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Australian Standard®

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# Boilers—Water-tube



STANDARDS AUSTRALIA

This Australian Standard was prepared by Committee ME/1, Boilers and Unfired Pressure Vessels. It was approved on behalf of the Council of Standards Australia on 25 July 1989 and published on 16 February 1990.

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The following interests are represented on Committee ME/1:

Aluminium Development Council
Australian Compressed Air Institute
Australian Institute for Non-destructive Testing
Australian Institute of Energy
Australian Institute of Petroleum
Australian Liquefied Petroleum Gas Association
Australian Valve Manufacturers Association
Boiler and Pressure Vessel Manufacturers Association of Australia
Bureau of Steel Manufacturers of Australia
Confederation of Australian Industry
Department of Defence
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Department of Labour and Industry, Tas.
Department of Labour, S.A.
Department of Labour, Vic.
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Society of Mechanical Engineers of Australasia
Sugar Research Institute
Welding Technology Institute of Australia
Workcover Authority, N.S.W.
Work Health Authority, N.T.

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*This Standard was issued in draft form for comment as DR 88028.*

STANDARDS AUSTRALIA

# Amendment No 1
# to
# AS 1228—1990
# Boilers—Water-tube

## CORRECTIONS

The 1990 edition of AS 1228 is amended as follows; the amendment should be inserted in the appropriate place.

*SUMMARY*: This Amendment applies to Equation 3.2.7.6(4), Figure 3.3.4.2 and running head on Page 82.

Published on 15 April 1991.

AMDT No 1 APR 1991

**Page 36 Equation 3.2.7.6(4)**

*Delete* $\eta_3 = \dfrac{(d_1 + d_2) \cos \alpha}{2a}$ and *substitute*

$$\eta_3 = 1 - \frac{(d_1 + d_2) \cos \alpha}{2a}$$

AMDT No 1 APR 1991

**Page 43 Figure 3.3.4.2**

*Delete* the Note box and the title and *substitute*:

NOTE: $L_1 = \sqrt{(2R_i t)}$ or $d_o/2$ whichever is less; $L_2$ shall not exceed $\sqrt{(d_o L_1)}$.

AMDT No 1 APR 1991

**Page 82 Running head (top left-hand of page)**

*Delete* '**AS 1228—1989**' and *substitute* '**AS 1228—1990**'.

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Australian Standard®

# Boilers—Water-tube

For history before 1972 see Preface.
AS 1228 first published 1972.
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# PREFACE

This edition of this Standard was prepared by he Standards Australia Committee on Boilers and Unfired Pressure Vessels, to supersede AS 1228—1984. The Standard was first published in 1974 as part of the program of revision of the *SAA Boiler Code*, which at that time was designated AS CB1. It forms part of the current *SAA Boiler Code* (AS 1200) which is referred to in Statutory Regulations in Australia, and which covers requirements for land installations of shell boilers, water-tube boilers, unfired pressure vessels, pressure piping, welder certification, and related matters.

AS CB1, the original *SAA Boiler Code*, was initially issued in 1931 to provide detailed guidance on the practices to be adopted in the design, construction and testing of boilers, unfired pressure vessels and associated equipment, and also to assist in obtaining uniform statutory requirements throughout Australia. It was revised and re-issued several times, and immediately prior to the publication of the first edition of AS 1228 in 1972, water-tube boilers were covered in the following Parts:

Parts I–IV—1952 *Boilers and unfired pressure vessels and their appurtenances*

Part V—1951 *Welding*

Revisions and additions have been made throughout the Standard; those Clauses, Tables, and Figures which have been subject to technical change are given in the List of Technical Changes following the Index. The changes include the addition of definitions for boiler components, revision of grades of steel plate, reduction in the required minimum thickness of drums and headers, review of requirements for bending of plates and tubes, clarification and review of non-destructive examination and heat treatment requirements for heating surface tubes and integral piping, and review of requirements for safety valves and water level gauges.

The revisions relating to heat treatment may affect welding procedure requirements but it is not intended that existing approved welding procedures will be invalidated by minor changes such as small variations in heat treatment temperatures.

The Standard follows, in principle, other parts of the *SAA Boiler Code* by giving guidance to manufacturers, inspecting authorities, and users in the form of minimum engineering standards for the design, construction, inspection, testing and installation of water-tube boilers.

It is based on BS 1113 *Specification for design and manufacture of water-tube steam generating plant (including superheaters, reheaters and steel tube economizers)*, which includes the relevant requirements of ISO/R 831, *Rules for Construction of Stationary Boilers*.

The ISO Recommendations and the Standards in this series have been formulated with the object of providing adequate protection of life and property, a reasonably long and safe period of usefulness, and a proper margin for deterioration in service.

