Singapore Standards Council

TR IEC/TS 60034-31 : 2017

IEC/TS 60034-31:2010, IDT

(ICS 29.160)

TECHNICAL REFERENCE

Rotating electrical machines –

Part 31 : Selection of energy-efficient motors including variable speed applications – Application guide

Published by

Enterprise Singapore

TR IEC/TS 60034-31 : 2017
IEC/TS 60034-31:2010, IDT
(ICS 29.160)

TECHNICAL REFERENCE

Rotating electrical machines –

Part 31 : Selection of energy-efficient motors including variable speed applications – Application guide

ISBN 978-981-47-8443-6

This Technical Reference was endorsed by the Energy Standards Committee on behalf of the Singapore Standards Council on 12 October 2017.

First published, 2018

The Energy Standards Committee, appointed by the Standards Council, consists of the following members:

		Name	Capacity
Chairman	:	Mr Ho Hiang Kwee	*Individual Capacity*
1st Dy Chairman	:	Mr Ram Bhaskar	*National Environment Agency*
2nd Dy Chairman	:	Mr Wong Kum Hoong	*Energy Market Authority*
Secretary 1	:	Mr Jason Low	*SPRING Singapore*
Secretary 2		Ms Barbara Bok	*SPRING Singapore*
Members	:	*Assoc Prof Chai Kah Hin*	*National University of Singapore*
		Mr Adrian Cheong Wah Onn	*Land Transport Authority*
		Capt Charles Alexandra De Souza	*Maritime and Port Authority of Singapore*
		Mr Huang Xuebo	*Agency for Science, Technology and Research*
		Ms Kavita Gandhi	*Sustainable Energy Association of Singapore*
		Ms Kriti Gupta	*SP PowerGrid Ltd*
		Mr Richard Kwok	*Singapore Business Federation*
		Mr Nilesh Jadhav	*Nanyang Technological University*
		Mr Tan Chek Sim	*Housing & Development Board*
		Mr Tan Pua Yong	*Singapore Manufacturing Federation*
		Er. Teo Kong Poon	*The Institution of Engineers, Singapore*
		Mr Toh Eng Shyan	*Building and Construction Authority*
		Prof Tseng King Jet	*Singapore Green Building Council*
		Mr Wong Toon Suan	*Gas Association of Singapore*
		Prof Wong Yew Wah	*ASHRAE Singapore Chapter*
		Er. Yeow Mei Leng	*Association of Consulting Engineers Singapore*
Co-opted Members	:	Mr Norman Lee	*Individual Capacity*
		Prof Toh Kok Chuan	*Individual Capacity*

The Working Group, appointed by the Energy Standards Committee to assist in the preparation of this standard, comprises the following experts who contributed in their *individual capacity*:

		Name
Convenor	:	Mr Roland Tan
Members	:	Assoc Prof Ang Hock Eng
		Mr Clarence Chiang
		Mr Chng Tuan Meng
		Er. Eddie Chong Chun Sen
		Mr Choong Chow Neng
		Mr Carsten Ederer
		Ms Lydia Goh
		Mr Norman Lee
		Ms Tracy Liu
		Mr Colin Ong
		Er. Ong Eng Tong
		Mr Kelvin Ong
		Mr Jerry Ooi
		Mr S Suresh Kumar
		Mr Toh Eng Shyan
		Dr Tseng King Jet
		Mr Xu Xiao Ming

The organisations in which the experts are involved are:

ABB Pte Ltd
Association of Consulting Engineers Singapore
Building and Construction Authority
Chevron Philips Chemicals Asia Pte Ltd
ebm-papst SEA Pte. Ltd.
EV Solutions Pte Ltd
G-Energy Global Pte Ltd
MSD International GmbH (Singapore Branch)
National Environment Agency
Nanyang Technological University
Schneider Electric Singapore Pte Ltd
Singapore Green Building Council
Singapore Manufacturing Federation
Sustainable Energy Association of Singapore
Teco Electric & Machinery (Pte) Ltd
The Institution of Engineers, Singapore

(blank page)

CONTENTS

National Foreword

This Technical Reference (TR) was prepared by a Working Group under the direction of the Energy Standards Committee.

This TR is identical with IEC/TS 60034-31:2010 published by the International Electrotechnical Commission.

Attention is drawn to the following:

1. The reference to “IEC 60034-1” shall be replaced by “SS IEC 60034-1”.

2. The comma has been used throughout as a decimal marker whereas in Singapore Standards it is a practice to use a full point on the baseline as the decimal maker.

