

Rotating electrical machines

Part 2.2: Specific methods for determining separate losses of large machines from tests — Supplement to AS 60034.2.1 (IEC 60034-2-2:2010, (ED. 1.0) MOD)



AS 60034.2.2:2023

This Australian Standard ® was prepared by EL-009, Rotating Electrical Machinery. It was approved on behalf of the Council of Standards Australia on 10 October 2023.

This Standard was published on 27 October 2023.

The following are represented on Committee EL-009:

Airconditioning & Refrigeration Equipment Manufacturers Association of Australia
Australian Industry Group
Department of Industry, Science and Resources
Engineers Australia
Fan Manufacturers Association of Australia and New Zealand

This Standard was issued in draft form for comment as DR AS 60034.2.2:2023.

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ISBN 978 1 76139 395 2

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Originated as part of AS 1359.33—1983.
Previous edition AS 1359.102.1—1997.
Revised and redesignated as AS 60034.2.2:2023.



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Preface

This Standard was prepared by the Standards Australia Committee EL-009, Rotating Electrical Machinery, to supersede AS 1359.102.1—1997, *Rotating electrical machines —General requirements, Part 102.1: Methods for determining losses and efficiency—General*.

The objective of this document is to establish additional methods of determining separate losses and to define an efficiency for large rotating electrical machines, supplementing AS 60034.2.1. These methods apply when full-load testing is not practical and result in a greater uncertainty.

The specific methods described are the following:

- (a) Calibrated-machine method.
- (b) Retardation method.
- (c) Calorimetric method.

This document is an adoption with national modifications and has been reproduced from IEC 60034-2-2:2010 (ED. 1.0), *Rotating electrical machines – Part 2-2: Specific methods for determining separate losses of large machines from tests – Supplement to IEC 60034-2-1*.

The modifications are additional requirements and are set out in Appendix ZZ, which has been added at the end of the source text.

Appendix ZZ lists the modifications to IEC 60034-2-2:2010 (ED. 1.0) for the application of this document in Australia.

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ROTATING ELECTRICAL MACHINES –

**Part 2-2: Specific methods for determining
separate losses of large machines from tests –
Supplement to IEC 60034-2-1**

FOREWORD

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

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

FDIS	Report on voting
2/1585/FDIS	2/1595/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.

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 amendment and the base publication will remain unchanged until the stability 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 2-2: Specific methods for determining separate losses of large machines from tests – Supplement to IEC 60034-2-1

1 Scope

This part of IEC 60034 applies to large rotating electrical machines and establishes additional methods of determining separate losses and to define an efficiency supplementing IEC 60034-2-1. These methods apply when full-load testing is not practical and result in a greater uncertainty.

NOTE In situ testing according to the calorimetric method for full-load conditions is recognized.

The specific methods described are:

- Calibrated-machine method.
- Retardation method.
- Calorimetric method.

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

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60034-1 and IEC 60034-2-1 apply, as well as the following.

3.1

calibrated machine

machine whose mechanical power input/output is determined, with low uncertainty, using measured electrical output/input values according to a defined test procedure

3.2

calibrated-machine method

method in which the mechanical input/output to/from an electrical machine under test is determined from the measurement of the electrical input/output of a calibrated machine mechanically coupled to the test machine

3.3

retardation method

method in which the separate losses in a machine under test are deduced from the measurements of the deceleration rate of its rotating components when only these losses are present

3.4**calorimetric method**

method in which the losses in a machine are deduced from the measurements of the heat generated by them

3.5**thermal equilibrium**

the state reached when the temperature rises of the several parts of the machine do not vary by more than a gradient of 2 K per hour

[IEV 411-51-08]

4 Symbols

In addition to the symbols in IEC 60034-2-1, the following apply.

4.1 Quantities

A	is an area, m^2 ,
C	is the retardation constant, $\text{kg m}^2 \text{min}^2$,
c_p	is the specific heat capacity of the cooling medium, $\text{J}/(\text{kg K})$,
h	is the coefficient of heat transfer, $\text{W}/(\text{m}^2 \text{K})$,
J	is the moment of inertia, kg m^2 ,
n	is the speed, min^{-1} ,
P_{1E}	is the excitation power supplied by a separate source, W ,
P_k	is the constant loss, W ,
P_{el}	is the electrical power, excluding excitation, W ,
P_e	is the excitation power, W ,
P_{Fe}	is the iron loss, W ,
P_{fw}	is the friction and windage loss, W ,
P_{sc}	is the short-circuit loss, W ,
P_{mech}	is the mechanical power, W ,
P_T	is the total loss, W ,
Q	is the volume rate of flow of the cooling medium, m^3/s ,
t	is the time, s ,
v	is the exit velocity of cooling medium, m/s ,
Δp	is the difference between the static pressure in the intake nozzle and ambient pressure, N/m^2 ,
$\Delta\theta$	is the temperature rise of the cooling medium, or the temperature difference between the machine reference surface and the external ambient temperature, K ,
δ	is the per unit deviation of rotational speed from rated speed,
ρ	is the density of the cooling medium, kg/m^3 ,
θ	is the temperature, $^{\circ}\text{C}$.

4.2 Subscripts

irs	for inside reference surface,
ers	for outside reference surface,
E	for exciter,
c	for the cooling circuit,