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AS 1797—1986

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SUPERSEDED BY: AS 1728-1997

Australian Standard®

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**Boilers—Fire-tube, shell, and  
miscellaneous**

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**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 the Standards Association of Australia on 18 June 1986 and published on 10 November 1986.

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The following interests are represented on Committee ME/1:

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Australian Institute for Non-destructive Testing  
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*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.

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Suggestions for improvements to Australian standards, addressed to the head office of the Association, 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.

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*This standard was issued in draft form for comment as DR 84130.*

**STANDARDS ASSOCIATION OF AUSTRALIA**  
**Incorporated by Royal Charter**

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**AMENDMENT No 1**  
**to**  
**AS 1797—1986**  
**BOILERS—FIRE-TUBE, SHELL, AND MISCELLANEOUS**

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**REVISED TEXT**

*SUMMARY:* This amendment applies to Clause 3.2.2.3(d), Formula 3.4.4.2, Fig. 3.6.1.2(A)(d), Table 3.6.3.5, Clause 4.1.3.1, and Table 7.3.8.

Published on 2 November 1987.

AMDT  
No 1  
NOV.  
1987

**Page 18. Clause 3.2.2.3(d).**

Third line, *delete* the full stop and *add*:

'by the length *D*.'

AMDT  
No 1  
NOV.  
1987

**Page 28. Formula 3.4.4.2.**

*Delete* '0.04' and *substitute* '0.40'.

AMDT  
No 1  
NOV.  
1987

**Page 49. Fig. 3.6.1.2(A)(d).**

After 'See note', *add* '3'.

AMDT  
No 1  
NOV.  
1987

**Page 58. Table 3.6.3.5.**

Thirteenth division, i.e. 'Flat end plate attachment to furnaces—', in last line, *insert* 'no' as follows:

'As shown in Fig. 3.6.1.2(B)(a) and (b) with no internal fillet weld'.

AMDT  
No 1  
NOV.  
1987

**Page 84. Clause 4.1.3.1.**

First paragraph, second and third lines, *delete* ', except as specified in Clause 3.7.2.3,'.

AMDT  
No 1  
NOV.  
1987

**Page 116. Table 7.3.8.**

Right hand column, middle (second) line, *delete* '18' and *substitute* '24'.

**AUSTRALIAN STANDARD**

**BOILERS—  
FIRE-TUBE, SHELL, AND  
MISCELLANEOUS**

**AS 1797—1986**

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## PREFACE

This edition of this standard was prepared by the Association's Committee on Boilers and Unfired Pressure Vessels, to supersede AS 1791—1981. The standard was first published in 1975 as part of the program of revision of Parts I to IV and V of AS CB1, SAA Boiler Code. It forms part of the SAA Boiler Code (AS 1200), which is referred to in Statutory Regulations in Australia, and which covers requirements for land installations of boilers, unfired pressure vessels, pressure piping, welder certification and related matters.—

Revisions and additions which were published as Amendment No 1 to AS 1797—1981 have been incorporated into this edition, together with other changes throughout the standard to the clauses, tables and figures listed in Annex 2.

Major changes in this edition include the following:

- (a) The revision of methods for the determination of metal temperatures, for the design of furnaces and other parts subject to external pressure, for the design of openings and for the design of tubeplates and stayed surfaces. The methods in this edition are in accordance with those in the International Organization for Standardization (ISO) draft code for shell boilers and in the latest edition of the similar U.K. code BS 2790, Shell Boilers of Welded Construction (other than water-tube boilers).
- (b) In accordance with the Committee's earlier decision to adopt in all its codes a standard basis for the determination of design strength values for materials, tables of design strength values calculated on the basis given in Appendix A have been included for all listed material.
- (c) Responsibilities, including the supply of information, and inspection requirements have been revised, clarified and in some cases consolidated. The inspection requirements (Clause 5.2) have been closely aligned with the similar requirements in AS 1210, SAA Unfired Pressure Vessels Code.
- (d) The requirements for inspection and cleaning and for seatings for mountings, which were in the manufacture and workmanship section of the previous editions, have been relocated in the design section; minor changes have been made in these requirements.

While the requirements in this standard align in many areas with BS 2790, other requirements, such as inspection clearances and openings, boiler mountings and the sections of the standard covering welding, inspection and testing, reflect current Australian practice.

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 fire-tube, shell and miscellaneous boilers.

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 extent, supplemented where necessary by further detail to obtain uniform interpretation of principle and guidance on the 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 of design may be used provided that the validity of the design is satisfactorily established.

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 a boiler together with 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 testing, 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 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 other aspects beyond the scope of the standard and who may specify additional or alternative requirements, but such requirements must not be less stringent 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 the above requirements should form part of the contract documents between the purchaser and the manufacturer. Attention is drawn to Appendix B 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 boiler is in accordance with this standard.

