

Australian Standard™

Flanges for pipes, valves and fittings

This Australian Standard was prepared by Committee ME/1, Pressure Equipment. It was approved on behalf of the Council of Standards Australia on 17 September 1999 and published on 17 January 2000.

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This Standard was issued in draft form for comment as DR 98317.

Australian Standard™

Flanges for pipes, valves and fittings

Originated in part as AS B52.1—1931
(being endorsement of BS 10.1—1928 without amendment).
Previous edition AS 2129—1994.
Third edition 2000.

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Published by Standards Australia International Ltd
PO Box 1055, Strathfield, NSW 2135, Australia

ISBN 0 7337 3065 5

PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee ME/1, Pressure Equipment Standard to supersede AS 2129—1994.

This Standard is the result of a consensus among representatives on the Joint Committee to produce it as an Australian Standard. Consensus means general agreement by all interested parties. Consensus includes an attempt to remove all objections and implies much more than the concept of a simple majority, but not necessarily unanimity. It is consistent with this meaning that a member may be included in the Committee list and yet not be in full agreement with all clauses of this Standard.

This Standard is derived from the British inch series flange Standard BS 10:1962, *Flanges and bolting for pipes, valves and fittings*. BS 10 was made obsolescent in 1970, however, it is still called up in British pressure equipment Standards. A 1992 survey of Australian industry showed that flanges in accordance with AS 2129 were still in great demand. As a result it was determined that AS 2129 should be revised and updated rather than being made obsolescent.

It is anticipated flanges to AS 2129 will remain in use for at least 50 years, particularly for replacement flanges. Consideration should be given to the use of alternative flanges, such as those to AS/NZS 4331, *Metallic flanges* (series), BS 4504, *Circular flanges for pipes valves and fittings, (PN designated)*, ANSI/ASME B16.5, *Pipe flanges and flanged fittings*, and AS 4087, *Metallic flanges for waterworks purposes*.

The main changes in this edition are as follows:

- (a) Incorporation of Amendment No. 1 to the 1994 edition.
- (b) Deletion of Table C which is now covered in AS 4087.
- (c) Updated referenced documents.

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

The term 'normative' has been used in this Standard to define the application of the Appendices. A 'normative' appendix is an integral part of this Standard.

CONTENTS

	<i>Page</i>
SECTION 1 SCOPE AND GENERAL	
1.1 SCOPE	4
1.2 OBJECTIVE	4
1.3 APPLICATION	4
1.4 REFERENCED DOCUMENTS	4
1.5 DEFINITIONS	5
1.6 CONFIGURATION	5
1.7 LIMITATIONS ON THE USE OF FLANGES	6
1.8 NON-STANDARD THICKNESS FLANGES	6
1.9 NOMINAL SIZE AND OUTSIDE DIAMETER	6
SECTION 2 TEMPERATURE/PRESSURE RATINGS	
2.1 GENERAL	7
2.2 INTERPOLATION OF INTERMEDIATE VALUES	7
SECTION 3 MATERIALS	
3.1 SELECTION OF MATERIALS	11
3.2 MATERIALS FOR FLANGES	11
3.3 LIMITATIONS ON THE USE OF PARTICULAR MATERIALS	11
3.4 ALTERNATIVE MATERIAL SPECIFICATIONS	11
SECTION 4 MANUFACTURING REQUIREMENTS AND DIMENSIONS	
4.1 MANUFACTURING METHODS	16
4.2 FLANGE DIMENSIONS	16
4.3 FLANGE FACES	16
4.4 PREPARATION FOR ATTACHMENT OF FLANGES	17
4.5 BOLT HOLES	19
4.6 SPOT-FACING AND BACK-FACING OF FLANGES	19
SECTION 5 MARKING AND MATERIAL CERTIFICATES	
5.1 MARKING	20
5.2 MATERIAL CERTIFICATES	20
SECTION 6 DIMENSIONS OF FLANGES	
21	
APPENDICES	
A SELECTION OF BOLTING	42
B ASSEMBLY OF FLANGED JOINTS	46
C LIST OF REFERENCED DOCUMENTS	48
D NOMINAL SIZE AND OUTSIDE DIAMETER OF PIPES	50