This TR is a provisional standard made available for application over a period of three years. The aim is to use the experience gained to update the TR so that it can be adopted as a Singapore Standard. Users of the TR are invited to provide feedback on its technical content, clarity and ease of use. Feedback can be submitted using the form provided in the TR. At the end of the three years, the TR will be reviewed, taking into account any feedback or other considerations, to further its development into a Singapore Standard if found suitable.

Attention is drawn to the possibility that some of the elements of this Technical Reference may be the subject of patent rights. Enterprise Singapore shall not be held responsible for identifying any or all of such patent rights.

NOTE

1. Singapore Standards (SSs) and Technical References (TRs) are reviewed periodically to keep abreast of technical changes, technological developments and industry practices. The changes are documented through the issue of either amendments or revisions.

2. An SS or TR is voluntary in nature except when it is made mandatory by a regulatory authority. It can also be cited in contracts making its application a business necessity. Users are advised to assess and determine whether the SS or TR is suitable for their intended use or purpose. If required, they should refer to the relevant professionals or experts for advice on the use of the document. Enterprise Singapore shall not be liable for any damages whether directly or indirectly suffered by anyone or any organisation as a result of the use of any SS or TR.

3. Compliance with a SS or TR does not exempt users from any legal obligations.

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

ROTATING ELECTRICAL MACHINES –

Part 31: Selection of energy-efficient motors including variable speed applications – Application guide

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of 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, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). 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. 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 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 IEC National Committees.
3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
6) All users should ensure that they have the latest edition of this publication.
7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

The main task of IEC technical committees is to prepare International Standards. In exceptional circumstances, a technical committee may propose the publication of a technical specification when

- the required support cannot be obtained for the publication of an International Standard, despite repeated efforts, or
- the subject is still under technical development or where, for any other reason, there is the future but no immediate possibility of an agreement on an International Standard.

Technical specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

IEC 60034-31, which is a technical specification, has been prepared by IEC technical committee 2: Rotating machinery.

The text of this technical specification is based on the following documents:

Enquiry draft	Report on voting
2/1575/DTS	2/1594/RVC

Full information on the voting for the approval of this technical specification 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 of the IEC 60034 series, published under the general title *Rotating electrical machines,* can be found on the IEC website.

NOTE A table of cross-references of all IEC TC 2 publications can be found in the IEC TC 2 dashboard 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 web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- transformed into an International standard,
- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

The present technical specification gives technical guidelines for the application of energy-efficient motors in constant-speed and variable speed applications. It does not cover aspects of a purely commercial nature.

Standards developed by IEC technical committee 2 do not deal with methods of how to obtain a high efficiency but with tests to verify the guaranteed value. IEC 60034-2-1 is the most important standard for this purpose.

For approximately 15 years regional agreements were negotiated in many areas of the world regarding efficiency classes of three-phase, cage-induction motors with outputs up to about 200 kW maximum, as motors of this size are installed in high quantities and are for the most part produced in series production. The design of these motors is often driven by the market demand for low investment cost, hence energy efficiency was not a top priority.

In IEC 60034-30, IE efficiency classes for single-speed cage-induction motors have been defined and test procedures specified:

IE1	Standard efficiency
IE2	High efficiency
IE3	Premium efficiency
IE4	Super-premium efficiency

Determination of efficiency for motors powered by a frequency converter will be included in IEC standard 60034-2-3.

However, for motors rated 1 MW and above, which are usually custom made, a high efficiency has always been one of the most important design goals. The full-load efficiency of these machines typically ranges between 95 % and 98 %. Efficiency is usually part of the purchase contract and is penalized if the guaranteed values are not met. Therefore, these higher ratings are of secondary importance when assigning efficiency classes.

With permission from the National Electrical Manufacturers Association (NEMA), some parts of this TS are based on NEMA MG 10, *Energy Management Guide For Selection and Use of Fixed Frequency Medium AC Squirrel-Cage Polyphase Induction Motors*.

ROTATING ELECTRICAL MACHINES –

Part 31: Selection of energy-efficient motors including variable speed applications – Application guide

1 Scope

This part of IEC 60034 provides a guideline of technical aspects for the application of energy-efficient, three-phase, electric motors. It not only applies to motor manufacturers, OEMs (original equipment manufacturers), end users, regulators and legislators but to all other interested parties.

This technical specification is applicable to all electrical machines covered by IEC 60034-30. Most of the information however is also relevant for cage-induction machines with output powers exceeding 375 kW.

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

IEC 60034-30, *Rotating electrical machines – Part 30: Efficiency classes of single-speed three-phase, cage induction motors (IE-code)*