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## FOREWORD

This standard does not prohibit the use of materials or methods of design or construction which are not specifically referred to herein. Therefore the application of the standards which comprise the SAA Boiler Code may give rise to a continual 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 adequately covered by that or other standards.

Where it is desired to use materials or methods of design or construction which do not comply with the requirements of or are not adequately covered by the standard, designs incorporating such departure should be submitted to the relevant Inspecting Authority for approval. Where necessary, SAA 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 design.

NOTE: Users are advised that this standard is usually used as the basis for the requirements for fire-tube, shell and miscellaneous boilers in all States and Territories of Australia.

In addition, where ambiguity is found, or where doubt arises as to the meaning or effect of the requirements of this standard or whether anything ought to be done or not done in order to comply fully with the standard, the question should be referred to SAA Committee ME/1 for an interpretation of the intent of those particular requirements of the standard.

It is emphasized that the abovementioned activities of the committee are limited to technical aspects of the standard and that the committee has no power or jurisdiction to adjudicate upon contractual or regulatory matters or the duties of persons concerned with the subject of the submission.

A method developed by Committee ME/1 for communicating the findings of the committee is by the use of Rulings. A Ruling is issued in reply to specific enquiry from a specific organization and applies only to the set of circumstances referenced in the Ruling. Copies of Rulings are sent to the relevant Inspecting Authorities and 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 'SAA Doc. 1200R'.

Where the committee judges the subject to be suitable, a Ruling may be incorporated in an amendment or revision to the relevant standard, whereupon the Ruling is withdrawn.

NOTE: The term 'Ruling' has been adopted to apply to all such interpretations. In the past both 'Ruling' and 'Committee Opinion' had been used.

## STANDARDS ASSOCIATION OF AUSTRALIA

## Australian Standard

## for

## BOILERS—FIRE-TUBE, SHELL, AND MISCELLANEOUS

## SECTION 1. SCOPE AND GENERAL

**1.1 SCOPE.** This standard sets out requirements for materials, design, construction, installation, inspection and testing of boilers defined as 'fire-tube' and 'miscellaneous' in AS 1200 and including shell boilers.

NOTE: The scope of this standard covers requirements for cast iron in addition to welded boilers. Other forms of construction should be by agreement between the parties concerned.

**1.2 APPLICATION.** This standard specifically applies to land installations of fire-tube, shell and miscellaneous boilers, excluding superheaters, reheaters and economizers.

NOTE: Where a superheater, reheater or economizer forms part of the integral boiler circuit, such equipment should comply with AS 1228.

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.

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).

**1.3 REFERENCED DOCUMENTS.** A list with titles of the documents referred to in this standard is given in Annex 1.

**1.4 DEFINITIONS.** For the purposes of this standard the following definitions apply:

**1.4.1 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.

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.

Boilers are divided into three types, viz fire-tube boilers, water-tube boilers, and miscellaneous boilers, as follows:

- (a) *Fire-tube boiler*—a boiler in which the fluid to be heated is contained in a vessel which may be directly heated and/or contain tubes in which combustion takes place or through which products of combustion flow. Typical examples of fire-tube boilers are shown in Figs 1.4.1(A) to 1.4.1(E).
- (b) *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 and which are exposed externally to combustion or products of combustion.
- (c) *Miscellaneous boilers*—boilers which are not classified as fire-tube or water-tube boilers.

Some types of fire-tube and miscellaneous boilers have an obvious shell and are also referred to commercially as 'shell boilers'.

**1.4.2 Electrode boiler**—a boiler in which the water or other liquid is heated by the passage of an alternating current through the liquid.

**1.4.3 Element boiler**—a boiler in which the water or other liquid is heated by an electrical element.

**1.4.4 Integral piping**—that piping within the whole of the circulatory system of the boiler between the feed inlet valve and the main stop valve. In addition, certain pipework (e.g. gauge pipes, blow-downs, soot blowers) connected to boiler pressure parts or to the pipes forming the main circulatory system, but not to external equipment or to atmosphere, is included in this category.

**1.4.5 Design pressure**—the gauge pressure used to determine the minimum thickness of the various pressure parts of a boiler in accordance with this standard. (See also Clause 3.1.2).

NOTE: It is recommended that there should be an adequate margin between the operating pressure and the design pressure in order to prevent unnecessary blowing of safety valves or the formation of steam in hot water boilers.

**1.4.6 Operating pressure**—the gauge pressure at which the boiler is normally operated. It shall not exceed the design pressure approved by the Inspecting Authority.

**1.4.7 Design temperature**—the metal temperature at the coincident design pressure used to select the design strength and to determine the dimensions of the boiler component under consideration (see also Clause 3.1.3).

**1.4.8 Design strength**—the maximum allowable stress for use in the formulas for calculation of pressure parts.

**1.4.9 Minimum calculated thickness**—the minimum thickness calculated according to the formulas to resist loadings, before corrosion or other allowances are added.