Australian Standard™

Heat exchangers— Tubeplates— Method of design

This Australian Standard was prepared by Committee ME/1, Pressure Equipment. It was approved on behalf of the Council of Standards Australia on 16 April 1999 and published on 5 July 1999.

The following interests are represented on Committee ME/1:

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Heat exchangers— Tubeplates— Method of design

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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 3857—1990, *Heat exchangers—Tubeplates—Method of design*. Acknowledgment is gratefully made of the considerable assistance provided by Orica Engineering Pty Ltd (formerly ICI Australia Engineering Pty Ltd) which developed this method of design.

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 objection 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 be in full agreement with all clauses of this Standard.

The main change in this revision is the incorporation of Amendment No. 1 to AS 3857—1990.

The Standard covers a method for the design of heat exchanger tubeplates. The Standard was originally drafted with the intention that it would be incorporated into AS 1210, *Pressure vessels*, as a replacement for the method contained in the first and second editions of AS 1210 but the draft was subsequently terminated. However, during the course of development of the proposal, its content was extended and it is now a self-contained method of design, suitable for publication as a separate Standard.

The Standard provides an additional method to other methods specified in AS 1210 for the design of tubeplates for heat exchangers complying with that Standard. The method may also be suitable for the design of some boiler tubeplates.

Although the design method may appear to be somewhat complex, it is no more so than some design methods for other pressure vessel components such as flanges.

While the method is applicable to long hand calculations, its most effective use will be achieved by programming a computer. An appendix provides a simple algorithm for calculating Lord Kelvin's modified Bessel functions and this algorithm allows programs to be compiled on a computer. Tabulated values of the functions are also provided in the appendix. Suggested worksheets and worked examples of calculations are included in another appendix.

As the proposed design method allows actual stresses at any location to be determined, it can be used for heat exchangers designed to AS 1210 Supplement 1, *Unfired Pressure vessels—Advanced design and construction* (Supplement to AS 1210—1997).

The theoretical background for the method given in this Standard is given in a technical paper titled 'Australian Tubesheet Code' by P McGowan and I Mirovics presented at the ASME Conference on Pressure Vessels and Piping at Nashville, Tennesee in June 1990.

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

STANDARDS AUSTRALIA

Australian Standard

Heat exchangers—Tubeplates—Method of design

1 SCOPE This Standard sets out a method for designing flat, circular tubeplates of the following configurations:

(a) Fixed tubeplates as in heat exchangers consisting of two tubeplates clamped or welded to a shell between them, with or without an expansion joint in the shell.

(b) Tubeplates of U-tube or bayonet heat exchangers.

(c) Floating tubeplates.

Such tubeplates are used in shell-and-tube heat exchangers and in some types of boilers including fire-tube and waste heat boilers.

2 APPLICATION This Standard is intended for use in association with an appropriate pressure vessel or boiler Standard such as—

(a) shell-and-tube heat exchangers . . . . . AS 1210 or AS 1210 Supplement 1

(b) boilers . . . . . AS 1228.

Calculated and permissible stresses in the tubeplates, tubes and shell shall be determined from this Standard but all other design criteria specified in the relevant pressure vessel or boiler Standard shall apply.

In the application of this Standard it will also be necessary to determine metal temperature from other sources (see Clause 5.1).

3 REFERENCED DOCUMENTS The following documents are referred to in this Standard:

AS	
1210	Pressure vessels
1210 Supplement 1	Unfired pressure vessels—Advanced design and construction (Supplement to AS 1210—1997)
1228	Pressure equipment—Boilers
EJMA	Standards of the Expansion Joint Manufacturers Association, Inc.

4 MATERIALS AND COMPONENTS

4.1 Acceptable materials Materials for tubeplates and associated components shall comply with a material specification listed, or as otherwise permitted, in AS 1210, AS 1210 Supplement 1 or AS 1228, as appropriate.

4.2 Design strength The material design strengths, used in the analysis of the tubeplate, shall comply with the values specified, or as otherwise permitted, in AS 1210, AS 1210 Supplement 1 or AS 1228, as appropriate.

4.3 Coefficient of thermal expansion The values which shall be used for the mean coefficient of thermal expansion are given in Table 4.3.

4.4 Young modulus (modulus of elasticity) The values which shall be used for Young Modulus are given in Table 4.4.

4.5 Expansion joints Metallic expansion joints should comply with the requirements specified in the 'Standards of the Expansion Joint Manufacturers Associations, Inc.' or equivalent.