

SLOVENSKI STANDARD

SIST EN 60034-2:1999/A1:1999

01-april-1999

Rotating electrical machines - Part 2: Methods for determining losses and efficiency of rotating electrical machinery from tests (excluding machines for traction vehicles) (IEC 60034-2:1972/A1:1995)

Rotating electrical machines -- Part 2: Methods for determining losses and efficiency of rotating electrical machinery from tests (excluding machines for traction vehicles)

Drehende elektrische Maschinen -- Teil 2: Verfahren zur Bestimmung der Verluste und des Wirkungsgrades von drehenden elektrischen Maschinen aus Prüfungen (ausgenommen Maschinen für Schienen- und Straßenfahrzeuge)

Machines électriques tournantes -- Partie 2: Méthodes pour la détermination des pertes et du rendement des machines électriques tournantes à partir d'essais (à l'exclusion des machines pour véhicules de traction)

Ta slovenski standard je istoveten z: EN 60034-2:1996/A1:1996

ICS:

29.160.01	Rotacijski stroji na splošno	Rotating machinery in general
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SIST EN 60034-2:1999/A1:1999 **en**

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EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 60034-2/A1

November 1996

UDC 621.313.017.2/.6.017.8.083.001.4
ICS 29.160.00

Descriptors: Rotating electrical machines, power losses, efficiency, determination, tests, power measurements

English version

Rotating electrical machines
Part 2: Methods for determining losses and efficiency of rotating electrical machinery from tests (excluding machines for traction vehicles)
(IEC 34-2:1972/A1:1995)

Machines électriques tournantes
Partie 2: Méthodes pour la
détermination des pertes et du
rendement des machines électriques
tournantes à partir d'essais
(à l'exclusion des machines pour
véhicules de traction)
(CEI 34-2:1972/A1:1995)

Drehende elektrische Maschinen
Teil 2: Verfahren zur Bestimmung der
Verluste und des Wirkungsgrades von
drehenden elektrischen Maschinen aus
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This amendment A1 modifies the European Standard EN 60034-2:1996; it was approved by CENELEC on 1996-07-02. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this amendment 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 amendment 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, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

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

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Foreword

The text of amendment 1:1995 to the International Standard IEC 34-2:1972, prepared by SC 2G, Test methods and procedures, of IEC TC 2, Rotating machinery, was submitted to the formal vote and was approved by CENELEC as amendment A1 to EN 60034-2 on 1996-07-02 without any modification.

The following dates were fixed:

- latest date by which the amendment has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 1997-06-01
- latest date by which the national standards conflicting with the amendment have to be withdrawn (dow) 1997-06-01

For products which have complied with HD 53.2 S1:1974 (converted into EN 60034-2) before 1997-06-01, as shown by the manufacturer or by a certification body, this previous standard may continue to apply for production until 2002-06-01.

Endorsement notice

The text of amendment 1:1995 to the International Standard IEC 34-2:1972 was approved by CENELEC as an amendment to the European Standard without any modification.

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NORME
INTERNATIONALE
INTERNATIONAL
STANDARD

CEI
IEC
34-2

1972

AMENDEMENT 1
AMENDMENT 1

1995-04

Amendement 1

Machines électriques tournantes –

Deuxième partie:

Méthodes pour la détermination des pertes et
du rendement des machines électriques tournantes
à partir d'essais (à l'exclusion des machines
pour véhicules de traction)

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Amendment 1

Rotating electrical machines –

Part 2:

Methods for determining losses and efficiency
of rotating electrical machinery from tests
(excluding machines for traction vehicles)

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FOREWORD

This amendment has been prepared by sub-committee 2G: Test methods and procedures, of IEC technical committee 2: Rotating machinery.

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

DIS	Reports on voting
2G(CO)21 2G(CO)22	2G(CO)25 2G(CO)26

Full information on the voting for the approval of this amendment can be found in the reports on voting indicated in the above table.

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3 General

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Replace the second paragraph by the following:

Unless otherwise agreed, measuring instruments and their accessories, such as measuring transformers, shunts and bridges used during the test shall have an accuracy of 0,5 or better (IEC 51), excluding three-phase wattmeters and wattmeters for low power factor, for which an accuracy class shall be 1,0 or better.

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3.1 List of symbols

Replace the list by the following:

C	= retardation constant
I	= current
I_1	= load current at rated voltage
I_{1r}	= main primary current at reduced voltage
I_o	= no-load current at rated voltage
I_{or}	= no-load current at reduced voltage
J	= moment of inertia
n	= speed of rotation in revolutions per minute
n_N	= rated speed
N	= number of full revolutions of the shaft

P	= losses which can be directly measured
P_1	= power absorbed at rated voltage
P_{1r}	= power absorbed by main primary winding at reduced voltage
P_{Fe}	= iron losses defined in accordance with 6.2 a), 8.1 a) and 10.1 a)
P_f	= friction and windage losses ("mechanical losses") defined in accordance with 6.2 b), 6.2 c), 8.1 b), 8.1 c), 10.1 b) and 10.1 c))
P_k	= short-circuit losses representing the sum of the $I^2 R$ losses in operating windings on load in accordance with 10.2 and additional load losses in accordance with 10.4
P_t	= total of the losses during the retardation test
S	= angular displacement of the machine shaft
s	= slip
U	= excitation voltage across terminals of main rheostat
U_e	= total excitation voltage
U_n	= rated voltage
U_r	= reduced voltage for load test
δ	= per unit deviation of rotational speed from rated speed
φ	= load phase angle at rated voltage
φ_r	= load phase angle at reduced voltage
φ_o	= no-load phase angle at rated voltage
φ_{or}	= no-load phase angle at reduced voltage

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7 Determination of efficiency

Add the following new subclause:

7.1.4.2 Additional load losses in d.c. motors supplied by static power converters

Whenever the current ripple factor (see 2.29, IEC 34-1: 1994) of the armature current exceeds 0,1, the additional losses caused by the a.c. component of the armature current shall be considered in addition to the losses specified in 7.1.4.

