

Australian/New Zealand Standard™

Fittings for polyethylene (PE) pipes for pressure applications



AS/NZS 4129:2020

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- Engineers Australia
- Plastics Industry Pipe Association of Australia
- Plastics New Zealand
- Plumbing Products Industry Group
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Australian/New Zealand Standard™

Fittings for polyethylene (PE) pipes for pressure applications

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Preface

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee PL-006, Polyolefin Pipe Systems, to supersede AS/NZS 4129:2008.

The fittings covered in this Standard are for use with polyethylene (PE) pipe specified in AS/NZS 4130, *Polyethylene (PE) pipes for pressure applications*, and AS 2698.2, *Plastics pipes and fittings for irrigation and rural applications*, Part 2: *Polyethylene rural pipe*, and PIPA POP 009, *Industry Guidelines — Polyethylene rural and flood pipe*.

This Standard follows the classification structure for pipes adopted by ISO (Renard 10 and 20 Series) excepting for Class Rural Mechanical Compression fittings.

This revision incorporates general updates to references and size range tables and includes new requirements for flanges, fabricated fittings and mechanical fittings. The revision also includes updates to align more closely with recent publications of related ISO and EN Standards.

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The terms “normative” and “informative” are used in Standards 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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NOTES

Australian/New Zealand Standard

Fittings for polyethylene (PE) pipes for pressure applications

Section 1 Scope and general

1.1 Scope

This Standard specifies requirements for fittings to be used with polyethylene pipe manufactured in accordance with AS/NZS 4130 or AS 2698.2 or POP 009. This Standard is applicable to fittings manufactured for the conveyance of water, fuel gas, and other fluids including compressed air.

NOTE For continuous use at temperatures above 20 °C refer to AS/NZS 2033 for polyethylene materials.

[Section 1](#) specifies general requirements that apply to all fittings except where subsequent sections detail or exempt specific requirements for particular types of fittings.

This Standard is not applicable to fittings that achieve end-load restraint by processes that reduce pipe and/or fitting spigot thickness to $< 0.9 T_{\min}$ as defined by AS/NZS 4130.

Requirements for demonstrating conformity to this Standard are specified in [Appendix A](#).

1.2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document.

NOTE Documents referenced for informative purposes are listed in the Bibliography.

AS 1049, *Telecommunication cables — Insulation, sheath and jacket*

AS 1145.2, *Determination of tensile properties of plastics materials, Part 2: Test conditions for moulding and extrusion plastics*

AS 1199.1, *Sampling procedures for inspection by attributes, Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection*

AS 1722.2, *Pipe threads of Whitworth form, Part 2: Fastening pipe threads*

AS 2129, *Flanges for pipes, valves and fittings*

AS 2193, *Calibration and classification of force-measuring systems*

AS 2345, *Dezincification resistance of copper alloys*

AS 2698.2, *Plastics pipes and fittings for irrigation and rural applications, Part 2: Polyethylene rural pipe*

AS 3688, *Water supply — Metallic fittings and end connectors*

AS ISO 7.1, *Pipe threads where pressure-tight joints are made on the threads — Dimensions, tolerances and designation*

AS/NZS 2280, *Ductile iron pipes and fittings*

AS/NZS 3500.0, *Plumbing and drainage, Part 0: Glossary of terms*

AS/NZS 4020, *Products for use in contact with drinking water*

AS/NZS 4087, *Metallic flanges for waterworks purposes*

AS/NZS 4130, *Polyethylene (PE) pipes for pressure applications*

AS/NZS 4131, *Polyethylene (PE) compounds for pressure pipes and fittings*



Documents

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AS/NZS 4158, *Thermal-bonded polymeric coatings on valves and fittings for water industry purposes*

AS/NZS 4331.1, *Metallic flanges, Part 1: Steel flanges*

AS/NZS 4331.2, *Metallic flanges, Part 2: Cast iron flanges*

AS/NZS 4331.3, *Metallic flanges, Part 3: Copper alloy and composite flanges*

AS ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*

ISO 228-1, *Pipe threads where pressure-tight joints are not made on the threads — Part 1: Dimensions, tolerances and designation*

ISO 1043-1, *Plastics — Symbols and abbreviated terms — Part 1: Basic polymers and their special characteristics*

