

Australian Standard[®]

Repair and off-take clamps for water industry purposes



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- Association of Accredited Certification Bodies
 - Australian Chamber of Commerce and Industry
 - Australian Industry Group
 - Plastics Industry Pipe Association of Australia
 - Plastics New Zealand
 - Water Industry Operations Group
 - Water New Zealand
 - Water Services Association of Australia
-

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Repair and off-take clamps for water industry purposes

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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee WS-016 Cast Iron Pressure Pipes and Fittings, to supersede AS 4181—1999, *Stainless steel clamps for waterworks purposes*.

This Standard is the result of a consensus among Australia/New Zealand representatives on the Committee to produce it as an Australian Standard.

The objective of this Standard is to include design, materials and type tests required for clamps for the Australian water industry.

The objectives of this revision are the following:

- (a) Introduction of a broader range of materials.
- (b) Increase in nominal diameters for repair clamps.
- (c) Recognition of issues associated with low stiffness pipes, as addressed in WSA 122, *Industry Standard for Flanged Off-take Clamps*.
- (d) Change of title to better reflect the scope of the Standard.

Key aspects from WSA 122 that have been incorporated into the Standard are the differentiation between Type R and Type F applications, and the associated type testing required to demonstrate suitability of a product.

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.

Statements expressed in mandatory terms in notes to tables and figures are deemed to be requirements of this Standard.

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STANDARDS AUSTRALIA

Australian Standard

Repair and off-take clamps for water industry purposes

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard specifies the requirements for the design, materials and in-service performance of Type R and Type F mechanical clamps for water industry purposes.

In this Standard—

- (a) Type R clamps are designated for applications involving rigid pipes, typically ductile iron (DI), grey cast iron (CI), steel (S), asbestos cement (AC), copper (CU) and reinforced concrete (RC); and
- (b) Type F clamps are designated for applications involving flexible pipes, typically oriented polyvinylchloride (PVC-O), modified polyvinylchloride (PVC-M), unplasticized polyvinylchloride (PVC-U) and glass reinforced thermoplastics (GRP).

Clamps complying with this Standard are intended for use in off-take connections on pressure pipelines of the sizes up to and including DN 600, and repair applications on pressure pipelines of all sizes, with a maximum operating temperature of 40°C.

This Standard does not cover the following:

- (i) The use of repair or off-take clamps on polyethylene (PE) pipelines.
- (ii) Tapping bands/saddles.

NOTE: Tapping bands and saddles area covered in AS/NZS 4793 or AS/NZS 4129.

1.2 DEMONSTRATION OF COMPLIANCE

Demonstration of compliance with this Standard shall be in accordance with Appendix A.

1.3 APPLICATION

1.3.1 General

Repair and off-take clamps have limited ability to accommodate axial deflection and, therefore, are not intended for use as couplings to join two pipes together.

Repair and off-take clamps are suitable for use in both above-ground and buried applications.

1.3.2 Repair clamps

Repair clamps complying with this Standard are intended to provide a permanent means of preventing loss from or contamination of pipelines that have been affected by corrosion or mechanical damage.

1.3.3 Tapped off-take clamps

Tapped off-take clamps complying with this Standard are intended to provide a permanent threaded connection into new and existing pipelines. Tapped off-take clamps are suitable replacements for existing tapped connections that are damaged or where the surface of the pipeline to be tapped is not suitable for the use of a tapping band.

Tapped off-take clamps may be used in under-pressure connection applications.

1.3.4 Flanged off-take clamps

Flanged off-take clamps complying with this Standard are intended to provide a permanent means of making a flanged connection to a pipeline.

Flange off-take clamps may be used in under-pressure connection applications.

1.4 NORMATIVE REFERENCES

The following are the normative documents referenced in this Standard:

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

AS

- 1112 ISO metric hexagon nuts
- 1112.1 Part 1: Style 1—Product grades A and B
- 1199 Sampling procedures and tables for inspection by attributes
- 1199.1 Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection
- 1646 Elastomeric seals for waterworks purposes
- 1831 Ductile cast iron
- 2074 Cast steels
- 2205 Methods for destructive testing of welds in metal
- 2205.10.1 Methods 10.1: Corrosion test for welded austenitic stainless steel
- 4291 Mechanical properties of fasteners made of carbon and alloy steel
- 4291.1 Part 1: Bolts, screws and nuts

AS ISO

- 7 Pipe threads where pressure-tight joints are made on the threads
- 7.1 Part 7.1: Dimensions, tolerances and designation

