



# **EPS 210 Engineering Product Specification for Welded Steel Pipes and Fittings**

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## Revision details

Version No.	Clause	Description of revision
2	All	Minor changes
	Introduction	Extended size to DN2200
	Reference Standard	Added AS/NZS 4331.1 to list
	3.1	Clarifying comment on rated pressure or allowable operating pressure
	3.2	Clarifying comment on design responsibility
	T3-1	Updated table 3-1
	T4-2	Updated table 4-2
	4.7	Clarifying comment on flanges not covered by AS 4087
	7	Deleted redundant section and reorganised paragraph
1	All	First issue

## Introduction

This Specification outlines the requirements for the manufacture, testing and supply of steel pressure pipes and fittings for water and wastewater applications in sizes DN100 to DN2200.

Sydney Water makes no warranties, express or implied, that compliance with the contents of this Specification shall be sufficient to ensure safe systems or work or operation.

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## Reference Standards

Standard No.	Document Title
AS 1281	Cement mortar lining of steel pipes and fittings
AS 1579	Arc-welded steel pipes and fittings for water and waste-water
AS 1646	Elastomeric seals for waterworks purposes
AS 3972	Portland and blended cement
AS 4041	Pressure piping
AS 4321	Fusion-bonded medium-density polyethylene coating and lining for pipes and fittings
AS/NZS 1554.1	Structural steel welding, Part 1: Welding of steel structures

Standard No.	Document Title
AS/NZS 4020	Testing of products for use in contact with drinking water
AS/NZS 4087	Metallic flanges for waterworks purposes
AS/NZS 4331.1	Metallic flanges, Part 1: Steel flanges
WSA 201	Manual for selection and application of protective coatings
AWWA C206	Field welding of steel water pipe
AWWA M11	Steel Water Pipe: A Guide for Design and Installation

# 1. Quality Assurance

Manufacturers of products covered by this specification shall demonstrate certification of their quality management system to the Australian quality system standard AS/NZS ISO 9001 by third party organisations certified to the Joint Accreditation System of Australia and New Zealand (JAS-ANZ).

# 2. Effect on Water Quality

Pipes and fittings that are intended for conveyance of drinking water shall comply with the requirements of AS/NZS 4020. Such compliance shall apply to pipe and fittings in the finished condition considering all coatings, linings, joint seals, flange gaskets, O-rings, and joint lubricants, which come into contact with the water in the pipeline. A scaling factor of 1 for pipe and 0.05 for fittings shall be used.

# 3. Manufacture

## 3.1 General

All welded steel pipes and fittings shall be manufactured and marked in accordance with AS 1579.

In the case of longitudinal welded pipes made from more than one plate, adjacent longitudinal welds shall be staggered by a minimum of 200mm.

The steel used in pipes and fittings shall have a Nominal Minimum Yield Strength (NMYS) or Specified Minimum Yield Strength (SMYS) of either 250MPa, 300MPa or 350MPa. Preferred rated pressure or allowable operating pressure (AOP) classes are PN16 (1.6 MPa), PN21 (2.1 MPa) and PN35 (3.5MPa), being 72% of the SMYS.

Manual or semi-automatic arc welding may be used for attaching flanges, tack-welding and for repairing defects. All welding shall be in accordance with AS 1554.1 Category SP.

Pipes may be reshaped by rolling or by pressure or by hammering provided it does not damage the pipe. Sizing and drifting of the ends is permitted. Reshaping by dropping is not allowed.

## 3.2 Dimensions

The purchaser shall provide all the information nominated in Appendix B of AS 1579. Design of the pipe and fittings shall be undertaken by the manufacturer.

Design of pipes and fittings shall be in accordance with the design basis detailed in AS 1579 plus the requirements of AWWA M11 or AS 4041 as appropriate.

In addition, no pipes or fittings shall have a wall thickness less than 5mm, with the sole exception being DN100 pipe and fittings where a minimum of 4.8mm may be used. The preferred nominal sizes and corresponding outside diameters shall be in accordance with Table 3-1 Preferred Sizes for Steel Pipe and Fittings. Whilst the sizes shown in Table 3-1 are preferred this does not preclude the use of other pipe sizes subject to prior approval of Sydney Water, for example where connecting or inserting into existing pipelines where the dimensions differ.

Definitions of dimensions shall be in accordance with AS 1579. Unless otherwise indicated, all lengths shall be taken as effective lengths except for flanged pipes, which shall be as exact length.

### 3.3 Tolerances

The manufacturing tolerances on circularity and circumference, length, straightness and end finish shall be as required in AS 1579.

All flanged pipes shall be supplied to exact length.

The tolerance on leg lengths for fittings shall be  $\pm 50$ mm, except where an exact leg length is specified, in which case the tolerance shall be  $\pm 5$ mm.

The tolerance on the angle between end faces shall be within  $1^\circ$  of the design value.

