

AS 4087:2011

(Incorporating Amendments up to and including No. 2)



STANDARDS
Australia



Metallic flanges for waterworks purposes



AS 4087:2011

This Joint Australian/New Zealand Standard was prepared by Joint Technical Committee WS-022, Valves for Water Supply Purposes. It was approved on behalf of the Council of Standards Australia on 15 March 2011 and on behalf of the Council of Standards New Zealand on 13 May 2011.

This Standard was published on 26 May 2011.

The following are represented on Committee WS-022:

- Australian Building Codes Board
- Australian Chamber of Commerce and Industry
- Australian Industry Group
- Australian Stainless Steel Development Association
- Australian Water Association
- Engineers Australia
- Institute of Instrumentation, Control & Automation Aust
- Master Plumbers Australia and New Zealand
- Plastics Industry Pipe Association of Australia
- Plumbing Products Industry Group
- Water Industry Alliance
- Water Services Association of Australia

This Standard was issued in draft form for comment as DR 4087.

Keeping Standards up-to-date

Ensure you have the latest versions of our publications and keep up-to-date about Amendments, Rulings, Withdrawals, and new projects by visiting:

www.standards.org.au

ISBN 978 0 7337 9866 5

Metallic flanges for waterworks purposes

Originated as AS 4087—1993.

Third edition 2004.

Revised and redesignated as AS/NZS 4087:2011.

Reissued incorporating Amendment No 2 (June 2023) as AS 4087:2011.

© Standards Australia Limited/Standards New Zealand 2023

All rights are reserved. No part of this work may be reproduced or copied in any form or by any means, electronic or mechanical, including photocopying, without the written permission of the publisher, unless otherwise permitted under the Copyright Act 1968 (Australia) or the Copyright Act 1994 (New Zealand).

Preface

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee WS-022, Valves for Water Supply Purposes, to supersede AS 4087—2004.

A2 This Standard incorporates Amendment No. 1 (September 2012) and Amendment No. 2 (June 2023). The start and end of changes introduced by the Amendment are indicated in the text by tags including the Amendment number 1. **A2**

A2 Amendment No. 2 to this document was prepared by the Australian members of the Joint Standards Australia/Standards New Zealand Committee WS-022, Valves for Water Supply Purposes. As a consequence of Amendment No. 2, which is published as an Australian-only amendment, this document will be redesignated from AS/NZS 4087 to AS 4087. **A2**

The objective of this Standard is to provide manufacturers with requirements for metallic flanges for waterworks purposes and installers of flanged components with guidance on the most appropriate jointing requirements to achieve a satisfactory long-term watertight joint.

The first flange Standard published in Australia was AS B52-1931, which was an endorsement of BS 10, the inch series flange British Standard, *Flanges and bolting for pipes valves and fittings*. Britain metricated in 1970 and adopted European (ISO) dimensions for flanges whilst Australia chose to continue with the same inch series flange dimensions. AS 2129, *Flanges for pipes, valves and fittings*, was published in 1978 to supersede AS B52 but incorporated 'soft metric' dimensions. The AS/NZS 4331 series, *Metallic flanges*, was published in 1995 as an endorsement of ISO hard metric flanges.

The most common AS 2129 flange tables used for waterworks purposes were Tables D, C, E, F and H with pressure ratings of 700, 1200, 1400, 2100 and 3500 kPa respectively. Table C flanges were subsequently re-rated to 1400 kPa in AS 2129—1991 to reflect industry experience.

AS 4087 was first published in 1993 to provide a dedicated flange Standard for waterworks purposes with a rationalized range of flanges. Table E was eliminated and flanges were designated by allowable operating pressure (AOP). The table below indicates bolting compatibility between AS 4087 and AS 2129 flanges.

Bolting compatibility	
A2 AS 4087 A2 Flange classification	AS 2129 Flange classification
PN 14	D, C
PN 16	D, C
PN 21	F, H
PN 35	F, H

The principal changes to this Edition are as follows:

- (a) Incorporation of previous amendments.
- (b) Requirements specified for non-circular flanges, including type tests based on ISO 2531, *Ductile iron pipes, fittings, accessories and their joints for water or gas applications*.
- (c) Inclusion of maximum allowable type test pressures, adopted from AS 2129, *Flanges for pipes, valves and fittings*.
- (d) Amendments to some flange hub dimensions to overcome bolt assembly impracticalities.

Statements expressed in mandatory terms in notes to 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.