AS/NZS

- 1462 Methods of test for plastics pipes and fittings
- 1462.6 Part 6: Thermoplastics pipes, fittings and assemblies for the transport of fluids under pressure—Resistance to internal pressure
- 1462.8 Part 8: Method of testing the leaktightness of assemblies
- 1554 Structural steel welding
- 1554.6 Part 6: Welding stainless steels for structural purposes
- 1594 Hot-rolled steel flat products
- 3678 Structural steel—Hot-rolled plates, floorplates and slabs
- 4020 Testing of products for use in contact with drinking water
- 4087 Metallic flanges for waterworks purposes
- 4158 Thermal bonded polymeric coatings on valves and fittings for water industry purposes

ASTM

- A240/ Standard Specification for Chromium and Chromium-Nickel Stainless Steel
- A240M Plate, Sheet, and Strip for Pressure Vessels and for General Applications
- A276 Standard Specification for Stainless Steel Bars and Shapes
- A312/ Standard Specification for Seamless, Welded, and Heavily Cold Worked
- A312M Austenitic Stainless Steel Pipes
- A380 Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems

API	
5L	Specification for Line Pipe
ANSI	
B16.3	Malleable Iron threaded Fittings: Classes 150 and 300
AWS	
A5.9	Specification For Bare Stainless Steel Welding Electrodes And Rods
ISO	
724	ISO general purpose metric screw threads—Basic dimensions
965	ISO general purpose metric screw threads—Tolerances
965-1	Part 1: Principles and basic data
3506	Mechanical properties of corrosion-resistant stainless steel fasteners (all parts)
6507	Metallic materials—Vickers hardness test
6507-1	Part 1: Test method
7089	Plain washers—Normal series—Product grade A
WIS	
04-52-03	Specification for anti-corrosion coatings on threaded fasteners
WTIA	
TN13	Stainless Steels for Corrosive Environments
WSA	
109	Industry Standard for Flange Gaskets and O-rings

1.5 DEFINITIONS

For the purposes of this Standard, the definitions below apply.

1.5.1 Allowable operating pressure (AOP)

The allowable internal pressure, excluding surge, which a component can safely withstand in service, expressed in megapascals.

1.5.2 Allowable site test pressure (ASTP)

The maximum pressure to be applied on site in a newly installed pipeline, including a safety factor and allowance for surge, expressed in megapascals.

1.5.3 DN (nominal size)

An alphanumeric designation of size for a component in a pipe work system, which is used for reference purposes. It comprises the letters DN followed by a dimensionless whole number, which is directly related to the physical size, in millimetres, of the internal or external, as applicable, nominal diameter of the pipe.

1.5.4 dn (nominal size of the connecting pipe)

An alphanumeric designation of size of the connecting pipe on an off-take clamp, which is used for reference purposes. It comprises the letters dn followed by a dimensionless whole number, which is directly related to the physical size, in millimetres, of the internal or external, as applicable, nominal diameter of the pipe.

1.5.5 Maximum allowable operating pressure (MAOP)

The maximum internal pressure, including surge, that a component can safely withstand in service, expressed in megapascals.

1.5.6 Maximum operating temperature

The maximum internal or external temperature (40°C) to which the clamp is exposed in service.

1.5.7 Off-take clamp

A clamp with an integral off-take in flange, nipple or socket design which retains the integrity of the clamp seal.

1.5.8 Pressure classification

A classification of clamp by a PN number based on the AOP, expressed in megapascals ($PN = 10 \times AOP$).

1.5.9 Repair clamp

An elastomeric-lined metal sheet with an integral clamping system designed for the repair of pipes and for providing a full circumferential seal.

1.5.10 Size range

The range of outside diameters of pipe for which the clamp is designed.

1.6 DESIGNATION OF SIZE

Off-take clamp size shall be designated by the nominal size of the host pipe followed by the nominal size of the connecting branch pipe (i.e. DN 100 × dn 80 signifies the fitting as suitable for a DN 100 pipe with a dn80 connecting pipe).

1.7 ALLOWABLE OPERATING PRESSURE (AOP) VALUES

The AOP values shall be $MAOP = 1.2 \times AOP$ and $ASTP = 1.25 \times AOP$.

NOTE: Allowable pressures for commonly used pressure application are given in Table 1.1.

1.8 DESIGN VARIATION

When there is variation in material properties, material thicknesses, fastening mechanisms, seal material or seal shape, it shall be deemed to be a design variation. Differences in clamp length or off-take size and type are not considered design variations.

TABLE 1.1
ALLOWABLE PRESSURES FOR COMMONLY USED
PRESSURE CLASSIFICATIONS

Pressure classification	Allowable operating pressure (AOP)	Maximum allowable operating pressure (MAOP)	Allowable site test pressure (ASTP)
PN	MPa	MPa	MPa
10	1.00	1.20	1.25
16	1.60	1.92	2.00
21	2.10	2.52	2.63
35	3.50	4.20	4.38

SECTION 2 MATERIALS

2.1 REQUIREMENTS

The material for the manufacture of clamps shall be in accordance with Table 2.1.

