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.

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Atmospheric heating of vessels containing fluids—Estimation of maximum temperature

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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 ICI 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.

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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).

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

