

Australian Standard™

**Atmospheric heating of vessels  
containing fluids—Estimation of  
maximum temperature**



Standards Australia

This Australian Standard was prepared by Committee ME/1, Pressure Equipment. It was approved on behalf of the Council of Standards Australia on 30 November 1999 and published on 3 April 2000.

---

The following interests are represented on Committee ME/1:

A.C.T. WorkCover  
Australasian Corrosion Association  
Australasian Institute of Engineer Surveyors  
Australian Aluminium Council  
Australian Building Codes Board  
Australian Chamber of Commerce and Industry  
Australian Industry Group  
Australian Institute of Energy  
Australian Institute of Petroleum  
Australian Liquefied Petroleum Gas Association  
Boiler and Pressure Vessel Manufacturers Association of Australia  
Bureau of Steel Manufacturers of Australia  
Department for Administrative and Information Services, S.A.  
Department of Employment, Training and Industrial Relations, Qld  
Department of Industries & Business, N.T.  
Department of Infrastructure, Energy and Resources, Tas.  
Department of Labour, New Zealand  
Electricity Engineers Association, New Zealand  
Electricity Supply Association of Australia  
Institute of Materials Engineering Australasia  
Institution of Engineers, Australia  
Institution of Professional Engineers, New Zealand  
National Association of Testing Authorities, Australia  
New Zealand Engineering Federation  
New Zealand Heavy Engineering Research Association  
New Zealand Institute of Welding  
New Zealand Petrochemical Users Group  
New Zealand Timber Industry Federation  
Victorian WorkCover Authority  
Welding Technology Institute of Australia  
WorkCover N.S.W.  
WorkSafe Western Australia

---

#### **Keeping Standards up-to-date**

Standards are living documents which reflect progress in science, technology and systems. To maintain their currency, all Standards are periodically reviewed, and new editions are published. Between editions, amendments may be issued. Standards may also be withdrawn. It is important that readers assure themselves they are using a current Standard, which should include any amendments which may have been published since the Standard was purchased.

Detailed information about Standards can be found by visiting the Standards Australia web site at [www.standards.com.au](http://www.standards.com.au) and looking up the relevant Standard in the on-line catalogue.

Alternatively, the printed Catalogue provides information current at 1 January each year, and the monthly magazine, *The Australian Standard*, has a full listing of revisions and amendments published each month.

We also welcome suggestions for the improvement in our Standards, and especially encourage readers to notify us immediately of any apparent inaccuracies or ambiguities. Contact us via email at [mail@standards.com.au](mailto:mail@standards.com.au), or write to the Chief Executive, Standards Australia International Ltd, PO Box 1055, Strathfield, NSW 2135.

---

*This Standard was issued in draft form for comment as DR 98125.*

Australian Standard™

**Atmospheric heating of vessels  
containing fluids—Estimation of  
maximum temperature**

Originally as AS 2872—1988.  
Second edition 2000.

**COPYRIGHT**

© Standards Australia International

All rights are reserved. No part of this work may be reproduced or copied in any form or by any means, electronic or mechanical, including photocopying, without the written permission of the publisher.

Published by Standards Australia International Ltd  
PO Box 1055, Strathfield, NSW 2135, Australia

ISBN 0 7337 3084 1

## PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee ME/1, Pressure Equipment to supersede AS 2872—1988.

This Standard is the result of a consensus among representatives on the Joint Committee to produce it as an Australian Standard. Consensus means general agreement by all interested parties. Consensus includes an attempt to remove all objections and implies much more than the concept of a simple majority, but not necessarily unanimity. It is consistent with this meaning that a member may be included in the Committee list and yet not in full agreement with all clauses of this Standard.

Changes since the last edition include the following:

- (a) Inclusion of properties of the refrigerant R134a.
- (b) The addition of Appendix C which provides the theoretical background for the method given in this Standard.
- (c) Inclusion of Appendix D which provides a sample of calculation of thermodynamic properties for refrigerant R404A.

The atmospheric data presented is believed to be conservatively realistic, but provision has been made for departure from the data where, for a particular location, more accurate historical data are available.

This method of estimation should be an aid to investigators concerned with—

- (i) the prediction of maximum temperatures and pressures in vessels;
- (ii) estimation of ullage requirements;
- (iii) assessment of maintenance requirements; and
- (iv) writing of application Standards.

Acknowledgment is gratefully made of the considerable assistance provided by Orica Engineering Pty Ltd (formerly IC Australia Engineering Pty Ltd), which included technical investigation and the development of the data and calculation methods presented in the Standard.

The terms 'normative' and 'informative' have been used in this Standard to define the application of the appendix to which they apply. A 'normative' appendix is an integral part of a Standard, whereas an 'informative' appendix is only for information and guidance.

## CONTENTS

	<i>Page</i>
1 SCOPE .....	4
2 NOTATION AND CALCULATION PARAMETERS .....	4
3 METEOROLOGICAL DATA .....	6
4 CALCULATION OF TEMPERATURES .....	6
5 VAPOUR PRESSURE .....	6
 APPENDICES	
A PROPERTIES OF FLUIDS .....	3
B SAMPLE CALCULATIONS AND CALCULATION SHEET .....	22
C THEORETICAL BACKGROUND TO THE METHOD GIVEN IN THIS STANDARD .....	25
D SAMPLE CALCULATION OF THERMODYNAMIC PROPERTIES FOR REFRIGERANT R404A .....	33

## STANDARDS AUSTRALIA

## Australian Standard

**Atmospheric heating of vessels containing fluids—  
 Estimation of maximum temperature**

**1 SCOPE** This Standard sets out a method for calculating temperatures and the corresponding vapour pressures of fluids in vessels subject to atmospheric heating in the hottest month of the year in various locations around Australia. It is primarily intended for compressed liquefied gases stored in steel containers, and is equally applicable to stationary as well as transport vessels. Because the method is quite general it may also be used for permanent gases and liquids, provided that the liquids are not too viscous (upper limit approximately 1 Pa.s). It may also be used for above-ground pipelines.

Some characteristic properties of a number of fluids are shown graphically in Appendix A.

## NOTES:

- 1 Sample calculations are shown in Appendix B.
- 2 The theoretical background for the method given in this Standard is given in Appendix C.

**2 NOTATION AND CALCULATION PARAMETERS** For the purpose of this Standard, the following notation applies:

- $A$  = total surface area, in square metres
- $A_s$  = daily mean projected area exposed to sun, in square metres
  - = 0 if vessel is shaded or under cover
- $a$  = absorptivity of surface
  - = 0.15 for aluminium
  - = 0.25 for clean white painted surface
  - = 0.25 for slightly dirty aluminium surface
  - = 0.30 for slightly dirty white painted surface
  - = 0.35 for dirty white painted surface but which is still recognizably white
  - = 0.40 for stainless steel clean surface
  - = 0.45 for slightly dirty stainless steel surface
  - = 0.45–0.60 for coloured surfaces (see manufacturer's data)
  - = 0.75 for heavily rusted surface
  - = 0.95 for matt black surface

NOTE: For painted surfaces that are dusty or degraded, use an intermediate value between the relevant value above and 0.75 (heavily rusted surface).

$$b = \frac{a}{h} \left( \frac{A_s}{A} \right), \text{ in square metre kelvins per watt}$$