SLOVENSKI STANDARD
oSIST prEN IEC 60034-30-1:2024

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Električni rotacijski stroji - 30-1. del: Razredi izkoristka enohitrostnih trifaznih motorjev s kratkostično kletko (koda IE)

Rotating electrical machines - Part 30-1: Efficiency classes of line operated AC motors (IE code)

Drehende elektrische Maschinen - Teil 30-1: Wirkungsrad-Klassifizierung von netzgespeisten Drehstrommotoren (IE-Code)

Machines électriques tournantes - Partie 30-1: Classes de rendement pour les moteurs à courant alternatif alimentés par le réseau (code IE)

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COMMITTEE DRAFT FOR VOTE (CDV)

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IEC TC 2 : ROTATING MACHINERY	
SECRETARIAT: United Kingdom	SECRETARY: Mr Charles Whitlock
OF INTEREST TO THE FOLLOWING COMMITTEES:	HORIZONTAL FUNCTION(S):
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☒ SUBMITTED FOR CENELEC PARALLEL VOTING **Attention IEC-CENELEC parallel voting** The attention of IEC National Committees, members of CENELEC, is drawn to the fact that this Committee Draft for Vote (CDV) is submitted for parallel voting. The CENELEC members are invited to vote through the CENELEC online voting system.	☐ NOT SUBMITTED FOR CENELEC PARALLEL VOTING

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TITLE:

Rotating electrical machines - Part 30-1: Efficiency classes of line operated AC motors (IE code)

PROPOSED STABILITY DATE: 2026

NOTE FROM TC/SC OFFICERS:

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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ROTATING ELECTRICAL MACHINES –

Part 30-1: Efficiency classes of line operated AC motors (IE code)

FOREWORD

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International Standard IEC 60034-30-1 has been prepared by IEC Technical Committee 2: Rotating machinery.

This second edition of IEC 60034-30-1 cancels and replaces the first edition of IEC 60034-30-1 (2014).

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

FDIS	Report on voting

Full information on the voting for the approval of this standard 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.

NOTE A table of cross-references of all IEC TC 2 publications can be found on the IEC TC 2 dashboard on the IEC website.

100 The committee has decided that the contents of this publication will remain unchanged until the
101 stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to
102 the specific publication. At this date, the publication will be

103 • reconfirmed,
104 • withdrawn,
105 • replaced by a revised edition, or
106 • amended.

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INTRODUCTION

This first part of the IEC standard series, 60034-30, provides for the global harmonization of energy-efficiency classes of electric motors. It deals with all kinds of electric motors that are rated for line operation (including starting at reduced voltage). This includes 50 Hz and/or 60 Hz single- and three-phase low voltage induction motors, regardless of their rated voltage, as well as line-start synchronous motors.

The second part of this standard series (IEC 60034-30-2) is prepared for motors rated for variable voltage and frequency supply.

This second edition of the first part introduces a new efficiency class, IE5. It should be noted that IE class definition is generally independent of the output power – frame size assignment. As standardized dimensions and outputs in the standard IEC 60072 is based on today's technology (up to IE4), it may be challenging to implement highest IE classes according to IEC 60072 standardized frame sizes.

Especially motors with lower output power ratings may need to be designed and manufactured in one frame size bigger than frame size assigned in IEC 60072-1 to reach IE4 and IE5 efficiency levels.

For a given power and frame size it is generally easier to achieve a higher motor efficiency when the motor is designed for and operated directly on-line with a 60 Hz supply frequency rather than on 50 Hz as explained in Note 1.

NOTE 1 As the utilization and size of motors are related to torque rather than power the theoretical power of single-speed motors increases linearly with supply frequency (and hence with speed), i.e. by 20 % from 50 Hz to 60 Hz.

