

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE

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

**Applications ferroviaires – Equipements électriques du matériel roulant –  
Partie 1: Conditions générales de service et règles générales**

IT-ET STANDARD PREVIEW  
(standards.iteh.ai)  
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**Applications ferroviaires – Equipements électriques du matériel roulant –  
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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**RAILWAY APPLICATIONS –  
ELECTRIC EQUIPMENT FOR ROLLING STOCK –****Part 1: General service conditions and general rules**

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International Standard IEC 60077-1 has been prepared by IEC technical committee 9: Electrical equipment and systems for railways.

This second edition cancels and replaces the first edition of IEC 60077-1, issued in 1999. It constitutes a technical revision.

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

- a) Descriptions regarding insulation coordination, environmental conditions and those of current return and protective bonding are deleted and replaced by references to IEC 62497-1, IEC 62498-1 and IEC 61991, except classes of air temperature, which are copied from Table 2 in IEC 62498-1:2010.
- b) Classification of equipment type is introduced.
- c) Temperature limits and temperature rise tests are reviewed.

d) Example of lifetime calculation: Annex C (informative) is introduced.

The text of this standard is based on the following documents:

FDIS	Report on voting
9/2266/FDIS	9/2278/RVD

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

This publication has been drafted in accordance with the ISO/IEC Directives, Part 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 publication will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

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## INTRODUCTION

Although this document specifies the general service conditions and general rules for electric equipment for railway rolling stock, further details for certain types of electric equipment may be given in other IEC standards.

IEC 60077 series consists of the following parts:

- Part 1 – General service conditions and general rules
- Part 2 – Electrotechnical components – General rules
- Part 3 – Electrotechnical components – Rules for DC circuit-breakers
- Part 4 – Electrotechnical components – Rules for AC circuit-breakers
- Part 5 – Electrotechnical components – Rules for HV fuses

Although all circuits of power or control electronic equipment connected to battery or contact line are covered by this document, internal circuits of these may be subject to special requirements covered by relevant product standards.

For electric equipment for rolling stock which conforms to an appropriate international standard, including items of industrial equipment, this document, plus the relevant equipment product standard for electric equipment where appropriate, specifies only those additional requirements to ensure satisfactory operation on rolling stock.

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# RAILWAY APPLICATIONS – ELECTRIC EQUIPMENT FOR ROLLING STOCK –

## Part 1: General service conditions and general rules

### 1 Scope

This part of IEC 60077 specifies the general service conditions and requirements for all electric equipment installed in power circuits, auxiliary circuits, control and indicating circuits etc., on railway rolling stock.

NOTE Some of these rules can, after agreement between the user and the manufacturer, be used for electrical equipment installed on vehicles other than railway rolling stock, such as mine locomotives, trolley buses, etc.

The purpose of this document is to harmonize as far as practicable all rules and requirements of a general nature applicable to electric equipment for rolling stock. This is in order to obtain uniformity of requirements and tests throughout the corresponding range of equipment to avoid the need for testing to different standards.

All requirements relating to:

- the environmental stresses expected during the normal service conditions;
- the construction;
- the performance and the associated tests which can be considered as general;

have therefore been gathered in this document together with specific subjects of wide interest and application, for example temperature rise, dielectric properties, etc.

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

IEC 60068-2-2, *Environmental testing – Part 2-2: Tests – Tests 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: Tests – 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 60085, *Electrical insulation – Thermal evaluation and designation*

IEC 60216-1, *Electrical insulating materials – Thermal endurance properties – Part 1: Ageing procedures and evaluation of test results*

IEC 60505, *Evaluation and qualification of electrical insulation systems*

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

IEC 60721-3-5, *Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities – Section 5: Ground vehicle installations*

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

IEC 61133:2016, *Railway applications – Rolling stock – Testing of rolling stock on completion of construction and before entry into service*

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

IEC 61991, *Railway applications – Rolling stock – Protective provisions against electrical hazards*