The Standard contains basic data necessary for design, including material specifications, design parameters, requirements for fabrication, inspection, and testing. These requirements are specified in terms of principles to the fullest possible extent, supplemented where necessary by further detail to obtain uniform interpretation of principles and guidance as to best methods.

In other areas the Standard indicates where caution is necessary because it is felt that a direct prohibition would be unwise at the present level of knowledge.

The specific design requirements of the Standard are based on a simplified engineering approach and are intended to be the standard methods of design. However, in special instances, particularly where guidance is not provided in this Standard, other methods may be used provided that the validity of the design is satisfactorily established.

Section 4 of this Standard (manufacture and workmanship) includes requirements for those matters which come within the normal function of the manufacturers. Requirements as to workmanship for plates, tubes, forgings and castings in the condition in which they are normally supplied to the manufacturer are included in the relevant Standards specifying such materials.

This Standard does not specify individual welding processes or procedures. It provides guidance by which a welding process or procedure or the application of equipment or material for various welding processes or procedures by individual manufacturers may be approved for the manufacture of water-tube boilers and their ancillary pressure parts. It also specifies requirements whereby the competence of individual welders may be established and qualified.

In general, the tests required for the approval of welding procedures, for the competence of welders and for production control, together with the requirements for non-destructive examination, have been formulated with fusion welding processes in mind. Where a pressure welding process is employed, e.g. flash welding for joining tubes, it will be necessary to modify or extend these requirements to ensure that adequate precautions are taken for the avoidance of faults peculiar to the process used. Special requirements of this nature should be subject to prior agreement between the manufacturer and the Inspecting Authority.

No guidelines on construction can be written in sufficient detail to ensure good workmanship in construction. Each boiler manufacturer is responsible for taking every necessary step to make sure that the quality of workmanship and construction is such as will ensure compliance with good engineering practice.

The user will also need to consider many factors beyond those covered by this Standard in the final specification of a boiler and is cautioned that the Standard is not a complete design handbook and that he should be aware of the need for competent engineering judgement.

It should be noted that the Standard has been written primarily to suit conditions in Australia where there is a strong relationship between the manufacturer (and designer) and the Inspecting Authority. However, it is not intended to weaken the important link between these parties and the purchaser, who will be concerned with many aspects beyond the scope of this Standard and who may specify additional or alternative requirements, but such requirements must not be less than those already specified in the Standard and must comply with the requirements of the Inspecting Authority in the State where the boiler is to be operated. Statements of above requirements should form part of the contract documents between the purchaser and manufacturer. Attention is drawn to Appendix D which sets out information that should be supplied by the purchaser and the manufacturer.

Users of this Standard are reminded that it has no legal authority in its own right, but may acquire legal standing in one or more of the following circumstances:

(a) Adoption by a government or other authority having jurisdiction.

(b) Adoption by a purchaser as the required Standard of construction when placing a contract.

(c) Adoption where a manufacturer states that a vessel is in accordance with this Standard.

Statements expressed in mandatory terms in Notes to Tables and Figures are deemed to be requirements of this Standard.

# CONTENTS



SEE AMENDMENT 2

SEE AMENDMENT 2

# FOREWORD

The application of the several Standards that form the SAA Boiler Code may give rise to a need for consideration of unusual and other designs which do not comply in all respects with the requirements of the relevant Standard or which are not dequately covered in any Standard.

Where it is desired to use materials or methods which do not comply with the requirements of, or are not adequately covered by the relevant Standard, designs incorporating such departures should be submitted to th relevant Inspecting Authority for approval. Where necessary, Standards Australia Committee ME/1, Boilers and Unfired Pressure Vessels, may be asked to serve in an advisory capacity in the determination of the suitability of such designs. (See also Clause 1.4.)

It is emphasized that this activity of the committee is limited to technical aspects of the Code and that the committee has no power or jurisdiction to adjudicate upon contractual matters or regulatory matters or the duties of any persons concerned with the subject of the submission.

It is further emphasized that the committee will undertake consideration of only those matters which relate to interpretation of, or proposed changes to, the Standards for which it is responsible. In particular it will not consider or make recommendations inicating approval of proprietary equipment, materials, components or methods.

A method developed by the committee for communicating its findings is the use of Rulings. A Ruling is issued in reply to a specific enquiry from a specific organization and applies only to the set of circumstances referenced in the Ruling. Rulings may be used by the authorities as the basis for approval of the particular application or for approval of similar submissions from other organizations. Current Rulings are available under the reference AS 1200 Supplement 1.

Where the committee judges the subject to be suitable, a Ruling may be incorporated in an amendment to the relevant Standard, whereupon the Ruling is withdrawn. If the timing is appropriate, the finding of the committee may be issued directly as an amendment.

