

Railway applications — Electrotechnical equipment for rolling stock —

Part 5: Electrotechnical components — Rules for HV fuses

The European Standard EN 60077-5:2003 has the status of a
British Standard

ICS 45.060

National foreword

This British Standard is the official English language version of EN 60077-5:2003. It is identical with IEC 60077-5:2003.

The UK participation in its preparation was entrusted by Technical Committee GEL/9, Railway electrotechnical applications, to Subcommittee GEL/9/2, Rolling stock, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

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**Railway applications -
Electrotechnical equipment for rolling stock
Part 5: Electrotechnical components -
Rules for HV fuses
(IEC 60077-5:2003)**

Applications ferroviaires -
Equipements électriques
du matériel roulant
Partie 5: Composants électrotechniques -
Règles pour les fusibles à haute tension
(CEI 60077-5:2003)

Bahnanwendungen -
Elektrische Betriebsmittel
auf Bahnfahrzeugen
Teil 5: Elektrotechnische Bauteile -
Regeln für Hochspannungssicherungen
(IEC 60077-5:2003)

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CENELEC

European Committee for Electrotechnical Standardization
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Europäisches Komitee für Elektrotechnische Normung

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Foreword

The text of document 9/752/FDIS, future edition 1 of IEC 60077-5, prepared by IEC TC 9, Electrical equipment and systems for railways, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60077-5 on 2003-09-01.

This standard should be read in conjunction with EN 60077-1:2002 and EN 60077-2:2002.

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) 2004-06-01
- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2006-09-01

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 ZA are normative and annexes B to D are informative.

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60077-5:2003 was approved by CENELEC as a European Standard without any modification.

CONTENTS

1	Scope and object	5
2	Normative references.....	5
3	Definitions	6
3.1	Components	6
3.2	Operational characteristics	7
4	Classification	9
4.1	Breaking range (see also Annex B)	9
4.2	Utilisation category	9
5	Characteristics.....	9
6	Product information.....	10
6.1	Documentation	10
6.2	Marking	10
7	Normal service conditions	10
8	Constructional and performance requirements	11
8.1	Constructional requirements	11
8.2	Performance requirements.....	11
9	Tests	13
9.1	Kinds of tests.....	13
9.2	Tests for the verification of constructional requirements	14
9.3	Type tests for the verification of performance requirements.....	14
9.4	Routine tests for the verification of performance requirements	22
	Annex A (normative) Connection diagram for temperature-rise tests	23
	Annex B (informative) Comparison between “a” and “g” fuse time current characteristics	24
	Annex C (informative) Diagram of the test circuit for breaking capacity tests	25
	Annex D (informative) Verification of breaking capacity.....	26
	Annex ZA (normative) Normative references to international publications with their corresponding European publications.....	28
	Figure A.1 – Connection diagram for temperature-rise tests.....	23
	Figure B.1 – Comparison between “a” and “g” fuse time current characteristics.....	24
	Figure C.1 – Diagram of the test circuit for breaking capacity tests	25
	Figure D.1 – Test circuit calibration	26
	Figure D.2 – Breaking operation when the instant of arc initiation is after the peak value of the current	27
	Figure D.3 – Breaking operation when the instant of arc initiation is prior to the peak value of the current	27
	Table 1 – Conventional times for “g” fuse-links	10
	Table 2 – Rated and test voltages for d.c. fuse-links supplied from the contact line	12

Table 3 – Sequence of tests for the highest rating of a homogenous series..... 15

Table 4 – Sequence of tests for the lowest rating of a homogenous series 16

Table 5 – Sequence of tests for intermediate ratings of a homogenous series..... 17

Table 6 – Tolerances on test values 17

Table 7 – Parameters for breaking capacity tests of d.c. fuse-links 19

Table 8 – Time constant of the test circuit 20

RAILWAY APPLICATIONS – ELECTRIC EQUIPMENT FOR ROLLING STOCK –

Part 5: Electrotechnical components – Rules for HV fuses

1 Scope and object

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

NOTE In this product standard 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 to be connected into power and/or auxiliary circuits. The nominal voltage of these circuits lies between 600 V d.c. and 3 000 V d.c., according to IEC 60850. These fuses may also be used in auxiliary a.c. circuits up to a nominal voltage of 1 500 V.

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

This product standard together with IEC 60077-2 states specifically:

- a) the characteristics of the fuses;
- b) the service conditions with which the fuses have to 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 to be adopted for these tests;
- d) the information to be marked on, or given with, the fuse.

This standard does not cover parallel connection of fuses.