Contents

Preface	ii
Foreword	vi
Section 1 Scope and general	1
1.1 Scope.....	1
1.2 Application.....	1
1.3 Normative references.....	1
1.4 Definitions.....	1
1.5 Configuration.....	2
1.5.1 General.....	2
1.5.2 Type.....	2
1.5.3 Flange face.....	3
1.6 Marking.....	4
Section 2 Classification and allowable pressures	5
Section 3 Materials	6
3.1 Flanges.....	6
3.2 Fasteners.....	6
3.3 Flange gaskets.....	7
3.4 O-rings for flanges.....	7
3.4.1 General.....	7
3.4.2 Material.....	7
3.4.3 Method of manufacture.....	7
3.4.4 Dimensions.....	7
3.4.5 Assembly.....	7
Section 4 Manufacturing requirements, dimensions and tolerances	8
4.1 Dimensions and tolerances.....	8
4.1.1 Thickness of flange.....	8
4.1.2 Outside diameter of flange.....	8
4.1.3 O-ring groove.....	8
4.1.4 Height of raised face.....	8
4.1.5 Diameter of raised face.....	8
4.1.6 Boltholes.....	9
4.2 Contact surfaces.....	9
4.2.1 General.....	9
4.2.2 Tolerance on flatness.....	9
4.3 Spot-facing and back-facing of flanges.....	9
4.3.1 Parallelism of bearing surfaces.....	9
4.3.2 Diameter of spot-facing.....	10
4.3.3 Back-facing.....	10
4.3.4 Thickness of flanges after spot-facing or back-facing.....	10
4.4 Preparation for the attachment of flanges.....	10
4.4.1 Screw-on flanges.....	10
4.4.2 Plate flanges.....	10
Section 5 Design	12
5.1 Circular flanges.....	12
5.2 Flanges with alternative external shape.....	12
5.2.1 General.....	12
5.2.2 Thickness.....	12
5.2.3 Performance requirements.....	12
Appendix A (normative) Normative references	13
Appendix B (normative) Dimensions of flanges	15
Appendix C (informative) Flange jointing guidelines	30

Appendix D (informative) Purchasing guidelines	32
Appendix E (normative) Type test for flanges with alternative external shapes	33
Bibliography	35
Amendment control sheet	36

Foreword

Limitations on the use of flanges specified in this Standard may be imposed by one or more of the following:

- (a) Material of construction.
- (b) Pressure class.
- (c) Configuration.
- (d) DN (nominal size).
- (e) Whether installed in buried or submerged or above-ground situations and for the last, the method of support (i.e. beam action).
- (f) Requirements of any relevant product Standard.

Where a pipeline component or appurtenance has an allowable operating pressure (AOP) that is different to an available flange pressure class for the relevant material, the next higher flange pressure class should be specified. For example a PN 10 grey cast iron butterfly valve should incorporate a [Figure B2](#) PN 14 flange and a PN 25 ductile iron fitting should incorporate a [Figure B6](#) PN 35 flange. Test pressures for the pipeline component or appurtenance should be as given in the pipeline component or appurtenance Standard.

The designer of a pipeline or pressure-retaining equipment should evaluate the possible conditions to which flanges will be exposed. The designer should determine whether flanges according to this Standard are suitable for the proposed application.

Australian Standard®

Metallic flanges for waterworks purposes

Section 1 Scope and general

1.1 Scope

This Standard specifies requirements for circular flanges manufactured from copper alloy, grey cast iron, ductile cast iron, or steel. The external shapes of flanges may alternatively be any other shape.

It covers nominal sizes with pressure ratings for PN 14, PN 16, PN 21 and PN 35 at operating temperatures not exceeding 80°C. The Standard also specifies requirements for jointing materials.

Flanges are suitable for use on pipes, pipe fittings, valves and other appurtenances that are primarily intended for the conveyance or storage of water or wastewater.

NOTE For applications outside the limits specified in this Standard the appropriate flange details may be determined from AS 2129 series, *Flanges for pipes, valves and fittings*, and AS/NZS 4331 series, *Metallic flanges*.

1.2 Application

Flange dimensions shall be in accordance with [Appendix B](#).

NOTE 1 Guidelines for designers and installers on the selection of correct jointing requirements for flanges are detailed in [Appendix C](#).

NOTE 2 Guidelines for purchasers on information that should be supplied at the time of enquiry or order are detailed in [Appendix D](#).

1.3 Normative references

The normative documents referenced in this Standard are listed in [Appendix A](#).

NOTE Documents referenced for informative purposes are listed in the [Bibliography](#).

