



IEC 60077-4

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REDLINE VERSION

# INTERNATIONAL STANDARD



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**Railway applications – Electric equipment for rolling stock –  
Part 4: Electrotechnical components – Rules for AC circuit-breakers**

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

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**RAILWAY APPLICATIONS –  
ELECTRIC EQUIPMENT FOR ROLLING STOCK –****Part 4: Electrotechnical components –  
Rules for AC 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.
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International Standard IEC 60077-4 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) standard values of transient recovery voltages and test procedure are reviewed;
- b) procedure of verification of temperature rise is changed;
- c) 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
9/2538/FDIS	9/2554/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.

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## INTRODUCTION

~~This International Standard is Part 4 of the IEC 60077 series.~~

~~The purpose of this product standard is to give additional or amended requirements on AC circuit breakers as a supplement to those given by IEC 60077-2.~~

~~During preparation of this product standard, IEC 60056 and IEC 60694 have been considered and their requirements have been kept as far as it has been 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.~~

## RAILWAY APPLICATIONS – ELECTRIC EQUIPMENT FOR ROLLING STOCK –

### Part 4: Electrotechnical components – Rules for AC circuit-breakers

#### 1 Scope

In addition to the general requirements of IEC 60077-2, this part of IEC 60077 gives rules for AC circuit-breakers, the main contacts of which are ~~to be~~ connected to AC overhead contact lines; the nominal voltage of these circuits being in accordance with IEC 60850.

This document, together with IEC 60077-2, states specifically:

- a) the characteristics of the circuit-breakers;
- b) the service conditions with which circuit-breakers ~~have to~~ comply with reference to:
  - operation and behaviour in normal service;
  - operation and behaviour in 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 ~~may~~ can be provided with devices for automatic opening under pre-determined conditions other than those of overcurrent, for example, undervoltage and reversal of power ~~current~~ 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 the circuit-breakers ~~should~~ comply with the relevant standard for electronics (IEC 60571).

NOTE 3 Certain of these rules ~~may~~, after agreement between the user and the manufacturer, ~~be~~ are used for electrotechnical 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 industrial circuit-breakers which ~~have to~~ comply with ~~IEC 60056~~ IEC 62271-100. For these, in order to ensure satisfactory operation, this document ~~should be~~ is used to specify only the particular requirements for rolling stock. In such cases, a specific document ~~should state~~ states the additional requirements with which the industrial circuit-breakers ~~are to~~ comply, for example:

- either to be adapted (e.g. for control voltage, environmental conditions, etc.);
- or to be installed and used so that they do not have to endure specific rolling stock conditions;
- or to be additionally tested to prove that these components can withstand satisfactorily the rolling stock conditions.

## 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(441):1984, International Electrotechnical Vocabulary (IEV) — Chapter 441: Switchgear, controlgear and Fuses~~

~~IEC 60056:2001, High voltage alternating current circuit-breaker<sup>\*</sup>~~

IEC 60060-1:~~1989~~2010, High-voltage test techniques – Part 1: General definitions and test requirements

IEC 60077-1:~~1999~~2017, Railway applications – Electric equipment for rolling stock. – Part 1: General service conditions and general rules

IEC 60077-2:~~1999~~2017, Railway applications – Electric equipment for rolling stock. – Part 2: Electrotechnical components – General rules

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

~~IEC 60571:1998, Railway applications — Electronic equipment used on rail vehicles~~

~~IEC 60694:1996, Common specification for high voltage switchgear and controlgear standards~~

~~IEC 60850:2000, Supply voltage of traction systems~~

IEC 61373:~~1999~~, Railway applications – Rolling stock equipment – Shock and Vibration tests

IEC 62271-1:2017, High-voltage switchgear and controlgear – Part 1: Common specifications for alternating current switchgear and controlgear

IEC 62271-100:~~2004~~2008, High-voltage switchgear and controlgear – Part 100: ~~High-voltage Alternating-current circuit-breakers~~

IEC 62271-100:2008/AMD1:2012

IEC 62271-100:2008/AMD2:2017

IEC 62271-102, High-voltage switchgear and controlgear – Part 102: Alternating current disconnectors and earthing switches

<sup>\*</sup>~~In preparation.~~



# INTERNATIONAL STANDARD

# NORME INTERNATIONALE

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**Railway applications – Electric equipment for rolling stock –  
Part 4: Electrotechnical components – Rules for AC circuit-breakers**

**Applications ferroviaires – Équipements électriques du matériel roulant –  
Partie 4: Composants électrotechniques – Règles pour disjoncteurs  
à courant monophasé**

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This document does not cover industrial circuit-breakers which comply with IEC 62271-100. For these, 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 circuit-breakers comply, for example:

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

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

IEC 62271-1:2017, *High-voltage switchgear and controlgear – Part 1: Common specifications for alternating current switchgear and controlgear*

IEC 62271-100:2008, *High-voltage switchgear and controlgear – Part 100: Alternating current circuit-breakers*

IEC 62271-100:2008/AMD1:2012

IEC 62271-100:2008/AMD2:2017

IEC 62271-102, *High-voltage switchgear and controlgear – Part 102: Alternating current disconnectors and earthing switches*

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## COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

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### APPLICATIONS FERROVIAIRES – ÉQUIPEMENTS ÉLECTRIQUES DU MATÉRIEL ROULANT –

#### Partie 4: Composants électrotechniques – Règles pour disjoncteurs à courant monophasé

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La Norme internationale IEC 60077-4 a été établie par le comité d'études 9 de l'IEC: Matériels et systèmes électriques ferroviaires.

Cette deuxième édition annule et remplace la première édition, parue en 2003. Elle constitue une révision technique.

