

Railway applications - Electric equipment for rolling stock - Part 2: Electrotechnical components - General rules

## EESTI STANDARDI EESSÕNA

## NATIONAL FOREWORD

See Eesti standard EVS-EN 60077-2:2017 sisaldab Euroopa standardi EN 60077-2:2017 ingliskeelset teksti.	This Estonian standard EVS-EN 60077-2:2017 consists of the English text of the European standard EN 60077-2:2017.
Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation.
Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 24.11.2017.	Date of Availability of the European standard is 24.11.2017.
Standard on kättesaadav Eesti Standardikeskusest.	The standard is available from the Estonian Centre for Standardisation.

Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile [standardiosakond@evs.ee](mailto:standardiosakond@evs.ee).

ICS 45.060.01

Standardite reprodutseerimise ja levitamise õigus kuulub Eesti Standardikeskusele

Andmete paljundamine, taastekitamine, kopeerimine, salvestamine elektroonsesse süsteemi või edastamine ükskõik millises vormis või millisel teel ilma Eesti Standardikeskuse kirjaliku loata on keelatud.

Kui Teil on küsimusi standardite autorikaitse kohta, võtke palun ühendust Eesti Standardikeskusega:  
Koduleht [www.evs.ee](http://www.evs.ee); telefon 605 5050; e-post [info@evs.ee](mailto:info@evs.ee)

The right to reproduce and distribute standards belongs to the Estonian Centre for Standardisation

No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying, without a written permission from the Estonian Centre for Standardisation.

If you have any questions about copyright, please contact Estonian Centre for Standardisation:

Homepage [www.evs.ee](http://www.evs.ee); phone +372 605 5050; e-mail [info@evs.ee](mailto:info@evs.ee)

English Version

Railway applications - Electric equipment for rolling stock -  
Part 2: Electrotechnical components - General rules  
(IEC 60077-2:2017)

Applications ferroviaires - Equipements électriques du  
matériel roulant - Partie 2: Composants électrotechniques -  
Règles générales  
(IEC 60077-2:2017)

Bahnanwendungen - Elektrische Betriebsmittel auf  
Bahnfahrzeugen - Teil 2: Elektrotechnische Bauteile -  
Allgemeine Regeln  
(IEC 60077-2:2017)

This European Standard was approved by CENELEC on 2017-09-01. 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.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, 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

## European foreword

The text of document 9/2267/FDIS, future edition 2 of IEC 60077-2, 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 60077-2:2017.

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) 2018-06-01
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2020-09-01

This document supersedes EN 60077-2:2002.

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.

## Endorsement notice

The text of the International Standard IEC 60077-2:2017 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60077-3	NOTE	Harmonized as EN 60077-3.
IEC 60077-4	NOTE	Harmonized as EN 60077-4.
IEC 60077-5	NOTE	Harmonized as EN 60077-5.
IEC 60947-1	NOTE	Harmonized as EN 60947-1.
IEC 60947-4-1	NOTE	Harmonized as EN 60947-4-1.
IEC 61140	NOTE	Harmonized as EN 61140.
IEC 61373	NOTE	Harmonized as EN 61373.

## 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 .....	9
3.3 Operational features .....	11
3.4 Abbreviated terms.....	14
4 Classification.....	15
5 Characteristics .....	15
5.1 List of characteristics .....	15
5.2 Type of component .....	15
5.3 Rated and limiting values for the main circuit .....	16
5.3.1 General .....	16
5.3.2 Rated voltages .....	16
5.3.3 Rated currents.....	16
5.3.4 Rated time constants (for DC switchgear).....	16
5.3.5 Rated power factor (for AC switchgear) .....	17
5.4 Operational frequencies .....	17
5.5 Component categories .....	17
5.6 Electric control circuits.....	17
5.7 Pneumatic control circuits .....	18
5.8 Manual control .....	18
5.9 Electric auxiliary circuits .....	18
5.10 Pneumatic auxiliary circuits.....	19
5.11 Peak arc voltages .....	19
6 Product information .....	19
6.1 Nature of the information .....	19
6.1.1 General .....	19
6.1.2 Component documentation .....	19
6.1.3 Other information.....	20
6.2 Marking.....	20
6.3 Instructions for storage, installation, operation and maintenance .....	20
7 Normal service conditions.....	21
8 Constructional and performance requirements .....	21
8.1 Constructional requirements .....	21
8.1.1 General .....	21
8.1.2 Terminals and connecting capacity .....	21
8.1.3 Protective bonding terminal .....	21
8.2 Performance requirements .....	21
8.2.1 Operating conditions.....	21
8.2.2 Temperature limits.....	22
8.2.3 Operation following inactivity .....	23
8.2.4 Electromagnetic compatibility (EMC) .....	23
8.2.5 Acoustic noise emission .....	23

