



IEC 60034-1

Edition 15.0 2026-03

INTERNATIONAL STANDARD

**Rotating electrical machines -
Part 1: Rating and performance**

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CONTENTS

FOREWORD	6
1 Scope	9
2 Normative references	9
3 Terms, definitions and abbreviated terms	11
3.1 Terms and definitions.....	11
3.2 Abbreviated terms.....	17
4 Duty	17
4.1 Declaration of duty.....	17
4.2 Duty types	17
4.2.1 Duty type S1 – Continuous running duty	17
4.2.2 Duty type S2 – Short-time duty	18
4.2.3 Duty type S3 – Intermittent periodic duty	19
4.2.4 Duty type S4 – Intermittent periodic duty with starting.....	20
4.2.5 Duty type S5 – Intermittent periodic duty with electric braking	22
4.2.6 Duty type S6 – Continuous operation periodic duty	23
4.2.7 Duty type S7 – Continuous operation periodic duty with electric braking	25
4.2.8 Duty type S8 – Continuous operation periodic duty with related load/speed changes.....	26
4.2.9 Duty type S9 – Duty with non-periodic load and speed variations	27
4.2.10 Duty type S10 – Duty with discrete constant loads and speeds	28
5 Rating	31
5.1 Assignment of rating	31
5.2 Classes of rating.....	31
5.2.1 Rating for continuous running duty	31
5.2.2 Rating for short-time duty	31
5.2.3 Rating for periodic duty.....	31
5.2.4 Rating for non-periodic duty.....	31
5.2.5 Rating for duty with discrete constant loads and speeds	32
5.2.6 Rating for equivalent loading	32
5.3 Selection of a class of rating	32
5.4 Allocation of outputs to class of rating.....	33
5.5 Rated output	33
5.5.1 DC generators	33
5.5.2 AC generators	33
5.5.3 Motors	33
5.5.4 Synchronous compensators	33
5.6 Rated voltage	33
5.6.1 DC generators	33
5.6.2 AC generators	33
5.6.3 AC motors	33
5.7 Preferred combinations of voltages and outputs.....	34
5.8 Machines with more than one rating.....	34
6 Site conditions.....	34
6.1 General.....	34
6.2 Altitude	34
6.3 Maximum ambient air temperature	34
6.4 Minimum ambient air temperature	35

6.5	Water coolant temperature	35
6.6	Standstill, storage and transport	35
6.7	Purity of hydrogen coolant	35
7	Electrical operating conditions	35
7.1	Electric supply	35
7.2	Form and symmetry of voltages and currents	36
7.2.1	AC motors	36
7.2.2	AC generators	37
7.2.3	Synchronous machines	38
7.2.4	DC motors supplied from static power converters	38
7.3	Voltage during starting of AC motors	39
7.4	Voltage and frequency variations during operation	40
7.5	Three-phase AC machines operating on unearthed systems	43
7.6	Voltage (peak and gradient) withstand levels	43
7.7	Sudden short circuits	44
8	Thermal performance and tests	44
8.1	Thermal class	44
8.2	Reference coolant	44
8.3	Conditions for thermal tests	45
8.3.1	Electric supply	45
8.3.2	Temperature of machine before test	45
8.3.3	Temperature of coolant	45
8.3.4	Measurement of coolant temperature during test	45
8.4	Temperature rise of a part of a machine	46
8.5	Methods of measurement of temperature	46
8.5.1	General	46
8.5.2	Resistance method	46
8.5.3	Embedded temperature detector (ETD) method	46
8.5.4	Thermometer method	47
8.6	Determination of winding temperature	47
8.6.1	Choice of method	47
8.6.2	Determination by resistance method	48
8.6.3	Determination by ETD method	49
8.6.4	Determination by thermometer method	50
8.7	Duration of thermal tests	50
8.7.1	Rating for continuous running duty	50
8.7.2	Rating for short-time duty	50
8.7.3	Rating for periodic duty	50
8.7.4	Ratings for non-periodic duty and for duty with discrete constant loads	50
8.8	Determination of the thermal equivalent time constant for machines of duty type S9	51
8.9	Measurement of bearing temperature	51
8.10	Limits of temperature and of temperature rise	51
8.10.1	General	51
8.10.2	Indirect cooled windings	52
8.10.3	Direct cooled windings	56
8.10.4	Adjustments to take account of hydrogen purity on test	57

