
Železniške naprave – Vozna sredstva – 3. del: Kombinirano preskušanje z indirektnim konverterjem napajanih izmeničnih motorjev in njihov krmilni sistem (IEC 61377-3:2002)

Railway applications - Rolling stock -- Part 3: Combined testing of alternating current motors, fed by an indirect convertor, and their control system

Bahnanwendungen - Bahnfahrzeuge -- Teil 3: Kombinierte Prüfung von Wechselstrommotoren, die von einem Zwischenkreis-Stromumrichter gespeist werden, und deren Steuerung

Applications ferroviaires - Matériel roulant -- Partie 3: Essais combinés des moteurs à courant alternatif, alimentés par un convertisseur à deux étages, et leur régulation

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**Railway applications -
Rolling stock
Part 3: Combined testing of alternating current motors,
fed by an indirect convertor,
and their control system
(IEC 61377-3:2002)**

Applications ferroviaires - Matériel roulant
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Bahnanwendungen - Bahnfahrzeuge
Teil 3: Kombinierte Prüfung
von Wechselstrommotoren, die von
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Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

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CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Foreword

The text of document 9/693/FDIS, future edition 1 of IEC 61377-3, 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 61377-3 on 2002-11-01.

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) 2003-08-01
- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2005-11-01

Annexes designated "normative" are part of the body of the standard.
In this standard, annexes A and ZA are normative.
Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 61377-3:2002 was approved by CENELEC as a European Standard without any modification.

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Annex ZA (normative)

Normative references to international publications with their corresponding European publications

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60050-411	1996	International Electrotechnical Vocabulary (IEV) Chapter 411: Rotating machines	-	-
IEC 60050-551	1998	Part 551: Power electronics	-	-
IEC 60050-811	1991	Chapter 811: Electric traction	-	-
IEC 60349-2 (mod)	1993	Railway applications - Rotating electrical machines for rail and road vehicles Part 2: Electronic converter-fed alternating current motors	EN 60349-2	2001
IEC/TR2 60349-3	1995	Electric traction - Rotating electrical machines for rail and road vehicles Part 3: Determination of the total losses of converter-fed alternating current motors by summation of the component losses	-	-
IEC 60571	1998	Electronic equipment used on rail vehicles	-	-
IEC 60850	2000	Railway applications - Supply voltages of traction systems	-	-
IEC 61287-1	1995	Power convertors installed on board rolling stock Part 1: Characteristics and test methods	-	-

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Applications ferroviaires – Matériel roulant –

Partie 3:

**Essais combinés des moteurs à courant alternatif,
alimentés par un convertisseur à deux étages,
et leur régulation**
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**Railway applications –
Rolling stock –**
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Part 3:

**Combined testing of alternating current
motors, fed by an indirect convertor,
and their control system**

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

RAILWAY APPLICATIONS – ROLLING STOCK –

**Part 3: Combined testing of alternating current motors,
fed by an indirect convertor, and their control system**

FOREWORD

- 1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the 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, the IEC publishes International Standards. 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. The 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 the 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 National Committees.
- 3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical specifications, technical reports or guides and they are accepted by the National Committees in that sense.
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International Standard IEC 61377-3 has been prepared by IEC technical committee 9: Electric railway equipment.

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

FDIS	Report on voting
9/693/FDIS	9/705/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.

Annex A forms an integral part of this standard.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until 2010. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

RAILWAY APPLICATIONS – ROLLING STOCK –

Part 3: Combined testing of alternating current motors, fed by an indirect convertor, and their control system

1 Scope and object

This International Standard applies to the combinations of motor(s), indirect convertors and their control system and its object is to specify:

- the performance characteristics of electric drives consisting of a convertor, alternating current motors, and the related control system;
- methods of verifying these performance characteristics by tests.

Two categories of combined systems can be considered:

- a) Alternating current motors fed from a convertor without any control between the mechanical output (torque, speed) and the convertor itself (mostly auxiliary motors, for example cooling fan motors). The motor works exactly as if it were fed from a busbar (at variable frequency and voltage or not).
- b) Alternating current motor(s) (paralleled or not) with a control between the mechanical output and the inverter.

The first category of systems is tested according to IEC 60349-2 and IEC 61287-1.

This standard applies to the second category, mainly traction drives.

IEC 60349-2 applies to convertor-fed alternating current motors, IEC 61287-1 to power electronic convertors; IEC 60571 applies to electronic equipment; this standard applies to the combination of motor(s), convertors, and their control system. As a consequence, IEC 60349-2 describes the tests to demonstrate the compliance of the motor to its specification, IEC 61287-1 does the same for the convertor. It is self-evident that some of the tests mentioned in this standard may in general replace the corresponding ones described in the above mentioned standards. An agreement should be reached between the parties to avoid the duplication of tests.

