SLOVENSKI STANDARD
SIST EN 50123-1:1998

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Railway applications - Fixed installations - D.C. switchgear - Part 1: General (IEC 61992-1:199X - (9/386/ANW) (Related))

Railway applications - Fixed installations - D.C. switchgear -- Part 1: General

Bahnanwendungen - Ortsfeste Anlagen - Gleichstromschalteinrichtungen -- Teil 1: Allgemeines

Applications ferroviaires - Installations fixes - Appareillages de coupure en courant continu (CC) -- Partie 1: Généralités

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English version

Railway applications
Fixed installations - D.C. switchgear
Part 1: General

Applications ferroviaires
Installations fixes
Appareillage à courant continu
Partie 1: Généralités

Bahnanwendungen
Ortsfeste Anlagen
Gleichstrom-Schalteinrichtungen
Teil 1: Allgemeines

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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 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 Unique Acceptance Procedure and was approved by CENELEC as EN 50123-1 on 1994-12-06.

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) 1995-12-01

- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 1995-12-01

Annexes designated "normative" are part of the body of the standard. Annexes designated "informative" are given for information only. In this standard, annexes A and B are normative and annexes C and D are informative.

INTRODUCTION

This European Standard consists of seven Parts. Part 1 gives general information related to d.c switchgear and controlgear in fixed installations of railway applications.

The other parts address the following specific equipment:

Part 2 d.c. circuit breakers;
Part 3 indoor d.c. switch-disconnectors and d.c. disconnectors;
Part 4 outdoor d.c. in-line switch-disconnectors and d.c. earthing switches;
Part 5 surge arresters and low-voltage limiters for specific use in d.c. systems;
Part 6 d.c. switchgear assemblies;
Part 7 measurement, control and protection of d.c. traction systems.

NOTE: Cables and busbars external to switchgear assemblies or apparatus, contact lines, feeding lines, line supports and insulators are subject to other standards.

1 SCOPE

This European Standard, consisting of seven Parts, specifies requirements for d.c. switchgear and controlgear and is intended to be used in fixed electrical installations, with nominal voltage not exceeding 3 000 V d.c., which supply electrical power to vehicles for public guided transport, i.e. railway vehicles, tramway vehicles, underground vehicles and trolleybuses.

NOTE: In 5.1.1.1 a restriction is shown in respect to the ripple factor of the supply.

2 NORMATIVE REFERENCES

This European Standard incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed thereafter. 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 50119	199x°	Railway applications - Fixed installations - Electric traction overhead contact lines systems - General requirements
EN 50121	series°	Railway applications - Electromagnetic compatibility (EMC)
EN 50122-1	199x°	Railway applications - Fixed installations - Part 1: Protective provisions relating to electrical safety and earthing
EN 50124-1	199x°	Railway applications - Insulation co-ordination - Part 1: Basic requirements - Clearances and creepage distances
EN 50126	series°	Railway applications - Specification and demonstration of reliability, availability, maintainability and safety (RAMS)

° Document in preparation in February 1995.

EN 50163	1995	Railway applications - Supply voltages of traction systems
EN 60099-1	1993	Surge arresters - Part 1: Non-linear resistor type gapped surge arresters for a.c. systems (IEC 99-1:1991)
EN 60507	1993	Artificial pollution tests on high voltage insulators to be used in a.c. systems (IEC 507:1991)
EN 60947-1 + A11	1991 1992	Low-voltage switchgear and controlgear - Part 1: General rules (IEC 947-1:1988, modified)
EN 60947-2 + A1	1991 1993	Part 2: Circuit breakers (IEC 947-2:1991) (IEC 947-2:1991/A1:1992)
HD 448 S3	1995	Common clauses for high-voltage switchgear and controlgear standards (IEC 694:1980 + A1:1985 + A2:1993)
HD 478	series	Classification of environmental conditions
HD 588.1 S1	1991	High-voltage test techniques - Part 1: General definitions and test requirements (IEC 60-1:1989)
IEC 50(441)	1984	International Electrical Vocabulary (IEV) Chapter 441: Switchgear, controlgear and fuses
IEC 50(446)	1983	Chapter 446: Electrical relays
IEC 50(605)	1983	Chapter 605: Generation, transmission and distribution of electricity - Substations
IEC 50(811)	1991	Chapter 811: Electric traction

NOTE: A list of publications which may be of use is given in the informative annex D: Bibliography.

