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## **Rotating electrical machines – Part 31: Selection of energy-efficient motors including variable speed applications – Application guidelines**

*(CENELEC Technical Specification 60034-31:2024)*

*(IEC Technical Specification 60034-31 2021)*

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English Version

**Rotating electrical machines - Part 31: Selection of energy-efficient motors including variable speed applications -  
Application guidelines  
(IEC/TS 60034-31:2021)**

Machines électriques tournantes - Partie 31: Choix des moteurs écoénergétiques incluant les applications à vitesse variable - Lignes directrices en matière d'application  
(IEC/TS 60034-31:2021)

Drehende elektrische Maschinen - Teil 31: Auswahl von Energiesparmotoren einschließlich Drehzahlstellantrieben - Anwendungsleitfaden  
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**CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels**

## European foreword

This document (CLC IEC/TS 60034-31:2024) consists of the text of IEC/TS 60034-31:2021 prepared by IEC/TC 2 “Rotating machinery”.

This document supersedes CLC/TS 60034-31:2011.

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

Any feedback and questions on this document should be directed to the users’ national committee. A complete listing of these bodies can be found on the CENELEC website.

## Endorsement notice

The text of the International Technical Specification IEC/TS 60034-31:2021 was approved by CENELEC as a European Technical Specification without any modification.

In the official version, for Bibliography, the following notes have to be added for the standard indicated:

IEC 60034-26      NOTE Approved as EN 60034-26

IEC/TS 60034-25      NOTE Approved as CLC/TS 60034-25

## Annex ZA (normative)

### Normative references to international publications with their corresponding European publications

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: [www.cencenelec.eu](http://www.cencenelec.eu).

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60034-1	-	Rotating electrical machines – Part 1: Rating and performance	EN 60034-1 <sup>1</sup>	-
IEC 60034-2-1	-	Rotating electrical machines - Part 2–1: Standard methods for determining losses and efficiency from tests (excluding machines for traction vehicles)	EN 60034-2-1	-
IEC 60034-2-3	2020	Rotating electrical machines - Part 2–3: Specific test methods for determining losses and efficiency of converter-fed AC motors	EN IEC 60034-2-3	2020
IEC 60034-12	-	Rotating electrical machines - Part 12: Starting performance of single-speed three-phase cage induction motors	EN 60034-12	-
IEC 60034-30-1	-	Rotating electrical machines - Part 30–1: Efficiency classes of line operated AC motors (IE code)	EN 60034-30-1	-
IEC 60072	series	Rotating electrical machines - Dimensions and output series	EN IEC 60072	series
IEC 61800-9-1	-	Adjustable speed electrical power drive systems - Part 9–1: Ecodesign for power drive systems, motor starters, power electronics and their driven applications - General requirements for setting energy efficiency standards for power driven equipment using the extended product approach (EPA) and semi analytic model (SAM)	EN 61800-9-1	-

<sup>1</sup> A new edition is currently under preparation. Stage of this document at the time of publication: prEN IEC 60034.

## CLC IEC/TS 60034-31:2024 (E)

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 61800-9-2	2017	Adjustable speed electrical power drive systems - Part 9–2: Ecodesign for power drive systems, motor starters, power electronics and their driven applications - Energy efficiency indicators for power drive systems and motor starters	EN 61800-9-2	2017
IEC/TS 60034-30-2	-	Rotating electrical machines - Part 30–2: Efficiency classes of variable speed AC motors (IE-code)	CLC IEC/TS 60034-30-2	-

# TECHNICAL SPECIFICATION



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**Rotating electrical machines –  
Part 31: Selection of energy-efficient motors including variable speed  
applications – Application guidelines**

