

© Copyright SEK Svensk Elstandard. Reproduction in any form without permission is prohibited.

Järnvägsanläggningar – Elutrustning för rälsfordon – Del 5: Högspänningssäkringar

*Railway applications –
Electrotechnical equipment for rolling stock –
Part 5: Electrotechnical components –
Rules for HV fuses*

Som svensk standard gäller europastandarden EN IEC 60077-5:2019. Den svenska standarden innehåller den officiella engelska språkversionen av EN IEC 60077-5:2019.

Nationellt förord

Europastandarden EN IEC 60077-5:2019

består av:

- **europastandardens ikraftsättningsdokument**, utarbetat inom CENELEC
- **IEC 60077-5, Second edition, 2019 - Railway applications - Electrotechnical equipment for rolling stock - Part 5: Electrotechnical components - Rules for HV fuses**

utarbetad inom International Electrotechnical Commission, IEC.

Standarden ska användas tillsammans med SS-EN 60077-1 och SS-EN 60077-2.

Tidigare fastställd svensk standard SS-EN 60077-5, utgåva 1, 2003, gäller ej fr o m 2022-12-04.

Standarder underlättar utvecklingen och höjer elsäkerheten

Det finns många fördelar med att ha gemensamma tekniska regler för bl a mätning, säkerhet och provning och för utförande, skötsel och dokumentation av elprodukter och elanläggningar.

Genom att utforma sådana standarder blir säkerhetsfordringar tydliga och utvecklingskostnaderna rimliga samtidigt som marknadens acceptans för produkten eller tjänsten ökar.

Många standarder inom elområdet beskriver tekniska lösningar och metoder som åstadkommer den elsäkerhet som föreskrivs av svenska myndigheter och av EU.

SEK är Sveriges röst i standardiseringsarbetet inom elområdet

SEK Svensk Elstandard svarar för standardiseringen inom elområdet i Sverige och samordnar svensk medverkan i internationell och europeisk standardisering. SEK är en ideell organisation med frivilligt deltagande från svenska myndigheter, företag och organisationer som vill medverka till och påverka utformningen av tekniska regler inom elektrotekniken.

SEK samordnar svenska intressenters medverkan i SEKs tekniska kommittéer och stödjer svenska experters medverkan i internationella och europeiska projekt.

Stora delar av arbetet sker internationellt

Utformningen av standarder sker i allt väsentligt i internationellt och europeiskt samarbete. SEK är svensk nationalkommitté av International Electrotechnical Commission (IEC) och Comité Européen de Normalisation Electrotechnique (CENELEC).

Standardiseringsarbetet inom SEK är organiserat i referensgrupper bestående av ett antal tekniska kommittéer som speglar hur arbetet inom IEC och CENELEC är organiserat.

Arbetet i de tekniska kommittéerna är öppet för alla svenska organisationer, företag, institutioner, myndigheter och statliga verk. Den årliga avgiften för deltagandet och intäkter från försäljning finansierar SEKs standardiseringsverksamhet och medlemsavgift till IEC och CENELEC.

Var med och påverka!

Den som deltar i SEKs tekniska kommittéarbete har möjlighet att påverka framtida standarder och får tidig tillgång till information och dokumentation om utvecklingen inom sitt teknikområde. Arbetet och kontakterna med kollegor, kunder och konkurrenter kan gynnsamt påverka enskilda företags affärsutveckling och bidrar till deltagarnas egen kompetensutveckling.

Du som vill dra nytta av dessa möjligheter är välkommen att kontakta SEKs kansli för mer information.

SEK Svensk Elstandard

Box 1284
164 29 Kista
Tel 08-444 14 00
www.elstandard.se

English Version

**Railway applications - Electric equipment for rolling stock - Part
5: Electrotechnical components - Rules for HV fuses
(IEC 60077-5:2019)**

Applications ferroviaires - Équipements électriques du
matériel roulant - Partie 5: Composants électrotechniques -
Règles pour les fusibles à haute tension
(IEC 60077-5:2019)

Bahnanwendungen - Elektrische Betriebsmittel auf
Fahrzeugen - Teil 5: Elektrotechnische Bauteile - Regeln für
Hochspannungssicherungen
(IEC 60077-5:2019)

This European Standard was approved by CENELEC on 2019-12-04. 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, 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

European foreword

The text of document 9/2539/FDIS, future edition 2 of IEC 60077-5, 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 60077-5:2019.

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) 2020-09-04
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2022-12-04

This document supersedes EN 60077-5:2003 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.

Endorsement notice

The text of the International Standard IEC 60077-5:2019 was approved by CENELEC as a European Standard without any modification.

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.