8.10.5	Permanently short-circuited windings, magnetic cores and all structural components (other than bearings) whether or not in contact with insulation	57
8.10.6	Commutators and sliprings, open or enclosed and their brushes and brushgear	57
9	Other performance and tests	59
9.1	Routine tests	59
9.2	Withstand voltage test.....	60
9.3	Occasional excess current	64
9.3.1	General	64
9.3.2	Generators	64
9.3.3	Motors (except commutator motors and permanent magnet motors)	64
9.3.4	Commutator machines	64
9.4	Momentary excess torque for motors	64
9.4.1	Polyphase induction motors and DC motors.....	64
9.4.2	Polyphase synchronous motors	65
9.4.3	Other motors	65
9.5	Pull-up torque and locked-rotor torque for cage induction motors with direct online starting	65
9.6	Safe operating speed of cage induction motors.....	65
9.7	Overspeed	66
9.8	Short-circuit current for synchronous machines.....	67
9.9	Short-circuit withstand test for synchronous machines	67
9.10	Commutation test for commutator machines.....	68
9.11	Total harmonic distortion (THD) for synchronous machines.....	68
9.11.1	General	68
9.11.2	Limits	68
9.11.3	Tests	68
9.12	Protective earth test.....	69
9.13	Measurement of insulation resistance and polarization index of winding insulation	69
9.14	Shaft-voltage test.....	70
10	Information requirements.....	70
10.1	General.....	70
10.2	Product documentation	70
10.3	Rating plate	70
10.4	Information content.....	71
10.4.1	General	71
10.4.2	Minimum information requirements	71
10.4.3	AC machines	72
10.4.4	All DC machines	72
10.4.5	Machines over 5 kW (or 5 kVA) rated output.....	72
10.4.6	Optional information	72
11	Miscellaneous requirements	73
11.1	Protective earthing of machines	73
11.2	Shaft-end key(s)	74
12	Tolerances	75
12.1	General.....	75
12.2	Tolerances on values of quantities.....	75

13	Electromagnetic compatibility (EMC)	76
13.1	General	76
13.2	Immunity	78
13.2.1	Machines not incorporating electronic circuits	78
13.2.2	Machines incorporating electronic circuits	79
13.3	Emission	79
13.4	Immunity tests	79
13.5	Emission measurements	79
14	Application requirements	80
	Annex A (informative) Guidance for the application of duty type S10 and for establishing the value of relative thermal life expectancy	81
	Annex B (informative) Electromagnetic compatibility (EMC) limits	82
	Bibliography	83
	Figure 1 – Continuous running duty – Duty type S1	18
	Figure 2 – Short-time duty – Duty type S2	19
	Figure 3 – Intermittent periodic duty – Duty type S3	20
	Figure 4 – Intermittent periodic duty with starting – Duty type S4	21
	Figure 5 – Intermittent periodic duty with electric braking – Duty type S5	23
	Figure 6 – Continuous operation periodic duty – Duty type S6	24
	Figure 7 – Continuous operation periodic duty with electric braking – Duty type S7	25
	Figure 8 – Continuous operation periodic duty with related load/speed changes – Duty type S8	27
	Figure 9 – Duty with non-periodic load and speed variations – Duty type S9	28
	Figure 10 – Duty with discrete constant loads – Duty type S10	30
	Figure 11 – Voltage and frequency limits for motors and for generators except generators or synchronous compensators within the scope of IEC 60034-3 and hydrogenerators within the scope of IEC 60034-33	42
	Figure 12 – Worst case increase in temperature rise ($\Delta\theta$) and recommended reduction of output power (ΔP) of motors as a function of the combined change of voltage and frequency $ \Delta\phi $ (indicative guideline to users of motors and generators only)	43
	Figure 13 – Factor K as a function of rated power in kW for determining $R_{PE,M}$	69
	Figure 14 – Flowchart clarifying the EMC requirements	78
	Table 1 – Preferred voltage ratings	34
	Table 2 – Unbalanced operating conditions for synchronous machines	38
	Table 3 – CCC symbol designation	39
	Table 4 – Primary functions of machines	41
	Table 5 – Reference coolant (see also Table 11)	44
	Table 6 – Time interval	49
	Table 7 – Measuring points	51
	Table 8 – Limits of temperature rise of windings indirectly cooled by air	53
	Table 9 – Limits of temperature rise of windings indirectly cooled by hydrogen	54
	Table 10 – Adjustments to limits of temperature rise at the operating site of indirect cooled windings to take account of non-reference operating conditions and ratings	55
	Table 11 – Assumed maximum ambient temperature	56