1.4 Definitions

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

1.4.1

allowable operating pressure

AOP

the allowable internal pressure, excluding surge, that a component can safely withstand in service

1.4.2

allowable site test pressure

ASTP

maximum pressure applied on site in a newly installed pipeline (includes a safety factor and allowances for surge)

1.4.3

coating

a corrosion-inhibiting medium applied to the surface of a flange

1.4.4

DN (nominal size)

an alphanumeric designation of size for components of a pipework system, which is used for reference purposes. It comprises the letters DN followed by a dimensionless whole number, which is indirectly related to the physical size, in millimetres, of the bore or outside diameter of the end connections

1.4.5**flange contact surface**

that part of the flange face upon which the gasket is compressed

1.4.6**flange face**

the reference plane that is perpendicular to the axis of the flange and coincident with the front of the flange (see [Figure 1.2](#) and [Appendix B](#))

1.4.7**flange thickness**

the distance from either the back face of a flange or, if the boltholes are spot-faced, the spot facing to the flange face (see [Appendix B](#))

1.4.8**fluid**

water, recycled water, sewage or wastewater at temperatures not exceeding 80°C

1.4.9**integral flange**

a flange that is cast or forged as part of a pressure-containing component

1.4.10**maximum allowable operating pressure****MAOP**

maximum internal pressure, including surge, that a component can safely withstand in service

1.4.11**maximum allowable type test pressure****MATTP**

the maximum allowable hydrostatic pressure applied to a flange for the purposes of proof or type testing an associated appurtenance

1.4.12**pressure class****PN**

a classification of flanges by PN number, based on the allowable operating pressure (AOP) expressed in megapascals ($PN = 10 \times AOP$)

1.4.13**temperature**

the temperature of the fluid contained by the pressure-containing component to which the flange is attached

1.5 Configuration**1.5.1 General**

Flange configuration is determined by—

- (a) the type, as specified in [Clause 1.5.2](#); and
- (b) the face, as specified in [Clause 1.5.3](#).

1.5.2 Type

The types of flanges shall be the following (see [Figure 1.1](#)):

- (a) Blank (steel and ductile iron).

- (b) Plate fixed by brazing or welding (copper alloy and steel).
- (c) Screw-on (ductile iron).
- (d) Integral—
 - (i) with neck (ductile iron); and
 - (ii) without neck (grey iron, copper alloy and steel).

NOTE For convenience, only the flat face variant of each type has been illustrated.

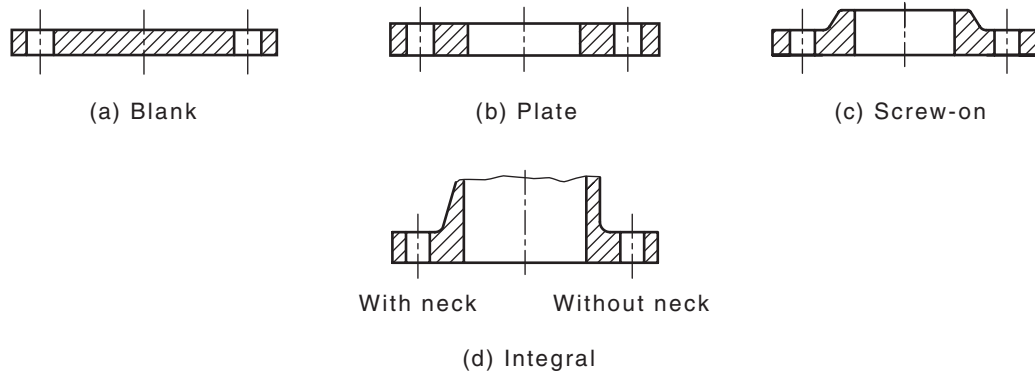


Figure 1.1 — Flange types

1.5.3 Flange face

Ⓐ Flanges shall be manufactured with a flat face, with or without an O-ring groove, or raised face, as given in [Table 1.1](#). A flat-face O-ring groove flange shall only be mated with a flat-face flange. Ⓐ

Table 1.1 — Allowable flange face types

Material	Pressure class	Face type
Copper alloy	14	Flat
Grey cast iron	14	Flat
	21	Flat
	35	Flat
Ductile cast iron	16	Raised
	35	Raised
Steel	16	Flat, O-ring or raised
	21	Flat, O-ring or raised
	35	Flat, O-ring or raised