3 DEFINITIONS

For the purposes of this standard, the definitions given in EN 60947, IEC 50(811), 50(441), 50(446) and 50(605) apply together with the following:

3.1 General terms

3.1.1 switching device

A device designed to make or break the current in one or more electric circuits. (IEC 50(441):1984, 14.01)

3.1.2 d.c. circuit breaker

A switching device capable of making, carrying and breaking direct currents under normal circuit conditions and also making, carrying (up to a specified limit and for a specified time) and breaking currents under specified abnormal conditions, such as those of short-circuit.

3.1.3 d.c. disconnector

A mechanical switching device, which provides, in the open position, for safety reasons, an isolating distance in accordance with specified requirements. The disconnector is capable of opening and closing a circuit when either negligible d.c. current is broken or made, or when no significant change in the voltage across the terminals of the disconnector occurs. It is also capable of carrying d.c. currents under normal circuit conditions and carrying, for a specified time, currents under abnormal conditions such as those of short-circuit.

NOTE 1: A disconnector is not suitable to make or break load current, fault current or other current arising from the effects of lightning or transient phenomena.

NOTE 2: A disconnector is only able to make or break current of very limited magnitude such as those arising from electrostatic charging or discharges across undamaged insulation. The ability to make or break minimum currents due to eventual marginal transient conditions of the network is subject to agreement between purchaser and supplier.

3.1.4 switch-disconnector

A mechanical switching device capable of making, carrying and breaking currents in normal circuit conditions and, when specified, in given operating overload conditions. In addition it is able to carry, for a specified time, currents under specified abnormal circuit conditions, such as short-circuit conditions. In addition it complies with the requirements for a disconnector (see 3.1.3).

When specified, a switch-disconnector may be designed for making short-circuit currents, but not to break the same.

NOTE: Outdoor switch-disconnectors, in given special conditions, may be required to be suitable to break overload currents of specified amplitude.

3.1.5 earthing switch

A mechanical switching device for earthing parts of the circuit, capable of withstanding for a specified time, currents under abnormal conditions such as those of short-circuit, but not required to carry currents under normal conditions of the circuit. (IEC 50(441):1984, 14.11)

NOTE: An earthing switch may have a short-circuit making capacity (see 3.2.23).

3.1.6 operation

The motion of the moving contact(s) from one position to another position, e.g. open to close or open to earth.

NOTE 1: This may be a closing operation or an opening operation.

NOTE 2: If a distinction is necessary, the terms "electrical operation" (e.g.: make, break) and "mechanical operation" (e.g.: closing and opening) should be used.

NOTE 3: The position of a switching device where the continuity of the main circuit is assured is indicated as "close" position.

NOTE 4: The position of a switching device where the prescribed distance between the contacts of the switching device is assured is indicated as "open" position.

3.1.7 operating cycle (of a mechanical switching device)

A succession of operations from one position to another and back to the first position through all other positions, if any. (IEC 50(441):1984, 16.02)

3.1.8 dependent manual operation (of a mechanical switching device)

An operation solely by means of directly applied manual energy, such that the speed and force of the operation are dependent upon the action of the operator. (IEC 50(441):1984, 16.13)

3.1.9 stored energy operation (of a mechanical switching device)

An operation by means of energy stored in the device itself prior to the completion of the operation and sufficient to complete it under predetermined conditions. (IEC 50(441):1984, 16.15)

NOTE: This kind of operation may be subdivided according to:

a) the energy storage mode (spring, weight, etc.);
b) the origin of energy (manual, electric, etc.);
c) the energy releasing mode (manual, electric, etc.).

