

SLOVENSKI STANDARD

SIST EN 50123-2:1998

01-november-1998

Railway applications - Fixed installations - D.C. switchgear - Part 2: D.C. circuit breakers

Railway applications - Fixed installations - D.C. switchgear -- Part 2: D.C. circuit breakers

Bahnanwendungen - Ortsfeste Anlagen - Gleichstromschalteinrichtungen -- Teil 2: Gleichstrom-Leistungsschalter

Applications ferroviaires - Installations fixes - Appareillages de coupure en courant continu (CC) -- Partie 2: Disjoncteurs pour courant continu

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Ta slovenski standard je istoveten z: **EN 50123-2:1995**

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ICS:

29.130.99	Druge stikalne in krmilne naprave	Other switchgear and controlgear
29.280	Ò\^ dã } æ\^ } æ\] !^ { æ	Electric traction equipment

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EUROPEAN STANDARD
NORME EUROPÉENNE
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EN 50123-2

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Descriptors: Railway fixed equipment, electric traction, d.c., circuit breaker, definition, performance evaluation, equipment specification, temperature rise, electric endurance test, fatigue test, heating test, dielectric strength test, information, marking

English version

Railway applications
Fixed installations - D.C. switchgear
Part 2: D.C. circuit breakers

Applications ferroviaires
Installations fixes
Appareillage à courant continu
Partie 2: Coupe-circuit

Bahnanwendungen
Ortsfeste Anlagen
Gleichstrom-Schaltanlagen
Teil 2: Gleichstrom-Leistungsschalter

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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 Unique Acceptance Procedure and was approved by CENELEC as EN 50123-2 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

This part 2 is to be used in conjunction with EN 50123-1:1995, Railway applications - Fixed installations - D.C. switchgear - Part 1: General.

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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1 SCOPE

This Part of EN 50123 specifies requirements for d.c. circuit breakers for use in stationary installations of traction systems.

NOTE 1: EN 50123-6 specifies requirements for d.c. switchgear assemblies

NOTE 2: EN 50121-5 specifies requirements for electromagnetic compatibility (EMC).

NOTE 3: EN 50126 specifies requirements for dependability.

2 NORMATIVE REFERENCES

For the purposes of this standard, the normative references given in EN 50123-1:1995 apply.

3 DEFINITIONS

For the purposes of this standard, the definitions given in EN 50123-1:1995 apply.

4 SERVICE CONDITIONS

Where service conditions differ from those defined as "normal" in clause 4 and annex B of EN 50123-1:1995, the purchaser shall state this fact in the tender specification. Where a d.c. circuit breaker is suitable for use in service conditions different from those defined as "normal" in clause 4 and annex B of EN 50123-1:1995, the manufacturer shall state this fact.

5 CHARACTERISTICS OF THE CIRCUIT BREAKER

5.1 Enumeration of the characteristics

The characteristics of a circuit breaker and its assigned designations and values where applicable are as follows:

- type of circuit breaker (5.2);
- rated values and limit values of the main circuit and short-circuit characteristics (5.3);
- control circuits (5.4);
- auxiliary circuits (5.5);
- releases or relays (5.6);
- switching overvoltages (5.7).

5.2 Type of circuit breaker

A circuit breaker is defined by the following details as applicable.

NOTE 1: As far as applicable the following requirements also apply to single-pole circuit breakers electrically or mechanically interlocked in multiple systems.

a) Interruption:

- in air;
- via a semiconductor.