<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 60269-1	2006	Low-voltage fuses - Part 1: General requirements	EN 60269-1	2007
+ A1	2009		+ A1	2009
+ A2	2014		+ A2	2014
IEC 60282-1	2009	High-voltage fuses - Part 1: Current-limiting fuses	EN 60282-1	2009
+ A1	2014		+ A1	2014
IEC 61373	-	Railway applications - Rolling stock equipment - Shock and vibration tests	EN 61373	-
ISO 3	-	Preferred numbers - Series of preferred numbers		-

CONTENTS

FOREWORD	4
1 Scope	6
2 Normative references	6
3 Terms, definitions and abbreviated terms	7
3.1 Components	7
3.2 Operational characteristics	8
3.3 Abbreviated terms	10
4 Classification	10
4.1 Breaking range	10
4.2 Utilisation category	11
5 Characteristics	11
6 Product information	12
6.1 Documentation	12
6.2 Marking	12
7 Normal service conditions	12
8 Constructional and performance requirements	12
8.1 Constructional requirements	12
8.1.1 General	12
8.1.2 Fuse-link	12
8.1.3 Fuse-base	13
8.1.4 Spring-loaded contacts	13
8.1.5 External terminals	13
8.2 Performance requirements	13
8.2.1 Operating conditions	13
8.2.2 Temperature limits	13
8.2.3 Dielectric properties	13
8.2.4 Rated voltage	13
8.2.5 Rated current of the fuse-link	14
8.2.6 Rated current of the fuse-base	14
8.2.7 Breaking capacity	14
8.2.8 Time-current characteristics	14
9 Tests	14
9.1 Kinds of tests	14
9.1.1 General	14
9.1.2 Type tests	15
9.1.3 Routine tests	15
9.1.4 Investigation tests	15
9.2 Tests for the verification of constructional requirements	15
9.2.1 General	15
9.2.2 Type tests	15
9.2.3 Routine tests	16
9.3 Type tests for the verification of performance requirements	16
9.3.1 Test sequence	16
9.3.2 General test conditions	17

9.3.3	Test sequence for the verification of general performance characteristics	18
9.3.4	Description of tests for the fuse-link.....	18
9.4	Routine tests for the verification of performance requirements	22
9.4.1	General	22
9.4.2	Resistance measurement	23
Annex A (normative)	Connection diagram for temperature rise tests	24
Annex B (informative)	Comparison between “a” and “g” fuse time current characteristics	25
Annex C (informative)	Diagram of the test circuit for breaking capacity tests.....	26
Annex D (informative)	Verification of breaking capacity.....	27
Bibliography		29
Figure A.1	– Connection diagram for temperature rise tests	24
Figure B.1	– Comparison between “a” and “g” fuse time current characteristics	25
Figure C.1	– Diagram of the test circuit for breaking capacity tests	26
Figure D.1	– Test circuit calibration.....	27
Figure D.2	– Breaking operation when the instant of arc initiation is after the peak value of the current	28
Figure D.3	– Breaking operation when the instant of arc initiation is prior to the peak value of the current	28
Table 1	– Conventional times for “g” fuse-links	11
Table 2	– Rated and test voltages for DC fuse-links supplied from the contact line	14
Table 3	– Sequence of tests for the highest rating of a homogeneous series	16
Table 4	– Sequence of tests for the lowest rating of a homogeneous series	17
Table 5	– Sequence of tests for the intermediate ratings of a homogeneous series.....	17
Table 6	– Tolerances on test values.....	18
Table 7	– Parameters for breaking capacity tests of DC fuse-links	20
Table 8	– Time constant of the test circuit.....	21

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**RAILWAY APPLICATIONS –
ELECTRIC EQUIPMENT FOR ROLLING STOCK –****Part 5: Electrotechnical components –
Rules for HV fuses****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 60077-5 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 2003. It constitutes a technical revision.

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

- a) test method of test duty III for verification of breaking capacity is reviewed.

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

FDIS	Report on voting
9/2539/FDIS	9/2555/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.

RAILWAY APPLICATIONS – ELECTRIC EQUIPMENT FOR ROLLING STOCK –

Part 5: Electrotechnical components – Rules for HV fuses

1 Scope

The purpose of this part of IEC 60077 is to give additional or amended rules for high voltage (HV) fuses as a supplement to those given by IEC 60077-2.

NOTE 1 In this document the term high voltage fuses is used in the context of the voltages used in the field of railway rolling stock.

The high voltage fuses concerned are those connected into power and/or auxiliary circuits. The nominal voltage of these circuits lies between 600 V DC and 3 000 V DC, according to IEC 60850. These fuses can also be used in auxiliary AC circuits up to a nominal voltage of 1 500 V.

NOTE 2 Certain of these rules, after agreement between the user and the manufacturer, are used for fuses installed on vehicles other than rail rolling stock such as mine locomotives, trolleybuses, etc.

This document together with IEC 60077-2 states specifically:

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

This document does not cover parallel connection of fuses.

During preparation of this document, IEC 60269-1 and IEC 60282-1 have been considered and their requirements have been kept as far as possible.

This document makes reference to the general rules for electrotechnical components given in IEC 60077-2, but for general conditions reference is made directly to IEC 60077-1.

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

IEC 60077-2:2017, *Railway applications – Electric equipment for rolling stock – Part 2: Electrotechnical components – General rules*

IEC 60269-1:2006, *Low-voltage fuses – Part 1: General requirements*

IEC 60269-1:2006/AMD1:2009

IEC 60269-1:2006/AMD2:2014

IEC 60282-1:2009, *High-voltage fuses – Part 1: Current-limiting fuses*

IEC 60282-1:2009/AMD1:2014

IEC 61373, *Railway applications – Rolling stock equipment – Shock and vibration tests*

ISO 3, *Preferred numbers – Series of preferred numbers*