NOTES:

1. In the past some Rulings have been designated 'Committee Opinions' but this term is no longer used.
2. In the past, the committee has also issued 'Interpretations' which were considered to be equivalent to an amendment. The practice has been discontinued and all Interpretations have now been withdrawn.

STANDARDS AUSTRALIA

# Australian Standard
# Boilers—Water-tube

## SECTION 1. SCOPE AND GENERAL

**1.1 SCOPE.** This Standard sets out requirements for materials, design, construction, installation, inspection, and testing of those parts of water-tube steamboilers and water-heating boilers subject to pressure.

NOTE: With the approval of the Inspecting Authority, this Standard may also apply to the parts of 'water-tube type' vapourgenerating and hot-liquid units subject to internal vapour or liquid pressure. SEE AMENDMENT.....2.....

This Standard specifically applies to land installations of water-tube boilers, as defined in Clause 1.4 including integral superheaters, reheaters, and steel tube economizers, and also to superheaters, reheaters, and steel tube economizers independently fired or heated.

It also applies to all pressure parts containing fluid up to and including the valves separating the pressure parts from—

(a) steam pipes to and from other equipment;

(b) water pipes to and from other equipment;

(c) drain pipes; and

(d) the surrounding atmosphere, except that for safety valves, their vent piping to the atmosphere is also covered.

For equipment such as reheaters which may not incorporate valves at their supply and return connection points, the Standard applies to the equipment included between the inlet to the inlet header and the outlet from the outlet header of such equipment.

The Standard does not apply to brickwork or similar settings, supports, insulation, air preheaters, mechanical stokers, ash disposal equipment, forced or induced draught equipment or their accessories except for items important to basic safety and inspection (see Section 8).

**1.2 REFERENCED DOCUMENTS.** A list with titles of the documents referred to in this Standard is given in Appendix G.

**1.3 CONDITIONS FOR COMPLIANCE WITH THIS STANDARD.** Use of the provisions of this Standard for design and construction is valid only when the relevant requirements of other Standards listed in Appendix G are completely satisfied. Boilers and their ancillary pressure parts may be marked and certified in accordance with Section 6 only when all relevant requirements of the Standards listed in Appendix G have been fulfilled.

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

**1.4.1 'Approved' and 'approval'**—approved by, or approval of the Inspecting Authority. SEE AMENDMENT.....2.....

**1.4.2 Boilers.**

**1.4.2.1** *Boiler*—an arrangement of vessels and interconnecting parts, wherein steam, or other vapour, is generated or water or other liquid is heated at a pressure above that of the atmosphere by the application of fire or the products of combustion or by electrical means or by solar means.

It also includes valves, gauges, and other fittings as required in Section 7 herein and, where consistent with the requirements of this Standard, includes the boiler setting and associated equipment. SEE AMENDMENT.....2.....

It does not include a fully flooded system or pressurized system where the water or other liquid is heated to a temperature lower than the normal atmospheric boiling temperature of the liquid.

**1.4.2.2** *Water-tube boiler*—a boiler in which the heat transfer takes place through the wall of tubes inside which the fluid to be heated flows or circulates.

**1.4.2.3** *Natural circulation boiler*—a water-tube boiler in which fluid circulation is a result of the thermosiphonic head produced by heating.

**1.4.2.4** *Forced, assisted, or controlled circulation boiler*—a water-tube boiler in which mechanical pumping is used either entirely or partly to promote the circulation of fluid through the tubes.

**1.4.2.5** *Once-through boiler*—a water-tube boiler in which the fluid passes from the inlet to the outlet of the boiler without internal recirculation.

**1.4.3 Boiler components.**

**1.4.3.1** *Drum*—a cylindrical pressure part having a diameter sufficiently large to admit personnel by design intent, for which purpose an access opening or branch is provided.

NOTE: A drum may have the function of a header, or additionally or alternatively other functions, such as to separate steam from water or to act as a reservoir for boiler water.

**1.4.3.2** *Header*—a pressure part whose principal purpose is to collect fluid from, or distribute fluid to, arrays of tubes directly connected to it.

**1.4.3.3** *Tube*—a tubular pressure part that is either exposed over much of its length to hot gases for purposes of heat transfer, or is directly butt welded to such a tubular pressure part.

NOTE: This definition also includes a stub on a drum or header.

**1.4.3.4** *Integral pipe*—a tubular pressure part that is not a tube, drum, or header.

NOTES:

1. The term 'pipe' implies that there is no design intent to effect heat transfer through the wall of the pressure part.
2. The term 'integral' implies that the pressure part is connected directly to other pressure parts without any intervening valve.
3. The term 'integral pipe', subject to Note 2, includes those parts of pipes that carry a flow of steam or water during normal operation, those that carry intermittent flow, e.g. drain pipes, and those in which no flow occurs, e.g. instrument piping. The principal integral pipework covered by this Standard is shown diagrammatically in Appendix E.