Australian Standard®

Unfired pressure vessels — Advanced design and construction

(Supplement to AS 1210—1989)

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 20 October 1989 and published on 2 April 1990.

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
Department of Industrial Affairs, Qld
Department of Labour, S.A.
Department of Labour, Vic.
Department of Labour and Industry, Tas.
Department of Occupational Health, Safety and Welfare, W.A.
Department of the Arts, Sport, the Environment, Tourism and Territories
Electricity Supply Association of Australia
Institute of Metals and Materials Australasia
Institution of Engineers Australia
Insurance Council of Australia
Metal Trades Industry Association of Australia
National Association of Testing Authorities Australia
Railways of Australia Committee
Society of Mechanical Engineers of Australasia
Sugar Research Institute
Welding Technology Institute of Australia
Work Health Authority, N.T.
Workcover, N.S.W.

This Standard was issued in draft form for comment as DR 88113.

Australian Standard®

Unfired pressure vessels — Advanced design and construction

(Supplement to AS 1210—1989)

First published as AS CB1 Int.6—1969.
Revised and redesignated AS 1210 Supplement 1—1979.
Second edition 1984.
Third edition 1990.

Incorporating:
Amdt 1—1995
Amdt 2—1997

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

ISBN 0 7262 6003 7

PREFACE

This edition of this Supplement was prepared by the Standards Australia Committee on Boilers and Unfired Pressure Vessels to supersede Supplement No 1 (June 1984) to AS 1210, *SAA Unfired Pressure Vessel Code, Class 1H Pressure Vessels of Advanced Design and Construction*. 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 shell boilers, water-tube boilers, unfired pressure vessels, pressure piping, welder certification, and related matters.

The Supplement provides for additional classes of vessels which require more precise design procedures to ensure that the higher design stresses can be tolerated for the particular design and that fatigue will be avoided.

Revisions and additions have been made throughout the Supplement.

A major revision in this edition is the introduction of a new classification of welded vessel (Class 2H) which permits the use of the higher design strengths applicable to Class 1H vessels with reduced levels of non-destructive examination but with the restrictions on the range and the thickness of materials used and the fatigue criteria under which the Class 2H vessels may be used. The introduction of requirements for Class 2H vessels was delayed until a full review of the material requirements in AS 1210, *SAA Unfired Pressure Vessels Code*, for low temperature service had been carried out.

An alternative method for assessing the need for a detailed fatigue analysis of the vessel and its components has been introduced.

Other revisions in this edition include a change of the membrane stress intensity limits for the test condition, clarification of the design strengths to be used in the design of flanges, changes in the requirements for clad plate and for low temperature service and clarification of coverage of cast and forged vessels.

The Supplement deals only with stationary vessels for a specific service where operation and maintenance control is fully exercised during the useful life of the vessel by the users in accordance with specified operating requirements for the vessel.

This Supplement lists only those requirements which differ from or are additional to those for Class 1 vessels in AS 1210. Together with AS 1210 it will directly satisfy the needs of most vessels. For complicated vessels or for vessels that are subject to unusual loads or fatigue, a comprehensive stress/load analysis is required.

This Supplement requires that all vessels be reviewed to ensure that unusual and excessive loads and fatigue cycling are maintained within safe limits. It prescribes detailed fatigue analysis where and when necessary. For vessels that are cleared from such a detailed investigation, the same design formulas as given in AS 1210 are used, except where otherwise specified.

Where fatigue, vessel configuration or loading is such that detailed stress analysis is required, the degree of such analysis can be determined only by a competent designer. The designer will need to refer to recognized engineering texts and techniques. Some authoritative national standards such as ANSI/ASME BPV-VIII-2, *Boiler and Pressure Vessel Code: Section VIII — Rules for construction of pressure vessels: Division 2 — Alternative rules*, and BS 5500, *Specification for unfired fusion welded pressure vessels*, provide tested shortcuts to many solutions encountered in advanced vessel design. These may be used, where appropriate by the designer as substitutes for fundamental stress analysis.

Acknowledgement is gratefully made to the American Society of Mechanical Engineers for permission to reproduce certain extracts from the ASME Boiler and Pressure Vessel Code. In addition, acknowledgement is made of the considerable assistance provided by British and other national Standards.

The International Organization for Standardization (ISO) Technical Committee ISO/TC 11 — Boilers and Pressure Vessels, has prepared a draft International Standard, ISO/DIS 2694, *ISO draft recommendation for pressure Vessels*, with the object of achieving agreement regarding uniformity of approach in national standards covering this subject. At this time, significant differences between the various national standards and ISO/DIS 2694 remain and these differences are still to be resolved.

