

Australian Standard™

Arc-welded steel pipes and fittings for water and wastewater

This Australian Standard was prepared by Committee WS-009, Rolled and Welded Steel Pipes. It was approved on behalf of the Council of Standards Australia on 25 May 2001 and published on 12 July 2001.

The following interests are represented on Committee WS-009:

Water Services Association of Australia
Australian Chamber of Commerce and Industry
Australian Industry Group
Bureau of Steel Manufacturers
New Zealand Manufacturers Federation
SunWater
Water Corporation of Western Australia
Central Highlands Water
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Australian Standard™

Arc-welded steel pipes and fittings for water and wastewater

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PREFACE

This Standard was prepared by the Standards Australia Committee WS-009, *Rolled and Welded Steel Pipes* to supersede AS 1579—1993.

The objective of this draft is to provide designers of rolled and welded steel pipe with requirements for design of steel pipe, and means of demonstrating compliance with the Standard.

The main changes in this revision are the following:

- (a) The provision of design methods that do not require hydrostatic testing in order to demonstrate compliance.
- (b) The inclusion of joints, joint dimensions and bends
- (c) Details of testing for steel piling.

This Standard may be used in conjunction with Standards for the protection of pipes and piles, which are referred to in the document.

Statements expressed in mandatory terms in notes to tables 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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STANDARDS AUSTRALIA

Australian Standard**Arc-welded steel pipes and fittings for water and wastewater**

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard specifies requirements for arc-welded steel pipes and fittings with butt-welded seams, having diameters equal to or greater than 114 mm outside diameter intended for the conveyance of water and wastewater at rated pressures up to 6.8 MPa, and for use as piles.

Methods of demonstrating compliance with this Standard are given in Appendix A.

NOTE: Purchasing guidelines are given in Appendix B.

1.2 REFERENCED DOCUMENTS

The following documents are referred to in this Standard.

AS

- | | |
|--------|--|
| 1199 | Sampling procedures and tables for inspection by attributes |
| 1281 | Cement mortar lining of steel pipes and fittings |
| 1349 | Bourdon tube pressure and vacuum gauges |
| 1399 | Guide to AS 1199—Sampling procedures and tables for inspection by attributes |
| 1646 | Elastomeric seals for waterworks purposes |
| 1646.1 | Part 1: General requirements |
| 1646.2 | Part 2: Material requirements for pipe joint seals used in water and wastewater |
| 1646.3 | Part 3: Material requirements for pipe joint seals used in water and wastewater applications with the exception of natural rubber and polyisoprene compounds |
| 1978 | Pipelines—Gas and liquid petroleum—Field pressure testing |
| 2812 | Welding, brazing and cutting of metals—Glossary of terms |
| 4087 | Metallic flanges for waterworks purposes |
| 4321 | Fusion-bonded medium-density polyethylene coating and lining for pipes and fittings |

AS/NZS

- | | |
|--------|---|
| 3500 | National Plumbing and Drainage Code |
| 3500.0 | Part 0: Glossary of terms |
| 1554 | Structural steel welding |
| 1554.1 | Part 1: Welding of steel structures |
| 1594 | Hot-rolled steel flat products |
| 3678 | Structural Steel—Hot-rolled plates, floorplates and slabs |
| 4020 | Products for use in contact with drinking water |

SAI

- | | |
|---------|---|
| HB18 | Guidelines for third-party certification and accreditation |
| HB18.28 | Guide 28: General rules for a model third-party certification system for products |

ISO	
559	Steel tubes for water and sewerage
2859	Sampling procedures for inspection by attributes
2859.1	Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection
3951	Sampling procedures and charts for inspection by variables for percent nonconforming
API	
5L	Specification for Line Pipe (see Note)
NOTE: Available from American Petroleum Institute, 1801 K St. N. W., Washington, DC 20037	

1.3 DEFINITIONS

For the purpose of this Standard, the definitions given in AS 1978, AS 2812, AS 3500.0 and those below apply. Where this Clause includes definitions of terms defined elsewhere, the definition provided herein apply.

1.3.1 Deflection angle

The acute angle formed between the axes of two adjacent pipes when a joint is completed between them.

1.3.2 Effective length

The overall length of the pipe minus the nominal joint entry, expressed in metres.

1.3.3 Hydrostatic test pressure

The pressure applied internally to the pipe or fitting during the hydrostatic test.

1.3.4 Layback

The angular distortion of a flange from its original plane due to welding the flange onto a pipe or fitting.

1.3.5 Nominal minimum yield strength (NMYS)

The anticipated minimum yield strength based on statistical records.

NOTE: This may be applied to analysis grades and by agreement with the purchaser to structural (mechanically tested) grades.

1.3.6 Non-destructive testing (NDT)

Testing of welds in accordance with AS/NZS 1554.1 Category SP.

1.3.7 Outside diameter (OD)

The specified outside diameter of the uncoated pipe or fitting expressed in millimetres.

