

Australian Standard®

Pressure equipment—Manufacture

This Australian Standard was prepared by Committee ME/1, Pressure Equipment. It was approved on behalf of the Council of Standards Australia on 17 January 1997 and published on 5 June 1997.

The following interests are represented on Committee ME/1:

A.C.T. WorkCover
Australasian Corrosion Association
Australasian Institute of Engineering Inspection
Australian Aluminium Council
Australian Building Codes Board
Australian Chamber of Commerce and Industry
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 Industrial Affairs, S.A.
Department of Labour, New Zealand
Department of Training and Industrial Relations, Qld
Electricity Corporation of New Zealand
Electricity Supply Association of Australia
Institute of Metals and Materials, Australasia
Institution of Engineers, Australia
Institution of Professional Engineers, New Zealand
Insurance Council of Australia
Metal Trades Industry Association of Australia
National Association of Testing Authorities, Australia
New Zealand Engineering Federation
New Zealand Heavy Engineering Research
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.
Work Health Authority, N.T.
Workplace Standards Authority, Tas.
WorkSafe, W.A.

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 all 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which subscribing members receive, and which gives details of new publications, new editions and amendments, and of withdrawn Standards.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 94387.

AS 4458—1997

Australian Standard[®]

Pressure equipment—Manufacture

First published as AS 4458—1997.

Incorporating:
Amdt 1—1999

PUBLISHED BY STANDARDS AUSTRALIA
(STANDARDS ASSOCIATION OF AUSTRALIA)
1 THE CRESCENT, HOMEBUSH, NSW 2140

ISBN 0 7337 1009 3

PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee ME/1 on Pressure Equipment.

This Standard is the result of a consensus among Australian and New Zealand representatives on the Joint Committee to produce this document as an Australian Standard. Consensus means general agreement by all 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 be in full agreement with all clauses of this Standard.

This Standard is one of the 'core' documents which form part of the revised arrangement of the pressure equipment Standards; and is intended to unify and revise the manufacturing requirements for the pressure equipment Standards, AS 1210, *Pressure vessels*, AS 1228, *Pressure equipment—Boilers* and AS 4041, *Pressure piping*.

In this way misunderstanding, cost and delay in manufacture can be reduced and safety can be improved. It is intended to avoid unnecessary duplication and promote greater confidence in reciprocal acceptance of qualified procedures.

This Standard is based largely on AS 1210, with due allowance for practices or requirements of AS 1228 and AS 4041.

Requirements have been formulated with a view to maximum compatibility with recognized International Standards.

Statements referred in mandatory terms in notes to tables and figures are deemed to be requirements of this 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.

© 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.

CONTENTS

	<i>Page</i>
SECTION 1 SCOPE AND GENERAL	
1.1 SCOPE	8
1.2 APPLICATION	8
1.3 REFERENCED DOCUMENTS	8
1.4 DEFINITIONS	8
SECTION 2 MATERIAL GROUPING	10
SECTION 3 DRAWINGS AND PRODUCT QUALITY	
3.1 CONSTRUCTION DRAWINGS	12
3.2 COMPETENCE OF MANUFACTURER	12
3.3 MANUFACTURE AND WORKMANSHIP	12
3.4 QUALITY ASSURANCE	12
3.5 INDEPENDENT INSPECTION	12
3.6 REPORTS	12
SECTION 4 MATERIAL IDENTIFICATION	
4.1 GENERAL	14
4.2 TYPES OF IDENTIFICATION OF MATERIALS	14
4.3 MATERIAL NOT FULLY IDENTIFIED	14
4.4 IDENTIFICATION AND MARKING	14
4.5 DEFECTS IN MATERIALS	16
SECTION 5 MATERIAL CUTTING	
5.1 GENERAL	17
5.2 THERMAL CUTTING	17
5.3 MECHANICAL CUTTING AND EDGE PREPARATION	19
5.4 EDGE EXAMINATION	19
5.5 EDGE FINISH	19
SECTION 6 FORMING OF PRESSURE EQUIPMENT COMPONENTS	
6.1 GENERAL	21
6.2 HOT FORMING OF PRESSURE EQUIPMENT COMPONENTS	22
6.3 COLD FORMING OF PRESSURE EQUIPMENT COMPONENTS FROM PLATES AND SECTIONS	27
6.4 COLD FORMING OF PIPES AND TUBES	30
6.5 INDUCTION BENDING OF PIPES	32
6.6 REPAIR OF SURFACE IMPERFECTIONS AFTER FORMING	33
SECTION 7 DIMENSIONAL TOLERANCES ON FORMED COMPONENTS AND PRESSURE EQUIPMENT	
7.1 GENERAL	34
7.2 TOLERANCES ON SHELL AND ENDS OF PRESSURE VESSELS AND BOILERS	34
7.3 GENERAL DIMENSIONAL TOLERANCES ON HEAT EXCHANGERS ..	38