STANDARDS AUSTRALIA

Australian Standard

Flanges for pipes, valves and fittings

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE This Standard specifies requirements for circular flanges of nominal sizes DN 15 to DN 3000, inclusive, and their bolting for use on pipes, valves, fittings and other pressure-retaining equipment containing fluid at pressures up to 19 300 kPa and at temperatures in the range -200°C to $+525^{\circ}\text{C}$.

These flanges are manufactured from carbon steel, carbon-manganese steel, alloy steel, stainless steel, grey iron, malleable iron, ductile cast iron*, or copper alloy.

This Standard is applicable to flanges for water, steam, compressed air, chemical and petroleum plants, hydraulic piping and where other Standards require compliance with this Standard.

This Standard is not intended to apply to flanges for water or waste water covered by AS 4087.

Flanges R, S and T are designated obsolescent and are not recommended for use in new equipment. They are retained to provide for the servicing of existing equipment that is expected to have a long working life. For new equipment, flanges R, S and T should be replaced with flanges to AS/NZS 4331, Parts 1 to 3, ANSI B16.5 or BS 4504 (series).

The history of AS 2129 flanges (and its predecessor BS 10) and the future use of these flanges is given in the Preface.

1.2 OBJECTIVE The objective of this Standard is to provide guidance to manufacturers and users on the materials, manufacturing requirements and dimensions of circular flanges for use with existing or new equipment.

1.3 APPLICATION

1.3.1 Flanges Flanges shall comply with the relevant requirements of this Section and with the specific requirements of the following Sections, as appropriate:

Section 2—Temperature/Pressure Ratings.

Section 3—Materials.

Section 4—Manufacturing Requirements and Dimensions.

Section 5—Marking and Material Certificates.

Section 6—Dimensions of Flanges.

1.3.2 Bolting Bolting for flanges shall comply with the requirements of Appendix A.

1.3.3 Assembly The assembly of flanged joints shall comply with the requirements of Appendix B.

1.4 REFERENCED DOCUMENTS The documents referred to in this Standard are listed, with titles, in Appendix C.

* Alternative names for ductile cast iron are 'spheroidal graphite iron', 'SG iron', and 'nodular graphite iron'.

1.5 DEFINITIONS For the purposes of this Standard, the following definitions apply:

1.5.1 Flange contact surface—that part of the flange face upon which the gasket is compressed.

1.5.2 Flange face—the reference plane which is perpendicular to the axis of the flange and coincident with the front of the flange from which is measured the thickness of the flange and also the height of the raised face or the depth of the O-ring groove. The profile of the front of a flange may be flat face*, raised face, or flat face with O-ring. (See Figure 1.1.)

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

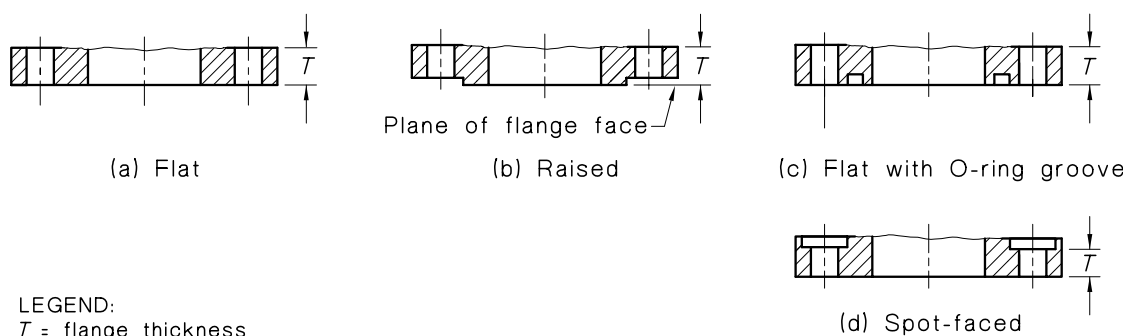


FIGURE 1.1 FLANGE FACE AND FLANGE THICKNESS

1.5.3 Flange thickness—the distance from the flange face to the back face of a flange or, if the bolt holes are spot-faced, from the flange face to the spot facing. (See Figure 1.1 and Clause 4.6.4).