8.2.6	Clearances .....	23
8.2.7	Creepage distances .....	23
8.2.8	Switching overvoltages .....	23
8.2.9	Operational performance capability.....	23
8.2.10	Ability to withstand vibration and shock .....	25
8.2.11	Ability to withstand short-time current .....	25
9	Tests .....	25
9.1	Kinds of tests .....	25
9.2	Verification of constructional requirements .....	26
9.3	Type tests .....	26
9.3.1	Test sequences .....	26
9.3.2	General test conditions .....	26
9.3.3	Test sequence I: General performance characteristics.....	27
9.3.4	Test sequence II: Rated service making and breaking capacities (if appropriate) .....	28
9.3.5	Test sequence III: Ability to withstand vibration and shock.....	30
9.3.6	Test sequence IV: Critical currents range .....	31
9.3.7	Test sequence V: Climatic conditions .....	31
9.3.8	Test sequence VI: Other tests.....	32
9.4	Routine tests.....	32
9.4.1	General .....	32
9.4.2	Functional test.....	32
9.4.3	Measurement of resistance or impedance.....	32
9.4.4	Air-tightness (for pneumatic components).....	32
9.4.5	Dielectric withstand .....	32
9.4.6	Check on the setting and operation of protective equipment and relays (calibration) .....	32
Annex A (normative) Correspondence between auxiliary contacts and steady states of switchgear .....		33
Bibliography.....		35
Figure A.1 – Relationship between auxiliary contacts and steady states of switchgear .....		34
Table 1 – Rated time constants.....		17
Table 2 – Temperature rise limits and temperature limits .....		22
Table 3 – Operational performance capability for category A1 components.....		24
Table 4 – Operational performance capability for category A2 components.....		24
Table 5 – Operational performance capability for category A3 components.....		25
Table 6 – Operational performance capability for category A4 components.....		25
Table 7 – List of test sequences .....		26
Table 8 – Tolerances on test values.....		27
Table 9 – Test method and severity .....		31

## **RAILWAY APPLICATIONS – ELECTRIC EQUIPMENT FOR ROLLING STOCK –**

### **Part 2: Electrotechnical components – General rules**

#### **1 Scope**

In addition to the rules given in IEC 60077-1, this part of IEC 60077 provides general rules for all electrotechnical components installed in power circuits, auxiliary circuits, control and indicating circuits, etc., on railway rolling stock.

The purpose of this document is to adapt the general rules given in IEC 60077-1 to all electrotechnical components for rolling stock, in order to obtain uniformity of requirements and tests for the corresponding range of components.

Electrotechnical components are mainly switchgear and controlgear, including also relays, valves, resistors, fuses, etc., irrespective of the nature of their control.

The incorporation of electronic components or electronic subassemblies into electrotechnical components is now common practice. Although this document is not applicable to electronic equipment, the presence of electronic components does not give grounds to exclude such electrotechnical components from the scope of this document.

Electronic subassemblies comply with the relevant standard.

Some of these rules, after agreement between the user and the manufacturer, are used for electrotechnical components installed on vehicles other than railway rolling stock, such as mine locomotives, trolleybuses, etc.

This document states:

- a) the characteristics of the components;
- b) the service conditions with which components have to comply;
- c) the tests intended to confirm compliance of the components with these characteristics under these service conditions, and the methods to be adopted for these tests;
- d) the information to be marked on, or given with, the apparatus.

This document does not cover industrial electrotechnical components which comply with their own product standard. In order to ensure satisfactory operation of these components for rolling stock, this document is used to specify only the particular requirements for railway application. In that case, a specific document would state the additional requirements with which the industrial components are to comply, e.g.:

- to be adapted (for example for control voltage, environmental conditions, etc.); or
- to be installed and used so as not to have to endure specific railway conditions; or
- to be additionally tested to prove that these components can satisfactorily withstand railway conditions.

In the event of there being a difference in requirements between this document and a railway rolling stock relevant product standard, then the product standard requirements take precedence.

## 2 Normative references

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.

IEC 60050-811:2017, *International Electrotechnical Vocabulary (IEV) – Chapter 811: Electric traction*

IEC 60068-2-1, *Environmental testing – Part 2-1: Tests – Test A: Cold*

IEC 60068-2-2, *Environmental testing – Part 2-2: Tests – Test B: Dry heat*

IEC 60068-2-30, *Environmental testing – Part 2-30: Tests – Test Db: Damp heat, cyclic (12 h + 12 h cycle)*

IEC 60068-2-52, *Environmental testing – Part 2-52: Test methods – Test Kb: Salt mist, cyclic (sodium, chloride solution)*

IEC 60068-2-78, *Environmental testing – Part 2-78: Tests – Test Cab: Damp heat, steady state*

IEC 60077-1:2017, *Railway applications – Electric equipment for rolling stock – Part 1: General service conditions and general rules*

IEC 60417, *Graphical symbols for use on equipment* (available at <http://www.graphical-symbols.info/equipment>)

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

IEC TR 60943, *Guidance concerning the permissible temperature rise for parts of electrical equipment, in particular for terminals*

## 3 Terms, definitions and abbreviated terms

For the purposes of this document, the terms and definitions given in IEC 60077-1 as well as the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

### 3.1 Components

#### 3.1.1

##### **active electrical component**

simple device or assembly of devices which, in response to a control signal, executes a function or various inseparable functions of logical or analogical nature by changing their state, for which the control or the function is electrical (e.g. contactor, relay, etc.)

Note 1 to entry: Passive electrical component is defined as the antonym of this term.