They shall be calculated as the eddy current losses caused by the fundamental component of the above-mentioned a.c. component.

The method of calculation used shall be the subject of agreement between manufacturer and purchaser.

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7.2 Total loss measurement

Delete this subclause and replace by the following:

7.2 Total loss measurement

7.2.1 Electrical back-to-back tests (see clause 16)

When identical machines are run at essentially the same rated conditions, the losses supplied from the electrical system are assumed to be equally distributed and the efficiency is calculated as 7.3.3.

The test shall be made as nearly as possible at the temperature attained in operation at the end of the time specified in the rating. No winding temperature correction shall be made.

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Add, after subclause 7.2.1, the following new subclause 7.3:

7.3 Direct measurement of efficiency

7.3.1 Braking test

When the machine is run at rated conditions of speed, voltage and current, the efficiency is then taken as the ratio of output to input. The test shall be made as nearly as possible at the temperature attained in operation at the end of the time specified in the rating. No winding temperature correction shall be made.

7.3.2 Calibrated machine test (see clause 13)

When the machine is run at rated conditions of speed, voltage and current, the efficiency is taken as the ratio of output to input.

The test shall be made as nearly as possible at the temperature attained in operation at the end of the time specified in the rating. No winding temperature correction shall be made.

7.3.3 Mechanical back-to-back test

When identical machines are run at essentially the same rated conditions, the losses are assumed to be equally distributed, and the efficiency is calculated from half the total losses and the electrical input (in the case of a motor) or electrical output (in the case of a generator).

The test shall be made as nearly as possible at the temperature attained in operation at the end of the time specified in the rating. No winding temperature correction shall be made.

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9.2 Total loss measurement

Delete this subclause and replace it by the following:

9.2 Total loss measurement

9.2.1 Electrical back-to-back test (see clause 16)

When identical machines are run at essentially the same rated conditions, the losses supplied from the electrical system are assumed to be equally distributed and the efficiency is calculated from half the total losses and the electrical input to one machine.

The test shall be made as nearly as possible at the temperature attained in operation at the end of the time specified in the rating. No winding temperature correction shall be made.

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NOTE – Where a gear box is required, as in the case of induction motors, it is necessary for the loss in this to be deducted from the electrical input before determining the losses in the electrical machine.

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Add, after the subclause 9.2.1, the following new subclause 9.3:

9.3 Direct measurement of efficiency

9.3.1 Braking test

When the machine is run at rated conditions of speed, voltage and current, the efficiency is taken as the ratio of output to input.

The test shall be made as nearly as possible at the temperature attained in operation at the end of the time specified in the rating. No winding temperature correction shall be made.

9.3.2 Calibrated machine test (see clause 13)

When the machine is running in accordance with clause 13 at rated conditions of speed, voltage and current, the efficiency is then taken as the ratio of output to input.

The test shall be made as nearly as possible at the temperature attained in operation at the end of the time specified in the rating. No winding temperature correction shall be made.

9.3.3 Mechanical back-to-back test

When identical machines are run at essentially the same rated conditions, the losses are assumed to be equally distributed, and the efficiency shall be calculated from half the total loss and the electrical input. The driven machine operates as an induction generator if a source of reactive power is provided, and a suitable load is connected to its terminals.

The test shall be made as nearly as possible at the temperature attained in operation at the end of the time specified in the rating. No winding temperature correction shall be made.

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10.1 Constant losses, item c)

Existing "Note" shall be marked as "Note 1".

Add the following Note 2:

NOTE 2 – For machines indirectly cooled or directly cooled by hydrogen, see 11.5 of IEC 34-1.

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11.1.3 Load losses

Delete the text and replace it by the following:

These consist of $I^2 R$ losses in primary windings. The $I^2 R$ losses in the primary winding are normally measured during the short-circuit test described in 11.1.4.

When they are to be given separately, the losses are calculated from the rated current and the resistance of the windings corrected to the reference temperature.

11.1.4 Additional load losses

Add to the second paragraph the following sentence:

Unless otherwise specified, it is assumed that the additional load losses vary as the square of the armature current.

Page 43

11.2 Total loss measurement

Delete this subclause and replace it by the following:

11.2 Total loss measurement

11.2.1 Electrical back-to-back test (see clause 16)

When identical machines are run at essentially the same rated conditions, the losses are assumed to be equally distributed and the efficiency shall be calculated as in 11.3.3.

The test shall be made as nearly as possible at the temperature attained in operation at the end of the time specified in the rating. No winding temperature correction shall be made.

11.2.2 Zero power factor test (see clause 14)

When the machine is run at rated conditions of speed, voltage and current, the total losses are equivalent to the absorbed power during the test, corrected for the difference between actual and the full-load exciting current losses.

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Add, after subclause 11.2.2, the new subclause 11.3:

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11.3 Direct measurement of efficiency

11.3.1 Braking test

When the machine is run at rated conditions of speed, voltage and current, the efficiency is taken as the ratio of output to input.

The test shall be made as nearly as possible at the temperature attained in operation at the end of the time specified in the rating. No winding temperature correction shall be made.

11.3.2 Calibrated machine test (see clause 13)

When the machine is run at rated conditions of speed, voltage and current, the efficiency is taken as the ratio of output to input.

The test shall be made as nearly as possible at the temperature attained in operation at the end of the time specified in the rating. No winding temperature correction shall be made.