NOTE 2: In this document only interruption in air or via a semiconductors are concerned. This document may be used for other specified interrupting media, as far as applicable, where clearly specified by mutual agreement between purchaser and supplier.

b) Breaking characteristics:

- high speed current limiting circuit breakers (H);
- very-high speed current limiting circuit breakers (V)
- semi-high speed circuit breakers (S).

c) Use (installation point) in the system:

- interconnecting circuit breaker (also called bus-section or section circuit breaker) (here indicated with the prefix I);
- line circuit breaker (L);
- rectifier circuit breaker (R).

d) Current interruption direction:

- unidirectional (U);
- bidirectional (B).

e) Duty of the main circuit

NOTE 3: To be specified when different from 5.3.3 and table 2.

f) Actuating of the closing and opening operations:

- stored energy operation; [SIST EN 50123-2:1998](#)
- independent manual operation; [http://standards.iteh.ai/catalog/standards/sist/728c380a-c310-40ce-a77e-1e2/sist-en-50123-2-1998](#)
- independent power operation;
- use of magnet;
- type of automatic tripping due to a release or relay;
- interlocks for opening and/or closing operations;
- trip-free provision;
- anti-pumping device.

g) Relay or release type:

- type of the relay(s) or release(s) involved.

h) Provision of an enclosure:

- without provision of an enclosure (O);
- with provision of an integral enclosure (see 3.3.13 of EN 50123-1:1995) (E).
- with provision of a separate protection enclosure (P);

The above designations are used in this document and may be used elsewhere adopting the conventional grouping as given in table 1:

When a circuit breaker is not suitable to perform all duties as given in 5.3.4.2, this fact shall be indicated by means of the lower case letter(s) designating actual capability according table 2, first column (e.g. Iff,fr/V/P).

Table 1 - Shortened type-designation

Items above	c*	b	d*	h*
Options	I	/ H	/ U	/ O
	L	/ V	or	/ E
	R	/ S	/ B	/ P
Examples	L/H/B/E			
	I/V/P		R/S/O	
* Optional designations				

Where semiconductor circuit breakers are only designed for use in rectifier equipped substations, they shall be clearly so marked. If they may also be used as track paralleling circuit breakers, when the substation rectifier circuit breakers are out of service, they shall also be clearly so marked.

5.3 Rated values and limit values for the main circuit

5.3.1 General

The rated characteristic values shall be specified by the purchaser. Nominal voltage values are to be selected from EN 50163, current values and track time constant (based on the track configuration which gives the largest time constant) should have one of the preferred values in EN 50123-1:1995.

These values should be confirmed by the supplier, who should indicate the limit values for the type of circuit breaker proposed, and supply any other relevant data.

All these values are to be stipulated in accordance with 5.3.2 to 5.3.4. The definitions are given in EN 50123-1:1995. Some data may be omitted by agreement.

5.3.2 Voltages

A circuit breaker is identified by the following rated voltages:

- **System voltages and limits**

See 3.2.1 of EN 50123-1:1995.

- **Rated voltage (U_{Ne})**

See 3.2.3 and 5.1.3 of EN 50123-1:1995.

- **Rated insulation voltage (U_{Nm})**

See 3.2.2 of EN 50123-1:1995.

It shall be equal to or higher than U_{max} .

- **Rated impulse withstand voltage (U_{Ni})**

See 3.2.4 of EN 50123-1:1995.

- **Power-frequency voltage withstand level (dry)**

See 3.2.5 of EN 50123-1:1995.

NOTE: This withstand level is a dry test, because applicable to indoor equipment.

5.3.3 Currents

A circuit breaker is defined by the following rated currents:

- **Rated conventional thermal current (I_{th} I_{the})**

See 3.2.8 and 3.2.9 of EN 50123-1:1995.

- **Rated service current (I_{Ne})**

See 3.2.10 of EN 50123-1:1995.

- **Rated short circuit current (I_{Nss})**

See 3.2.12 of EN 50123-1:1995.

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

See 3.2.11 of EN 50123-1:1995.

- **Overload capability**

The purchaser shall inform the supplier of the load cycle needed. See 3.2.10, Note 2 of EN 50123-1:1995.

5.3.4 Short-circuit characteristics

5.3.4.1 Rated short-circuit breaking and making capacities

These values are defined in 3.2.19 and 3.2.23 of EN 50123-1:1995 and are associated with the rated voltage, the rated service current, the rated maximum short-circuit current, the track time-constant and the rated speed (H or V or S).

The rated short-circuit making capacity is the prospective peak of the rated short-circuit current I_{Nss} (see 3.2.12.1 of EN 50123-1:1995).

