

**Nadomešča:  
SIST EN 60077-3:2003**

---

**Železniške naprave - Električna oprema za vozna sredstva - 3. del: Elektrotehnične komponente - Pravila za močnostna stikala za enosmerni tok (IEC 60077-3:2019)**

Railway applications - Electric equipment for rolling stock - Part 3: Electrotechnical components - Rules for d.c. circuit-breakers

Bahnanwendungen - Elektrische Betriebsmittel auf Bahnfahrzeugen - Teil 3: Elektrotechnische Bauteile - Regeln für DC-Leistungsschalter

Applications ferroviaires - Equipements électriques du matériel roulant - Partie 3: Composants électrotechniques - Règles pour disjoncteurs à courant continu

**Ta slovenski standard je istoveten z: EN IEC 60077-3:2019**

**ICS:**

29.120.50	Varovalke in druga nadtokovna zaščita	Fuses and other overcurrent protection devices
29.280	Električna vlečna oprema	Electric traction equipment
45.060.01	Železniška vozila na splošno	Railway rolling stock in general

**SIST EN IEC 60077-3:2020** en

**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

SIST EN IEC 60077-3:2020

<https://standards.iteh.ai/catalog/standards/sist/86d592ab-657c-4b80-b51e-bfa7d1887993/sist-en-iec-60077-3-2020>

EUROPEAN STANDARD

EN IEC 60077-3

NORME EUROPÉENNE

EUROPÄISCHE NORM

December 2019

ICS 45.060.01

Supersedes EN 60077-3:2002 and all of its amendments  
and corrigenda (if any)

English Version

## Railway applications - Electric equipment for rolling stock - Part 3: Electrotechnical components - Rules for DC circuit-breakers (IEC 60077-3:2019)

Applications ferroviaires - Équipements électriques du  
matériel roulant - Partie 3: Composants électrotechniques -  
Règles pour disjoncteurs à courant continu  
(IEC 60077-3:2019)

Bahnanwendungen - Elektrische Betriebsmittel auf  
Fahrzeugen - Teil 3: Elektrotechnische Bauteile - Regeln für  
DC-Leistungsschalter  
(IEC 60077-3:2019)

This European Standard was approved by CENELEC on 2019-11-29. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre 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 CEN-CENELEC Management Centre has the same status as the official versions.

[SIST EN IEC 60077-3:2020](https://standards.iteh.ai/catalog/standards/sist/86d592ab-657c-4b80-b51e-)

<https://standards.iteh.ai/catalog/standards/sist/86d592ab-657c-4b80-b51e->

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.



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

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

**EN IEC 60077-3:2019 (E)****European foreword**

The text of document 9/2537/FDIS, future edition 2 of IEC 60077-3, prepared by IEC/TC 9 "Electrical equipment and systems for railways" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 60077-3:2019.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2020-08-29
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2022-11-29

This document supersedes EN 60077-3:2002 and all of its amendments and corrigenda (if any).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

## **iTeh STANDARD PREVIEW** **(standards.iteh.ai)**

### **Endorsement notice**

[SIST EN IEC 60077-3:2020](https://standards.iteh.ai/catalog/standards/sist/86d592ab-657c-4b80-b51e-bfa7d1887993/sist-en-iec-60077-3-2020)

[https://standards.iteh.ai/catalog/standards/sist/86d592ab-657c-4b80-b51e-](https://standards.iteh.ai/catalog/standards/sist/86d592ab-657c-4b80-b51e-bfa7d1887993/sist-en-iec-60077-3-2020)

[bfa7d1887993/sist-en-iec-60077-3-2020](https://standards.iteh.ai/catalog/standards/sist/86d592ab-657c-4b80-b51e-bfa7d1887993/sist-en-iec-60077-3-2020)

The text of the International Standard IEC 60077-3:2019 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following note has to be added for the standard indicated:

IEC 60947-2    NOTE    Harmonized as EN 60947-2

## Annex ZA (normative)

### Normative references to international publications with their corresponding European publications

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: [www.cenelec.eu](http://www.cenelec.eu).