ISO 1133-1, *Plastics — Determination of the melt mass-flow rate (MFR) and the melt volume-flow rate (MVR) of thermoplastics — Part 1: Standard method*

ISO 1167-1, *Thermoplastics pipes, fittings and assemblies for the conveyance of fluids — Determination of the resistance to internal pressure — Part 1: General method*

ISO 1167-2, *Thermoplastics pipes, fittings and assemblies for the conveyance of fluids — Determination of the resistance to internal pressure — Part 2: Preparation of pipe test pieces*

ISO 1167-4, *Thermoplastics pipes, fittings and assemblies for the conveyance of fluids — Determination of the resistance to internal pressure — Part 4: Preparation of assemblies*

ISO 3126, *Plastics piping systems — Plastics components — Determination of dimensions*

ISO 3459, *Plastic piping systems — Mechanical joints between fittings and pressure pipes — Test method for leaktightness under negative pressure*

ISO 3501, *Plastics piping systems — Mechanical joints between fittings and pressure pipes — Test method for resistance to pull-out under constant longitudinal force*

ISO 3503, *Plastics piping systems — Mechanical joints between fittings and pressure pipes — Test method for leaktightness under internal pressure of assemblies subjected to bending*

ISO 4427-3, *Plastics piping systems — Polyethylene (PE) pipes and fittings for water supply, Part 3: Fittings*

ISO 6957, *Copper alloys — Ammonia test for stress corrosion resistance*

ISO 7686, *Plastics pipes and fittings — Determination of opacity*

ISO 9080, *Plastics piping and ducting systems — Determination of the long-term hydrostatic strength of thermoplastics materials in pipe form by extrapolation*

ISO 9624, *Thermoplastics piping systems for fluids under pressure — Flange adapters and loose backing flanges — Mating dimensions*

ISO 11357-6, *Plastics — Differential scanning calorimetry (DSC) — Part 6: Determination of oxidation induction time (isothermal OIT) and oxidation induction temperature (dynamic OIT)*

ISO 11413, *Plastics pipes and fittings — Preparation of test piece assemblies between a polyethylene (PE) pipe and an electrofusion fitting*

ISO 12176-2, *Plastics pipes and fittings — Equipment for fusion jointing polyethylene systems — Part 2: Electrofusion*

ISO 12176-4, *Plastics pipes and fittings — Equipment for fusion jointing polyethylene systems — Part 4: Traceability coding*

ISO 13460-1, *Agricultural irrigation equipment — Plastics saddles — Part 1: Polyethylene pressure pipes*

ISO 13950, *Plastics pipes and fittings — Automatic recognition systems for electrofusion joints*

ISO 13951, *Plastics piping systems — Test method for the resistance of plastic pipe/pipe or pipe/fitting assemblies to tensile loading*

ISO 13953, *Polyethylene (PE) pipes and fittings — Determination of the tensile strength and failure mode of test pieces from a butt-fused joint*

ISO 13954, *Plastics pipes and fittings — Peel decohesion test for polyethylene (PE) electrofusion assemblies of nominal outside diameter greater than or equal to 90 mm*

ISO 13955, *Plastics pipes and fittings — Crushing decohesion test for polyethylene (PE) electrofusion assemblies*

ISO 13956, *Plastics pipes and fittings — Decohesion test of polyethylene (PE) saddle fusion joints — Evaluation of ductility of fusion joint interface by tear test*

ISO 13957, *Plastics pipes and fittings — Polyethylene (PE) tapping tees — Test method for impact resistance*

ISO 15494, *Plastics piping systems for industrial applications — Polybutene (PB), polyethylene (PE), polyethylene of raised temperature resistance (PE-RT), crosslinked polyethylene (PE-X), polypropylene (PP) — Metric series for specifications for components and the system*

ISO 17885:2015, *Plastics piping systems — Mechanical fittings for pressure piping systems — Specifications*

ISO 21751, *Plastics pipes and fittings — Decohesion test of electrofusion assemblies — Strip-bend test*

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

EN 12842, *Ductile iron fittings for PVC-U or PE piping systems — Requirements and test methods*

EN 1555-3, *Plastics Piping Systems For The Supply Of Gaseous Fuels — Polyethylene (Pe), Part 3: Fittings*