A rated short-circuit breaking capacity requires the circuit breaker to be able to interrupt any short-circuit current of a value lower than or equal to this rated breaking capacity at the time-constant stipulated.

A circuit breaker having a breaking capacity at a rated track time constant is capable of the same breaking capacity at all lower values of track time constant.

The prospective maximum short-circuit current is the sum of the prospective short-circuit currents from all sources connected to the system, including rectifier convertors and regenerative trains.

When fixing the maximum short-circuit current and the above time-constant, clause 5 of EN 50123-1:1995 shall be considered.

5.3.4.2 Duties and test cycles

The test duties required of a circuit breaker for each of the three uses are listed in table 2. The test cycles applying to the duties are shown in table 3.

Table 2 - Circuit breaker duties

Duty	Use	Conditions	Test current	Prospective peak	Time constant
f	L	max. fault	I_{Nss}	$\geq 1,42 I_{Nss}$	BC
e	L	max. energy	$0,5 I_{Nss}^*$	BC	$0,5 T_{Nc}^*$
d	L	dist. fault	$2 I_{Ne}$	BC	T_{Nc}
l	L	low current	I_c	NA	$\geq 0,01$ s
ff	I	max. fault forward	I_{Nss}	$\geq 1,42 I_{Nss}$	BC
fr	I	max. fault reverse	I_{Nss}	$\geq 1,42 I_{Nss}$	BC
lr	I	reverse low current after forward short-circuit	I_c	NA	$\geq 0,01$ s
r	R	short-circuit reverse	$I_{Nss}(n-1)/n$	$\geq 1,42 I_{Nss}(n-1)/n$	
s	R	short-time current	I_{Ncw}	$\geq 1,42 I_{Ncw}$ (see P1, annex C)	

NOTES:

NA means not applicable

BC means by consequence of other circuit parameters

n means the number of rectifier converters involved.

For other symbols see EN 50123-1:1995, clause 3. When $n=1$ then the test current should be dependent on adjacent feeds and regenerating sources.

I_{ss} is to be determined for each type of actual circuit situation. Therefore I_{Nss} may be different for line, interconnecting and rectifier circuit breakers.

* The factor affecting both I_{Nss} and T_{Nc} for maximum fault position is taken for practical reasons as 0,5. For low values of T_c , see the tabled values in 5.1.1.3 of EN 50123-1:1995.

For substations equipped with smoothing reactors of high value, the maximum energy condition may correspond to the maximum fault condition.

Table 3 - Test duty cycles

Duties	Test cycle
f, e, d *	
duty 1	0 - 15 s - CO - 15 s - CO - 60 s - CO
duty 2	0 - 7 s - CO - 10 s - CO - 60 s - CO
ff, fr, r	0 - max. 20 s - CO
l, lr	(0 - 120 s - CO) cycles by 10 times
s	carrying for 0,25 s
NOTES: O = opening operation; C = closing operation First opening is made on a short circuit being established * The choice between duties 1 and 2 is left to the purchaser. If no choice is made, then the duty cycle required is duty 1.	

Circuit breakers designed for more duties shall be submitted to every test cycle concerned; unless otherwise agreed between purchaser and supplier, these tests are to be carried out on a single circuit breaker which may be maintained between duty cycles. Any further duty cycles on the same circuit breaker shall not be performed unless a sufficient time to cool down the circuit breaker components is allowed.

The tests shall be performed with the series overcurrent release set at the maximum setting, e.g. four times I_{th} or I_{the} for test duties f), e), ff), fr) and 0,5 times for test duties r), s).

For test duties d) and l), the circuit breaker shall be set to trip when the sustained value is reached. For test duty d), when the track time constants are long, the trip shall be initiated at 0,15 s.

5.4 Control circuits

The control circuits are identified by the following characteristics as a minimum:

- the rated voltage of the control circuits;
- the kind of current (d.c. or a.c.);
- the current frequency, in case of an a.c. current.

The rated voltage of the supply source and its frequency are the values on which the performances, the thermal behaviour and the insulation characteristics are based.