Table 3-1 Preferred Sizes for Steel Pipe and Fittings

Nominal size (mm)	Outside diameter (mm)
100	114
150	168
200	219
250	273
300	324
350	356
400 *** (DN375 DI)	406
450	457
500 *** (DN450 DI)	508
** 550 *** (DN500 DI)	559
600	610
** 650 *** (DN600 DI)	660
700	711
750	762
800 *** (DN750 DI)	813
900	914
1000	1016
** 1050	1067

Nominal size (mm)	Outside diameter (mm)
**1100	1124
1200	1219
**1250	1283/1290
1400	1404/1422
1500	1575
1600	1626
1800	1829
2000	2032
2200	2235

\*\* These sizes are not standard ISO sizes

\*\*\* Equivalent nominal ductile iron sized pipes (for clarity only)

### 3.4 Fittings

Bends shall conform to the dimensions detailed in AS 1579 Appendix D. Where pipe sizes are not provided the same design basis as used in AS 1579 Appendix D shall apply.

## 4. Joints

Six joint types are allowable for use. They are detailed in the following sections – also see Drawing DTC 1150. Alternative types of joint may be used subject to prior approval from Sydney Water.

### 4.1 Spherical Slip-in type

Spherical Slip-in (SSJ) type joints, suitable for field welding from the outside only, shall be used in sizes less than or equal to DN750. Slip-in joints shall allow an axial deflection angle up to at least 1.5° and not more than 3°, shall result in a root gap of ≤ 1.5mm, and shall maintain a minimum overlap of twice the pipe wall thickness at maximum deflection. The cement mortar end dimensions shall be in accordance with AS 1281. Typical end dimensions are shown in Table 4-1 for some selected pipe sizes with 3° joint deflection.

A zinc/aluminium metal spray coating (metallizing) shall be applied to the internal steel pipe socket surface between the cement mortar and the socket end. The surface shall be prepared to a AS 1627.4 Class 2 ½ finish and be metal sprayed with 85% zinc / 15% aluminium alloy to a minimum thickness of 150µm. The metallised zinc surface shall be sealed with a ≥ 80µm minimum thickness epoxy or polyurethane seal coating.

Table 4-1 SSJ End Dimensions for Typical Pipe Sizes (mm)

Pipe OD / Wall Thickness	Nominal entry	Nominal socket setback	Nominal spigot setback	Nominal joint gap	Maximum joint gap - joint un-deflected	Maximum joint gap when deflected 3°
114 x 4.8	12	30	3	21	30	33
168 x 5	16	30	3	19	28	32
219 x 5	16	30	3	17	26	32
273 x 5	20	30	3	13	22	29
324 x 5	20	30	3	13	22	30
356 x 5	20	45	3	25	34	43
406 x 5	24	45	3	21	30	41
457 x 5	24	45	3	21	30	42
508 x 5	28	45	3	20	29	42
559 x 5	30	70	3	40	49	64
610 x 5	32	70	3	41	50	66
660 x 5	34	70	3	36	45	62
711 x 6	38	70	3	35	44	63

## 4.2 Spherical Ball and Socket

Spherical Ball and socket joints (BSJ) shall be used for pipes DN750 and greater suitable for field welding from both the inside and outside. Spherical spigot and socket designs shall allow axial deflection up to a minimum of 3° with a maximum weld preparation root gap of 1.5mm while maintaining a minimum overlap of 3 times the plate thickness.

All BSJ shall include a tapped hole (in the socket) in the area between welds for test purposes (complete with plug), in accordance with AWWA C206.

## 4.3 Flexible Elastomeric Sealed Joints

The manufacturer shall demonstrate the flexible elastomeric or rubber ring joint has been tested in accordance with the requirements of AS 1579 Appendix G and meets or exceeds those requirements.

The elastomeric seals shall comply with the requirements of AS 1646.

Pipes and fittings ordered with elastomeric sealed joints shall be supplied with the necessary quantity of seals and lubricant.

Joints shall accommodate the minimum deflections specified in Table 4.2.



Table 4-2 Minimum deflection angles for flexible elastomeric sealed joints

Nominal Size (mm)	Minimum Deflection angle
≤500	3°
500-650	2.5°
650-750	2°
750-1000	1.5°
1000-1500	1°
>1500	TBC by manufacturer

## 4.4 Socket Weld Ended

This joint combines the flexible elastomeric sealed joint (for sealing to ensure no internal steel surfaces are exposed to the conveyed fluid) plus an external fillet weld (which provides longitudinal restraint).

Field fillet welding design and procedures shall be nominated in the design drawings and determined in consultation with the manufacturer to ensure longitudinal restraint and provide the required pressure rating.

The fusion bonded polyethylene (FBPE) coating shall extend under the elastomeric seal to ensure the conveyed fluid does not contact bare steel and shall be applied in accordance with AS 4321.

The joint shall be designed to ensure there is no overheating of the FBPE lining and elastomeric seal where it's in contact with the conveyed fluid and where it's in contact with the elastomeric seal.

The elastomeric seals shall comply with the requirements of AS 1646.

Pipes and fittings shall be supplied with the necessary quantity of seals and lubricant.

Joints shall accommodate a deflection of  $\geq 1.1^\circ$ .

## 4.5 Plain Ended

Plain ended pipes and/or fittings suitable for field welding using a welding collar. No axial deflection is permitted with these joint types.