3.1.10 independent manual operation (of a mechanical switching device)

A stored energy operation where the energy originates from manual power, stored and released in one continuous operation, such that the speed and force of the operation are independent from the action of the operator. (IEC 50(441):1984, 16.16)

3.1.11 independent power operation

An operation by means of energy where the energy originates from an external power source and is released in a single continuous operation, such that the speed and force of the operation are independent from the action of the operator.

3.1.12 switching device with interlock preventing opening and/or closing operations

A switching device in which an operation (closing and/or opening) is prevented by interlocking means reflecting given system conditions.

3.1.13 utilization category (of a switching device)

A combination of specified requirements related to the condition in which the switching device fulfils its purpose, selected to represent a characteristic group of practical applications. (IEC 50(441):1984, 17.19)

NOTE: The specified requirements may concern e.g. the values of the making capacities, if applicable, breaking capacities and other characteristics, the associated circuits and the relevant conditions of use and behaviour. **The term "duty" used elsewhere in the Standard corresponds to a particular aspect of the utilization category.**

3.1.14 unidirectional switching device

A switching device (e.g. a circuit breaker), the purpose of which is to interrupt d.c. current which is flowing in a prescribed direction through that device, and which is identified accordingly.

3.1.15 bidirectional switching device

A switching device (e.g. a circuit breaker), the purpose of which is to interrupt d.c. current which flows in either direction through that device, and which is identified accordingly.

NOTE: Proof of bidirectional ability is included in the interrupting type tests.

3.2 Performance characteristics

3.2.1 System voltages

3.2.1.1 nominal voltage (U_n)

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

NOTE: The rated voltage may differ from the nominal voltage by a quantity within permitted tolerances.

3.2.1.2 Limits of system voltages

3.2.1.2.1 highest system voltage (U_{max})

The highest value given for the voltage in the continuous operating conditions specified in EN 50163 (U_{max1}).

3.2.1.2.2 lowest system voltage (U_{min})

The lowest value given for the voltage in the continuous operating conditions specified in EN 50163 (U_{min1}).

3.2.2 rated insulation voltage (U_{Nm})

The maximum value of the d.c. voltage for which the equipment is designed in respect to its insulation.

NOTE: Standard values for rated insulation voltage are given in EN 50124-1.

3.2.3 rated voltage (U_{Ne})

Voltage value, given by the manufacturer, which, combined with rated service current, determines the utilisation of the equipment and to which the corresponding tests and utilisation categories, if any, relate.

3.2.4 rated impulse withstand voltage (U_{Ni})

The peak value of an impulse voltage of prescribed form and polarity which the equipment is capable of withstanding to, without failure, under specified conditions of test.

NOTE: Standard values for impulse level are given in EN 50124-1.

3.2.5 power-frequency voltage withstand level (dry and wet)

A power-frequency test voltage level which, when withstood by the equipment, proves the integrity of its insulations in operating conditions.

NOTE: Power frequency voltage withstand levels are given in EN 50124-1.

3.2.6 recovery voltage

The voltage which appears across the terminals of a switching device after the breaking of the current. (IEC 50(441):1984, 17.25)

3.2.6.1 maximum arc voltage (U_{arc})

The maximum voltage appearing across the switching device during arcing.

3.2.7 prospective current

A current that would flow in the circuit if the device was replaced by a conductor of negligible impedance. (IEC 50(441):1984, 17.01)

NOTE: The prospective current may be qualified in the same way as a real current: prospective broken current, peak value of the prospective current, etc.

3.2.8 conventional free-air thermal current (I_{th})

The maximum value of test current to be used for temperature rise test of an equipment in free-air (see Notes 1 and 2).

NOTE 1: Free-air is the indoor air existing in normal conditions, reasonably free from dust and external radiations.

NOTE 2: A free-air device is a device supplied by the manufacturer without an enclosure (see 3.3.12) or a device supplied by the manufacturer with an integral enclosure (see 3.3.13).