EN 12201-3, *Plastics piping systems for water supply, and for drainage and sewerage under pressure — Polyethylene (PE), Part 3: Fittings*

EN 12814-3, *Testing of welded joints in thermoplastics semi-finished products, Part 3: Tensile creep test*

EN 14525, *Ductile iron wide tolerance couplings and flange adaptors for use with pipes of different materials: ductile iron, grey iron, steel, PVC-U, PE, fibre-cement*

ASME A182, *Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service*

ASME B16.5, *Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard*

ASME B16.47, *Large Diameter Steel Flanges: NPS 26 through NPA 60 Metric/Inch Standards*

ASTM A276, *Standard Specification for Stainless Steel Bars and Shapes*

ASTM D1600, *Standard Terminology for Abbreviated Terms Relating to Plastics*

PIPA POP-009, *Industry Guidelines — Polyethylene rural and flood pipe*

1.3 Terms and definitions

For the purpose of this Standard the definitions given in AS/NZS 4130 and AS/NZS 3500.0, and those below apply.

1.3.1 General definitions

1.3.1.1

fabricated fittings

fittings manufactured from pipe, billet or fitting sub-sections using fusion jointing methods, where joints are used to form the fitting geometry

1.3.1.2

saddle

fitting used to assemble a branch outlet on a polyethylene pipe through a hole cut in the pipe wall

1.3.2 Geometrical definitions

1.3.2.1

mean outside diameter of the spigot of a fitting

D_m

arithmetic mean of a number of measurements, in millimetres, of the outer circumference of the tubular part of the fitting in any cross-section, divided by π (3.1416) and rounded to the nearest 0.1 mm

1.3.2.2

nominal diameter of a fitting

DN

nominal size, based on pipe outside diameter, in millimetres

1.3.2.3

nominal wall thickness of a fitting

T_n

nominal wall thickness, in millimetres, of a fitting, taken as the nominal wall thickness of the corresponding pipe series

1.3.2.4

out-of-roundness of the spigot of a fitting

maximum outside diameter minus the minimum outside diameter of the fusion end-piece measured in the same plane, parallel to the plane of the spigot end, at a distance not greater than L_2 from that plane

Note 1 to entry: Refer to ISO 4427-3:2019 Figure 3.

1.3.2.5

standard dimension ratio

SDR

nominal ratio of the pipe outside diameter to its wall thickness

$$SDR = \frac{DN}{T_n}$$

1.3.2.6

wall thickness of a fitting

T

wall thickness at any point of the body of the fitting, which could be submitted to the full stress induced by the pressure of the fluid in the piping system

1.3.3 Material definitions

1.3.3.1

compound

homogenous mixture of base polymer, such as PE and additives, at concentrations necessary for the particular application

Note 1 to entry: Examples of additives are anti-oxidants, pigments and UV stabilizers.

1.3.3.2

recycled material

material from used pipes fitting or valves from other used products which has been cleaned crushed or ground

1.3.3.3

reprocessable material

thermoplastics material prepared from clean unused rejected pipes, fittings or valves, produced in a manufacturer's plant by a process such as injection-moulding or extrusion, which will be reprocessed in the same plant

Note 1 to entry: Such material may include trimmings from the production of such pipes, fittings and valves.

1.3.3.4

virgin material

thermoplastics material in a form such as granules or powder, which has not been previously processed other than for compounding, and to which no reprocessable or recyclable materials have been added

1.3.4 Definitions relating to service conditions

1.3.4.1

fuel gas

any fuel that is supplied through pipes or in containers and is a gas at a temperature of +15 °C and an absolute pressure of 101.325 kPa

Note 1 to entry: Compressed air is not defined as fuel gas, and is tested in accordance with water application class fittings.

Note 2 to entry: The reference to the conditions of temperature and pressure is to distinguish between fuel gasses and fuel liquids. There is no implication that those are the conditions which the gas is under in the pipe.

