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INTERNATIONAL STANDARD

NORME INTERNATIONALE

Electric traction – Rotating electrical machines for rail and road vehicles – Part 4: Permanent magnet synchronous electrical machines connected to an electronic converter

Traction électrique – Machines électriques tournantes des véhicules ferroviaires et routiers – Partie 4: Machines électriques synchrones à aimants permanents connectées à un convertisseur électronique

IEC 60349-4:2012

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FOREWORD

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This International Standard IEC 60349-4 has been prepared by IEC technical committee 9: Electrical equipment and systems for railways.

This standard is derived from IEC 60349-2 changing the subject to permanent magnet synchronous machines.

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

FDIS	Report on voting
9/1734/FDIS	9/1759/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.

A list of all parts of IEC 60349 series, under the general title *Electric traction – Rotating electrical machines for rail and road vehicles*, can be found on the IEC website.

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 the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

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- withdrawn,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

ELECTRIC TRACTION – ROTATING ELECTRICAL MACHINES FOR RAIL AND ROAD VEHICLES –

Part 4: Permanent magnet synchronous electrical machines connected to an electronic converter

1 Scope and object

This part of IEC 60349 applies to converter-fed permanent magnet synchronous motors or generators (machines) forming part of the equipment of electrically propelled rail and road vehicles.

This standard is derived from IEC 60349-2 changing the subject to permanent magnet synchronous machines.

The object of this part is to enable the performance of a machine to be confirmed by tests and to provide a basis for assessment of its suitability for a specified duty and for comparison with other machines.

Where further testing is to be undertaken in accordance with a combined test, it may be preferable, that some type and investigation tests be carried out on the combined test bed, to avoid duplication.

Particular attention is drawn to the need for collaboration between the designers of the machine and its associated converter as detailed in 5.1.

NOTE 1 This part also applies to machines installed on trailers hauled by powered vehicles.

NOTE 2 The basic requirements of this part may be applied to machines for special purpose vehicles such as mine locomotives but this part does not cover flameproof or other special features that may be required.

NOTE 3 It is not intended that this part should apply to machines on small road vehicles, such as battery-fed delivery vehicles, factory trucks, etc. This part also does not apply to minor machines such as windscreen wiper motors, etc. that may be used on all types of vehicles.

NOTE 4 Industrial type machines complying with IEC 60034 may be suitable for some auxiliary drives, provided that it is demonstrated that operation on a converter supply will meet the requirements of the particular application.

The electrical input to motors covered by this part is be from an electronic converter. Generators may be connected to a rectifier or a converter.

The machines covered by this part are classified as follows:

a) Traction motors

   Motors for propelling rail or road vehicles.

b) Main generators

   Generators for supplying power to traction motors on the same vehicle or train.

c) Auxiliary motors not covered by IEC 60034

   Motors for driving compressors, fans, auxiliary generators or other auxiliary machines.

d) Auxiliary generators not covered by IEC 60034

   Generators for supplying power for auxiliary services such as air conditioning, heating, lighting and battery charging, etc.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60034-1, *Rotating electrical machines – Part 1: Rating and performance*

IEC 60034-8, *Rotating electrical machines – Part 8: Terminal markings and direction of rotation*

IEC 60034-9, *Rotating electrical machines – Part 9: Noise limits*

IEC 60034-14, *Rotating electrical machines – Part 14: Mechanical vibration of certain machines with shaft heights 56 mm and higher – Measurement, evaluation and limits of vibration severity*

IEC 60050-131, *International Electrotechnical Vocabulary (IEV) – Chapter 131: Circuit theory*

IEC 60050-151, *International Electrotechnical Vocabulary (IEV) – Chapter 151: Electrical and magnetic devices*

IEC 60050-221, *International Electrotechnical Vocabulary (IEV) – Chapter 221: Magnetic materials and components*

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

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

IEC 60085, *Thermal evaluation and classification of electrical insulation*

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

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

3 Terms and definitions

For the purposes of this document the terms and definitions given in IEC 60050-131, IEC 60050-151, IEC 60050-221, IEC 60050-411, and IEC 60050-811 as well as the following, apply.

3.1
rating of a machine
combination of simultaneous values of electrical and mechanical quantities, with their duration and sequence, assigned to the machine by the manufacturer

3.1.1
rated value
numerical value of any quantity included in a rating

3.1.2
continuous rating
mechanical output that the motor (or electrical output that the generator) can deliver on the test bed for an unlimited time under the conditions specified in 8.1 without exceeding the limits of

temperature rise given in Table 2, all other appropriate requirements in this part also being satisfied

Note 1 to entry: Several continuous ratings may be specified.

3.1.3
short-time rating
(for example, 1 h)
mechanical output that the motor (or electrical output that the generator) can deliver on the test bed for the stated time without exceeding the limits of temperature rise given in Table 2. The test being carried out as specified in 8.1 starting with the machine cold, all other appropriate requirements in this part being also satisfied

3.1.4
short-time overload rating
mechanical output that the motor (or electrical output that the generator) can deliver on the test bed for the stated time without exceeding the agreed limits of temperature

Note 1 to entry: Short-time overload ratings are of value in determining the suitability of machines 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 the repeated short load cycles of rapid transit and similar duties, and should not be specified for such applications.

3.1.5
intermittent duty rating
duty cycle in which the machine may be operated without the temperature rises exceeding the limits given in Table 2 at any point

3.1.6
equivalent rating
continuous rating with constant values of voltage, current and speed that, as far as temperature rise is concerned, is equivalent to the intermittent duty cycle which the machine has to withstand in service

Note 1 to entry: This rating should be agreed between user and manufacturer.

3.1.7
guaranteed rating
rating assigned by the manufacturer for test purposes

3.1.8
guaranteed rating of a machine
normally the continuous rating but in special cases the user and manufacturer may agree that it be a short-time or intermittent rating

3.1.9
guaranteed rating of an auxiliary machine
continuous rating unless otherwise specified

3.1.10
rated voltage
root-mean-square value of the fundamental component of the line-to-line voltage of a machine when it is operating at a guaranteed rating

3.1.11
rated speed
speed at a guaranteed rating