AS 60034.17—2009

Australian Standard®

Rotating electrical machines

Part 17: Cage induction motors when fed from converters—Application guide

This Australian Standard® was prepared by Committee EL-009, Rotating Electrical Machinery. It was approved on behalf of the Council of Standards Australia on 11 June 2009. This Standard was published on 15 July 2009.

The following are represented on Committee EL-009:

- Airconditioning and Refrigeration Equipment Manufacturers Association of Australia
- Australian Chamber of Commerce and Industry
- Australian Electrical and Electronic Manufacturers Association
- Australian Greenhouse Office, Department of the Environment and Water Resources
- Australian Industry Group
- Bureau of Steel Manufacturers of Australia
- Department of Defence (Australia)
- Electrical Apparatus Service Association
- Energy Efficiency and Conservation Authority of New Zealand
- Engineers Australia
- Ministry of Economic Development (New Zealand)
- Registered Master Builders

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Standards Australia wishes to acknowledge the participation of the expert individuals that contributed to the development of this Standard through their representation on the Committee and through the public comment period.

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Part 17: Cage induction motors when fed from converters – Application guide

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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee EL-009, Rotating Electrical Machinery.

This Standard was prepared by the Australian members of the Joint Standards Australia/Standards New Zealand Committee EL-009. After consultation with stakeholders in both countries, Standards Australia and Standards New Zealand decided to develop this Standard as an Australian Standard rather than an Australian/New Zealand Standard.

The objective of this Standard is to specify requirements for steady state operation of cage induction motors when fed from converters.

This Standard is identical with, and has been reproduced from IEC 60034-17, Ed. 4 (2006), *Rotating electrical machines—Part 17: Cage induction motors when fed from converters — Application guide.*

This Standard is Part 17 of a Series dealing with rotating electrical machinery. Additional parts will be added from time to time. This Series when complete will consist of the following parts:

AS	
1359.102.2	Rotating electrical machines—Methods for determining losses and efficiency of rotating electrical machinery from tests—Measurement of losses by the calorimetric method
60034	Rotating electrical machines
60034.1	Part 1: Rating and performance
60034.2.1	Part 2.1: Methods for determining losses and efficiency from tests (excluding machines for traction vehicles)
60034.3	Part 3: Specific requirements for synchronous generators driven by steam turbines or combustion gas turbines
60034.4	Part 4: Methods for determining synchronous machine quantities from tests
60034.5	Part 5: Degrees of protection provided by the integral design of rotating electrical machines (IP code)—Classification
60034.6	Part 6: Method of cooling (IC code)
60034.7	Part 7: Classification of types of construction, mounting arrangements and terminal box position (IM code)
60034.8	Part 8: Terminal markings and direction of rotation
60034.9	Part 9: Noise limits
60034.11	Part 11: Thermal protection
60034.12	Part 12: Starting performance of single-speed three-phase cage induction motors
60034.14	Part 14: Mechanical vibration of certain machines with shaft heights 56 mm and higher—Measurement, evaluation and limits of vibration severity
60034.15	Part 15: Impulse voltage withstand levels of rotating a.c. machines with form-wound stator coils
60034.16	Part 16: Excitation systems for synchronous machines (all parts)
60034.17	Part 17: Cage induction motors when fed from converters—Application guide (this Standard)
60034.18	Part 18: Functional evaluation of insulation systems (all parts)
60034.19	Part 19: Specific test methods for d.c. machines on conventional and rectifier-fed supplies
60034.20.1	Part 20.1: Control motors—Stepping motors
60034.22	Part 22: AC generators for reciprocating internal combustion (RIC) engine driven generating sets
60034.23	Part 23: Specification for the refurbishing of rotating electrical machines

AS	
60034.25	Part 25: Guidance for the design and performance of a.c. motors specifically designed for converter supply
60034.26	Part 26: Effects of unbalanced voltages on the performance of three-phase cage induction motors
60034.27	Part 27: Off-line partial discharge measurements on the stator winding insulation of rotating electrical machines
60034.28	Part 28: Test methods for determining quantities of equivalent circuit diagrams for the three-phase low voltage cage induction motors
60034.29	Part 29: Equivalent loading and superposition techniques—Indirect testing to determine temperature rise.

As this Standard is reproduced from an International Standard, the following applies:

(a) Its number does not appear on each page of text and its identity is shown only on the cover and title page.

(b) In the source text 'IEC 60034-17' should read 'AS 60034.17'.

(c) A full point should be substituted for a comma when referring to a decimal marker.

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INTRODUCTION

The performance characteristics and operating data for drives with converter-fed cage induction motors are influenced by the complete drive system, comprising supply system, converter, induction motor, mechanical shafting and control equipment. Each of these components exists in numerous technical variations. Any values quoted in this technical specification are thus indicative only.

In view of the complex technical interrelations within the system and the variety of operating conditions, it is beyond the scope and object of this technical specification to specify numerical or limiting values for all the quantities which are of importance for the design of the drive.

To an increasing extent, it is practice that drives consist of components produced by different manufacturers. The object of this technical specification is to explain and quantify, as far as possible, the criteria for the selection of components and their influence on the performance characteristics of the drive.

The technical specification deals with motors within the scope of IEC 60034-12, i.e. low-voltage series-fabricated three-phase cage induction motors, which are designed originally for mains supply, covering the design N or design H requirements. Motors which are specifically designed for converter supply are covered by IEC 60034-25.

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1 Scope

This technical specification deals with the steady-state operation of cage induction motors within the scope of IEC 60034-12, when fed from converters. It covers the operation over the whole speed setting range, but does not deal with starting or transient phenomena.

Only indirect type converters are dealt with. This type comprises converters with impressed direct current in the intermediate circuit (current source converters) and converters with impressed d.c. voltage (voltage source converters), either of the block type or the pulse controlled type, without restriction on pulse number, pulse width or switching frequency. For the purposes of this technical specification, a converter may include any type of electronic switching device, for example transistors (bipolar or MOSfet), IGBTs, thyristors, GTO-thyristors, etc. with analog or digital control electronics.

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.

References to international standards that are struck through in this clause are replaced by references to Australian Standards that are listed immediately thereafter and identified by shading. Any Australian Standard that is identical to the International Standard it replaces is identified as such.

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

AS 60034.1, *Rotating electrical machines,* Part 1: *Rating and performance*

~~IEC 60034-12, *Rotating electrical machines – Part 12: Starting performance of single-speed three-phase cage induction motors*~~

AS 60034-12, *Rotating electrical machines,* Part 12: *Starting performance of single-speed three-phase cage induction motors* (identical to IEC 60034-12)

IEC 60034-25, *Rotating electrical machines – Part 25: Guide for the design and performance of cage induction motors specifically designed for converter supply*

3 Characteristics of the motor

The output current of a current source converter passes through the stator winding of the motor during the commutating period. Therefore, a knowledge of the motor equivalent circuit is important for the design of the commutating circuits.

In the case of voltage source converters, a knowledge of the motor equivalent circuit is normally not important for the design of the commutating circuit, but the harmonic impedances of the motor greatly influence the losses caused by harmonics.