



**SLOVENSKI STANDARD**  
**SIST EN 60034-1:2010**

**01-november-2010**

**Nadomešča:**  
**SIST EN 60034-1:2005**

---

**Električni rotacijski stroji - 1. del: Nazivni podatki in preskus lastnosti (IEC 60034-1:2010, spremenjen)**

Rotating electrical machines - Part 1: Rating and performance (IEC 60034-1:2010, modified)

Drehende elektrische Maschinen - Teil 1: Bemessung und Betriebsverhalten (IEC 60034-1:2010, modifiziert)

Machines électriques tournantes - Partie 1: Caractéristiques assignées et caractéristiques de fonctionnement (CEI 60034-1:2010, modifiée)

**Ta slovenski standard je istoveten z: EN 60034-1:2010**

---

**ICS:**

29.160.01	Rotacijski stroji na splošno	Rotating machinery in general
-----------	------------------------------	-------------------------------

**SIST EN 60034-1:2010**

**en,fr**

**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

SIST EN 60034-1:2010

<https://standards.iteh.ai/catalog/standards/sist/6db6b339-454c-42eb-99dd-64c4ed5ccc56/sist-en-60034-1-2010>

EUROPEAN STANDARD  
NORME EUROPÉENNE  
EUROPÄISCHE NORM

**EN 60034-1**

October 2010

ICS 29.160

Supersedes EN 60034-1:2004

English version

**Rotating electrical machines -  
Part 1: Rating and performance**  
(IEC 60034-1:2010, modified)

Machines électriques tournantes -  
Partie 1: Caractéristiques assignées  
et caractéristiques de fonctionnement  
(CEI 60034-1:2010, modifiée)

Drehende elektrische Maschinen -  
Teil 1: Bemessung und Betriebsverhalten  
(IEC 60034-1:2010, modifiziert)

This European Standard was approved by CENELEC on 2010-10-01. 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 Central Secretariat 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 Central Secretariat 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, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

**CENELEC**

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

**Management Centre: Avenue Marnix 17, B - 1000 Brussels**

## Foreword

The text of the International Standard IEC 60034-1:2010, prepared by IEC TC 2, Rotating machinery, together with the common modification prepared by the Technical Committee CENELEC TC 2, Rotating machinery, was submitted to the CENELEC formal vote and was approved by CENELEC as EN 60034-1 on 2010-10-01.

This European Standard supersedes EN 60034-1:2004.

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

The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2011-10-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2013-10-01

This draft European Standard has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association and covers essential requirements of EC Directive 2004/108/EC. See Annex ZZ.

Annex ZA has been added by CENELEC.

**ITeH STANDARD PREVIEW**  
**(standards.iteh.ai)**

SIST EN 60034-1:2010

<https://standards.iteh.ai/en/standards/SIST-EN-60034-1-2010/64c4ed5ccc56/sist-en-60034-1-2010>  
**Endorsement notice**

The text of the International Standard IEC 60034-1:2010 was approved by CENELEC as a European Standard with agreed common modifications as given below.

### COMMON MODIFICATION

## 13 Electromagnetic compatibility (EMC)

### 13.2 Immunity

#### 13.2.2 Machines incorporating electronic circuits

At the end of 13.3.2 **add** the following warning:

**WARNING:** Class A equipment is intended for use in an industrial environment. In the documentation for the user, a statement shall be included drawing attention to the fact that there may be potential difficulties in ensuring electromagnetic compatibility in other environments, due to conducted as well as radiated disturbances.