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

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## CONTENTS

FOREWORD.....	6
INTRODUCTION.....	8
1 Scope.....	9
2 Normative references .....	9
3 Terms, definitions, symbols and acronyms.....	10
3.1 Terms and definitions.....	10
3.2 Symbols.....	10
3.3 Acronyms.....	10
4 Background .....	11
4.1 General.....	11
4.2 Introduction to IEC standards.....	14
4.2.1 Overview .....	14
4.2.2 Scope of efficiency classification .....	16
4.2.3 Efficiency interpolation (IEC 60034-2-3).....	16
5 Applications.....	18
5.1 Applications where the motor is fully loaded over longer periods of time .....	18
5.2 Applications with square torque-speed characteristic (pumps, fans, compressors) .....	18
5.2.1 General .....	18
5.2.2 Throttling versus variable speed control of pump systems .....	19
5.2.3 On/off flow control of pump systems .....	20
5.2.4 Pump systems for variable flow and their energy saving potential.....	20
5.2.5 Summary for fan system design.....	21
5.3 Applications with a constant torque characteristic (conveyors, lifts, hoist drives) .....	21
5.3.1 General .....	21
5.3.2 Conveyors with constant speed versus variable speed control .....	21
6 Fundamentals of electrical machines .....	22
6.1 General.....	22
6.2 Technology .....	23
6.2.1 Technologies for fixed speed, line start motors .....	23
6.2.2 Technologies for Variable Frequency Drive motors .....	23
6.3 Efficiency .....	23
6.3.1 General .....	23
6.3.2 Motor losses .....	25
6.3.3 Motors for higher efficiency classes .....	25
6.3.4 Variations in motor losses.....	26
6.4 Power factor .....	26
6.5 Pole number, frequency and speed relations.....	27
6.6 Differences between constant speed and variable speed operations .....	27
7 Motors for constant speed operation.....	28
7.1 General.....	28
7.2 Motors rated for 50 Hz and 60 Hz .....	28
7.3 Starting performance .....	29
7.4 Operating speed and slip .....	30
7.5 Motor losses for variable load .....	30
7.6 Power factor .....	31



7.7	Partial load efficiency .....	32
7.8	Motors rated for different voltages or a voltage range .....	33
7.9	Soft starters .....	33
7.10	IE efficiency classes .....	33
7.11	Efficiency testing methods .....	33
7.12	Effects of power supply and ambient temperature variations .....	34
7.12.1	Effects of power quality and variations in voltage and frequency .....	34
7.12.2	Effects of voltage unbalance .....	34
7.12.3	Effects of ambient temperature .....	34
7.12.4	Voltages variations .....	35
7.13	Motor dimensioning .....	35
8	Motors for variable speed operation .....	35
8.1	General .....	35
8.2	Motors rated for arbitrary speeds .....	36
8.3	Motor losses for variable frequency and load .....	36
8.4	Further losses in motors designed for constant speed in variable speed operation .....	36
8.5	Variable frequency drives .....	36
8.6	Variable frequency drive losses .....	36
8.7	Variable frequency drive power factor .....	37
8.8	Partial speed and partial torque efficiency of motor drive system .....	38
8.9	IE and IES efficiency classes .....	38
8.10	Efficiency determination methods .....	38
8.11	Motor and variable frequency drive system dimensioning .....	39
9	System selection guidelines .....	40
9.1	Introduction to system selection methodology .....	40
9.1.1	System design for minimal energy use .....	40
9.1.2	Efficiency optimization potential of system versus components .....	41
9.1.3	Selection criteria .....	41
9.1.4	System with variable frequency drive .....	42
9.2	Cost of electric motor systems .....	43
9.2.1	Component costs .....	43
9.2.2	Operating cost .....	44
9.2.3	Life cycle cost .....	44
10	Maintenance and lifetime expectations .....	45
10.1	Common causes of failures in industrial motors .....	45
10.2	Lifetime expectations of lubricants for bearings .....	45
10.3	Lifetime expectations of insulations for windings .....	45
10.4	Potential failure sources in bearings and insulation for motors supplied by VFD .....	46
10.5	Variable frequency drive maintenance and expected lifetime .....	46
10.6	Different categories of maintenance .....	46
Annex A (informative)	Typical efficiency values and losses of motors and variable frequency drives .....	48
A.1	General .....	48
A.2	Losses of direct-on-line motors .....	48
A.3	Losses of variable speed motors .....	49
A.4	Losses of variable frequency drives (VFD) .....	50
Annex B (informative)	Tables of typical efficiency values of motors Direct-on-Line (DOL) .....	51