Table 12 – 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	57
Table 13 – Limits of temperature of directly cooled windings and their coolants	58
Table 14 – 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	58
Table 15 – Adjusted limits of temperature at the test site θ_T for windings directly cooled by air to take account of test site operating conditions	59
Table 16 – Minimum routine tests for machines assembled and tested in the factory of the manufacturer.....	60
Table 17 – Withstand voltage tests	62
Table 18 – Test voltage factors for machines with an assigned IVIC according to IEC 60034-18-41 and IEC 60034-18-42	63
Table 19 – Maximum safe operating speed (min^{-1}) of three-phase single-speed cage induction motors for voltages up to and including 1 000 V.....	66
Table 20 – Overspeeds	67
Table 21 – Cross-sectional areas of earthing conductors	74
Table 22 – Schedule of tolerances on values of quantities	75
Table B.1 – Electromagnetic emission limits per CISPR 11 Class B Group 1	82
Table B.2 – Electromagnetic emission limits per CISPR 11 Class A Group 1	82

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**Rotating electrical machines -
Part 1: Rating and performance**

FOREWORD

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

This fifteenth edition cancels and replaces the fourteenth edition published in 2022. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

Clause, subclause or table number	Change
1	Clarification with respect to machines with integrated EMC-active components added
2	Normative references updated
3	Note on meaning of “agreement” deleted; list of abbreviations added
4.2.9, 4.2.10	References to IEC TS 60034-25 deleted, as converter duty is now defined in 3.36
5.1	Reference to IEC TS 60034-25 converted into note
6.6	Clarification of requirements
7.2.1	Reference to IEC TS 60034-25 converted into note
7.5	Clarification of requirements
7.6	Reference to IEC TS 60034-25 converted into note
8.1	Clarification of references
8.6.1	Clarification on choice of method for large machines
Table 11	Updated values for thermal class 200 (N)
8.10.3	Clarification of requirements
9.2	Clarification on test voltage for old machines after rewinding
Table 17	Items 9 and 10 merged and clarified
9.7	Clarification on overspeed test for machines held at stock added
Table 20	Clarification on test speed for converter duty machines
10.2	Clarification of term ‘digital form’
10.3	Note on QR code deleted
11.1	Reference to protective earth test added
13.1	Clarifying flowchart added
13.2.2	Clarification on motors with integrated VSD added
13.3	Clarification of requirements after consultation with ACEC
13.5	Clarification of requirements after consultation with ACEC
14	Note on safety converted to normal text

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

Draft	Report on voting
2/2257/FDIS	2/2296/RVD

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/standardsdev/publications.

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 on the IEC TC 2 dashboard 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.

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1 Scope

This part of IEC 60034 is applicable to all rotating electric machines, except rotating electric machines for rail and road vehicles, which are covered by the IEC 60349 series of standards.

