



BSI Standards Publication

Rotating electrical machines

Part 30-3: Efficiency classes of high voltage AC motors (IE-code)

National foreword

This British Standard is the UK implementation of EN IEC 60034-30-3:2024. It is identical to IEC 60034-30-3:2024.

The UK participation in its preparation was entrusted to Technical Committee PEL/2, Rotating electrical machinery.

A list of organizations represented on this committee can be obtained on request to its committee manager.

Contractual and legal considerations

This publication has been prepared in good faith, however no representation, warranty, assurance or undertaking (express or implied) is or will be made, and no responsibility or liability is or will be accepted by BSI in relation to the adequacy, accuracy, completeness or reasonableness of this publication. All and any such responsibility and liability is expressly disclaimed to the full extent permitted by the law.

This publication is provided as is, and is to be used at the recipient's own risk.

The recipient is advised to consider seeking professional guidance with respect to its use of this publication.

This publication is not intended to constitute a contract. Users are responsible for its correct application.

© The British Standards Institution 2024
Published by BSI Standards Limited 2024

ISBN 978 0 539 13989 1

ICS 29.160.01; 29.160.10; 29.160.30

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 March 2024.

Amendments/corrigenda issued since publication

Date	Text affected
------	---------------

English Version

Rotating electrical machines - Part 30-3: Efficiency classes of
high voltage AC motors (IE-code)
(IEC 60034-30-3:2024)

Machines électriques tournantes - Partie 30-3: Classes de
rendement des moteurs à courant alternatif à haute tension
(code IE)
(IEC 60034-30-3:2024)

Drehende elektrische Maschinen - Teil 30-3:
Wirkungsgradklassen von Hochspannungs-
Wechselstrommotoren (IE-Code)
(IEC 60034-30-3:2024)

This European Standard was approved by CENELEC on 2024-03-21. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye and the United Kingdom.



European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

European foreword

The text of document 2/2131/CDV, future edition 1 of IEC 60034-30-3, prepared by IEC/TC 2 "Rotating machinery" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 60034-30-3:2024.

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) 2024-12-21
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2027-03-21

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 Standard IEC 60034-30-3:2024 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 standard indicated:

IEC 60034-5 NOTE Approved as EN IEC 60034-5
IEC 60034-6 NOTE Approved as EN 60034-6
IEC/TS 60034-31 NOTE Approved as CLC IEC/TS 60034-31

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.cenelec.eu.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60034-1	2022	Rotating electrical machines - Part 1: Rating and performance	EN IEC 60034-1	— 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 60050-411	1996	International Electrotechnical Vocabulary - Chapter 411: Rotating machinery	-	-
+ A1	2007		-	-
+ A2	2021		-	-

¹ Under preparation. Stage at the time of publication: FprEN IEC 60034-1:2021.

CONTENTS

FOREWORD.....	3
INTRODUCTION.....	5
1 Scope.....	6
2 Normative references	9
3 Terms, definitions and symbols.....	9
3.1 Terms and definitions.....	9
3.2 Symbols.....	10
4 Efficiency classification.....	10
4.1 Determination	10
4.1.1 General	10
4.1.2 Auxiliary devices.....	10
4.2 Efficiency rating – General procedure	11
5 Required documentation.....	18
Annex A (informative) Standardized nameplate efficiency values	19
Annex B (informative) Proposal for technology factor for starting conditions for high voltage cage induction motors outside the scope of this document.....	20
Annex C (informative) Example for determining the nominal efficiency.....	21
Bibliography.....	22
Figure 1 – Envelope of the load torque during starting: Load torque during starting in % of rated torque over speed in % of rated speed.....	7
Table 1 – Maximum external moment of inertia	8
Table 2 – Reference efficiency values η_r for $2p = 2$, $f_N = 50$ Hz	11
Table 3 – Reference efficiency values η_r for $2p = 4$, $f_N = 50$ Hz	12
Table 4 – Reference efficiency values η_r for $2p = 6$, $f_N = 50$ Hz	13
Table 5 – Reference efficiency values η_r for $2p = 2$, $f_N = 60$ Hz	14
Table 6 – Reference efficiency values η_r for $2p = 4$, $f_N = 60$ Hz	15
Table 7 – Reference efficiency values η_r for $2p = 6$, $f_N = 60$ Hz	16
Table 8 – Technology factor c_U for rated voltage U_N	17
Table 9 – Technology factor c_C for method of cooling (IC class).....	17
Table 10 – Technology factor c_S for starting conditions for motors within the scope of this document	17
Table A.1 – Standardized nameplate efficiency levels.....	19
Table B.1 – Technology factor c_S for starting conditions for high voltage cage induction motors outside the scope of this document	20

INTERNATIONAL ELECTROTECHNICAL COMMISSION

ROTATING ELECTRICAL MACHINES –

Part 30-3: Efficiency classes of high voltage 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.
- 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) IEC draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC had not received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at <https://patents.iec.ch>. IEC shall not be held responsible for identifying any or all such patent rights.

IEC 60034-30-3 has been prepared by IEC technical committee 2: Rotating machinery. It is an International Standard.

The text of this International Standard is based on the following documents:

Draft	Report on voting
2/2131/CDV	2/2160/RVC

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

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 webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

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 provides the global harmonization of energy-efficiency classes of three-phase cage induction motors with rated voltage above 1 000 V that are rated for direct online starting and fixed-speed operation at a 50 Hz or 60 Hz supply with sinusoidal voltage.

For these motors, the demands of the power supply and of the driven equipment in many cases govern the design of the electrical machine. Due to the large size and power of high-voltage (HV) motors, these demands are more complex than for low-voltage motors and often limit the design. Vice versa, the properties of the electrical machine itself influence the grid considerably in many cases.

In order to ensure an easy applicability of this document, the scope is limited to the most relevant applications, i.e. motors for driving the vast majority of pumps, fans, or compressors, which cover approximately 80 % to 90 % of all applications. Motors for special applications, e.g. for accelerating very high load inertia, for very low supply voltage during starting, for very low locked-rotor current or for accelerating against high load torque, are therefore out of the scope of this document.

Despite this, the motor technology, namely

- rated voltage,
- method of cooling,
- locked-rotor current,

have a significant influence on the achievable motor efficiency as well as the rated frequency, the rated power and the number of poles, and are considered when specifying the efficiency class.

NOTE When specifying or designing a power drive system, low voltage motors will mostly have a higher efficiency than high voltage motors with the same rated power. However, considering the losses of the complete system, i.e. including cabling and transformer losses, high voltage solution might be advantageous.