

Australian Standard<sup>®</sup>

---

**Rotating electrical machinery—  
General requirements**

**Part 102.2: Methods for determining  
losses and efficiency—Calorimetric  
method**

---

This Australian Standard was prepared by Committee EL/9, Rotating Electrical Machinery. It was approved on behalf of the Council of Standards Australia on 10 March 1997 and published on 5 July 1997.

---

The following interests are represented on Committee EL/9:

- Australian British Chamber of Commerce
  - Australian Chamber of Commerce and Industry
  - Australian Electrical and Electronic Manufacturers Association
  - Bureau of Steel Manufacturers of Australia
  - Department of Defence
- 

**Review of Australian Standards.** To keep abreast of progress in industry, Australian Standards are subject to periodic review and are kept up to date by the issue of amendments or new editions as necessary. It is important therefore that Standards users ensure that they are in possession of the latest edition, and any amendments thereto.

Full details of Australian Standards and related publications will be found in the Standards Australia Catalogue of Publications; this information is supplemented each month by the magazine 'The Australian Standard', which subscribing members receive, and which gives details of new publications, new editions and amendments, and of withdrawn Standards.

Suggestions for improvements to Australian Standards, addressed to the head office of Standards Australia, are welcomed. Notification of any inaccuracy or ambiguity found in an Australian Standard should be made without delay in order that the matter may be investigated and appropriate action taken.

---

*This Standard was issued in draft form for comment as DR 96092.*

Australian Standard<sup>®</sup>

---

**Rotating electrical machinery—  
General requirements**

**Part 102.2: Methods for determining  
losses and efficiency—Calorimetric  
method**

---

Originated as part of AS 1359.33—1983.  
Revised and redesignated in part as AS 1359.102.2—1997.

## PREFACE

This Standard was prepared by the Standards Australia Committee EL/9, Rotating Electrical Machinery, to supersede in part, AS 1359.33—1983, *General requirements for rotating electrical machines, Part 33: Methods for determining losses and efficiency*.

This Standard is based on IEC 34-2A, *Rotating electrical machines, Part 2: Methods for determining losses and efficiency of rotating electrical machinery from tests (excluding machines for traction vehicles)*, First supplement: *Measurement of losses by the calorimetric method*.

This Standard is a Part of the AS 1359 series listed in AS 1359.0, Part 1, titled: *Introduction and list of Parts*.

The objective of this Standard is to provide the rotating electrical machine industry with the calorimetric method of determining losses and efficiency mainly of large generators.

---

## CONTENTS

	<i>Page</i>
1 SCOPE AND REFERENCED DOCUMENTS . . . . .	3
2 GENERAL CONSIDERATIONS FOR CALORIMETRIC TESTING . . . . .	3
3 WATER AS THE COOLING MEDIUM . . . . .	7
4 AIR AS THE COOLING MEDIUM . . . . .	15

### © Copyright — STANDARDS AUSTRALIA

Users of Standards are reminded that copyright subsists in all Standards Australia publications and software. Except where the Copyright Act allows and except where provided for below no publications or software produced by Standards Australia may be reproduced, stored in a retrieval system in any form or transmitted by any means without prior permission in writing from Standards Australia. Permission may be conditional on an appropriate royalty payment. Requests for permission and information on commercial software royalties should be directed to the head office of Standards Australia.

Standards Australia will permit up to 10 percent of the technical content pages of a Standard to be copied for use exclusively in-house by purchasers of the Standard without payment of a royalty or advice to Standards Australia.

Standards Australia will also permit the inclusion of its copyright material in computer software programs for no royalty payment provided such programs are used exclusively in-house by the creators of the programs.

Care should be taken to ensure that material used is from the current edition of the Standard and that it is updated whenever the Standard is amended or revised. The number and date of the Standard should therefore be clearly identified.

The use of material in print form or in computer software programs to be used commercially, with or without payment, or in commercial contracts is subject to the payment of a royalty. This policy may be varied by Standards Australia at any time.

## STANDARDS AUSTRALIA

### Australian Standard

## Rotating electrical machines—General requirements

### Part 102.2: Methods for determining losses and efficiency—Calorimetric method

#### 1 SCOPE AND REFERENCED DOCUMENTS

**1.1 Scope** This Standard specifies methods for determining losses and efficiency that have been devised mainly for large generators, but the principles used can also be applied to other machines.

The calorimetric method can be used to determine the efficiency of electrical rotating machinery either—

- (a) by the determination of the total losses on load; or
- (b) by the determination of the segregated losses and hence the conventional total loss by summation of the segregated losses.

Depending upon the circumstances, calorimetric measurements may be made in two different ways as follows:

- (i) Measurement of the quantity and rise in temperature of the cooling medium (direct method).
- (ii) Calibration of the rise in temperature of the cooling medium.

The calorimetric measurements should be performed for each cooling circuit, either primary or secondary, separately.

The symbols used are shown in Table 1.

**1.2 Referenced documents** The following Standards are referred to in this Standard:

AS

2360 Measurement of fluid flow in closed conduits

2360.1 Pressure differential methods (published in Sections)

#### 2 GENERAL CONSIDERATIONS FOR CALORIMETRIC TESTING

**2.1 Stable conditions** Provided that the operating conditions and inlet temperature of the cooling medium are sufficiently stable, thermal equilibrium can be considered to have been achieved when measurements of rise in temperature and the volume rate of flow of the cooling medium indicate that the losses are constant to within  $\pm 0.01$  p.u. over a period of 2 h, or when the temperature rise of the cooling medium does not vary by more than  $\pm 0.01$  p.u. in 1 h, the volume rate of flow being constant.

If the inlet temperature of the cooling medium or the temperature of the windings varies by more than  $\pm 0.3^\circ\text{C}/\text{h}$ , it may be very difficult to achieve thermal equilibrium. In such cases, a lower value should be aimed at. For the calorimetric measurement of air, this condition may be regarded as a criterion of thermal stability. However, for the determination of total losses or when close tolerances on measurement are not required, a variation of  $\pm 0.5^\circ\text{C}/\text{h}$  is permissible.

If the inlet temperature of the cooling medium does not satisfy the conditions specified above, it may be necessary to postpone the tests until more suitable conditions prevail.