A complete combined test is heavy, and often requires high power, which is not always available in workshop. An agreement between user and manufacturer may be reached to allow testing either in the workshop or on the vehicle.

At the time of drafting of this standard, only the following combinations of motors and inverters have been used for traction applications, but it may also apply to other combinations which may be used in the future:

- asynchronous motors fed by voltage stiff (voltage source) inverter;
- asynchronous motors fed by current stiff (current source) inverter;
- synchronous motors fed by current stiff (current source) inverter.

The input of these inverters (see figure 2) can be a d.c. supply line or an intermediate d.c. link, which can be obtained from an a.c. line by means of a rectifier (2.2.1 of IEC 61287-1) or from a d.c. line by means of a chopper (2.2.2 of IEC 61287-1) or from autonomous supplies (such as on-board generators, accumulators or other electric energy sources) (1.1 of IEC 61287-1).

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 60050-411:1996, *International Electrotechnical Vocabulary (IEV) – Chapter 411: Rotating machinery*

IEC 60050-551:1998, *International Electrotechnical Vocabulary (IEV) – Part 551: Power electronics*

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

IEC 60349-2:1993, *Electric traction – Rotating electrical machines for rail and road vehicles – Part 2: Electronic convertor-fed alternating current motors*

IEC 60349-3:1995, *Rotating electrical machines for rail and road vehicles – Part 3: Determination of the total losses of convertor-fed alternating current motors by summation of the component losses*

IEC 60571:1998, *Electronic equipment used on rail vehicles*
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IEC 60850:2000, *Railway applications – Supply voltage of traction systems*

IEC 61287-1:1995, *Power convertors installed on board rolling stock – Part 1: Characteristics and test methods*

3 Definitions

For the definition of general terms used in this standard, reference should be made to IEC 60050(411), IEC 60050(551), IEC 60050(811), IEC 61287-1 and IEC 60349-2.

For the purpose of this International Standard, the following definitions apply.

3.1

combined system

unit consisting of the indirect convertor, the motor(s), their related control system, equivalent power cables connecting them, and an equivalent cooling system

3.2

user

organization which orders the combined system. The user is normally an organisation which uses the vehicle or the equipment, unless the responsibility is delegated to a main contractor or consultant (see figure 1).

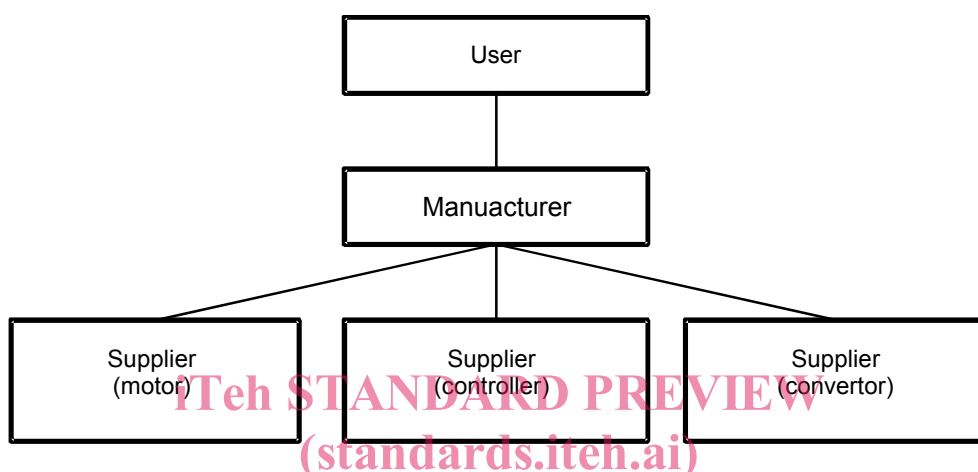
3.3**manufacturer**

organization which has the technical responsibility for the supply of the combined system (see figure 1)

NOTE The manufacturer as defined above may also be the supplier of the motor, of the inverter, of the controller, or of all, or of none of them.

3.4**supplier**

organization which has the responsibility of one or more of the constituents of the combined system (see figure 1)



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Figure 1 – Combined system – involved parties

3.5**manufacturer's works**

location where tests are generally performed

3.6**duty**

statement of the load to which the combined system is subjected, including, if applicable, electric braking, no load, rest and de-energized periods, as well as their duration and sequence in time

3.7**duty cycle**

variation of load with time which may or may not be repeated, and in which the cycle time is too short for thermal equilibrium to be attained

3.8**load profile** (see also IEC 61287-1)

mainly the convertor output current and other relevant parameters, as a function of time, to which the combined system is subject, to obtain the duty defined in 3.6

NOTE The load profile can correspond to the effective duty, or be a theoretical cycle.

3.9**rating of a combined system**

combination of simultaneous values of electrical and mechanical quantities, with their duration and sequence, assigned to the combined system by the manufacturer