## Annex ZA (normative)

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

The following referenced documents are indispensable for the application 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 When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60027-1	-	Letter symbols to be used in electrical technology - Part 1: General	EN 60027-1	-
IEC 60027-4	-	Letter symbols to be used in electrical technology - Part 4: Rotating electrical machines	EN 60027-4	-
IEC 60034-2	Series	Rotating electrical machines - Part 2: Standard methods for determining losses and efficiency from tests (excluding machines for traction vehicles)	EN 60034-2	Series
IEC 60034-3	-	Rotating electrical machines - Part 3: Specific requirements for synchronous generators driven by steam turbines or combustion gas turbines	EN 60034-3	-
IEC 60034-5	-	Rotating electrical machines - Part 5: Degrees of protection provided by the integral design of rotating electrical machines (IP code) - Classification	EN 60034-5	-
IEC 60034-8	-	Rotating electrical machines - Part 8: Terminal markings and direction of rotation	EN 60034-8	-
IEC 60034-12	-	Rotating electrical machines - Part 12: Starting performance of single-speed three-phase cage induction motors	EN 60034-12	-
IEC 60034-15	-	Rotating electrical machines - Part 15: Impulse voltage withstand levels of form-wound stator coils for rotating a.c. machines	EN 60034-15	-
IEC 60034-17	-	Rotating electrical machines - Part 17: Cage induction motors when fed from converters - Application guide	-	-
IEC 60034-18	Series	Rotating electrical machines - Part 18: Functional evaluation of insulation systems	EN 60034-18	Series
IEC 60034-30	-	Rotating electrical machines - Part 30: Efficiency classes of single-speed, three-phase, cage-induction motors (IE code)	EN 60034-30	-
IEC 60038	-	IEC standard voltages	-	-
IEC 60050-411	1996	International Electrotechnical Vocabulary (IEV) - Chapter 411: Rotating machinery	-	-

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60060-1	-	High-voltage test techniques - Part 1: General definitions and test requirements	HD 588.1	-
IEC 60072	Series	Dimensions and output series for rotating electrical machines	-	-
IEC 60085	-	Electrical insulation - Thermal evaluation and designation	EN 60085	-
IEC 60204-1	-	Safety of machinery - Electrical equipment of machines - Part 1: General requirements	EN 60204-1	-
IEC 60204-11	-	Safety of machinery - Electrical equipment of machines - Part 11: Requirements for HV equipment for voltages above 1 000 V a.c. or 1 500 V d.c. and not exceeding 36 kV	EN 60204-11	-
IEC 60335-1	-	Household and similar electrical appliances - Safety - Part 1: General requirements	EN 60335-1	-
IEC 60445	-	Basic and safety principles for man-machine interface, marking and identification - Identification of equipment terminals and conductor terminations	EN 60445	-
IEC 60664-1	-	Insulation coordination for equipment within low-voltage systems - Part 1: Principles, requirements and tests	EN 60664-1	-
IEC 60971 <sup>1)</sup>	-	Semiconductor convertors. Identification code - for convertor connections	-	-
IEC 61293	-	Marking of electrical equipment with ratings related to electrical supply - Safety requirements	EN 61293	-
CISPR 11	-	Industrial, scientific and medical equipment - Radio-frequency disturbance characteristics - Limits and methods of measurement	EN 55011	-
CISPR 14	Series	Electromagnetic compatibility - Requirements for household appliances, electric tools and similar apparatus	EN 55014	Series
CISPR 16	Series	Specification for radio disturbance and immunity measuring apparatus and methods	EN 55016	Series

---

<sup>1)</sup> IEC 60971 was withdrawn and not replaced in 2004.

## **Annex ZZ** (informative)

### **Coverage of Essential Requirements of EC Directives**

This European Standard has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association and within its scope the standard covers all relevant essential requirements as given in Annex I of the EC Directive 2004/108/EC.

Compliance with this standard provides one means of conformity with the specified essential requirements of the Directive concerned.

WARNING: Other requirements and other EC Directives may be applicable to the products falling within the scope of this standard.

**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

SIST EN 60034-1:2010

<https://standards.iteh.ai/catalog/standards/sist/6db6b339-454c-42eb-99dd-64c4ed5ccc56/sist-en-60034-1-2010>

## Bibliography

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

IEC 60034-6	NOTE Harmonized as EN 60034-6.
IEC 60034-7	NOTE Harmonized as EN 60034-7.
IEC 60034-9	NOTE Harmonized as EN 60034-9.
IEC 60034-11	NOTE Harmonized as EN 60034-11.
IEC 60034-14	NOTE Harmonized as EN 60034-14.
IEC 60034-29	NOTE Harmonized as EN 60034-29.
IEC 60079 series	NOTE Harmonized in EN 60079 series (partially modified).
IEC 60349 series	NOTE Harmonized in EN 60349 series (partially modified).