IEC 61992-1, *Railway applications – Fixed installations – DC switchgear – Part 1: General*

IEC 62236-3-2, *Railway applications – Electromagnetic compatibility – Part 3-2: Rolling stock – Apparatus*

IEC 62497-1, *Railway applications – Insulation coordination – Part 1: Basic requirements – Clearances and creepage distances for all electrical and electronic equipment*

IEC 62498-1:2010, *Railway applications – Environmental conditions for equipment – Part 1: Equipment on board rolling stock*

### **3 Terms, definitions and abbreviated terms (see also Annex A)**

For the purposes of this document, the following terms and definitions 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 General**

##### **3.1.1**

##### **rolling stock**

all the vehicles with or without motors

Note 1 to entry: Examples of vehicles include a locomotive, a coach and a wagon.

[SOURCE: IEC 60050-811:2017, 811-02-01]

##### **3.1.2**

##### **vehicle**

single item of rolling stock

## 3.2 Circuits

### 3.2.1

#### **power circuit**

circuit carrying the current of the machines and equipment, such as the converters and traction motors, which transmit the traction output

[SOURCE: IEC 60050-811:2017, 811-25-03]

### 3.2.2

#### **main circuit**

all the conductive parts of a device carrying the current for the function to which this device has been applied

### 3.2.3

#### **auxiliary circuit**, <of a train>

circuit carrying the current of the auxiliaries such as the compressors and fans

[SOURCE: IEC 60050-811:2017, 811-25-05]

### 3.2.4

#### **control circuit**, <of a train>

circuit used to actuate the power or auxiliary equipment

[SOURCE: IEC 60050-811:2017, 811-25-12]

### 3.2.5

#### **indicating circuit**

circuit transmitting a signal indicating or recording whether a particular operating condition exists or not (for example a signal indicating a failure in the electrical equipment)

[SOURCE: IEC 60050-811:2017, 811-25-14]

## 3.3 Battery supplied equipment

### 3.3.1

#### **battery**

electrochemical system capable of storing in chemical form the electric energy received and which can give it back by reconversion

### 3.3.2

#### **battery on float** <charge>

secondary battery whose terminals are permanently connected to a source of constant voltage sufficient to maintain the battery approximately fully charged, and which is intended to supply power to an electric circuit, if the normal supply is temporarily interrupted

Note 1 to entry: The battery is absorbing a float charge current in this mode.

[SOURCE: IEC 60050-482:2004, 482-05-35, modified – Note 1 to entry has been added.]

### 3.3.3

#### **float charge battery system**

equipment mostly operated with the battery on float charge

### 3.3.4

#### **battery off charge system**

equipment mostly supplied while the battery is not being charged

### 3.4 Test categories

#### 3.4.1

##### **type test**

conformity test made on one or more items representative of the production

[SOURCE: IEC 60050-811:2017, 811-10-04]

#### 3.4.2

##### **routine test**

conformity test made on each individual item during or after manufacture

[SOURCE: IEC 60050-811:2017, 811-10-05]

#### 3.4.3

##### **sampling test**

test on a sample

[SOURCE: IEC 60050-811:2017, 811-10-06]

#### 3.4.4

##### **investigation test**

special test of an optional character carried out in order to obtain additional information

[SOURCE: IEC 60050-811:2017, 811-10-07]

#### 3.4.5

##### **exposed conductive part**

conductive part which can readily be touched and which is not normally alive, but which may become alive under fault conditions

[SOURCE: IEC 60050-441:1984, 441-11-10, modified – Note has been deleted.]

### 3.5 Characteristic quantities

#### 3.5.1

##### **limiting value**

greatest or smallest admissible value of a quantity in a specification of a component, device, equipment, or system

[SOURCE: IEC 60050-151:2001, 151-16-10, modified – The order of phrases has been changed.]