I^2R winding-losses are dominant especially in small and medium sized induction motors. They basically remain constant at 50 Hz and 60 Hz as long as the torque is kept constant. Although windage, friction and iron losses increase with frequency, they play a minor role especially in motors with a number of poles of four and higher. Therefore, at 60 Hz, the losses increase less than the 20 % power increase when compared to 50 Hz and consequently, the efficiency is improved.

In practice, both 60 Hz and 50 Hz power designations of single-speed motors usually conform to standard power levels in accordance with IEC 60072-1. Therefore, an increased rating of motor power by 20 % is not always possible. However, the general advantage of 60 Hz still applies when the motor design is optimized for the respective supply frequency rather than just re-rated.

The difference in efficiency between 50 Hz and 60 Hz varies with the number of poles and the size of the motor. In general, the 60 Hz efficiency of three-phase, cage-induction motors in the power range from 0,75 kW up to 375 kW is between 2,5 percentage points to less than 0,5 percentage points greater when compared to the 50 Hz efficiency. Only large 2-pole motors may experience a reduced efficiency at 60 Hz due to their high share of iron, windage and friction losses.

It is not expected that all manufacturers will produce motors for all efficiency classes, nor all ratings of a given class.

Users should dimension motors in their applications correctly based on the load profile, operating hours in order to maximize energy savings considering most energy efficient solutions in addition that all other requirements set by the application are covered. It may not be energy efficient to select motors of a high efficiency class for intermittent or short time duty due to increased inertia and start-up losses.

NOTE 2 The application guide IEC/TS 60034-31:2021 gives further information on useful applications of high-efficient electric motors.

In order to achieve a significant market share it is essential for high-efficiency motors to meet national/regional standards for assigned powers in relation to mechanical dimensions (such as frame-size, flanges). Standard IEC 60072-1:2022 defines the relationship between mechanical dimensions and rated output as well there are several national/regional frame assignment standards (JIS C 4212, NBR 17094, NEMA MG13, SANS 1804 and others). As this standard (IEC 60034-30-1) defines energy-efficiency classes independent of dimensional constraints it may not be possible in all markets to produce motors with higher efficiency classes and maintain the mechanical dimensions of the national/regional standards.

Together with demands to create higher energy efficiency classes, components and equipment also material efficiency should not be forgotten. Based on physics there will be a need to use more materials like electric steel, copper, and aluminium to be able to design and manufacture higher and higher efficient motors. Consequently, it may not be possible to design for example IE5 class motors utilizing same frame sizes as IE4 class motors as well as motors will be heavier requiring most probably redesigning the application.

IE codes are not limited only to motors and are used to classify other components such as frequency converters (IEC 61800-9-2). The same standard defines also IES classes to combinations of components (such as power drive systems).

However, it is anticipated that other components are rated with a comparable system: IE1 meaning low efficiency up to IE5 meaning the highest efficiency.

The efficiency levels in this standard for 50 Hz and 60 Hz are not always entirely consistent across all numbers of poles and over the whole power range.

NOTE 3 The efficiency levels for 60 Hz motors were assigned for compatibility with U.S. and North American legal requirements.

ROTATING ELECTRICAL MACHINES –

Part 30-1: Efficiency classes of line operated AC motors (IE code)

1 Scope

This part of IEC 60034 specifies efficiency classes for single-speed electric motors that are rated according to IEC 60034-1 or IEC 60079-0 and are rated for operation on a sinusoidal 50 Hz, 60 Hz and/or 50/60 Hz voltage supply and:

- have a rated power P_N from 0,12 kW to 1 000 kW
- have a rated voltage U_N from 50 V up to and including 1 000 V
- have 2, 4, 6 or 8 poles
- are capable of continuous operation at their rated power with a temperature rise within the specified insulation temperature class

  NOTE 1 Most motors covered by this standard are rated for duty type S1 (continuous duty). However, some motors that are rated for other duty cycles are still capable of continuous operation at their rated power and these motors are also covered.