**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

SIST EN 60034-1:2010

<https://standards.iteh.ai/catalog/standards/sist/6db6b339-454c-42eb-99dd-64c4ed5ccc56/sist-en-60034-1-2010>





IEC 60034-1

Edition 12.0 2010-02

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE

Rotating electrical machines –  
Part 1: Rating and performance

STANDARD PREVIEW  
(standards.iteh.ai)

Machines électriques tournantes –  
Partie 1: Caractéristiques assignées et caractéristiques de fonctionnement

SIST EN 60034-1:2010  
64c4ed5ccc56/sist-en-60034-1-2010

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

COMMISSION  
ELECTROTECHNIQUE  
INTERNATIONALE

PRICE CODE  
CODE PRIX

**XB**

ICS 29.160

ISBN 2-8318-1074-1

## CONTENTS

FOREWORD.....	5
1 Scope.....	7
2 Normative references .....	7
3 Terms and definitions .....	8
4 Duty .....	13
4.1 Declaration of duty .....	13
4.2 Duty types .....	13
5 Rating .....	26
5.1 Assignment of rating.....	26
5.2 Classes of rating .....	26
5.3 Selection of a class of rating .....	27
5.4 Allocation of outputs to class of rating .....	27
5.5 Rated output .....	28
5.6 Rated voltage .....	28
5.7 Co-ordination of voltages and outputs .....	28
5.8 Machines with more than one rating .....	29
6 Site operating conditions .....	29
6.1 General.....	29
6.2 Altitude.....	29
6.3 Maximum ambient air temperature.....	29
6.4 Minimum ambient air temperature .....	29
6.5 Water coolant temperature .....	29
6.6 Storage and transport.....	30
6.7 Purity of hydrogen coolant.....	30
7 Electrical operating conditions .....	30
7.1 Electrical supply .....	30
7.2 Form and symmetry of voltages and currents .....	30
7.3 Voltage and frequency variations during operation .....	33
7.4 Three-phase a.c. machines operating on unearthed systems.....	35
7.5 Voltage (peak and gradient) withstand levels.....	35
8 Thermal performance and tests .....	35
8.1 Thermal class.....	35
8.2 Reference coolant .....	35
8.3 Conditions for thermal tests.....	36
8.4 Temperature rise of a part of a machine .....	37
8.5 Methods of measurement of temperature.....	37
8.6 Determination of winding temperature .....	38
8.7 Duration of thermal tests .....	41
8.8 Determination of the thermal equivalent time constant for machines of duty type S9.....	41
8.9 Measurement of bearing temperature .....	42
8.10 Limits of temperature and of temperature rise .....	42
9 Other performance and tests .....	50
9.1 Routine tests .....	50
9.2 Withstand voltage test .....	51

9.3	Occasional excess current.....	53
9.4	Momentary excess torque for motors.....	54
9.5	Pull-up torque.....	55
9.6	Safe operating speed of cage induction motors.....	55
9.7	Overspeed.....	56
9.8	Short-circuit current for synchronous machines.....	57
9.9	Short-circuit withstand test for synchronous machines.....	57
9.10	Commutation test for commutator machines.....	58
9.11	Total harmonic distortion ( <i>THD</i> ) for synchronous machines.....	58
10	Rating plates.....	58
10.1	General.....	58
10.2	Marking.....	59
11	Miscellaneous requirements.....	60
11.1	Protective earthing of machines.....	60
11.2	Shaft-end key(s).....	62
12	Tolerances.....	62
12.1	General.....	62
12.2	Tolerances on values of quantities.....	62
13	Electromagnetic compatibility (EMC).....	64
13.1	General.....	64
13.2	Immunity.....	64
13.3	Emission.....	65
13.4	Immunity tests.....	65
13.5	Emission tests.....	65
14	Safety.....	65
Annex A (informative) Guidance for the application of duty type S10 and for establishing the value of relative thermal life expectancy <i>TL</i> .....		
		67
Annex B (informative) Electromagnetic compatibility (EMC) limits.....		
		68
Bibliography.....		
		69
Figure 1	– Continuous running duty – Duty type S1.....	14
Figure 2	– Short-time duty – Duty type S2.....	15
Figure 3	– Intermittent periodic duty – Duty type S3.....	16
Figure 4	– Intermittent periodic duty with starting – Duty type S4.....	17
Figure 5	– Intermittent periodic duty with electric braking – Duty type S5.....	18
Figure 6	– Continuous operation periodic duty – Duty type S6.....	19
Figure 7	– Continuous operation periodic duty with electric braking – Duty type S7.....	20
Figure 8	– Continuous operation periodic duty with related load/speed changes – Duty type S8.....	22
Figure 9	– Duty with non-periodic load and speed variations – Duty type S9.....	23
Figure 10	– Duty with discrete constant loads – Duty type S10.....	25
Figure 11	– Voltage and frequency limits for generators.....	34
Figure 12	– Voltage and frequency limits for motors.....	34
Table 1	– Preferred voltage ratings.....	29
Table 2	– Unbalanced operating conditions for synchronous machines.....	32