	<i>Page</i>
7.4 DIMENSIONAL TOLERANCES FOR BOILER TUBES AFTER BENDING	38
7.5 DIMENSIONAL TOLERANCES FOR PIPE AND TUBE AFTER BENDING	39
SECTION 8 WELDED CONSTRUCTION—ASSEMBLY OF JOINTS PRIOR TO WELDING	
8.1 GENERAL	41
8.2 ASSEMBLY OF PARTS FOR WELDING	41
8.3 WELDED JOINTS—BOILERS AND PRESSURE VESSELS	42
8.4 WELDED JOINTS—PIPING	45
SECTION 9 WELDING QUALIFICATIONS, CONSUMABLES AND EQUIPMENT	
9.1 GENERAL	48
9.2 WELDING PROCEDURE QUALIFICATION	48
9.3 WELDER QUALIFICATION	48
9.4 RECORD OF WELDERS	48
9.5 WELDING CONSUMABLES AND EQUIPMENT	48
SECTION 10 WELDING PREHEAT	
10.1 GENERAL	51
10.2 METHOD OF PREHEATING	51
10.3 TEMPERATURE MEASUREMENT	51
10.4 CONTINUITY OF PREHEAT DURING WELDING	51
10.5 INTERRUN TEMPERATURES	51
10.6 PREHEAT TEMPERATURE	51
SECTION 11 WELDED JOINTS	
11.1 CONDITIONS FOR WELDED JOINTS PRIOR TO AND DURING WELDING	54
11.2 STRIKING OF PO	54
11.3 INTERRUN CLEANING	54
11.4 SURFACE OF FINISHED WELD	54
11.5 PEENING OF WELDS	55
11.6 REMOVAL OF TEMPORARY ATTACHMENTS AND ARC STRIKES ...	55
11.7 WELD REPAIRS	56
11.8 THERMAL STRAIGHTENING	56
11.9 STRUCTURAL WELDING	56
SECTION 12 NON-WELDED JOINTS	
12.1 GENERAL	57
12.2 THREADED JOINTS	57
12.3 FLANGED JOINTS	57
12.4 FLARED, FLARELESS AND COMPRESSION JOINTS	57
12.5 CAULKED JOINTS	58
12.6 SPECIAL FITTINGS	58

	<i>Page</i>
SECTION 13 WELD NON-DESTRUCTIVE EXAMINATION AND REPAIR	
13.1 GENERAL	59
13.2 NON-DESTRUCTIVE EXAMINATION	59
13.3 REPAIR TO WELDS AND COMPONENTS	59
13.4 PRODUCTION TEST PLATES	59
SECTION 14 HEAT TREATMENT	
14.1 GENERAL	60
14.2 TYPES OF HEAT TREATMENT	60
14.3 PRESSURE EQUIPMENT REQUIRING POSTWELD HEAT TREATMENT	60
14.4 STAGE OF POSTWELD HEAT TREATMENT	64
14.5 THICKNESS FOR POSTWELD HEAT TREATMENT	64
14.6 METHODS OF HEATING	65
14.7 POSTWELD HEAT TREATMENT PROCEDURE FOR FERRITIC STEELS	68
14.8 REDUCED HOLDING TEMPERATURES FOR POSTWELD HEAT TREATMENT	69
14.9 POSTWELD HEAT TREATMENT PROCEDURE FOR HIGH CHROMIUM ALLOY STEELS (MATERIAL GROUPS A AND B)	69
14.10 POSTWELD HEAT TREATMENT OF AUSTENITIC AND FERRITIC- AUSTENITIC CHROMIUM-NICKEL STEELS	69
14.11 EXEMPTIONS TO POSTWELD HEAT TREATMENT OF ATTACHMENTS TO POSTWELD HEAT TREATED EQUIPMENT	70
14.12 POSTWELD HEAT TREATMENT OF CLAD AND LINED EQUIPMENT	70
14.13 POSTWELD HEAT TREATMENT OF DISSIMILAR MATERIAL JOINTS	71
14.14 HEAT TREATMENT OF ELECTROSLAG WELDS	71
14.15 HEAT TREATMENT OF NON-FERROUS METALS	71
14.16 HEAT TREATMENT OF TEST PLATES	71
14.17 RECORDING OF HEAT TREATMENT	72
14.18 HEAT TREATMENT VERIFICATION TESTS FOR EQUIPMENT CONSTRUCTED IN MATERIAL GROUPS F AND G	72
SECTION 15 CLAD AND LINED CONSTRUCTION	
15.1 GENERAL	74
15.2 CONSTRUCTION	74
15.3 WELDING	74
15.4 POSTWELD TREATMENT	74
SECTION 16 BRAZED CONSTRUCTION	
16.1 GENERAL	75
16.2 MATERIAL FOR BRAZING	75
16.3 ASSEMBLY OF COMPONENTS	75
16.4 PREPARATION OF SURFACES FOR BRAZING	75
16.5 BRAZING PROCESSES	75
16.6 BRAZING PROCEDURES	76