NOTE: This is the preferred method of specifying pipe diameter.

1.3.8 Nominal size (DN)

A numerical designation of size, which is common to all components in a piping system other than components designated by outside diameters.

NOTE: Nominal size is loosely related to manufacturing dimensions, and is designated by DN followed by a number.

1.3.9 Ovality

The difference between maximum and minimum diameters after due allowance for sag.

1.3.10 Pile

A circular structural member that is driven into soil and is not used for internal pressure containment.

1.3.11 Specified minimum yield strength (SMYS)

The specified minimum yield strength when ordering a structural (mechanically tested) grade of steel.

1.3.12 Rated pressure (P_r)

The maximum internal hydrostatic pressure, at which the pipe is suitable for sustained operation.

1.3.13 Wall thickness (t)

The nominal thickness of the wall of a pipe or fitting, not including any lining or coating and not taking into account the effect of manufacturing tolerances.

1.3.14 Working pressure

The maximum operating internal hydrostatic pressure for the pipeline determined by the designer after considering the rated pressure of the pipe and fittings and taking into account the various factors such as external loads and transient hydrostatic conditions.

1.4 MARKING

Pipes and fittings shall be legibly and permanently marked on the external surface, no closer than 150 mm from an end, with the following information:

- (a) A unique serial number that is maintained throughout the manufacturing operations.
- (b) The place of manufacture.
NOTE: This is not required where the place of manufacture is readily traceable from the unique serial number.
- (c) Outside diameter (pipes only).
- (d) Wall thickness (pipes only).
- (e) The number of this Australian Standard, i.e. AS 1579.
- (f) The manufacturer's name or registered trademark.
- (g) For hydrostatically tested pipes only, the rated pressure, in megapascals.
- (h) For non-hydrostatically tested pipes only, the words 'Not hydrostatically tested'. Additionally where required for non-hydrostatically tested pipes, '100% NDT AS 1554.1 SP'.
- (i) For pipes or fittings complying with AS/NZS 4020 'AS/NZS 4020'.

1.5 INFORMATION TO BE SUPPLIED BY THE PURCHASER

NOTE: Guidelines for information to be supplied by the purchaser at the time of inquiry are given in Appendix B.

1.6 COATING AND LINING

Pipes and fittings intended for the conveyance of water and sewage shall be protected from corrosion by a coating and lining, suitable for their intended purpose. Coatings shall be applied in accordance with AS 1281 and AS 4321. Other coatings and linings may be applied as specified by the purchaser.

1.7 HANDLING, LIFTING AND STORAGE

Pipes, piles and fittings shall be lifted and handled in a manner that is safe and avoids permanent distortion of the pipe, pile or fitting and damage to the coating and/or lining.

Pipes, piles and fittings shall be supported, both in storage and during transport, in a manner that is safe and avoids permanent distortion of the pipe, pile or fitting and damage to either the coating and/or lining.

1.8 EFFECT ON WATER

Pipes and fittings supplied to this Standard, which are for use in contact with water intended for human consumption, shall comply with AS/NZS 4020. Such compliance shall apply to the pipe and fittings in the finished condition taking into account all coatings and/or linings that come into contact with the water in the pipeline.

SECTION 2 R A T E D P R E S S U R E

2.1 HYDROSTATICALLY TESTED PIPE

The maximum internal hydrostatic pressure at which hydrostatically tested pipe is suitable for sustained operation is calculated from the following equations:

$$P_r = 0.72 \frac{(2 \times SMYS \times t)}{OD} \text{ or; } \dots 2.1(1)$$

$$P_r = 0.72 \frac{(2 \times NMYS \times t)}{OD} \dots 2.1(2)$$

The maximum rated pressure for pipes and fittings produced in accordance with this Standard is 6.8 MPa. This maximum is dictated by a pressure test equipment limit of 8.5 MPa.

In emergency situations transient pressures may lead to an increase in pipe stress. Under these conditions the maximum allowable combined stresses shall be determined by the designer, but shall not exceed $0.90 \times SMYS$.

2.2 NON-HYDROSTATICALLY TESTED PIPE

For pipe that is not hydrostatically tested in accordance with this Standard, the designer shall determine the design pressure rating of the pipe.

The wall thickness of all pipes that are non-hydrostatically tested shall be no less than 8.0 mm. All welds shall be 100 % non-destructively tested in accordance with AS 1554.1, Category SP.

The maximum hoop stress at the rated pressure shall not exceed 0.50 of the specified minimum yield stress of the steel.

2.3 FITTINGS

The rated pressure of fittings produced in accordance with this Standard shall be the responsibility of the designer.