Table 3 – Primary functions of machines.....	34
Table 4 – Reference coolant (see also Table 10) .....	36
Table 5 – Time interval .....	40
Table 6 – Measuring points.....	42
Table 7 – Limits of temperature rise of windings indirectly cooled by air .....	44
Table 8 – Limits of temperature rise of windings indirectly cooled by hydrogen .....	45
Table 9 – Adjustments to limits of temperature rise at the operating site of indirect cooled windings to take account of non-reference operating conditions and ratings .....	45
Table 10 – Assumed maximum ambient temperature .....	47
Table 11 – Adjusted limits of temperature rise at the test site ( $\Delta\theta_T$ ) for windings indirectly cooled by air to take account of test site operating conditions.....	48
Table 12 – Limits of temperature of directly cooled windings and their coolants .....	49
Table 13 – Adjustments to limits of temperature at the operating site for windings directly cooled by air or hydrogen to take account of non-reference operating conditions and ratings.....	50
Table 14 – Adjusted limits of temperature at the test site $\theta_T$ for windings directly cooled by air to take account of test site operating conditions .....	50
Table 15 – Minimum schedule of routine tests .....	51
Table 16 – Withstand voltage tests .....	52
Table 17 – Maximum safe operating speed ( $\text{min}^{-1}$ ) of three-phase single-speed cage induction motors for voltages up to and including 1 000 V.....	56
Table 18 – Overspeeds.....	57
Table 19 – Cross-sectional areas of earthing conductors.....	62
Table 20 – Schedule of tolerances on values of quantities.....	63
Table B.1 – Electromagnetic emission limits for machines without brushes .....	68
Table B.2 – Electromagnetic emission limits for machines with brushes.....	68

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

## ROTATING ELECTRICAL MACHINES –

## Part 1: Rating and performance

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

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

This twelfth edition cancels and replaces the eleventh edition published in 2004. It constitutes a technical revision.

Major changes were not introduced in this edition. The corrections, clarifications and improvements include:

Clause or subclause	Change
6.5	Clarification of water coolant temperature
8.10.2	Minor change to Table 12
10.2	Recognition of IE code, of open circuit voltage of synchronous machines excited by permanent magnets and of maximum operation speed of machines specifically designed for converter supply
12	Clarification of the term 'tolerances'

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

FDIS	Report on voting
2/1579/FDIS	2/1587/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.

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

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

The committee has decided that the contents of this publication will remain unchanged until the maintenance result 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.

## ROTATING ELECTRICAL MACHINES –

### Part 1: Rating and performance

#### 1 Scope

This part of IEC 60034 is applicable to all rotating electrical machines except those covered by other IEC standards, for example, IEC 60349 [10]<sup>1)</sup>.

Machines within the scope of this standard may also be subject to superseding, modifying or additional requirements in other publications, for example, IEC 60079 [8] and IEC 60092 [9].

NOTE If particular clauses of this standard are modified to meet special applications, for example machines subject to radioactivity or machines for aerospace, all other clauses apply insofar as they are compatible.

#### 2 Normative references

The following referenced documents are indispensable for the application 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 60027-1, *Letter symbols to be used in electrical technology – Part 1: General*

IEC 60027-4, *Letter symbols to be used in electrical technology – Part 4: Rotating electrical machines*

<https://standards.iteh.ai/catalog/standards/sist/6db6b339-454c-42eb-99dd-64c4ed5ccc56/sist-en-60034-1-2010>

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

IEC 60034-3, *Rotating electrical machines – Part 3: Specific requirements for synchronous generators driven by steam turbines or combustion gas turbines*

IEC 60034-5, *Rotating electrical machines – Part 5: Degrees of protection provided by the integral design of rotating electrical machines (IP code) – Classification*

IEC 60034-8, *Rotating electrical machines – Part 8: Terminal markings and direction of rotation*

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

IEC 60034-15, *Rotating electrical machines – Part 15: Impulse voltage withstand levels of form-wound stator coils for rotating a.c. machines*

IEC 60034-17, *Rotating electrical machines – Part 17: Cage induction motors when fed from converters – Application guide*

IEC 60034-18 (all parts), *Rotating electrical machines – Part 18: Functional evaluation of insulating systems*

---

1) Figures in square brackets refer to the Bibliography.