Alternative materials may be used provided they are equivalent in performance, particularly with respect to strength, corrosion-resistance, clamp operation and durability.

NOTE: Material equivalence may be considered by a ruling committee of asset owners and manufacturers selected by the Water Services Association of Australia (WSAA) from standing members of the relevant Standards Australia Committee(s).

TABLE 2.1
MATERIAL REQUIREMENTS

Component	Materials	
	Material	Standard
Clamp body	Coated ductile iron Grade 500-7 or 400-12	AS 1831 AS/NZS 4158
	Stainless steel Grade 316/316L	ASTM A240/A240M ASTM A276 ASTM A312/A312M ANSI B16.3
	Coated steel:	All products coated to AS/NZS 4158
	C3	AS 2074
	HA1016	AS/NZS 1594
	HXA1016	AS/NZS 1594
Seals	250 or 300	AS/NZS 1594
	250 or 300	AS/NZS 3678
	Grade X42 or X52 ERW	API 5L
Fasteners	Elastomer SBR, NBR EPDM	AS 1646
Washers	Stainless steel Grade 316/316L	ASTM A240/A240M/ASTM A276 ISO 3506 (All parts)
	Carbon steel	AS 4291 (coated to WIS 04-52-03)
	Stainless steel Grade 316/316L	ASTM A240/A240M ISO 6507-1, hardness 200HV

2.2 STAINLESS STEEL

Stainless steel components that are subjected to welding, including repair welding, during the manufacture of any component shall either be low carbon or stabilized grade, or shall meet the carbon requirements specified in WTIA TN13. All stainless steel components shall be passivated in accordance with ASTM A380.

All welding shall be carried out in accordance with AS/NZS 1554.6 with welding quality Category 2B. Welding shall be capable of meeting the requirements of the intergranular corrosion test specified in AS 2205.10.1 and electrodes to AWS A5.9, except inspection. Inspection shall be carried out by suitably trained persons approved by the manufacturer to meet its requirements.

2.3 COATING

The internal and external surfaces of ductile iron and carbon steel clamp components shall be coated with thermal-bonded polymeric coating in accordance with AS/NZS 4158.

2.4 ELASTOMERIC SEALS

Elastomeric seals shall comply with the requirements of AS 1646, except for flange gaskets and O-rings which shall comply with WSA 109.

2.5 EFFECT ON WATER

Clamps shall comply with AS/NZS 4020 using a scaling factor of 0.05.

SECTION 3 DESIGN

3.1 CLAMP COMPONENTS

The clamp shall comprise a body (with or without a branch off-take connection), an elastomeric seal and a means of attachment to the pipe.

3.2 CLAMP DESIGN FEATURES

3.2.1 Type R clamps

Type R clamps shall be designed for use on 'rigid' pipes including DI, CI, S, CU, RC and AC.

3.2.2 Type F clamps

Type F clamps shall be—

- (a) designed for application to flexible pipes including PVC-O, PVC-M, PVC-U, GRP and other plastics pipes;

NOTES:

- 1 Type F may be designed for use on Series 1 or Series 2 or both Series 1 and Series 2 flexible pipes
 - 2 PVC-O, PVC-M AND PVC-U pipes are manufactured in two series, Series 1 and Series 2. The outside diameters of Series 1 and Series 2 pipes for a particular DN are different. Dimensions for Series 1 and Series 2 are given in the relevant Standards.
 - 3 GRP pipes are manufactured internationally in a number of series, Series A and Series B1, B2, B3, B4, B5 and B6. The internal and external diameters of the different series pipes from a particular DN are different. Dimensions for the different series pipes are given in the relevant Standard. AS 3571.1 lists variations to ISO 10467:2004 for Australian applications.
- (b) full circle design, incorporating a positive stop feature to prevent diametrical deflection as specified in Clause 4.1.3 and, if spacers or other means are used to limit the fully tightened position, they shall be captive in the clamp; and
 - (c) able to accommodate the maximum and minimum tolerances of pipe diameter and ovality for the material specific pipe Standard(s) for which they are designed.

3.2.3 Type R and Type F clamps

Type R and Type F clamps shall be designed for use on rigid and flexible pipes, provided the pipes meet the requirements for both Type R and Type F clamps.

3.3 MEANS OF ATTACHMENT

The means of attachment shall ensure that the clamp meets the performance requirements of this Standard. Where nuts and bolts are used, either the nuts or the bolts, or both, shall be retained in the clamp.

The clamping system shall be self aligning and locking in its assembly prior to the tightening of its retaining system.

3.4 BI-METALLIC CONTACT

Where a clamp is intended for use on metallic pipes, electrical insulation shall be incorporated into the clamp design to prevent bi-metallic corrosion.

NOTE: Coatings may provide suitable electrical insulation.