1.3.4.2

hoop stress

stress in a pipe or fitting under pressure, acting tangentially to the perimeter of a transverse section

1.3.4.3

maximum allowable operating pressure

MAOP

maximum pressure that can be sustained, with a design factor, by the type or class of fitting for its estimated useful life under the anticipated operating conditions

1.3.4.4

nominal working pressure

maximum pressure that can be sustained by the fitting for its estimated useful life under the expected working conditions

1.3.4.5

test pressure

pressure applied internally to pipes or fittings when being tested

1.3.5 Definitions specific to the design of electrofusion fittings

1.3.5.1

electrofusion socket fitting

polyethylene (PE) fitting that contains one or more integral heating elements that are capable of transforming electrical energy into heat to produce a fusion joint with a spigot-end or a pipe

1.3.5.2

electrofusion saddle fitting

polyethylene (PE) fitting (top-loading or wraparound) that contains one or more integral heating elements that are capable of transforming electrical energy into heat to produce a fusion joint with a pipe

1.3.5.3

tapping tee

electrofusion saddle fitting that contains an integral cutter designed to cut through the pipe wall

Note 1 to entry: The cutter remains in the body of the saddle after installation.

1.3.5.4

branch saddle

electrofusion saddle fitting that requires an ancillary cutting tool to drill a hole in the adjoining main pipe

1.3.5.5

U-regulation

control of the energy supplied, during fusion-jointing of an electrofusion fitting, by regulating the voltage

1.3.5.6

I-regulation

control of the energy supplied, during fusion-jointing of an electrofusion fitting, by regulating the current

1.3.6 Definitions specific to flanges

1.3.6.1

flange adaptor

PE flanges with a flange face outer diameter smaller than the circle inscribed by its flange bolts

1.3.6.2

full face flange

PE flanges with a flange face outside diameter equal to the outside diameter of the flanges referenced by the Standards in [Table G.1](#) and represented by [Figure G.1](#)

1.3.6.3

metallic backing ring

loose metallic flange installed behind a flange adaptor or full face flange for the purpose of transferring bolt clamping forces and preventing distortion of the PE flange components

1.4 Notation

The following symbols and abbreviations are used throughout this Standard; however, symbols specific to a section are listed therein:

DN = nominal size, based on pipe outside diameter, in millimetres

D_m = mean outside diameter, in millimetres

D_i = mean inside diameter, in millimetres

PN = an alphanumeric designation, for reference purposes, related to the mechanical characteristics of a component of a pipework system (refer AS/NZS 4130)

SDR = see [Clause 1.3.2.5](#)

T = wall thickness of the fitting at any point, in millimetres

T_n = nominal wall thickness, in millimetres

T_S = thickness of the fusion-face wall at any point up to a maximum distance L_1 (the cut-back length) from the mouth, in millimetres

1.5 Classification

Fitting classification shall be in accordance with the requirements of AS/NZS 4130, AS/NZS 2698.2 or POP-009 for the pipe type for which the fittings have been designed.

1.6 Size specification

1.6.1 General

Sizes of fittings shall be specified in accordance with [Clauses 1.6.2](#), [1.6.3](#) and [1.6.4](#).

1.6.2 Straight-through fittings

For fittings with two unequal ends, the larger end shall be given first.

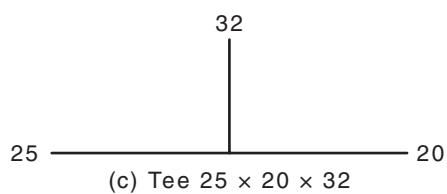
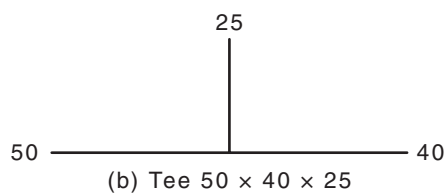
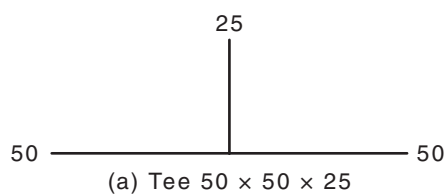
1.6.3 Fittings having three ends

Fitting having three ends (tees) shall be specified first by the end of the “run”, that is, the two ends (the larger shall be specified first) in the same straight line, and then by the remaining end (see [Figure 1.1](#)).