	<i>Page</i>
16.7 BRAZING PERSONNEL	76
16.8 SURFACE OF FINISHED JOINT	76
16.9 POST-BRAZING OPERATIONS	76
16.10 REPAIR OF DEFECTIVE BRAZING	76
 SECTION 17 FORGED CONSTRUCTION	
17.1 GENERAL	77
17.2 METHODS OF FORMING FORGED ENDS	77
17.3 TOLERANCES ON PRESSURE VESSEL CYLINDERS AND ENDS	77
17.4 HEAT TREATMENT	77
17.5 NON-DESTRUCTIVE EXAMINATION	78
17.6 ATTACHMENT OF FORGINGS	78
17.7 WELDING OF FORGED PARTS	78
17.8 REPAIR OF IMPERFECTIONS	79
 SECTION 18 CAST CONSTRUCTION	
18.1 GENERAL	80
18.2 ATTACHMENT	80
18.3 NON-DESTRUCTIVE EXAMINATION	80
18.4 REPAIR OF IMPERFECTIONS	80
 SECTION 19 TUBE HOLE DRILLING AND TUBE EXPANSION	
19.1 GENERAL	81
19.2 TUBE HOLES—DIAMETER AND FINISH	81
19.3 LOCATION OF TUBE HOLES IN WELDED JOINTS FOR BOTH BOILERS AND HEAT EXCHANGERS	81
19.4 CONDITION OF TUBES	82
19.5 TUBEPLATE LIGAMENT	83
19.6 EXPANSION OF TUBES	83
 SECTION 20 PRESSURE TESTING	
20.1 GENERAL	85
20.2 TEST PRESSURE	85
 SECTION 21 FINAL CLEANING, SURFACE TREATMENT AND DIMENSIONAL CHECKS	
21.1 CLEANING AND SURFACE TREATMENT	86
21.2 DIMENSIONAL CHECKS	86
21.3 PROTECTION FOR TRANSPORT	86
 SECTION 22 NON-METALLIC PRESSURE EQUIPMENT	
22.1 SCOPE	87
22.2 GENERAL REQUIREMENTS	87

	<i>Page</i>
APPENDICES	
A LIST OF REFERENCED DOCUMENTS	88
B TYPICAL FERROUS MATERIAL SPECIFICATIONS	91
C MANUFACTURER'S DATA REPORT	92
D DESCALING OF AUSTENITIC AND FERRITIC-AUSTENITIC Cr-Ni STEEL VESSELS	96
E SUGGESTED PRACTICE ON PEENING OF WELDS	97
F RECOMMENDED DIMENSIONAL TOLERANCES FOR PRESSURE VESSELS AND PIPING	98

STANDARDS AUSTRALIA

Australian Standard

Pressure equipment—Manufacture

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE This Standard sets out requirements for the manufacture of pressure equipment as specified in the pressure equipment Standards AS 1210, AS 1228 and AS 4041. Fabrication, heat treatment, forged construction, cast construction and testing are covered.

1.2 APPLICATION This Standard is intended for use by designers, manufacturers, fabricators, inspection bodies, inspectors and all persons concerned with the manufacture of pressure equipment.

This Standard applies to pressure equipment covered by AS/NZS 1200 and AS 3920.1.

The relevant requirements of AS/NZS 1200 apply to this Standard.

1.3 REFERENCED DOCUMENTS A list of the documents referred to in this Standard is given in Appendix A.

1.4 DEFINITIONS For the purposes of this Standard, the definitions below apply.

1.4.1 Construction—design, manufacture and supply. (See Figure 1.1).

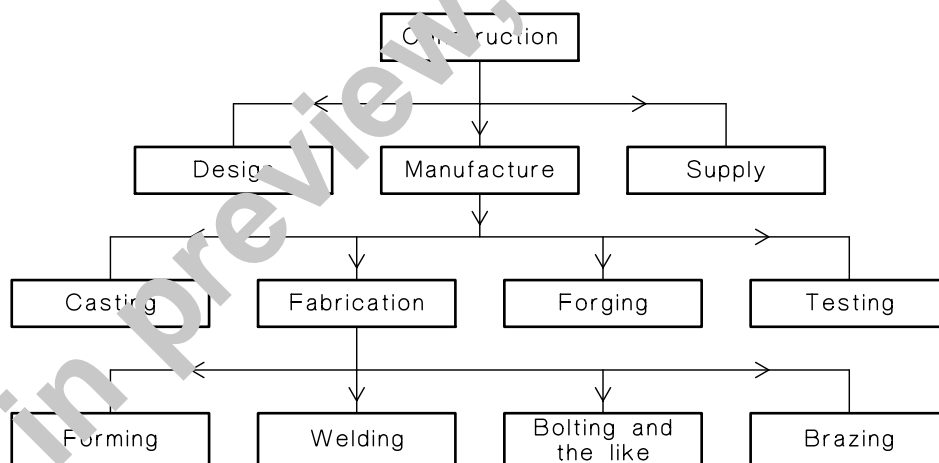


FIGURE 1.1 TERMS USED IN CONSTRUCTION

1.4.2 Designer—a person who designs pressure equipment or is responsible for the design.

1.4.3 Fabrication—the forming and joining of pressure equipment components which includes cutting, bending, rolling, pressing, swaging, upsetting, threading, welding, brazing, machining and any other operation on these components, but which is not part of installation.

NOTE: Fabrication may be carried out in the shop or on site.