1.5.4 Fluid—any vapour, liquid, gas or mixture thereof.

1.5.5 Integral flange—a flange which is cast or forged as part of a pressure-containing component.

1.5.6 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 or by thread size. It is a convenient round number for reference purposes and is only loosely related to manufacturing dimensions.

1.5.7 Pressure—the gauge pressure of the fluid contained by the pressure-containing component.

1.5.8 Temperature—the temperature of the fluid contained by the pressure-containing component to which the flange is attached, unless otherwise stated.

1.6 CONFIGURATION

1.6.1 General Flange configuration is determined by—

- (a) the type, as specified in Clause 1.6.2; and
- (b) the face, as specified in Clause 1.6.3.

1.6.2 Type The types of flanges are as illustrated in Figure 1.2.

1.6.3 Flange faces Each of the basic types may have, subject to the limitations given in Table 4.1, any one of the faces illustrated in Figure 1.1.

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

* An alternative term for 'flat face' is 'full face'.

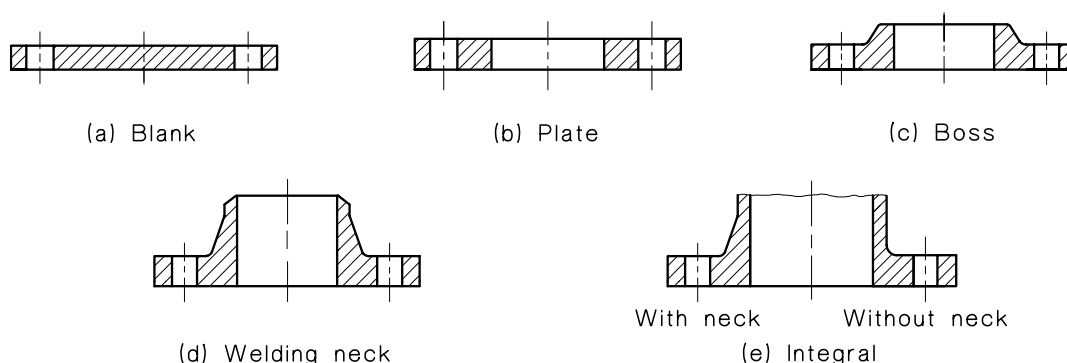
1.7 LIMITATIONS ON THE USE OF FLANGES Limitation on the use of a flange may be imposed by any one or more of the following:

- (a) Material.
- (b) Flange table.
- (c) Flange type.
- (d) Fluid.
- (e) Temperature.
- (f) Hydrostatic test pressure.

The hydrostatic test pressure of a flange, when installed in a system, shall not exceed the maximum allowable hydrostatic test pressure (at nominal 20°C) shown in the appropriate Table (Tables 2.1 to 2.10).

Limitations of a particular nature may be imposed for specific applications by the relevant application Standard which should be consulted.

Flange Tables A, D and E may not be suitable for use with hard gaskets, such as spiral wound gaskets, or narrow face gaskets, as the flange may deform permanently before satisfactory seating loads are achieved. (Refer also to Paragraph B3.2 for gasket selection.)



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

FIGURE 1.2 FLANGE TYPES

1.8 NON-STANDARD THICKNESS FLANGES The thickness of a flange may be reduced by up to 5% from the tabulated thickness provided—

- (a) the yield strength of the flange material is at least 20% stronger than the minimum specified yield strength of a material listed for the particular flange;
- (b) the purchaser agrees; and
- (c) the flange is designated as non-standard.