Cette édition inclut les modifications techniques majeures suivantes par rapport à l'édition précédente:

- a) les valeurs normalisées des tensions transitoires de rétablissement et la procédure d'essai sont revues;
- b) modification de la procédure de vérification de l'échauffement;

- c) ajout de l'essai d'étanchéité comme essai de type et du mesurage de la résistance d'isolement.

Le texte de cette Norme internationale est issu des documents suivants:

FDIS	Rapport de vote
9/2538/FDIS	9/2554/RVD

Le rapport de vote indiqué dans le tableau ci-dessus donne toute information sur le vote ayant abouti à l'approbation de cette Norme internationale.

Ce document a été rédigé selon les Directives ISO/IEC, Partie 2.

Il convient qu'il soit lu conjointement avec l'IEC 60077-1 et l'IEC 60077-2.

Une liste de toutes les parties de la série IEC 60077, publiées sous le titre général *Applications ferroviaires – Équipements électriques du matériel roulant*, peut être consultée sur le site web de l'IEC.

Le comité a décidé que le contenu de ce document ne sera pas modifié avant la date de stabilité indiquée sur le site web de l'IEC sous "<http://webstore.iec.ch>" dans les données relatives au document recherché. A cette date, le document sera

- reconduit,
- supprimé,
- remplacé par une édition révisée, ou
- amendé.

## APPLICATIONS FERROVIAIRES – ÉQUIPEMENTS ÉLECTRIQUES DU MATÉRIEL ROULANT –

### Partie 4: Composants électrotechniques – Règles pour disjoncteurs à courant monophasé

#### 1 Domaine d'application

En complément des exigences générales de l'IEC 60077-2, la présente partie de l'IEC 60077 donne les règles relatives aux disjoncteurs à courant monophasé dont les contacts principaux sont destinés à être raccordés à des lignes aériennes de contact à courant monophasé. La tension nominale de ces circuits est conforme à l'IEC 60850.

En complément de l'IEC 60077-2, le présent document précise particulièrement:

- a) les caractéristiques des disjoncteurs;
- b) les conditions de service que les disjoncteurs supportent du point de vue:
  - du fonctionnement et du comportement en service normal;
  - du fonctionnement et du comportement en cas de court-circuit;
  - des propriétés diélectriques;
- c) les essais de conformité des composants avec les caractéristiques dans les conditions de service ainsi que les méthodes d'essai correspondantes à utiliser;
- d) les informations à donner ou à marquer sur le disjoncteur.

NOTE 1 Les disjoncteurs qui font l'objet du présent document peuvent être équipés de dispositifs d'ouverture automatique dans des conditions prédéterminées autres que celles de la surcharge, comme une tension insuffisante ou l'inversion de la direction du flux de puissance, par exemple. Le présent document ne traite pas de la vérification de tels fonctionnements dans de telles conditions prédéterminées.

NOTE 2 L'incorporation de composants électroniques ou de sous-ensembles électroniques dans les composants électrotechniques est maintenant une pratique courante.

Bien que le présent document ne soit pas applicable aux matériels électroniques, la présence de composants électroniques n'est pas une raison suffisante pour exclure ces composants électrotechniques du domaine d'application du document.

Les sous-ensembles électroniques inclus dans les disjoncteurs sont conformes à la norme correspondante applicable à l'électronique (IEC 60571).

NOTE 3 Après accord entre l'utilisateur et le constructeur, certaines de ces règles sont utilisées pour les composants électriques installés dans des véhicules autres que ceux du matériel roulant ferroviaire, telles que les locomotives pour les mines, les trolleybus, etc. Dans ces cas, des exigences supplémentaires peuvent être nécessaires.

Le présent document ne couvre pas les disjoncteurs industriels conformes à l'IEC 62271-100. Pour ces derniers, dans le but d'obtenir un fonctionnement satisfaisant, le présent document est employé uniquement pour spécifier les exigences particulières relatives au matériel roulant. Dans de tels cas, un document spécifique indique les exigences complémentaires auxquelles les disjoncteurs industriels se conforment, par exemple:

- pour être adaptés (par exemple tension de commande, conditions d'environnement, etc.);
- ou pour être installés et utilisés de sorte qu'ils n'aient pas à subir les conditions particulières du matériel roulant;
- ou pour subir des essais complémentaires afin de montrer que ces composants peuvent supporter de façon satisfaisante les conditions du matériel roulant.

## 2 Références normatives

Les documents suivants cités dans le texte constituent, pour tout ou partie de leur contenu, des exigences du présent document. Pour les références datées, seule l'édition citée s'applique. Pour les références non datées, la dernière édition du document de référence s'applique (y compris les éventuels amendements).

IEC 60060-1:2010, *Technique des essais à haute tension – Partie 1: Définitions et exigences générales*

IEC 60077-1:2017, *Applications ferroviaires – Equipements électriques du matériel roulant – Partie 1: Conditions générales de service et règles générales*

IEC 60077-2:2017, *Applications ferroviaires – Equipements électriques du matériel roulant – Partie 2: Composants électrotechniques – Règles générales*

IEC 60529, *Degrés de protection procurés par les enveloppes (Code IP)*

IEC 61373, *Applications ferroviaires – Matériel roulant – Essais de chocs et vibrations*

IEC 62271-1:2017, *Appareillage à haute tension – Partie 1: Spécifications communes pour appareillage à courant alternatif*

IEC 62271-100:2008, *Appareillage à haute tension – Partie 100: Disjoncteurs à courant alternatif*

IEC 62271-100:2008/AMD1:2012

IEC 62271-100:2008/AMD2:2017

IEC 62271-102, *Appareillage à haute tension – Partie 102: Sectionneurs et sectionneurs de terre à courant alternatif*