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

This product standard 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 referenced documents are indispensable for the application 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(441):1984, *International Electrotechnical Vocabulary (IEV) – Chapter 441: Switch-gear, controlgear and fuses*

IEC 60050(811):1991, *International Electrotechnical Vocabulary (IEV) – Chapter 811: Electric traction*

IEC 60077-1:1999, *Railway applications – Electric equipment for rolling stock – Part 1: General service conditions and general rules*

IEC 60077-2:1999, *Railway applications – Electric equipment for rolling stock – Part 2: Electrotechnical components – General rules*

IEC 60269-1:1998, *Low-voltage fuses – Part 1: General requirements*

IEC 60282-1:2002, *High-voltage fuses – Part 1: Current – limiting fuses*

IEC 60850:2000, *Railway applications – Supply voltages of traction systems*

IEC 61373:1999, *Railway applications – Rolling stock equipment – Shock and vibration tests*

ISO 3:1973, *Preferred numbers – Series of preferred numbers*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60077-1 and IEC 60077-2 together with the following definitions apply.

3.1 Components

3.1.1

fuse

device that, by the fusing of one or more of its specifically designed and proportioned components, opens the circuit in which it is inserted by breaking the current when this exceeds a given value for a sufficient time. The fuse comprises all the parts that form the complete device.

[IEV 441-18-01]

3.1.2

fuse-link

part of a fuse (including the fuse-element(s)) intended to be replaced after the fuse has operated

[IEV 441-18-09]

3.1.3

fuse-element

part of the fuse-link designed to melt under the action of current exceeding some definite value for a definite period of time

[IEV 441-18-08]

3.1.4

fuse-base

fixed part of a fuse provided with contacts and terminals

[IEV 441-18-02]

3.1.5

indicating device

part of a fuse provided to indicate whether the fuse has operated

[IEV 441-18-17]

3.2 Operational characteristics

3.2.1

prospective current

current that would flow in the circuit if the fuse were replaced by a conductor of negligible impedance

[IEV 441-17-01, modified]

3.2.2

prospective peak current

peak value of a prospective current during the transient period following fault current initiation

[IEV 441-17-02, modified]

NOTE This term is commonly associated with short-circuit conditions.

3.2.3

pre-arcing time

interval of time between the beginning of a current large enough to cause a break in the fuse-elements and the instant when an arc is initiated

[IEV 441-18-21]

3.2.4

arcing time

interval of time between the instant of the initiation of the arc in a fuse and the instant of final arc extinction in that fuse

[IEV 441-17-37, modified]

3.2.5

operating time

sum of the pre-arcing time and the arcing time

[IEV 441-18-22]

3.2.6

arc voltage

instantaneous value of voltage which appears across the terminals of a fuse during the arcing time

[IEV 441-18-30]

3.2.7

peak arc voltage

maximum instantaneous value of voltage which under prescribed conditions appears across the terminals of a fuse during the arcing time

[IEV 441-17-30, modified]

NOTE After extinction of the arc, an overvoltage (transient recovery voltage) may be present across the terminals. The value of this will depend on the circuit characteristics and the fuse. This overvoltage is not part of the peak arc voltage (see Figures D.2 and D.3).

3.2.8**d.c. or power frequency steady-state recovery voltage**

recovery voltage in a circuit after the transient voltage phenomena have subsided, expressed by the mean value where ripple is present

[IEV 441-17-28, modified]

NOTE This is shown as B_1 and B_2 in Figures D.2 and D.3.

3.2.9**peak let-through current**

maximum instantaneous value of current attained during the operation of a fuse

[IEV 441-17-12, modified]

3.2.10 **I^2t ; Joule integral**

integral of the square of the current over a given time interval

[IEV 441-18-23]

$$I^2t = \int_{t_0}^{t_1} i^2 dt$$

NOTE 1 The pre-arcing I^2t is the I^2t integral extended over the pre-arcing time of the fuse.

NOTE 2 The operating I^2t is the I^2t integral extended over the operating time of the fuse.

NOTE 3 The energy in joules liberated in one ohm of resistance in a circuit protected by a fuse is equal to the value of the operating I^2t expressed in A^2s .

3.2.11**time-current characteristic**

curve giving the time, e.g. pre-arcing time or operating time, as a function of the prospective current under stated conditions of operation

[IEV 441-17-13]

3.2.12**conventional non-fusing current**

value of current specified as that which the fuse-link is capable of carrying for a specified time (conventional time) without melting

[IEV 441-18-27]

3.2.13**conventional fusing current**

value of current specified as that which causes operation of the fuse-link within a specified time (conventional time)

[IEV 441-18-28]

3.2.14**rated value**

quantity value, generally assigned by a manufacturer, for a specified operating condition of a fuse

[IEV 811-11-02, modified]

NOTE The rated values usually stated for fuses are voltage, current, breaking capacity and power dissipation.