AS 4041—2006

Australian Standard®

# Pressure piping

This Australian Standard® was prepared by Committee ME-001, Pressure Equipment. It was approved on behalf of the Council of Standards Australia on 16 June 2006.
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- LPG Australia
- Materials Australia
- National Association of Testing Authorities
- Pressure Equipment Association
- Victorian WorkCover Authority
- Welding Technology Institute of Australia
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Standards Australia wishes to acknowledge the participation of the expert individuals that contributed to the development of this Standard through their representation on the Committee and through public comment period.

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# Pressure piping

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# PREFACE

This Standard was prepared by the Australian members of Joint Standards Australia/Standards New Zealand Committee ME-001, Pressure Equipment, to supersede AS 4041—1998, *Pressure piping*. After consultation with stakeholders in both countries, Standards Australia and Standards New Zealand decided to develop this Standard as an Australian Standard rather than an Australian/New Zealand 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.

This Standard makes use of current American Standards such as ASME B31.3, *Process piping*, as well as Australian Standards. This has been done where practicable to align with international practices to provide flexibility in design and to enable current proven computer programs for the above Standard to be used to satisfy the design requirements of this Standard (see Clause 1.6). BS 806, *Specification for the design and construction of ferrous piping installations for and in connection with land boilers* was originally used as the basis for much of this Standard and even though BS 806 has been withdrawn the parts of this Standard where BS 806 was used are still considered valid and relevant and have been retained. BS 806 was superseded by the European Standard EN 13480, *Metallic industrial piping*.

Comparison of this Standard with ASME B31.1, *Power piping* and ASME B31.3 shows that for the same pressure and application, piping to this Standard may be thinner than piping to the two American Standards at low to medium temperatures. These two American Standards have been consulted as a major source of material.

The extension of scope in this edition to embrace room-temperature-safe fluids brings into contrast three different traditions of steel pipe engineering which exist side by side in Australia. All are successful in their particular scope of application.

The first tradition is that of power and process piping using steam and other hazardous fluids. This tradition is noted for higher safety factors, thick pipe, and the greater use of pre- and post-weld heat treatment and sophisticated quality assurance.

Another tradition is the non-code tradition for room temperature safe fluids. This is more influenced by the third tradition than by the first. It uses thick or thin pipe and rarely applies postweld heat treatment and only uses limited quality assurance.

The third pipe tradition is that of petroleum and natural gas pipelines. This tradition uses lower safety factors, thin pipe, rarely applies preheat and rarely uses postweld heat treatment but has adequate quality assurance.

The extension of scope that joined tradition 1 and 2 (and possibly tradition 3 in special cases) presented the Committee with a difficulty in preventing unnecessary increases in costs for the present non-code piping systems in Australia while maintaining safety. The more conservative requirements of tradition 1, and ASME B31.3 are not appropriate for applying these features to room-temperature safe fluids in modern low carbon equivalent pipe steels. Hence a four-tier pipe classification system is introduced to ensure adequate safety, performance and economy of piping systems for the wider range of industrial applications from critical pipe used in power stations to low hazard piping found in small industrial plant. In summary this edition will generally permit thinner steel pipe to be used for a given pressure than previously. Also there is a change to some of its pressure testing equations for steel pipe. The traditional value of 1.5 $P$ applies for steam and water piping for steam boilers only.

This Standard is arranged similarly to AS 1210, *Pressure vessels*, including Supplement 1, *Unfired Pressure Vessels—Advance design and construction (Supplement to AS 1210—1997*), and its class system parallels that of these Standards. Without inferring equality of the safety factor, the alignment of classes is approximately as follows:

| AS 4041 Class | AS 1210 Class |
|---|---|
| 1 | 1H |
| 2A | 2H |
| 2P | — |
| 3 | 3 |

Australian, American, and European material and component Standards which are used to a considerable extent in Australia have been listed. This Standard now provides for a wider range of materials than previously covered. A basis for specifying non-metallic pressure piping is given by reference to ASME B31.3 but with provision for substitution of equivalent Australian Standards.

The Standard follows in principle other Standards forming part of AS/NZS 1200, *Pressure equipment*, in providing guidance for owners, designers, manufacturers, inspection bodies and users in the form of minimum engineering requirements for the safe design, fabrication, installation, testing, and commissioning of pressure piping based on world-wide advances and experience. It also provides basic requirements and references for welding qualification, non-destructive testing, operation, maintenance and in-service inspection.

The principle objective of this Standard is to provide clear uniform national requirements which will result in reasonably certain protection of the general public, persons installing and operating the piping, and of adjacent property and environment, which give economic piping, and which show where a margin for deterioration may be necessary to give adequate and safe service life. Additional requirements may be necessary to prevent damage from unusual conditions, third parties and abnormal forces.

The Standard provides an authoritative source of important principles, data, and practical guidelines to be used by responsible and competent persons. It is not practicable nor indeed desirable for the Standard to specify every aspect of piping design and fabrication. It is neither an instruction manual nor a complete design or construction specification. The Standard does not replace the need for appropriate experience, competent engineering judgement, and the application of fundamental engineering principles.

Acknowledgment is gratefully made to the American Society of Mechanical Engineers and the British Standards Institution for the considerable assistance provided by the above referenced national Standards.

Statements expressed in mandatory terms in notes and footnotes 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.

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## S E C T I O N 1 S C O P E A N D G E N E R A L

### 1.1 SCOPE

This Standard sets out minimum requirements for the materials, design, fabrication, testing, inspection, reports and pre-commissioning of piping subject to internal pressure or external pressure or both. Specific requirements are given for piping constructed of carbon, carbon-manganese, low alloy and high alloy steels, ductile and cast iron, copper, aluminium, nickel, titanium and alloys of these materials. General requirements and reference to Standards for non-metallic piping are included.

The Standard makes extensive use of AS/NZS 3992, AS 4037 and AS 4458.

This Standard applies specifically to pressure piping, i.e. piping which may present a significant risk of injury to people, property or the environment owing to hazards arising from—

(a) the effects of pressure, either as a result of internal pressure causing an explosion or projectile, or as a result of external pressure causing buckling and collapse;

(b) release of contents which are lethal, toxic, harmful to human tissue (e.g. hot, cold, corrosive) flammable, combustible or are otherwise hazardous; or

(c) release of contents which directly or indirectly result in injury or damage e.g. piping for pollutants, fire-fighting purposes or cooling purposes.

This Standard is intended to apply to the following piping except when varied by the relevant Standard:

(i) Piping for land steam boilers, prime-movers, refrigerant and other industrial plant except where the piping forms an integral part of a boiler or pressure vessel and the requirements of AS 1210 or AS 1228 apply.

(ii) Hydraulic piping, water piping (including feed water piping), process piping and water piping forming part of a fire protection system (see AS 4118 and AS 4214). See also Items (A) to (F) of this Clause.

(iii) Piping within boundaries of chemical manufacturing or processing installations, petroleum refineries, petrochemical plant, gas process plant, refinery tank farms, terminals and bulk handling plants.

(iv) Oil fuel piping within the scope of AS 1375, AS 1692 and AS 1940.

(v) Liquefied petroleum gas piping within the scope of AS/NZS 1596.

(vi) Anhydrous ammonia within the scope of AS/NZS 2022.

(vii) Low-temperature and refrigeration piping within the scope of AS/NZS 1677.

(viii) Piping for road tank vehicles within the scope of AS 2809.

(ix) Compressed air piping, the design pressure of which exceeds 70 kPa (internal) or 32 kPa (external).

(x) Piping for low pressure gas systems complying with AS 5601.



 

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