Machines with integrated EMC-active components such as a variable frequency converter are considered being a power drive system (see the IEC 61800 series of standards). In such cases, this document applies to the motor component of the power drive system only.

Machines within the scope of this document can also be subject to superseding, modifying or additional requirements in other standards, for example, IEC 60079 and IEC 60092.

NOTE If particular clauses of this document 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 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 60027-1, *Letters symbols to be used in electrical technology - Part 1: General*

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

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 and for synchronous compensators*

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

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

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

IEC 60034-12:2016, *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 60034-18-41, *Rotating electrical machines - Part 18-41: Partial discharge free electrical insulation systems (Type I) used in rotating electrical machines fed from voltage converters - Qualification and quality control tests*

IEC 60034-18-42, *Rotating electrical machines - Part 18-42: Partial discharge resistant electrical insulation systems (Type II) used in rotating electrical machines fed from voltage converters - Qualification tests*

IEC 60034-27-4, *Rotating electrical machines - Part 27-4: Measurement of insulation resistance and polarization index of winding insulation of rotating electrical machines*

IEC 60034-29, *Rotating electrical machines - Part 29: Equivalent loading and superposition techniques - Indirect testing to determine temperature rise*

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

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

IEC 60034-33, *Rotating electrical machines - Part 33: Synchronous hydrogenerators including motor-generators - Specific requirements*

IEC 60050-411:1996, *International Electrotechnical Vocabulary (IEV) - Part 411: Rotating machinery*

IEC 60060-1, *High-voltage test techniques - Part 1: General terminology and test requirements*

IEC 60085, *Electrical insulation - Thermal evaluation and designation*

IEC 60204-1, *Safety of machinery - Electrical equipment of machines - Part 1: General requirements*

IEC 60204-11, *Safety of machinery - Electrical equipment of machines - Part 11: Requirements for equipment for voltages above 1 000 V AC or 1 500 V DC and not exceeding 36 kV*

IEC 60335-1:2020, *Household and similar electrical appliances - Safety - Part 1: General requirements*

IEC 60364 (all parts), *Low-voltage electrical installations*

IEC 60417, *Graphical symbols for use on equipment - 12-month subscription to regularly updated online database comprising all graphical symbols published in IEC 60417*

IEC 60445, *Basic and safety principles for man-machine interface, marking and identification - Identification of equipment terminals, conductor terminations and conductors*

IEC 60664-1, *Insulation coordination for equipment within low-voltage systems - Part 1: Principles, requirements and tests*

CISPR 11:2024, *Industrial, scientific and medical equipment - Radio-frequency disturbance characteristics - Limits and methods of measurement*

CISPR 14 (all parts), *Electromagnetic compatibility - Requirements for household appliances, electric tools and similar apparatus*

CISPR 16 (all parts), *Specification for radio disturbance and immunity measuring apparatus and methods*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions in IEC 60050-411, and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

NOTE For definitions concerning cooling and coolants, other than those in 3.17 to 3.22, IEC 60034-6 applies.

3.1.1

rated value

quantity value assigned, generally by a manufacturer, for a specified operating condition of a machine

Note 1 to entry: The rated voltage or voltage range is the rated voltage or voltage range between lines at the machine terminals.

[SOURCE: IEC 60050-411:1996, 411-51-23, modified – Note 1 to entry has been added.]

3.1.2

rating

set of rated values and operating conditions

[SOURCE: IEC 60050-411:1996, 411-51-24]

3.1.3

rated output

<of a machine> value of the output included in the rating

3.1.4

load

all the values of the, in case of a generator, electrical and, in case of a motor, mechanical quantities that signify the demand made on a rotating machine by an electrical circuit or a mechanism at a given instant

[SOURCE: IEC 60050-411:1996, 411-51-01, modified – “in case of a generator” and “in case of a motor” have been added.]

3.1.5

no-load

<operation> state of a machine rotating with zero output power (but under otherwise normal operating conditions)

[SOURCE: IEC 60050-411:1996, 411-51-02, modified – “(but under otherwise normal operating conditions)” has been added.]

