ICS 29.160.01 SLOVENSKÁ TECHNICKÁ NORMA September 2020

STN	**Točivé elektrické stroje Časť 2-3: Špecifické skúšobné metódy na určovanie strát a účinnosti striedavých motorov napájaných z meniča**	**STN EN IEC 60034-2-3** 35 0000

Rotating electrical machines - Part 2-3: Specific test methods for determining losses and efficiency of converter-fed AC motors

Táto norma obsahuje anglickú verziu európskej normy.
This standard includes the English version of the European Standard.

Táto norma bola oznámená vo Vestníku ÚNMS SR č. 08/20

Obsahuje: EN IEC 60034-2-3:2020, IEC 60034-2-3:2020

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN IEC 60034-2-3

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English Version

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

Machines électriques tournantes - Partie 2-3: Méthodes d'essai spécifiques pour la détermination des pertes et du rendement des moteurs à courant alternatif alimentés par convertisseur
(IEC 60034-2-3:2020)

Drehende elektrische Maschinen - Teil 2-3: Besondere Verfahren zur Bestimmung der Verluste und des Wirkungsgrades von umrichtergespeisten Wechselstrommaschinen
(IEC 60034-2-3:2020)

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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 2/1974/FDIS, future edition 1 of IEC 60034-2-3, prepared by IEC/TC 2 "Rotating machinery" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 60034-2-3:2020.

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)	2021-01-23
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2023-04-23

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.

Endorsement notice

The text of the International Standard IEC 60034-2-3:2020 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/TS 60034-25:2014	NOTE	Harmonized as CLC/TS 60034-25:—[1] (not modified)
IEC 61800-2:2015	NOTE	Harmonized as EN 61800-2:2015 (not modified)
IEC 61800-4:2002	NOTE	Harmonized as EN 61800-4:2003 (not modified)

[1] To be published. Stage at the time of publication: CLC/prTS 60034-25:2017.

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.

Publication	Year	Title	EN/HD	Year
IEC 60034-1	2017	Rotating electrical machines - Part 1: Rating and performance	-	-
IEC 60034-2-1	2014	Rotating electrical machines - Part 2-1: Standard methods for determining losses and efficiency from tests (excluding machines for traction vehicles)	EN 60034-2-1	2014
IEC 61000-2-4	2002	Electromagnetic compatibility (EMC) - Part 2-4: Environment - Compatibility levels in industrial plants for low-frequency conducted disturbances	EN 61000-2-4	2002
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 60034-2-3

Edition 1.0 2020-03

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

COMMISSION ELECTROTECHNIQUE INTERNATIONALE

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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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 60034-2-3 has been prepared by IEC technical committee 2: Rotating machinery.

This first edition cancels and replaces IEC TS 60034-2-3, published in 2013.

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

FDIS	Report on voting
2/1974/FDIS	2/1982/RVD

Full information on the voting for the approval of this International Standard 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 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 objective of this document is to define test methods for determining total losses including additional high frequency motor losses and efficiency of converter-fed motors. Additional high frequency losses appear in addition to the losses on nominally sinusoidal power supply as determined by the methods of IEC 60034-2-1:2014. Results determined according to this document are intended to allow comparison of losses and efficiency of different motors when fed by converters.

Furthermore, the document gives seven standardized operating points to characterize the development of losses and efficiency across the whole torque/speed range. An interpolation procedure is provided to calculate losses and efficiency at any operating point (torque, speed).

In power-drive systems (PDS), the motor and the frequency converter are often manufactured by different suppliers. Motors of the same design are produced in large quantities. They may be operated from the grid or from frequency converters of many different types, supplied by many different manufacturers. The individual converter properties (switching frequency, DC link voltage level, etc.) will also influence the system efficiency. As it is impractical to determine motor losses for every combination of motor, frequency converter, connection cable, output filter and parameter settings, this document describes a limited number of approaches, depending on the voltage level and the rating of the machine under test.

The losses determined according to this document are not intended to represent the losses in the final application. They provide, however, an objective basis for comparing different motor designs with respect to suitability for converter operation.

In general, when fed from a converter, motor losses are higher than during operation on a nominally sinusoidal system. The additional high frequency losses depend on the harmonic spectrum of the impressed converter output quantity (either current or voltage) which is influenced by its circuitry and control method. For further information, see IEC TS 60034-25:2014.

It is not the purpose of this document to define test procedures either for power drive systems or for frequency converters alone.

Comparable converter

Latest experience and theoretical analysis have shown that the additional high frequency motor losses generally do not increase much with load. The methods in this document are mainly based on supplies from converters with pulse width modulation (PWM).

With respect to these types of converters and the growing need for verification of compliance with national energy efficiency regulations, this document defines a so-called comparable converter for testing of low voltage motors.

In principle, the comparable converter is a voltage source with a typical high frequency harmonic content supplying the machine under test. It is not applicable to medium voltage motors.

Limitations for the application of the comparable converter

It has to be noted that the test method with the comparable converter described herein is a standardized method intended to give comparable efficiency figures for standardized test conditions. A motor ranking with respect to suitability for converter operation may be derived, but it is not equivalent to determining of the actual motor losses for operation with a specific converter which requires a test of the whole power drive system (PDS) with the specific converter used in the final application.

Deviations are also expected for motors driven by multi-level voltage source or current source converters where the additional high frequency motor losses differ much more depending on speed and load than for two-level voltage source converters. Hence the determination of losses and efficiency should preferably use procedures where the motor is operated together with the same converter with which it is driven in service.

Another option is the determination of the additional high frequency motor losses by calculation. If this is requested by the customer, the pulse pattern of the converter is required. Such procedures are not part of this document.

The provided interpolation procedure for the determination of losses and efficiency at any operating point (torque, speed) is limited to the base speed range (constant torque range, constant flux range).

ROTATING ELECTRICAL MACHINES –

Part 2-3: Specific test methods for determining losses and efficiency of converter-fed AC motors

1 Scope

This part of IEC 60034 specifies test methods and an interpolation procedure for determining losses and efficiencies of converter-fed motors within the scope of IEC 60034-1:2017. The motor is then part of a variable frequency power drive system (PDS) as defined in IEC 61800-9-2:2017.

Applying the approach of the comparable converter, the motor efficiency determined by use of this document is applicable for comparison of different motor designs only.

The document also specifies procedures to determine motor losses at any load point (torque, speed) within the base speed range (constant torque range, constant flux range) based on determination of losses at seven standardized load points. This procedure is applicable to any variable speed AC motor (induction and synchronous) rated according to IEC 60034-1:2017 for operation on a variable frequency and variable voltage power supply.

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 60034-1:2017*, Rotating electrical machines – Part 1: Rating and performance*

IEC 60034-2-1:2014, *Rotating electrical machines – Part 2-1: Standard methods for determining losses and efficiency from tests (excluding machines for traction vehicles)*

IEC 61000-2-4:2002, *Electromagnetic compatibility (EMC) – Part 2-4: Environment – Compatibility levels in industrial plants for low-frequency conducted disturbances*

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*