Annex C (informative) Examples of energy savings and life cycle cost savings .....	55
C.1 General.....	55
C.2 Water pump .....	55
C.3 Common interpretation error in fan applications when replacing motor .....	58
C.4 Fans in parallel .....	59
C.5 Electric motor materials versus energy efficiency and CO <sub>2</sub> emissions.....	60
Annex D (informative) Calculation sheet for losses and efficiency interpolation.....	62
Bibliography.....	63
 Figure 1 – Industrial electric motors in numbers .....	13
Figure 2 – Estimated global market shares of industrial electric motors per efficiency class in the time period 1995 to 2020.....	14
Figure 3 – Components of a motor driven unit.....	14
Figure 4 – Seven standardized operating points from IEC 60034-2-3 .....	17
Figure 5 – Reduction of motor input power between one efficiency class to the next higher class in percentage versus rated motor output power, shown cumulative for 4-pole motors.....	18
Figure 6 – System curves with and without a throttle valve and pump curves at constant speeds.....	20
Figure 7 – Average electric power consumption for end-suction own bearing (ESOB) clean water pumps driven by different motors connected DOL or with VFD .....	21
Figure 8 – System curves for conveyor (belt) drives, hoist drives, lifts, etc. ....	22
Figure 9 – Squirrel cage induction motor.....	23
Figure 10 – Operating capability for a DOL motor compared to a VFD motor.....	28
Figure 11 – Typical 4-pole induction motor power loss distribution versus power rating .....	31
Figure 12 – Performance characteristics of 4-pole, three phase, cage induction motors of different power ratings .....	32
Figure 13 – Typical variations of current, speed, power factor and efficiency with voltage for constant output power .....	35
Figure 14 – Schematic layout of a variable frequency drive .....	37
Figure 15 – Distortion power factor versus the total harmonic distortion of the line current at the input to a variable frequency drive.....	38
Figure 16 – Typical system curves for different applications.....	39
Figure 17 – Overview of a Motor Driven Unit and related equipment of a system .....	40
Figure 18 – Relative cost of major components in an MDU, depending on rated power, according to a European market survey in 2017/2018 .....	43
Figure 19 – Distribution of failure causes for induction motors in industry .....	45
Figure 20 – Simplistic representation in relative scale of three different maintenance categories, namely corrective, preventive and predictive principles.....	47
Figure C.1 – Standard water pump characteristic.....	55
Figure C.2 – The torque versus synchronous speed for an induction motor of class IE2, a line-started synchronous motor of class IE4 and the system curve of a fan, respectively .....	58
Figure C.3 – Comparison of two different fan control methods with equal flow .....	59
Figure C.4 – Energy flow diagram from primary energy source, coal, to the electric motor.....	61
Figure D.1 – Extract from EXCEL calculation sheet available for download .....	62

Table 1 – Overview of IEC standards on energy efficiency of power drive systems and motor driven units .....	16
Table 2 – Loss distribution in three phase, 4-pole, cage induction electric motors .....	25
Table 3 – Relations between pole number, frequency and speed .....	27
Table 4 – Exemplary efficiency calculation of a motor when operated at 50 Hz and 60 Hz with the same torque, using a 50 Hz motor rating as the basis .....	29
Table 5 – IE efficiency classes of line operated AC motors .....	34
Table B.1 – Typical efficiency values of 50 Hz IE1 induction motors .....	51
Table B.2 – Typical efficiency values of 50 Hz IE2 induction motors .....	52
Table B.3 – Typical efficiency values of 50 Hz IE3 induction motors .....	53
Table B.4 – Typical efficiency values of 50 Hz IE4 induction motors .....	54
Table C.1 – Calculation of motor performance at operating points 1 to 3.....	57
Table C.2 – System losses and performance .....	57
Table C.3 – Calculated electricity, coal weight and CO <sub>2</sub> emissions savings .....	61

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

## ROTATING ELECTRICAL MACHINES –

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

## 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.
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- 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 TS 60034-31, which is a Technical Specification, has been prepared by IEC technical committee 2: Rotating machinery.

