

Railway applications — Rolling stock —

Part 1: Combined testing of inverter-fed alternating current motors and their control system

The European Standard EN 61377-1:2006 has the status of a
British Standard

ICS 45.060

National foreword

This British Standard was published by BSI. It is the UK implementation of EN 61377-1:2006, incorporating corrigendum December 2006. It is identical with IEC 61377-1:2006. It supersedes BS EN 61377:1997 which is withdrawn.

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A list of organizations represented on GEL/9/2 can be obtained on request to its secretary.

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**Railway applications -
Rolling stock
Part 1: Combined testing of inverter-fed alternating current motors
and their control system**

Applications ferroviaires -
Matériel roulant
Partie 1: Essais combinés de moteurs
à courant alternatif alimentés par onduleur
et de leur régulation

Bahnanwendungen -
Bahnfahrzeuge
Teil 1: Kombinierte Prüfung
von wechselrichtergespeisten
Wechselstrommotoren
und deren Steuerung

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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

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Foreword

The text of document 9/904/FDIS, future edition 1 of IEC 61377-1, 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 61377-1 on 2006-03-01.

This European Standard supersedes EN 61377:1996 + corrigendum November 1996.

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) 2006-12-01
- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2009-03-01

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 61377-1:2006 was approved by CENELEC as a European Standard without any modification.

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RAILWAY APPLICATIONS – ROLLING STOCK –

Part 1: Combined testing of inverter-fed alternating current motors and their control system

1 Scope and object

This part of IEC 61377 applies to the combinations of motor(s), inverter and their control system, and its object is to specify:

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

Two categories of combined systems can be considered:

- alternating current motors fed from an inverter without any control between the mechanical output (torque, speed) and the inverter 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);
- 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.

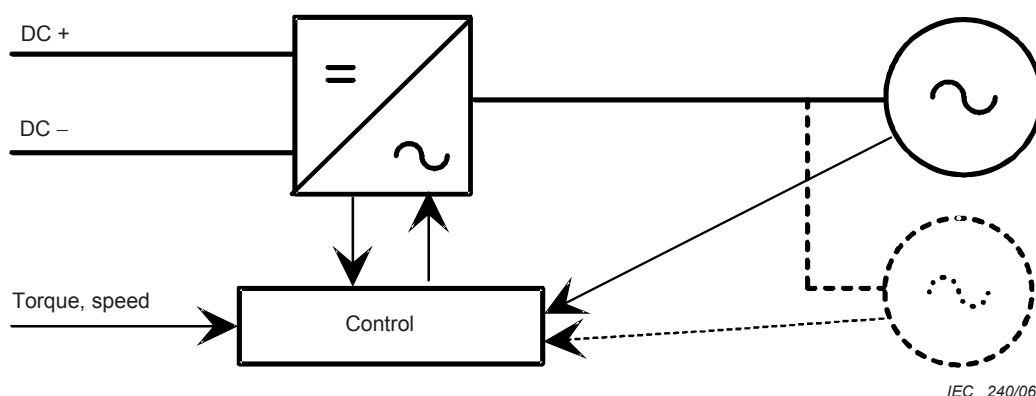


Figure 1 – Traction drive

IEC 60349-2 applies to convertor-fed alternating current motors, IEC 61287-1 to power electronic convertors, IEC 60571 to electronic equipments, and this standard applies to the combination of motor(s), inverter, 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 inverter. It is self-evident that some of the tests mentioned in this standard generally may 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 a workshop. An agreement between user and manufacturer may be reached to allow testing either in the workshop or on the vehicle. Testing may be split off partially in a workshop and partially on track.

At the time of drafting this standard, only the following combinations of motors and inverters were 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 can be a d.c. supply line, a rectifier, a chopper, an input convertor, a diesel generator with integrated rectifiers, etc.

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 amendment) applies. .