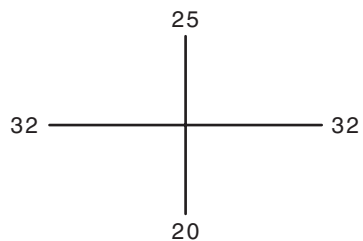
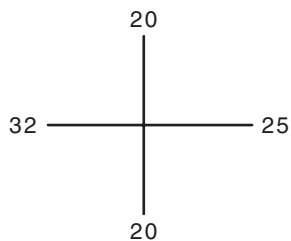
1.6.4 Fittings having four ends

Fittings having four ends (crosses) shall be specified first by the larger end on the “run” and then by the other end 180° adjacent of that run followed by the remaining ends, the larger of the two remaining ends being specified first (see [Figure 1.2](#)).

Dimensions in millimetres

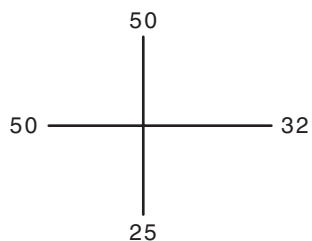
**Figure 1.1 — Examples of sizes of fittings having three ends**

Dimensions in millimetres



(a) Cross 32 x 25 x 20 x 20

(b) Cross 32 x 32 x 25 x 20



(c) Cross 50 x 32 x 50 x 25

Figure 1.2 — Examples of sizes of fittings having four ends

1.7 Threaded end connections on fittings

Threads on fitting ends shall be right-hand Whitworth form and shall conform to AS ISO 7.1, AS 1722.2 or ISO 228-1, as appropriate, and conform to the performance requirements of [Section 2](#).

A female thread shall be designed with consideration of installation torque.

NOTE The manufacturer may provide either —

- (a) a permanent metallic ring feature to control creep of the socket; or
- (b) a torque test value based on AS 4623 in an installation document provided with the product.

1.8 Fittings intended for connection to other pipe systems

Fittings, such as end connectors intended to connect polyethylene pipe systems to pipe systems made from other materials (e.g. copper), shall conform to the relevant dimensional and performance requirements of the appropriate Australian, New Zealand or Joint Australian/New Zealand Standard for the other pipe system. With the exception of pressure testing, where there is a variation in criteria between that Standard and this Standard, the more stringent criteria shall apply.

1.9 Flanged ends on fittings

Flanges, which are required to connect to existing systems or for specific applications, shall be constructed such that they can be attached to flanges conforming to AS/NZS 4331 (series), AS 2129, AS/NZS 4087, AS ISO 9624, ASME/ANSI B16.5, ASME/ANSI B16.47 or other equivalent International Standards, and conform to the performance requirements of [Section 2](#).

Flanges shall be perpendicular to and concentric with the longitudinal axis of the fitting.

1.10 Freedom from defects

1.10.1 General

The defects described in this Clause cannot be completely quantified. Where the presence, size or frequency of any defect is considered to be of concern, arrangements should be made between the purchaser/water or gas authority/certifying body, as appropriate, and the manufacturer. This may be achieved by the provision of acceptable type samples or methods of test.

Where the presence, size or frequency of any imperfection is considered to be of concern, the manufacturer may be required to demonstrate fitness for purpose of the products.

1.10.2 Requirements

1.10.2.1 General requirements

The fitting shall be clean, smooth and free from burrs, fins, irregularities and sharp edges that could affect the performance or function of the fitting in service and the safe handling of the fitting during installation and use. There shall be no imperfections that will score the pipe or cause damage to other fittings.

The bore of fittings shall be free from irregularities that may restrict the free flow of fluids except in the case of fabricated fittings where internal weld beads are accepted.

1.10.2.2 Requirements specific to plastics materials

The surfaces of plastics components shall be free from grooves, pinholes, blisters, heat marks and other imperfections that could affect the performance or function of the fitting in service.

1.10.2.3 Requirements specific to metallic materials

Fittings made from metallic materials shall be sound and free from folds, laps, blisters, laminations, blow holes and other imperfections that could affect the performance or function of the fittings in service. Metallic fittings shall conform to the requirements of AS 3688 as applicable.

Pitting shall not be present on sealing faces or thread faces. Pitting shall be permissible in other locations, provided the minimum wall thicknesses given in the manufacturer's specification are maintained and the pits will not affect the performance and function of the fitting in service.