1.9 NOMINAL SIZE AND OUTSIDE DIAMETER Appendix D tabulates, for the nominal size (DN), the outside diameter of pipes in accordance with the relevant Standards.

SECTION 2 TEMPERATURE / PRESSURE RATINGS

2.1 GENERAL The temperature/pressure ratings of flanges shall be as shown in Tables 2.1 to 2.10, subject to the limitations listed in Clause 1.7.

The integrity of a flanged joint is dependent upon the correct selection of bolting (see Appendix A), the gasket, and on the method of assembly (see Appendix B).

The pressure ratings given in these Tables are maximum permissible non-shock pressures at the temperatures shown. Where a flange is subject to shock or fatigue, calculations are to be made to ensure that the selected pressure rating is suitable.

The maximum hydrostatic test pressure shown in the tables should be considered in relation to the test pressure of the system (see Appendix B).

The various types of flanges are not necessarily applicable to all temperature, pressure and size ranges. References are to be made to the appropriate clauses and tables for details.

2.2 INTERPOLATION OF INTERMEDIATE VALUES Where the temperature lies between tabulated values, the related pressure shall be obtained by linear interpolation between the adjacent figures.

TABLE 2.1
TEMPERATURE/PRESSURE RATINGS FOR FLANGES OF CARBON STEEL AND CARBON-MANGANESE STEEL

Flange Table	Pressure, kPa												Maximum allowable hydrostatic test pressure kPa
	Temperature, °C												
	-18 to 120	-50 to 232	250	275	300	325	350	375	400	425	450	475	
A	300	170*	—	—	—	—	—	—	—	—	—	—	525
D	—	700	650	600	570	550	500	450	400	350	—	—	1 050
E	—	1 400	1 300	1 200	1 100	1 000	950	900	800	700	—	—	2 100
F	—	2 100	2 000	1 800	1 700	1 600	1 400	1 300	1 200	1 000	—	—	3 150
H	—	3 500	3 300	3 100	2 900	2 600	2 400	2 200	2 000	1 700	1 300	900	5 250
J	—	4 800	4 600	4 300	4 000	3 700	3 400	3 100	2 700	2 400	1 900	1 300	7 200
K	—	6 200	5 900	5 500	5 100	4 700	4 300	3 900	3 500	3 100	2 400	1 600	9 300
R	—	8 300	7 900	7 400	6 800	6 300	5 800	5 200	4 700	4 200	3 200	2 200	12 450
S	—	12 400	11 800	11 100	10 300	9 500	8 700	7 900	7 100	6 300	4 800	3 300	18 600
T	—	19 300	18 400	17 200	16 000	14 700	13 500	12 200	11 000	9 800	7 500	5 100	28 950

* This rating applies to temperatures greater than 120°C but less than 232°C and does not apply to flange sizes greater than 900 nominal size.

TABLE 2.2
TEMPERATURE/PRESSURE RATINGS FOR FLANGES OF LOW ALLOY STEEL

Flange Table	Pressure, kPa														Maximum allowable hydro- static test pressure kPa
	Temperature, °C														
	-100 to 232	250	275	300	325	350	375	400	425	450	475	482	500	525	
H	3 500	3 300	3 200	3 000	2 800	2 600	2 500	2 300	2 100	2 000	1 800	1 700	1 200	500	5 250
J	4 800	4 700	4 400	4 200	3 900	3 700	3 500	3 200	3 000	2 700	2 500	2 400	1 700	700	7 200
K	6 200	6 000	5 700	5 400	5 100	4 700	4 400	4 100	3 800	3 500	3 200	3 100	2 200	940	9 300
R	8 300	8 000	7 600	7 200	6 700	6 300	5 900	5 500	5 100	4 700	4 300	4 100	3 000	1 300	12 450
S	12 400	12 000	11 400	10 700	10 100	9 500	8 900	8 300	7 600	7 000	6 400	6 200	4 400	1 900	18 600
T	19 300	18 600	17 600	16 700	15 700	14 800	13 800	12 800	11 900	10 900	9 900	9 700	6 900	3 000	28 950