SECTION 3 MANUFACTURE

3.1 PIPE AND PILES

3.1.1 Steel

Hydrostatically tested pipes shall be manufactured from an analysis or structural grade of hot rolled steel complying with AS/NZS 1594 or AS/NZS 3678. Piles and non-hydrostatically tested pipe shall be manufactured from a structural grade of steel complying with AS/NZS 1594 or AS/NZS 3678. Alternatively, piles may be manufactured from an analysis grade complying with AS/NZS 1594, in which case the steel shall be mechanically tested in accordance with AS 1391 to demonstrate that it meets the tensile requirements specified by the purchaser. The steel shall have a carbon equivalent (CE) not exceeding 0.40 when calculated using the following formula:

$$CE = \frac{\%Mn}{6} + \left(\frac{\%Cr + \%Mo + \%V}{5} \right) + \left(\frac{\%Ni + \%Cu}{15} \right) \quad \dots 3.1$$

3.1.2 Welding

All welds shall be complete penetration butt welds carried out in accordance with AS 1554.1 Category SP.

Pipes for water and wastewater shall be produced using at least one internal pass and one external pass. Welds may be made by any combination of longitudinal, circumferential or spiral welding. The height of weld reinforcement shall not exceed 3 mm, and the maximum misalignment between plates of the same nominal thickness in butt welds shall be as follows:

- (a) 1.5 mm where $t < 12$ mm.
- (b) 3.0 mm where $t \geq 12$ mm.

Repair welds shall be carried out in accordance with AS 1554.1 Category SP.

3.1.3 Pipe and pile sizes

The minimum outside diameter shall be 114 mm.

NOTE: Whereas this Standard does not place any restrictions on pipe sizes, ISO pipe sizes shown in Appendix C are preferred.

3.1.4 Tolerances on dimensions

3.1.4.1 General

Tolerances in Clauses 3.1.4.1 to 3.1.4.4 shall apply to the finished pipe along the length of the barrel of the pipe (i.e. excluding the joint region, where relevant).

3.1.4.2 Diameter

The outside diameter of the pipe shall be measured by taping the circumference. It shall not deviate from the specified diameter by more than $\pm 0.50\%$. The pipe dimension shall be measured at completion, unless the manufacturer can demonstrate that measurements recorded during manufacture are suitable.

3.1.4.3 Ovality

Ovality shall not exceed 1% of the specified outside diameter. Ovality shall be measured at the pipe ends.

3.1.4.4 Length

The following apply to the length of pipes:

- (a) Where pipes are ordered without an exact length (i.e. as standard length), the measured length of any pipe shall not differ from the length ordered by more than ± 75 mm.

NOTE: Pipes may be supplied with a maximum variation of ± 300 mm, provided the number of pipes supplied to this wider tolerance does not exceed 5% of the total order and advice is given to the purchaser.

- (b) Where pipes are ordered to be of exact length, the order shall show the word, 'exact', and the measured length of any pipe shall not differ from the length ordered by more than ± 12 mm.

- (c) Where pipes are ordered in random lengths, the average length and the minimum length shall be subject to agreement between the purchaser and the manufacturer.

3.1.4.5 Straightness

The deviation from straightness shall be not greater than 0.2% of the pipe length. Straightness shall be measured at the side of the pipe so that any sag does not influence the measurement.

NOTE: Pipes manufactured for cement mortar lining (in accordance with AS 1281) may need to be made to a tighter straightness tolerance to ensure uniformity of lining application.

3.2 FITTINGS

3.2.1 Manufacture

Fittings shall be made from pipe manufactured in accordance with this Standard, or shall be fabricated from structural steel complying with AS/NZS 1594 or AS/NZS 3678. The CE shall not exceed 0.40.

The use of pipe manufactured in accordance with API Specification 5L shall be acceptable for branches only (e.g. offtakes, scour valves, air valves, etc.). Where such pipe is used, the CE of the material shall not exceed 0.40.

NOTE: The use of fittings, incorporating pipe branches manufactured in accordance with API Specification 5L, shall be the responsibility of the fittings designer.

Fittings shall be supplied with joints as specified by the purchaser.

3.2.2 Welding

Welds shall be carried out in accordance with AS 1554.1 Category SP. Single-sided butt-welds are permissible provided full penetration is achieved. The height of weld reinforcement shall not exceed 3 mm, and the maximum misalignment between plates of the same nominal thickness in butt welds shall be as specified in Clause 3.1.2.

3.2.3 Dimensions and tolerances on fittings

Fittings may be manufactured in a range of outside diameters and wall thicknesses.

NOTE: See Appendix D for dimensions of a typical range of fittings.

The end faces of fittings shall be at right angles to the axis of the relevant leg of the fitting.

3.2.4 Tolerance on dimensions

Tolerances shall be as follows:

- (a) The tolerance on diameter and ovality shall be the same as for pipe of the same size.
- (b) The tolerance on leg lengths shall be ± 50 mm, except where an exact leg length is specified then the tolerance shall be ± 5 mm.
- (c) The tolerance on the angle between end-faces shall be within one degree of the design value.