No components shall be burned, plugged, stopped or patched.

1.11 Effect on water

For applications other than fuel gas and compressed air, fittings and lubricants shall meet the requirements of AS/NZS 4020 when tested utilizing a scaling factor of 0.01 for cold water applications.

1.12 Requirements specific to plastics materials

1.12.1 Plastics-moulded material test

Verification of long-term behaviour of the plastic material shall be in accordance with ISO 17885:2015 Clause 8.2.

1.12.2 Plastics body fittings test

Plastics body fittings shall be type tested for resistance to internal pressure in accordance with ISO 1167 series. The fitting body shall be tested under the conditions specified in [Table 1.2](#). Special sealing plugs connected to one another by a rod allowing some longitudinal movement of the ends may be used or the plug may be held in place by the nut used on a compression fitting assembly.

For the purposes of this test, PN for fuel gas fittings shall be taken as the MAOP of the relevant SDR gas pipe, based on a safety factor of 2, applied to the minimum required strength (MRS) of the pipe material.

No leakage or bursting of the fitting body shall occur within the minimum test period. If leakage occurs at the sealing plugs, the test is not valid and shall be repeated using another test specimen. For materials that are not listed in [Table 1.2](#) or ISO 17885, test conditions shall be established in accordance with ISO 9080, and the conditions of the materials shall be at least equivalent to those conditions listed in [Table 1.2](#) for the evaluation of the long-term performance of the material.

Table 1.2 — Test conditions — Fitting body

Material	Temperature °C	Test duration h	Test pressure MPa
PVC-U	20	1	4.2 × PN
	20	1000	3.2 × PN
PE80	80	1000	0.6 × PN
PE100	80	1000	0.6 × PN
PPH (homopolymer)	20	1	3.3 × PN
	95	1000	0.55 × PN
PPB (block copolymer)	20	1	2.5 × PN
	95	1000	0.4 × PN
PPR (random copolymer)	20	1	2.5 × PN
	95	1000	0.55 × PN

Table 1.2 (continued)

Material	Temperature °C	Test duration h	Test pressure MPa
POM (homopolymer)	20	1	$6.3 \times \text{PN}$
	60	1000	$1.5 \times \text{PN}$
POM (copolymer)	20	1	$5.0 \times \text{PN}$
	60	1000	$0.95 \times \text{PN}$
ABS	20	1	$3.1 \times \text{PN}$
	70	1000	$0.5 \times \text{PN}$
PA (reinforced polyamide)	20	1	$4.2 \times \text{PN}$
	20	250	$3.2 \times \text{PN}$

1.12.3 Opacity test

Plastics body fittings (other than black) shall be type tested in accordance with ISO 7686. The amount of light transmitted through the fitting wall shall be less than or equal to 0.2 %.

1.12.4 Chemical resistance for fuel gas applications

Compounds intended for use in fuel gas pipe and fittings shall be tested in accordance with [Appendix B](#). The chemical resistance of a compound shall be such that it shall not increase in mass by more than 0.5 % and shall not change in tensile stress at yield by more than 12 %.

1.13 Requirements specific to metallic materials

1.13.1 Metallic materials

1.13.1.1 General

Where specified by the purchaser, metallic materials shall be corrosion resistant or protected against corrosion.

1.13.1.2 Ductile iron

Ductile iron materials shall conform to the properties of fittings specified in AS/NZS 2280.

1.13.1.3 Corrosion-resistant metallic materials

For the purposes of this Standard the following materials are deemed to be corrosion resistant:

- (a) Copper alloys conforming to AS 3688.
- (b) Stainless steels conforming to ASTM A276, or ASTM A182, with a minimum pitting resistance equivalent number (PREN) of 22.

NOTE The pitting resistance equivalent number can be calculated as

$$\text{PREN} = \% \text{Cr} + (3.3 \times \% \text{Mo}) + (16 \times \% \text{N}).$$

Other materials may be considered based on published corrosion resistance data.

1.13.1.4 Protection against corrosion of other metallic materials

With the exception of stainless steels, all ferrous materials, such as steel, ductile iron and cast iron, and other metals including aluminium alloys shall be coated in accordance with AS/NZS 4158.