3.1.6

full load

load which causes a machine to operate at its rating

[SOURCE: IEC 60050-411:1996, 411-51-10]

3.1.7

full load value

quantity value for a machine operating at full load

Note 1 to entry: This concept applies to power (for example “full load power”), torque, current, speed, etc.

[SOURCE: IEC 60050-411:2007, 411-50-25, modified – Note 1 to entry has been added.]

3.1.8

rest and de-energized

complete absence of all movement and of all electrical supply or mechanical drive

[SOURCE: IEC 60050-411:1996, 411-51-03]

3.1.9

duty

statement of the load(s) to which the machine is subjected, including, if applicable, starting, electric braking, no-load and rest and de-energized periods, and including their durations and sequence in time

[SOURCE: IEC 60050-411:1996, 411-51-06]

3.1.10

duty type

continuous, short-time or periodic duty, comprising one or more loads remaining constant for the duration specified, or a non-periodic duty in which generally load and speed vary within the permissible operating range

[SOURCE: IEC 60050-411:1996, 411-51-13]

3.1.11

cyclic duration factor

ratio between the period of loading, including starting and electric braking, and the duration of the duty cycle, expressed as a percentage

[SOURCE: IEC 60050-411:1996, 411-51-09]

3.1.12

locked-rotor torque

minimum measured torque the motor develops at its shaft end with the rotor locked, over all its angular positions, at rated voltage and frequency

[SOURCE: IEC 60050-411:1996, 411-48-06, modified – “smallest” has been replaced with “minimum”.]

3.1.13

locked-rotor current

greatest steady-state root mean square (RMS) current taken from the line with the rotor locked, over all angular positions of its rotor, at rated voltage and frequency

[SOURCE: IEC 60050-411:1996, 411-48-16, modified – “motor held at rest” has been replaced with “rotor locked”.]

3.1.14**pull-up torque**

<of an AC motor> minimum steady-state asynchronous torque which the motor develops between zero speed and the speed which corresponds to the breakdown torque, when the motor is supplied at the rated voltage and frequency

Note 1 to entry: This definition does not apply to those asynchronous motors of which the torque continually decreases with increase in speed.

Note 2 to entry: In addition to the steady-state asynchronous torques, harmonic synchronous torques, which are a function of rotor load angle, will be present at specific speeds. At such speeds, the accelerating torque may be negative for some rotor load angles.

Note 3 to entry: Experience and calculation show this to be an unstable operating condition, and therefore, harmonic synchronous torques do not prevent motor acceleration, and are excluded from this definition.

[SOURCE: IEC 60050-411:1996, 411-48-42, modified – “smallest” has been replaced with “minimum”. Note 2 to entry has been modified. Note 3 to entry has been added.]

3.1.15**breakdown torque**

<of an AC motor> maximum steady-state asynchronous torque which the motor develops without an abrupt drop in speed, when the motor is supplied at the rated voltage and frequency

Note 1 to entry: This definition does not apply to motors with torques that continually decrease with increase in speed.

[SOURCE: IEC 60050-411:1996, 411-48-43]

3.1.16**pull-out torque**

<of a synchronous motor> maximum torque which the synchronous motor develops at synchronous speed with rated voltage, frequency and field current

[SOURCE: IEC 60050-411:1996, 411-48-44]

3.1.17**cooling**

procedure by means of which heat resulting from losses occurring in a machine is given up to a primary coolant, which may be continuously replaced or may itself be cooled by a secondary coolant in a heat exchanger

[SOURCE: IEC 60050-411:1996, 411-44-01]

3.1.18**coolant**

medium, liquid or gas, by means of which heat is transferred

[SOURCE: IEC 60050-411:1996, 411-44-02]

3.1.19**primary coolant**

medium, liquid or gas, which, being at a lower temperature than a part of a machine and in contact with it, removes heat from that part

[SOURCE: IEC 60050-411:1996, 411-44-03]