- are marked with any ambient temperature within the range of –20 °C to +60 °C

  NOTE 2 The rated efficiency and efficiency classes are based on 25 °C ambient temperature according to IEC 60034-2-1.

  NOTE 3 Motors exclusively rated for temperatures outside the range – 20 °C and +60 °C are considered to be of special construction and are consequently excluded from this standard.

  NOTE 4 Smoke extraction motors with a temperature class of up to and including 400 °C are covered by this standard.

- are marked with an altitude up to 4 000 m above sea level.

  NOTE 5 The rated efficiency and efficiency class are based on a rating for altitudes up to 1 000 m above sea level.

This standard establishes a set of nominal efficiency values based on supply frequency, number of poles and motor output power. No distinction is made between motor technologies, supply voltage or motors with increased insulation designed specifically for converter operation even though these motor technologies may not all be capable of reaching the higher efficiency classes (see Table 1). This makes different motor technologies fully comparable with respect to their energy efficiency potential.

NOTE 6 Regulators should consider the above constraints when assigning national minimum energy-efficiency performance standards (MEPS) with respect to any particular type of motor.

The efficiency of power-drive systems is not covered by this standard. Motor losses due to harmonic content of the supply voltage, losses in cables, filters and frequency-converters, are not covered.

Motors with flanges, feet and/or shafts with mechanical dimensions different from IEC 60072-1 are covered by this standard.

Geared motors are covered by this standard including those incorporating non-standard shafts and flanges.

Excluded are:

- Single-speed motors with 10 or more poles or multi-speed motors.
- Motors with mechanical commutators (such as DC motors).

- Motors completely integrated into a machine (for example pump, fan and compressor) that cannot be practically tested separately from the machine even with provision of a temporary end-shield and drive-end bearing. This means the motor shall: a) share common components (apart from connectors such as bolts) with the driven unit (for example, a shaft or housing) and b) not be designed in such a way as to enable the motor to be separated from the driven unit as an entire motor that can operate independently of the driven unit. That is, for a motor to be excluded from this standard, the process of separation shall render the motor inoperative.

  (TEAO, IC418) Totally enclosed air-over machines, i.e. totally enclosed frame-surface cooled machines intended for exterior cooling by a ventilating means external to the machine, are covered by this standard. Efficiency testing of such motors may be performed with the fan removed and the cooling provided by an external blower with a similar airflow rate as the original fan.

- Motors with integrated frequency-converters (compact drives) when the motor cannot be tested separately from the converter. Energy efficiency classification of compact drives shall be based on the complete product (PDS ie. Power Drive System) and is defined in IEC 61800-9-2.

  NOTE 7 A motor is not excluded when the motor and frequency-converter can be separated, and the motor can be tested independently of the converter.

- Brake motors when the brake is an integral part of the inner motor construction and can neither be removed nor supplied by a separate power source during the testing of motor efficiency.

  NOTE 8 Brake motors with a brake coil that is integrated into the flange of the motor are covered as long as it is possible to test motor efficiency without the losses of the brake (for example by dismantling the brake or by energizing the brake coil from a separate power source).

  When the manufacturer offers a motor of the same design with and without a brake the test of motor efficiency may be done on a motor without the brake. The determined efficiency may then be used as the rating of both motor and brake motor.

- Submersible motors specifically designed to operate wholly immersed in a liquid.
- Smoke extraction motors with a temperature class above 400 °C.

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 60034-2-1, *Rotating electrical machines – Part 2-1: Standard methods for determining losses and efficiency from tests (excluding machines for traction vehicles)*

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

IEC 60034-6, *Rotating electrical machines – Part 6: Methods of cooling (IC Code)*

IEC/TS 60034-25, *Rotating electrical machines – Part 25: Guidance for the design and performance of a.c. motors specifically designed for converter supply*

IEC 60038, *IEC standard voltages*

IEC 60079-0, *Explosive atmospheres – Part 0: Equipment – General requirements*