Its value is equal to or greater than the maximum value of the rated service current (I_{Ne}) of the equipment.

3.2.9 conventional enclosed thermal current (I_{the})

The value of the current stated by the manufacturer to be used for the temperature rise tests of the equipment when mounted in a specified enclosure.

Its value is equal to or greater than the maximum value of the rated service current (I_{Ne}) of the enclosed equipment.

3.2.10 rated service current (I_{Ne})

The value of current stated by the manufacturer taking into account the rated voltage (see 3.2.3), the continuous duty and the utilisation category (see 3.1.13) and the protective enclosure type, if any.

NOTE 1: Any value of currents, exceeding I_{Ne} is an overload condition. All circuit breaker rated currents are chosen to cover overload periods according to a load cycle specified by the purchaser.

NOTE 2: If an overcurrent load cycle is specified by the purchaser, it should define the steady state currents before and after the load cycle. If the temperature rises resulting from the load cycle exceed the rated temperature rises, then a higher rated service current needs to be used.

3.2.11 Rated short-time withstand current (I_{Ncw})

The sustained thermal current the circuit breaker is able to carry, in a defined time period, without reaching hazardous temperatures in any part of the main circuit.

NOTE 1: A temperature exceeding by more than 15 % the temperature-rises shown in Clause 6, is considered a hazardous temperature, unless otherwise agreed.

NOTE 2: The word "sustained" means that short-time withstand currents are not peak-currents in transient conditions, but are steady-state currents.

NOTE 3: A circuit breaker has a thermal time constant which is different for its various parts, from few minutes to say one hour.

NOTE 4: Short-time ratings only apply to circuit breakers not fitted with series trip devices, or in a unidirectional device where a series trip is inoperative. In practice this would apply to a rectifier circuit breaker in the forward direction where a series trip only acts in the reverse direction.

Rated short-time currents need not have the same value as the rated short-circuit current I_{Nss}.

3.2.12 short-circuit current (I_{ss})

A prospective sustained current resulting from a short-circuit due to a fault or an incorrect connection in an electric circuit.

3.2.12.1 rated short-circuit current (I_{Nss})

The maximum value of the prospective sustained short-circuit current that the device will carry.

3.2.13 peak of the short-circuit current ($\hat{\imath}_{ss}$)

The peak prospective value of the short-circuit current under transient conditions.

3.2.14 cut-off current

The maximum instantaneous value of current attained during the breaking operation of a switching device. (IEC 50(441):1984, 17.12)

3.2.15 time-constant (t_c, T_c)

The value of the ratio inductance over resistance.

NOTE: Lower case t is used for actual values of time-constant, while capital t is used for pre-determined values.

3.2.16 rated track time-constant (T_{Nc})

The time-constant of the track itself plus all parts of the circuit on the load side of a switching device, including any low-frequency, high-frequency impedance bonds.

3.2.17 breaking current

The current of a switching device at the instant of initiation of the contact separation during a breaking process.

3.2.18 breaking capacity

A value of the prospective breaking current that a switching device is capable of breaking at a stated voltage and under prescribed conditions of use and behaviour. (IEC 50(441):1984, 17.08)

3.2.19 rated short-circuit breaking capacity

A breaking capacity for which prescribed conditions include a short-circuit at the load terminals of the switching device.

3.2.20 critical current (I_c)

A value or range of values of current for which the interrupting time is significantly extended or for which there is the risk of re-ignition of the arc.

3.2.21 maximum circuit-energy short-circuit

The short-circuit having the maximum possible value of circuit energy, which normally occurs at a short distance along the track from the substation.

NOTE: See annex C.

3.2.22 making capacity

A value of the prospective making current that a switching device is capable of making at a stated voltage, under prescribed conditions of use and behaviour. (IEC 50(441):1984, 17.09)

3.2.23 rated short-circuit making capacity

A making capacity for which the prescribed conditions include a short-circuit at the load side terminals of the switching device.

3.2.24 distant fault short-circuit

A short-circuit at a position remote from the switching device interrupting the fault.