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60077-1	2017	Railway applications - Electric equipment for rolling stock - Part 1: General service conditions and general rules	EN 60077-1	2017
IEC 60077-2	2017	Railway applications - Electric equipment for rolling stock - Part 2: Electrotechnical components - General rules	EN 60077-2	2017
IEC 60529	-	Degrees of protection provided by enclosures (IP Code)	-	-
IEC 61373	-	Railway applications - Rolling stock equipment - Shock and vibration tests	EN 61373	-

<https://standards.iteh.ai/catalog/standards/sist/86d592ab-657c-4b80-b51e-bfa7d1887993/sist-en-iec-60077-3-2020>

**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

SIST EN IEC 60077-3:2020

<https://standards.iteh.ai/catalog/standards/sist/86d592ab-657c-4b80-b51e-bfa7d1887993/sist-en-iec-60077-3-2020>



IEC 60077-3

Edition 2.0 2019-10

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE

**Railway Applications – Electric equipment for rolling stock –  
Part 3: Electrotechnical components – Rules for DC circuit-breakers**

**Applications ferroviaires – Équipements électriques du matériel roulant –  
Partie 3: Composants électrotechniques – Règles pour disjoncteurs  
à courant continu**

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

COMMISSION  
ELECTROTECHNIQUE  
INTERNATIONALE

ICS 45.060.01

ISBN 978-2-8322-7507-8

**Warning! Make sure that you obtained this publication from an authorized distributor.  
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

## CONTENTS

FOREWORD .....	4
1 Scope .....	6
2 Normative references .....	7
3 Terms, definitions and abbreviated terms .....	7
3.1 Components .....	7
3.2 Component parts .....	8
3.3 Operational features .....	9
3.4 Breaking characteristics .....	10
3.5 Abbreviated terms .....	12
4 Classification .....	12
5 Characteristics .....	12
5.1 List of characteristics .....	12
5.2 Type of circuit-breaker .....	12
5.3 Rated values and limiting values for the main circuit .....	13
5.3.1 General .....	13
5.3.2 Rated voltages .....	13
5.3.3 Rated currents .....	13
5.3.4 Rated time constants .....	13
5.3.5 Rated short-circuit making and breaking capacity .....	14
5.4 Operational frequencies .....	14
5.5 Electric and pneumatic control circuits .....	14
5.6 Electric and pneumatic auxiliary circuits .....	14
5.7 Overcurrent release .....	14
5.8 Peak arc voltages .....	14
6 Product information .....	14
6.1 Component documentation .....	14
6.2 Marking .....	15
7 Normal service conditions .....	15
8 Constructional and performance requirements .....	15
8.1 Constructional requirements .....	15
8.2 Performance requirements .....	15
8.2.1 Operating conditions .....	15
8.2.2 Temperature limits .....	15
8.2.3 Operation following inactivity .....	15
8.2.4 Electromagnetic compatibility (EMC) .....	15
8.2.5 Acoustic noise emission .....	15
8.2.6 Clearances .....	15
8.2.7 Creepage distances .....	15
8.2.8 Switching overvoltages .....	15
8.2.9 Operational performance capability .....	16
8.2.10 Ability to withstand vibration and shock .....	16
8.2.11 Ability to make and break under short-circuit conditions .....	17
9 Tests .....	17
9.1 Kinds of tests .....	17
9.1.1 General .....	17

9.1.2	Type tests.....	17
9.1.3	Routine tests .....	17
9.1.4	Investigation tests.....	17
9.2	Verification of constructional requirements.....	18
9.2.1	General .....	18
9.2.2	Type tests.....	18
9.2.3	Routine tests .....	18
9.3	Type tests for verification of performance requirements .....	18
9.3.1	Test sequences .....	18
9.3.2	General test conditions .....	19
9.3.3	Test sequence I: General performance characteristics.....	20
9.3.4	Test sequence II: Rated short-circuit making and breaking capacities.....	21
9.3.5	Test sequence III: Ability to withstand vibration and shock.....	23
9.3.6	Test sequence IV: Searching for critical currents .....	24
9.3.7	Test sequence V: Climatic conditions .....	24
9.3.8	Test sequence VI: Other tests.....	24
9.4	Routine tests for verification of performance requirements .....	25
9.4.1	General .....	25
9.4.2	Functional test.....	25
9.4.3	Measurement of resistance.....	25
9.4.4	Calibration of releases.....	25
9.4.5	Air-tightness (for pneumatic circuit-breaker) .....	25
9.4.6	Dielectric withstand .....	25
Annex A (normative)	Test circuit to verify the making and breaking capacities .....	26
Annex B (informative)	Verification of short-circuit making and breaking capacities .....	27
Bibliography	.....	29
Figure A.1	– Diagram of the test circuit .....	26
Figure B.1	– Calibration of the circuit to obtain the prospective peak making current .....	27
Figure B.2	– Oscillogram corresponding to a break after the current has passed its maximum value.....	28
Figure B.3	– Oscillogram corresponding to a break before the current has reached its maximum value (current-limiting circuit-breaker).....	28
Table 1	– Rated time constants.....	13
Table 2	– Operational performance capability .....	16
Table 3	– List of type test sequences for performance requirements .....	18
Table 4	– Tolerances on test values.....	19