#### 3.5.2

##### **nominal value**

value of a quantity used to designate and identify a component, device, equipment, or system

Note 1 to entry: The nominal value is generally a rounded value.

Note 2 to entry: In this document, the term "nominal" is used only as common practice to designate contact line and battery voltage circuits.

[SOURCE: IEC 60050-811:2017, 811-11-01, modified – Note 2 to entry has been added.]

**3.5.3****rated value**

value of a quantity used for specification purposes, established for a specified set of operating conditions of a component, device, equipment, or system

[SOURCE: IEC 60050-811:2017, 811-11-02]

**3.5.4****equivalent continuous duty**

duty of electrical equipment on rolling stock, which corresponds to the actual service, generally characterized by values of current, voltage, compressed air pressure, etc., which vary with time

Note 1 to entry: The various parts of the equipment are defined by a complete statement of the conditions to be fulfilled. However, it is sometimes sufficient to specify an equivalent duty which corresponds from the point of view of either electrical, mechanical or thermal stresses to the service considered, and is known as being equivalent to the actual service. It is the equivalent continuous duty to which the relevant tests are referred.

**3.5.5****equivalent continuous rated current**

current corresponding to the equivalent continuous duty

**3.6 Terms related to lifetime****3.6.1****ageing**

change with passage of time of physical, chemical or electrical properties of a component or module under specified operating conditions, which may result in degradation of significant performance characteristics

Note 1 to entry: This entry was numbered 393-18-41 in IEC 60050-393:2003.

[SOURCE: IEC 60050-395:2014, 395-07-100]

**3.6.2****endurance**

ability to withstand the action of ageing factors

Note 1 to entry: The endurance may be characterized by the results of accelerated ageing tests.

[SOURCE: IEC 60050-212:2010, 212-12-08]

**3.6.3****thermal endurance**

ability to withstand the action of temperature

[SOURCE: IEC 60050-212:2010, 212-12-09]

**3.6.4****durability**

ability to perform as required, under given conditions of use and maintenance, until the end of useful life

Note 1 to entry: For the purpose of this document, "durability" is used in order to express the expectancy of the life duration (time or number of operating cycles) which can be performed by the equipment before repair or replacement of parts.

[SOURCE: IEC 60050-192:2015, 192-01-21, modified – Note 1 to entry has been added.]

### 3.7 Abbreviated terms

AC	Alternating Current
DC	Direct Current
EMC	Electromagnetic Compatibility
RMS	Root Mean Square value
PD	Pollution degree
OV	Overvoltage category
VC	Voltage Class

## 4 Classification

This clause is intended to list the characteristics of equipment on which information may be given by the manufacturer and which shall be verified by testing where relevant.

Equipment covered by this document is classified, according to the supply source of its control and auxiliary circuits. Details are given in 5.3.3.2.

## 5 Characteristics of the utilization category

### 5.1 General

The utilization category of equipment defines the intended application and shall be specified in the relevant product standard; it is characterized by one or more of the following parameters:

- current(s);
- voltage(s);
- frequency(ies);
- air pressure(s).

See also Annex A.

NOTE This list is not exhaustive and can include other parameters as applicable.

### 5.2 Rated voltages

#### 5.2.1 General

The term rated voltage can generally be related to both the input and output values of equipment. The quantity is assigned generally by the manufacturer.

#### 5.2.2 Rated operational voltage ( $U_r$ )

The rated operational voltage of equipment is a value of voltage which combined with a rated operational current and rated operational frequency, determines the application of the equipment and to which the relevant tests and the utilization categories are referred.

NOTE Symbol  $U_e$  was used in the first edition of IEC 60077-1.  $U_{Ne}$  is used in IEC 61992-1.

#### 5.2.3 Rated insulation voltage ( $U_{Nm}$ )

Definition of a rated insulation voltage is given in IEC 62497-1.

The rated insulation voltage is the value of voltage to which rated impulse voltage and creepage distances are referred.