This publication contains an attached file titled, "TS 60034-31 Generic Efficiency Interpolation", in the form of an XLS document. This file is intended to be used as a complement and does not form an integral part of this Technical Specifications.

This second edition cancels and replaces the first edition published in 2010. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) references to relevant standards have been updated;
- b) global market data for industrial motors have been updated;
- c) guidelines and theories about normal industrial applications have been described;
- d) energy efficiency comparison examples have been given.

The text of this Technical Specification is based on the following documents:

DTS	Report on voting
2/2007/DTS	2/2028A/RVDTS

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

A list of all parts in the IEC 60034 series, published under the general title *Rotating electrical machines*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document will be

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

**IMPORTANT – The "colour inside" logo on the cover page of this document 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

This document gives technical and economical guidelines for the use of energy-efficient motors in constant speed and variable speed operations in different applications.

About 50 % of the total global electric energy consumption is converted in electric motors, which are the largest consumers of electricity per component type and industrial motors alone accounting for around 30 % of all electricity in 2016. The wording 'electricity consumption' is commonly used even though most of this energy is doing useful work. Electric motors convert electric energy into mechanical energy where a minor part is converted into heat losses. Therefore, electric motors, and especially motors operated with variable speed drives that enable control of both speed and torque according to varying load requirements, are key components that can achieve significant electricity savings.

A simple measure for reducing energy consumption is of course to invest in electric motors with higher efficiency that normally result in rapid return on investments due to the dominating operational costs through electricity bills. The highest energy saving potentials though can only be identified by taking a holistic system perspective. It is estimated that only 12 % of the installed base of electric motors are controlled by variable frequency drives, even though it is estimated that more than 50 % of these motors would benefit by such control when for instance wasteful mechanical control as throttling for varying the flow of a medium is replaced. This document is intended to give guidance for proper use of constant speed motors and variable speed motors and when to use them in light of actual applications and duty profiles.

Examples of constant torque duty profiles and quadratic torque duty profiles are given and practical implications are described in order to facilitate enhanced understanding around viable customs. Some parts of the document may be applicable for other motors as well.

## ROTATING ELECTRICAL MACHINES –

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

#### 1 Scope

This part of IEC 60034 provides a guideline of technical and economical aspects for the application of energy-efficient electric AC motors. It applies to motor manufacturers, OEMs (original equipment manufacturers), end users, regulators, legislators and other interested parties.

This document is applicable to all electrical machines covered by IEC 60034-1, IEC 60034-30-1 and IEC TS 60034-30-2.

#### 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 60034-2-1, *Rotating electrical machines – Part 2-1: Standard methods for determining losses and efficiency from tests (excluding machines for traction vehicles)*

IEC 60034-2-3:2020, *Rotating electrical machines – Part 2-3: Specific test methods for determining losses and efficiency of converter-fed AC motors*

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

IEC 60034-30-1, *Rotating electrical machines – Part 30-1: Efficiency classes of line operated AC motors (IE code)*

IEC TS 60034-30-2, *Rotating electrical machines – Part 30-2: Efficiency classes of variable speed AC motors (IE-code)*

IEC 60072 (all parts), *Dimensions and output series for rotating electrical machines*

IEC 61800-9-1, *Adjustable speed electrical power drive systems – Part 9-1: Ecodesign for power drive systems, motor starters, power electronics and their driven applications – General requirements for setting energy efficiency standards for power driven equipment using the extended product approach (EPA) and semi analytic model (SAM)*

IEC 61800-9-2:2017, *Adjustable speed electrical power drive systems – Part 9-2: Ecodesign for power drive systems, motor starters, power electronics and their driven applications – Energy efficiency indicators for power drive systems and motor starters*