room or location which serves exclusively for the operation of electrical equipment and is kept secure by a means appropriate to the voltage and location

NOTE 1 Access to such areas is permitted only to *skilled persons* and *instructed persons*.

NOTE 2 The definition of *closed electrical operating area* can be suitable for underfloor or upperroof cabinets. Generally speaking, it is any location (inside or outside the car body) which is kept secured because of the voltage that can assume the equipment inside it. Access to such areas is not allowed to *ordinary persons*.

3.2.2
contact line
conductor system for supplying electrical energy to vehicles through current-collecting equipment [IEV 811-33-01]

3.2.3
contact wire
electric conductor of an overhead *contact line* with which the current collectors make contact [IEV 811-33-15]

3.2.4
direct contact
contact of persons or livestock with *live parts* [IEV 826-03-05]

3.2.5
earth
conductive mass of the earth, whose electrical potential at any point is conventionally taken as equal to zero [IEV 826-04-01]

3.2.6
electrical operating area
any room or location which serves primarily for the operation of electrical equipment and is normally entered only by *skilled persons* or *instructed persons*

NOTE Generally speaking, an *electrical operating area* is any location (mainly inside the car body) where electrical equipments operate. The above is the main function of this area but not the only one. In fact, normally the area is not kept secured and the protection against *direct contact* is achieved by other means (e.g. *obstacles*).

3.2.7
electric shock
dangerous physiological effect resulting from the passing of an electric current through a human or animal body [IEV 826-03-04, mod.]

3.2.8
exposed conductive part
any metallic or other form of conductive material which is not energized except in case of *failure*, and which may be accessible to touch

3.2.9
failure
termination of the ability of an item to perform a required function

3.2.10
hazard
a physical situation with a potential of human injury [EN 50126, 3.17]

3.2.11
indirect contact
contact of persons or livestock with *exposed conductive parts* which have become live under fault conditions [IEV 826-03-06]

3.2.12
interlocking device
a device which makes the operation of a switching device dependent upon the position or operation of one or more other pieces of equipment [IEV 441-16-49]

3.2.13
live part
conductor or conductive part intended to be energized in normal use, including a neutral conductor [IEV 826-03-01, mod.]

3.2.14
nominal voltage
voltage by which an installation or part of an installation is designated [IEV 826-02-01]

NOTE 1 The voltages are expressed by the value between poles, ripple-free for D.C. and by the r.m.s. value between phases for A.C.

NOTE 2 The actual voltage may differ from the *nominal voltage* by a quantity within permitted tolerances. For further information about traction systems supply voltages, see EN 50163.

3.2.15
obstacle
a part preventing unintentional *direct contact*, but not preventing *direct contact* by deliberate action [IEV 826-03-14]

3.2.16
power circuit
a circuit carrying the current of the machines and equipment, such as convertors and traction motors, which transmit the traction output [IEV 811-25-03]

3.2.17
protective bonding
equipotential connection for protective purposes

3.2.18
protective conductor
conductor used for some protective measures for protection against *electric shock* for electrically connecting any of the following parts:

- *exposed conductive parts;*
- main earthing terminal;
- *earth* electrode;
- earthed point of the source or artificial neutral [IEV 826-04-05, mod.]

4 Classification of voltage bands

4.1 General principles

This European Standard is based on the maximum supply voltages at which the equipment or electrical circuits are subjected.

The voltages are classified into bands according to the nominal value as shown in Table 1. Different installation rules apply to each of these bands.

The power supply of the various circuits installed in railway rolling stock are of different types such as

- batteries,
- transformers,
- voltage dividers,
- rotating machines,
- static converters,
- capacitors,
- special sources.

Table 1 - Voltage bands

Band	***Nominal voltage*** U_n	
	A.C. V	**D.C.** V
I	$U \leq 25$	$U \leq 60$
II	$25 < U \leq 50$	$60 < U \leq 120$
III	$50 < U \leq 1\,000$	$120 < U \leq 1\,500$
IV	$U > 1\,000$	$U > 1\,500$

4.2 Connections between circuits

Circuits operating at different *nominal voltages* connected by power conversion equipment which does not provide a conducting path between them, or circuits which are linked only by a connection direct to the vehicle body external to the power conversion circuitry, shall be individually classified at the *nominal voltage* of each circuit.

If the conducting paths referred in this subclause include capacitive or inductive connections, whose impedance is low enough to induce hazardous voltages into any circuit under either normal or fault conditions, then all the circuits so connected shall be classified at the *nominal voltage* of the highest voltage circuit.

NOTE This condition can apply to circuits connected, for example, by means of a chopper converter with impedance coupling.

Where circuits are linked conductively to a higher voltage source other than simply by circuit bonds connected to the vehicle body (for example by an auto-transformer or potential divider), all circuits in the group shall be treated as if energized at the *nominal voltage* of the source, unless the conditions of 4.3 have been met.

4.3 Exceptions

If voltage conversion from one band to another involves overvoltage detection resulting in disconnection of the primary or the secondary circuit, or having other means capable of preventing excessive voltage in the secondary circuit, then the secondary circuit shall be classified according to the highest voltage at which the detection equipment will operate.

NOTE 1 The integrity of the detection equipment should be taken into account.

Circuits not connected to the vehicle body, for example floating supplies, shall be classified as appropriate in order to ensure that the requirements of this European Standard are met, taking due account of the potentials possible in such circuits under normal or fault conditions.

The limit between bands III and IV is allowed to be lowered to take account of special national conditions.

NOTE 2 The above mentioned conditions are listed in annex A.

5 Protective provisions against *direct contact*

Live parts capable of causing an *electric shock* shall be protected against *direct contact*. All types of equipment shall be capable of being operated without loss of protection against *direct contact*. Protection against *direct contact* shall be provided by at least one of the means described in 5.1 to 5.3, supplemented as necessary by warning labels as described in 5.4.

5.1 Protection by insulation

In addition to the requirements of EN 50124-1, the insulating materials used to cover *live parts* shall be appropriate to the nominal equipment operating voltage and the conditions of use. Further provisions should be considered in order to minimize the consequences of damage.

5.2 Protection by prevention of access

Access to *live parts* shall be prevented by placing them within *closed electrical operating areas* or by placing them out of reach. The rest of this clause explains the measures required.