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**RAILWAY APPLICATIONS –  
ELECTRIC EQUIPMENT FOR ROLLING STOCK –****Part 3: Electrotechnical components –  
Rules for DC circuit-breakers**

## FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 60077-3 has been prepared by IEC technical committee 9: Electrical equipment and systems for railways.

This second edition cancels and replaces the first edition, issued in 2001. It constitutes a technical revision.

This edition includes the following main technical changes with regard to the previous edition:

- a) procedure of verification of temperature rise is changed;
- b) air-tightness test as type test, insulation resistance measurement are added.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
9/2537/FDIS	9/2553/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

This document should be read in conjunction with IEC 60077-1 and IEC 60077-2.

A list of all parts in the IEC 60077 series, published under the general title *Railway applications – Electric equipment for rolling stock*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

**ITeH STANDARD PREVIEW**  
**(standards.iteh.ai)**

SIST EN IEC 60077-3:2020

<https://standards.iteh.ai/catalog/standards/sist/86d592ab-657c-4b80-b51e-bfa7d1887993/sist-en-iec-60077-3-2020>

## RAILWAY APPLICATIONS – ELECTRIC EQUIPMENT FOR ROLLING STOCK –

### Part 3: Electrotechnical components – Rules for DC circuit-breakers

#### 1 Scope

In addition to the general requirements of IEC 60077-2, this part of IEC 60077 gives the rules for circuit-breakers, the main contacts of which are connected to DC power and/or auxiliary circuits. The nominal voltage of these circuits does not exceed 3 000 V DC according to IEC 60850.

This part of IEC 60077, together with IEC 60077-2, states specifically:

- a) the characteristics of the circuit-breakers;
- b) the service conditions with which circuit-breakers complies with reference to:
  - operation and behaviour in normal service;
  - operation and behaviour in the case of short circuit;
  - dielectric properties;
- c) the tests for confirming the compliance of the components with the characteristics under the service conditions and the methods to be adopted for these tests;
- d) the information to be marked on, or given with, the circuit breaker.

NOTE 1 Circuit-breakers which are dealt with in this document can be provided with devices for automatic opening under predetermined conditions other than those of overcurrent, for example, under-voltage and reversal of power flow direction. This document does not deal with the verification of operation under such predetermined conditions.

NOTE 2 The incorporation of electronic components or electronic sub-assemblies into electrotechnical components is now common practice.

Although this document is not applicable to electronic equipment, the presence of electronic components does not provide a reason to exclude such electrotechnical components from the scope.

Electronic sub-assemblies included in circuit-breakers comply with the relevant document for electronics (IEC 60571).

NOTE 3 Certain of these rules, after agreement between the user and the manufacturer, are used for electro-technical components installed on vehicles other than rail rolling stock such as mine locomotives, trolleybuses, etc. In this case, particular additional requirements can be necessary.

This document does not cover:

- e) multi-connection of electro-technical components to achieve a particular duty;
- f) industrial circuit-breakers which complies with IEC 60947-2;
- g) DC circuit-breakers for fixed installations which complies with IEC 61992-2.

For f) and g), in order to ensure satisfactory operation, this document is used to specify only the particular requirements for rolling stock. In such cases, a specific document states the additional requirements with which the industrial or fixed installations circuits breakers comply, for example:

- either to be adapted (for example, for control voltage, environmental conditions, etc.);
- or to be installed and used in such a way that they do not have to endure specific rolling stock conditions;