With the changes introduced by Amendment No. 2, this 1990 edition of AS 1210 Supplement 1 is suitable for use with the 1997 edition of AS 1210, *Pressure vessels*.

CONTENTS

Page

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 adequately 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 the 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 indicating 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
Unfired pressure vessels — Advanced design and construction
(Supplement to AS 1210—1989)

SECTION S1. SCOPE AND GENERAL REQUIREMENTS

S1.1 SCOPE. Clause 1.1 applies with the following additions:

Supplement 1 (hereafter referred to as 'the Supplement' or 'this Supplement') specifies requirements for two additional classes of vessel identified as Class 1H and Class 2H with the latter further subdivided into classifications 2HA and 2HB, and for cast and forged vessels, which —

(a) utilize advanced design and construction methods;

(b) generally permit design strengths higher than those specified in AS 1210; and

(c) comply with the requirements specified in AS 1210 for cast, forged or Class 1 welded vessels as appropriate, except as modified by this Supplement.

This Supplement does not apply to transportable vessels nor does it apply to vessels of riveted or brazed construction. Only those requirements which supplement or differ from those specified in AS 1210 for cast, forged or Class 1 welded construction are specified in this Supplement.

S1.3 APPLICATION OF SUPPLEMENT. Clause 1.3 applies except that the first paragraph shall be replaced by the following:

The requirements of this Supplement are specifically intended for application to unfired pressure vessels having —

(a) design pressures above the curves in Figures 1.3.1 and 1.3.2; and

(b) operating temperature limits of various materials and components as stated in the appropriate Section of this Supplement.

NOTE: The Supplement does not specify a limitation on pressures and is not all-inclusive for all types of construction. For very high pressures, some additions to or deviations from the requirements of this Supplement, to the satisfaction of the Inspecting Authority and purchaser, may be necessary.

S1.6 CLASSES OF VESSEL CONSTRUCTION. Clause 1.6 applies with the following addition:

This Supplement specifies the requirements for two additional classes of vessels, viz Class 1H and Class 2H, and the latter is subdivided into classifications 2HA and 2HB.

The range of materials permitted for Class 2H construction (see Clause S2.1.1) is limited but the extent of non-destructive examination may be reduced from that required for Class 1H construction (see Clause S5.3.4.1) provided that criteria for design against fatigue failure, as appropriate for Class 2HA and Class 2HB respectively, are fulfilled (see Clause S3.1.5.4).

S1.7 APPLICATION OF VESSEL CLASSES AND TYPES. Clause 1.7 applies with the following modification:

S1.7.2.4 *Mixed classes of construction.* Clause 1.7.2.4 does not apply to this Supplement and the following shall be substituted:

See Clause S3.1.5.4 for the permissible mixing of components of Class 1H, Class 2HA, and Class 2HB construction.

S1.8 DEFINITIONS. Clause 1.8 applies, with the following additions and modifications to particular Clauses.

S1.8.10 Design strength. Clause 1.8.10 does not apply to this Supplement and the following shall be substituted:

Design strength (f) — the maximum allowable stress value for use in the equations for the calculation of pressure parts, and the basis for determining stress intensity limits (see Clause S3.3).

S1.8.24 Parties concerned. Clause 1.8.24 does not apply to this Supplement and the following shall be substituted:

Parties concerned — the purchaser, the manufacturer, Inspecting Authority, and the designer (see Clause S3.1.2).

S1.12 DESIGNATION. Clause 1.12 does not apply to this Supplement and the following shall be substituted:

S1.12 DESIGNATION. Unfired pressure vessels constructed to this Supplement shall be designated by the number of the Standard to which it is a supplement, i.e. AS 1210, and the method or class of construction:

For Class 1H welded construction . . AS 1210 — 1H
For Class 2HA welded construction AS 1210 — 2HA
For Class 2HB welded construction AS 1210 — 2HB
For cast construction . . . . . AS 1210 — CH
For forged construction . . . . . AS 1210 — FH
For mixed construction — an appropriate combination of symbols, e.g. . . . . AS 1210 — 1H/2HA

S1.13 REFERENCED DOCUMENTS. Clause 1.13 applies and this Supplement makes reference to the following documents:

AS	
1065	Non-destructive testing — Ultrasonic testing of carbon and low alloy steel forgings
1200	SAA Boiler Code
1200	Supplement 1 — Rulings to the SAA Boiler Code