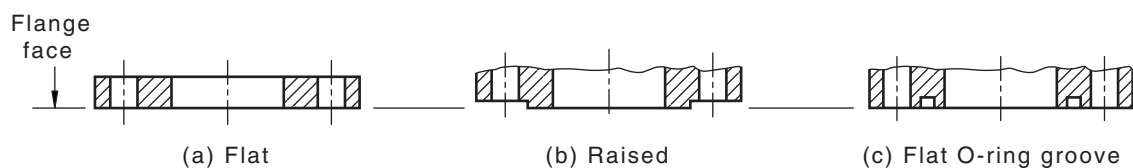


Figure 1.2 — Flange faces

1.6 Marking

Flanges (other than integral flanges) shall be permanently and legibly marked on the rim or on the back of the flange between the rim and the pitch circle diameter, with the following information:

- (a) The number of this Standard, i.e. AS 4087.
- (b) DN (nominal size).
- (c) Pressure class, PN.
- (d) Material (e.g. DI, steel).
- (e) Manufacturer's name or trademark.
- (f) Where thread sealants not complying with AS/NZS 4020 are used with screwed flanges, a warning statement 'Not for drinking water'.

Integral flanges need not be marked in accordance with this Standard if the product Standard specifies information to be marked on the product.

NOTE Manufacturers making a statement of compliance with this Australian/New Zealand Standard on a product, packaging, or promotional material related to that product are advised to ensure that such compliance is capable of being verified.

Section 2 Classification and allowable pressures

The classification and allowable pressures for flanges shall be in accordance with [Table 2.1](#). The integrity of a flanged joint is dependent upon the correct selection of jointing materials and the correct method of assembly.

NOTE For guidelines on flange jointing, see [Appendix C](#).

The various types of flanges are not necessarily applicable to all Classifications and nominal sizes (see [Table 2.1](#) and [Appendix B](#)).

Table 2.1 — Classification and allowable pressures

Pressure Class PN	AOP kPa	MAOP kPa	ASTP kPa	MATTP, kPa		DN range (inclusive)			
				Copper alloy and steel	Grey cast iron and ductile cast iron	Copper alloy	Grey cast iron	Ductile cast iron	Steel
14	1 400	1 680	1 750	2 100	2 800	15 to 150	80 to 1 200	—	—
16	1 600	1 920	2 000	2 400	3 200	—	—	80 to 1 200	50 to 1 200
21	2 100	2 520	2 625	3 150	4 200	—	80 to 1 200	—	50 to 1 200
35	3 500	4 200	4 375	5 250	7 000	—	80 to 600	80 to 1 200	50 to 1 200

Section 3 Materials

3.1 Flanges

Materials from which flanges are manufactured shall be free from defects that could affect the performance or function of the flanges at the allowable test pressures and service conditions.

Flange material grades shall be in accordance with [Table 3.1](#) and—

- (a) for an integral flange, be of the same type or grade as the parent article; or
- (b) for a non-integral flange, be compatible with the material of the parent article to which it is to be joined.

Table 3.1 — Flange material grades²

Material	Standard	Material designation
Copper alloy	AS 1565	C83600, C90250, C90810, C92410
Ductile cast iron	AS 1831	ISO1083/JS/500-7/S ISO1083/JS/450-10/S ISO1083/JS/400-12/S ISO1083/JS/400-15/S
Grey cast iron	AS 1830	ISO185/JL/200 ISO185/JL/250
Steel	AS 2074 AS 3678 ASTMA240MAS2074	C3 250 304, 304L, 310, 316, 316L, 321 H3A, H3B, H3C, H5A, H5B, H5C, H6A, H6B, H6C
* Other grades of steel or alloy steel may be used subject to the yield stress being not less than 250 MPa		

3.2 Fasteners

Fasteners shall be in accordance with [Table 3.2](#). Alternative fasteners may be specified by the purchaser.

Where specified, galvanized coatings shall comply with AS 1214.

Table 3.2 — Fasteners

Component	Material			Dimensional	Mechanical	
	Composition	Standard	Grade	Standard	Standard	Property class
Bolts	Carbon steel	AS 2074	C1	AS 1111.1 AS 1110.1	AS 4291.1	4.6 8.8
	Stainless steel	ASTM A276	316	AS 1110.1	ISO 3506-1	A4-50 A4-70 A4-80
Studbolts	Carbon steel	AS 2074	C1	AS 2528	AS 4291.1	8.8
	Stainless steel	ASTM A276	316		ISO 3506-1	A4-70 A4-80
Nuts	Carbon steel	AS 2074	C1	AS 1112.1	AS 4291.2	5 8
	Stainless steel	ASTMA564M	316		ISO 3506-2	A4-80