Where pipes or fittings are ordered with ends suitable for field welding using welding collars the ends shall be finished at right angles with the axis of the pipe or relevant leg of a fitting. The welds on the outside of the barrel shall be ground flush for a minimum of 150mm from the end of the pipe.

A suitable welding collar shall be supplied with each of these joints. The collar thickness shall not be less than 6mm nor less than the pipe wall thickness and shall comply with AWWA C206.

## 4.6 Spigot Banded Joints

Spigot banded pipes or fittings shall be fabricated from plain ended pipe or fittings with the spigot bands welded to the end of the pipe or fitting.

Spigot bands shall be manufactured using either:

- Plate of the same grade of steel as the pipe or fitting, where the spigot band is welded in position prior to coating with fusion bonded polyethylene.

Note: allowance shall be made for coating thickness in calculating dimensions.

- b. Plate of the same grade of steel as the pipe or fitting and after welding apply a thermally sprayed zinc/aluminium coating system i.e. metallizing, as specified in Clause 4.1.
- c. Where the spigot band forms part of a dismantling joint, only grade 316L shall be used. All welding to be carried out using a suitable stabilised stainless steel electrode. It shall be matched and fitted to the dismantling joint ring flanges after welding to the pipe.

Sydney Water's Deemed-to-Comply (DTC) drawing DTC-1150 provides examples of acceptable fabrication methods of spigot banded joints.

## 4.7 Flanged Joints

Unless otherwise indicated flanges shall be attached according to the applicable weld geometries shown in AS 4041 Figure 3.24.4.8. Arc welding shall be done in accordance with AS/NZS 1554.1.

Flanges must be circular and conform in dimensions and drilling to AS 4087. Where the sizes and/or pressure classes are not covered in AS 4087, flanges must conform to AS 2129 or AS 4331.1, as appropriate.

Flanges may be welded either directly to the pipe or fitting after machining or to a coaming piece which is subsequently attached to the pipe or fitting by butt welding.

Flanges shall be at right angles to the axis of the pipe or to the relevant leg of a fitting.

## 5. Internal Lining

### 5.1 Cement mortar lining

Cement mortar lining for water applications shall be in accordance with AS 1281, using AS 3972 type GP, GB or SR cement. Unless otherwise specified, seal coating complying with ISO 16132 shall be applied for cement mortar lining where the total alkalinity of the water being conveyed is less than 30 mg/L.

The cement mortar lining of spherical spigot and socket pipes and fittings shall be finished as specified in AS 1281.

The cement mortar lining at the ends of plain ended, flanged, spigot and spigot banded pipes and fittings shall be finished as specified in AS 1281.

Pipes and fittings for wastewater applications and other non-drinking water applications (e.g. recycled water, raw water, etc) may need a specialized lining in which case the lining specification shall be subject to agreement between Sydney Water and the Designer. A durability assessment must be done to ensure the proposed lining meet the design life of the pipe.

### 5.2 Other types of lining

Other types of internal lining for pipes and fittings that are recommended in WSA 201 may be applied. The selection and detail of the lining shall be subject to agreement between Sydney Water and the Designer.

## 6. External Coating

### 6.1 Fusion Bonded Polyethylene Coating

Fusion bonded polyethylene coating shall be applied in accordance with AS 4321.

Where pipe and fittings have flexible elastomeric sealed joints, the coating shall terminate under the lining.

Where pipes and fittings have welded joints, the coating shall terminate 100 to 125 mm from the pipe or fitting end ready for welding and application of heat shrink sleeves for corrosion protection.

## 6.2 Other types of coatings

Other types of external coating for pipes and fittings that are recommended in WSA 201 may be applied. The selection and detail of the coating shall be subject to agreement between Sydney Water and the Designer.

## 7. Inspection and Testing

All pipes and fittings shall meet the requirements of AS 1579.

Each pipe shall be subject to a Hydrostatic Pressure Test. The test procedure shall be in accordance with AS 1579 4.1.2, 4.1.3 and Appendix F.

All (100%) pressure pipe containing butt welds in fittings shall be either:

- a. Examined non-destructively using radiography or ultrasonic techniques in accordance with AS 1554.1 category SP and acceptance standards shall be as specified in AS 1554.1 category SP: or
- b. Shall satisfy a Hydrostatic Pressure Test. For flanged pipes and fittings where the hydrostatic test pressure is more than the maximum pressure specified in AS/NZS 4087 the pipe or fitting shall be pressure tested prior to the welding of flanges.

Testing and inspection of coatings and linings shall be as specified in the relevant Australian Standard and/or WSA 201, whichever is applicable.

## 8. 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, and in accordance with the manufacturer's requirements.

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, and in accordance with the manufacturer's requirements.

# Ownership

## Ownership

Role	Title
<b>Group</b>	Engineering & Technical Support
<b>Owner</b>	Norbert Schaeper (Manager, Engineering)
<b>Author</b>	Gary de Leeuw (Principal Civil Engineer)

## Change history

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2	Gary de Leeuw	11/12/2023	Norbert Schaeper	18/12/2023
1	Jerry Sunarho Ashley Fletcher	29/06/2018	Ken Wiggins	29/06/2018