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

IEC 60050(551), *International Electrotechnical Vocabulary (IEV) – Chapter 551: Power electronics*

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

IEC 60349-2:2002, *Electric traction – Rotating electrical machines for rail and road vehicles – Part 2: Electronic convertor-fed alternating current motors*

IEC 60571, *Electronic equipment used on rail vehicles*

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

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

IEC 61377-2:2002, *Railway applications – Rolling stock – Combined testing – Part 2: Chopper-fed direct current traction motors and their control*

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*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050(411), IEC 60050(551), IEC 60050(811), IEC 61287-1, IEC 60349-2 and the following apply:

3.1

combined system

unit consisting of the inverter, 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 organization which uses the vehicle or the equipment, unless the responsibility is delegated to a main contractor or consultant

3.3

manufacturer

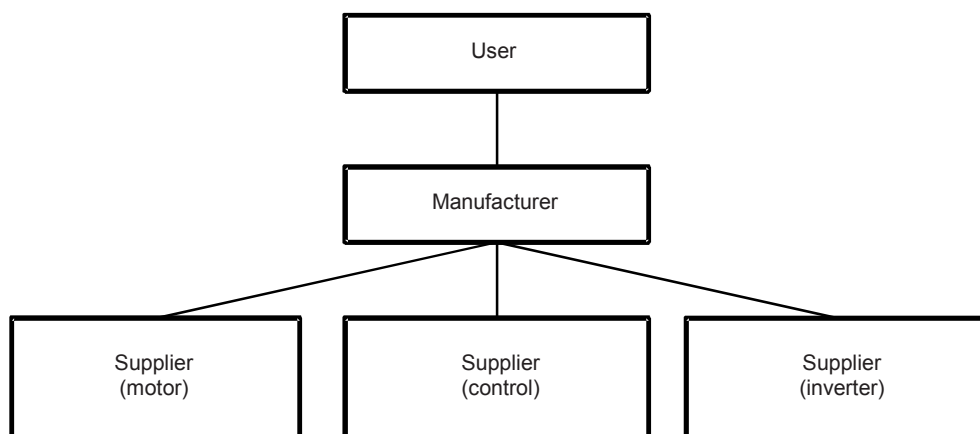
organization which has the technical responsibility for the supply of the combined system

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

3.4

supplier

organization which has the responsibility of one or more of the constituents of the combined system



IEC 241/06

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, including their durations and sequence in time

3.7

duty cycle of vehicle/load profile

duty cycle of vehicle is the speed and mass of train and track over the time.

The load profile for converter is calculated by the engineering from the duty cycle of vehicle. Load profile (current/power versus time) is the repetitive cycle or the load current/power under specified conditions such as starting and braking. Also the voltage has to be considered

3.8

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

3.9

rated value

numerical value of any quantity included in a rating

3.10

continuous rating

mechanical output that the combined system can deliver on the test bed at a given speed for an unlimited time without exceeding the limits of temperature rise given in IEC 60349-2 and IEC 61287-1

NOTE Several continuous ratings may be specified.

3.11

short-time rating (for example 1 h)

mechanical output that the combined system can deliver on the test bed at a given speed for the stated time without exceeding the limits of temperature rise given in Table 2 of IEC 60349-2 and in IEC 61287-1, starting with the combined system cold, all other requirements of here mentioned standards being satisfied

3.12

short-time overload rating

mechanical output that the combined system can deliver on the test bed at a given speed for the stated time. The test is carried out as specified in 8.1.6 of IEC 60349-2, without exceeding the limits of temperature rise given in Table 3 of IEC 60349-2 and in IEC 61287-1

NOTE Short-time overload ratings are of value in determining the suitability of combined systems for duties which involve relatively long periods of operation below the continuous rating followed by a period above it. These are most likely to occur in locomotive applications. They are not relevant to repeated short-load cycles of rapid transit and similar duties, and should not be specified for such applications.

3.13

intermittent duty rating

duty cycle on which the combined system may be operated without the temperature rise at any point exceeding the limits given in IEC 60349-2 and IEC 61287-1

3.14

periodic duty rating

periodic duty on which the combined system may be operated without the temperature rise at any point exceeding the limits given in IEC 60349-2 and IEC 61287-1