Irish Standard
I.S. EN 60034-30-1:2014

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

I.S. EN 60034-30-1:2014

Incorporating amendments/corrigenda/National Annexes issued since publication:

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 60034-30-1

June 2014

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Supersedes EN 60034-30:2009,
CLC/TS 60034-31:2011 (partially)

English Version

Rotating electrical machines - Part 30-1: Efficiency classes of line operated AC motors (IE code) (IEC 60034-30-1:2014)

Machines électriques tournantes - Partie 30-1: Classes de rendement pour les moteurs à courant alternatif alimentés par le réseau (code IE)
(CEI 60034-30-1:2014)

Drehende elektrische Maschinen - Teil 30-1: Wirkungrad-Klassifizierung von netzgespeisten Drehstrommotoren (IE-Code)
(IEC 60034-30-1:2014)

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Europäisches Komitee für Elektrotechnische Normung

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Ref. No. EN 60034-30-1:2014 E

Foreword

The text of document 2/1729/FDIS, future edition 1 of IEC 60034-30-1, prepared by IEC/TC 2 "Rotating machinery" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 60034-30-1:2014.

The following dates are fixed:

– latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2015-01-10
– latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2017-04-10

This document supersedes EN 60034-30:2009 and partially supersedes CLC/TS 60034-31:2011 (Annex A).

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Endorsement notice

The text of the International Standard IEC 60034-30-1:2014 was approved by CENELEC as a European Standard without any modification.

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

IEC 60034-5	NOTE	Harmonized as EN 60034-5.
IEC 60034-12	NOTE	Harmonized as EN 60034-12.
IEC/TS 60034-31:2010	NOTE	Harmonized as CLC/TS 60034-31:2011 (not modified).

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

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.

NOTE 1 When 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.cenelec.eu.

Publication	Year	Title	EN/HD	Year
IEC 60034-1	-	Rotating electrical machines Part 1: Rating and performance	EN 60034-1	-
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 60034-6	-	Rotating electrical machines Part 6: Methods of cooling (IC Code)	EN 60034-6	-
IEC 60038	-	IEC standard voltages	EN 60038	-
IEC 60079-0	-	Explosive atmospheres Part 0: Equipment - General requirements	EN 60079-0	-
IEC/TS 60034-2-3	-	Rotating electrical machines Part 2-3: Specific test methods for determining losses and efficiency of converter-fed AC induction motors	-	-
IEC/TS 60034-25	-	Rotating electrical machines Part 25: Guidance for the design and performance of a.c. motors specifically designed for converter supply	CLC/TS 60034-25	-

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IEC 60034-30-1

Edition 1.0 2014-03

INTERNATIONAL STANDARD

NORME INTERNATIONALE

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

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

IEC 60034-30-1:2014-03(en-fr)

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ROTATING ELECTRICAL MACHINES –

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

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

This first edition of IEC 60034-30-1 cancels and replaces IEC 60034-30 (2008). It also cancels and replaces Annex A of IEC 60034-31 (2010). In the next revision of IEC 60034-31:2010 this annex will be removed from its contents.

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

FDIS	Report on voting
2/1729/FDIS	2/1739/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.

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.

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.

INTRODUCTION

This IEC standard 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 all single- and three-phase low voltage induction motors, regardless of their rated voltage and frequency, as well as line-start permanent-magnet motors.

A second part of this standard series (IEC 60034-30-2) will be prepared for motors rated for variable voltage and frequency supply, such as synchronous motors. The second part will also provide for harmonic voltage losses in motors capable of line operation when fed by frequency converters.

IEC 60034-30-1 widens the product range covered in the first edition of IEC 60034-30 significantly. The power range has been expanded (starting at 0,12 kW and ending at 1 000 kW). All technical constructions of electric motors are covered as long as they are rated for on-line operation and not just three-phase, cage-induction motors as in the first edition.

The IE4 class is newly included in this standard. The informative definition of IE4, which was previously included in IEC/TS 60034-31:2010, is therefore outdated.

The new class IE5 is not yet defined in detail but is envisaged for potential products in a future edition of the standard.

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 have to conform to standard power levels in accordance with IEC 60072-1 and local standards such as EN 50347. 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 select the efficiency class in accordance with a given application depending on the actual operating hours. 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 60034-31:2010 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). There are a number of national/regional frame assignment standards (EN 50347, JIS C 4212, NBR 17094, NEMA MG13, SANS 1804 and others) but there is no

IEC standard. 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.

IE codes are not limited to motors but may be used to classify other components such as frequency converters and gearboxes.

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

Combinations of components (such as power drive systems) will need a combined efficiency rating. That rating should not be an IE code in order to avoid confusion. It will be defined in other IEC standards.

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. legal requirements.

NOTE 4 The efficiency levels for 50 Hz motors between 0,75 kW and 375 kW remain unchanged for compatibility with European 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, are rated for operation on a sinusoidal voltage supply and:

- have a rated power P_N from 0,12 kW to 1 000 kW;
- have a rated voltage U_N above 50 V up to 1 kV;
- 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 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 limit efficiency values based on frequency, number of poles and motor 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. In particular, 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 : Power Drive System) and will be defined in a separate standard.

  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/TS 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*