NOTE: Supply voltage means the actual voltage measured at the terminals of the circuit breaker control circuit when carrying the operating current. The control circuit is taken to include the auxiliary resistors and any accessory (e.g. rectifiers), supplied by the manufacturer or indicated by the manufacturer as essential for the correct operation of the circuit breaker.

The rated voltage and the insulation characteristics shall be in accordance with EN 50124-1.

The supply voltage shall remain within 80% and 110% of the rated voltage in accordance with 5.2 of EN 50123-1:1995.

Where the control voltage is the same as in the main circuit, the same variations as in the main circuit apply.

The manufacturer shall inform the purchaser of the value(s) of the current drawn by the control circuits at the rated voltage. In case of control circuits which draw current intermittently, the duration of the current flow shall be given.

5.5 Auxiliary contacts and circuits

Auxiliary circuits are mainly defined by the number of contacts provided, by their rating (thermal current and voltage) and by their characteristics (NO or NC or commutation). Unless otherwise required, the rated voltage shall be in accordance with 5.2 of EN 50123-1:1995, the rated insulation voltage according to EN 50124-1 and the purchaser shall specify the minimum number of auxiliary contacts required.

The auxiliary wiring connected to a circuit at 1000 V a.c. or 1500 V d.c. or above shall be physically separated from those connected to a circuit at a voltage below said limits.

For other characteristics of the auxiliary circuits, the requirements of 5.4 apply.

5.6 Releases

NOTE: In case relays are used the following requirements apply too, insofar as applicable.

5.6.1 Type

The classifications of the releases comprises:

- series (direct or indirect) overcurrent releases;
- shunt releases;
- under-voltage releases;
- other releases.

5.6.2 Characteristics

A release may be instantaneous or time lagged or time dependant or a combination of all.

Other characteristics are as follows:

a) for overcurrent (d.c.) releases:

- type (overcurrent direct or indirect);
- rated current;
- the setting current (or setting range);
- the direction of the main carrying current in case of unidirectional circuit breaker;
- characteristics of the actuating time which the release gives the circuit breaker as a function of the parameters of variation (e.g. as a function of the rate of change of the current).

The rated current of an overcurrent release is the current value corresponding to the 100 % current setting. The release shall be capable of withstanding this current under the test conditions specified in clause 8, without the temperature rise exceeding the values specified in clause 6 of EN 50123-1:1995.

For the circuit breakers provided with interchangeable or adjustable releases, the current setting (or the setting range, if applicable) shall be indicated on the release or on its setting scale. The indication may be either in ampere or in multiples of the current indicated on the release. The range to be used shall be one of the following:

- 0,5 I_{th} or I_{the} (for rectifier circuit breakers only);
- 1,5 to 3 I_{th} or I_{the} ;
- 2,5 to 4 I_{th} or I_{the} .

NOTE: If the purchaser makes no choice for the settings of L and I circuit breakers, then 1,5 to 3 is supplied.

b) for the shunt release:

- the rated voltage;
- the power taken at the rated voltage for a specified time.

5.7 Switching overvoltages

The manufacturer shall specify the maximum value of the arc voltage (U_{arc}) caused by the operation of the circuit breaker when it is tested in accordance with clause 8.

NOTE: This maximum voltage is the peak voltage measured during any test duty and is not necessarily seen with maximum current.

Under no circumstances shall this value exceed both that of the rated impulse withstand voltage of the equipment and four times the nominal voltage. If lower switching overvoltages are required, these shall be specified by the purchaser.

6 CONSTRUCTION

6.1 General

6.1.1 Materials

No materials containing asbestos shall be used in the construction of the switchgear.

NOTE: Special attention is to be paid to the ability of the material used to resist moisture and fire: materials used should be of the self extinguishing type, such that the risk of propagation of fire from one cubicle to another is minimized. See EN 50123-1:1995, annex B.

All like plant and apparatus, supplied by a manufacturer for a given use and with the same characteristics, shall be interchangeable as a whole and also as regards its parts.