TABLE 2.3
**TEMPERATURE/PRESSURE RATINGS FOR FLANGES OF
STAINLESS STEEL TYPES 304, 316, 321, 347 AND 348**

Flange Table	Pressure, kPa														Maximum allowable hydrostatic test pressure kPa
	Temperature, °C														
	-200 to 50	100	150	200	250	275	300	325	350	375	400	425	450	475	
D	700	700	700	650	650	600	570	550	500	450	400	350	—	—	1 430
E	1 400	1 400	1 400	1 300	1 300	1 200	1 100	1 000	950	900	800	700	—	—	2 850
F	2 100	2 100	2 100	2 000	1 900	1 800	1 700	1 600	1 400	1 300	1 200	1 000	—	—	4 350
H	3 500	3 500	3 500	3 300	3 200	3 100	2 900	2 600	2 400	2 200	2 000	1 700	1 300	900	7 200

TABLE 2.4
**TEMPERATURE/PRESSURE RATINGS FOR FLANGES OF
STAINLESS STEEL TYPES 304L AND 316L**

Flange Table	Pressure, kPa														Maximum allowable hydrostatic test pressure kPa
	Temperature, °C														
	-200 to 50	100	150	200	250	275	300	325	350	375	400	425	450	475	
D	700	700	650	600	550	550	550	550	500	450	400	350	—	—	1 200
E	1 400	1 400	1 300	1 200	1 100	1 100	1 100	1 000	950	900	800	700	—	—	2 400
F	2 100	2 100	1 900	1 800	1 700	1 600	1 600	1 600	1 400	1 300	1 200	1 000	—	—	3 750
H	3 500	3 500	3 200	2 900	2 800	2 800	2 800	2 600	2 400	2 200	2 000	1 700	1 300	900	6 150

TABLE 2.5
TEMPERATURE/PRESSURE RATINGS FOR FLANGES OF
STAINLESS STEEL TYPES 309 AND 310

Flange Table	Pressure, kPa														Maximum allowable hydrostatic test pressure kPa
	Temperature, °C														
	-200 to 50	100	150	200	250	275	300	325	350	375	400	425	450	475	
D	700	700	700	700	650	600	570	550	500	450	400	350	—	—	1 350
E	1 400	1 400	1 400	1 400	1 300	1 200	1 100	1 000	950	900	800	700	—	—	2 700
F	2 100	2 100	2 400	2 100	2 000	1 800	1 700	1 600	1 400	1 300	1 200	1 000	—	—	4 200
H	3 500	3 500	3 500	3 500	3 300	3 100	2 900	2 600	2 400	2 200	2 000	1 700	1 300	900	6 900

TABLE 2.6
TEMPERATURE/PRESSURE RATINGS FOR
FLANGES OF MALLEABLE IRON,
AND DUCTILE IRON

Flange Table	Pressure, kPa						Maximum allowable hydrostatic test pressure
	Temperature, °C						
	-18 to 120	150	175	190	200	220	kPa
A	350	290	230	200	190	170	700

TABLE 2.7
TEMPERATURE/PRESSURE RATINGS FOR
FLANGES OF GREY IRON

Flange Table	Pressure, kPa						Maximum allowable hydrostatic test pressure
	Temperature, °C						
	-18 to 120	150	175	190	200	220	kPa
A	350	290	230	200	190	170	700
D	700	510	440	390	370	340	1 400
E	400	1 200	1 000	850	800	650	2 800
F	2 100	1 800	1 500	1 400	1 300	1 000	4 200
H	3 500	2 800	2 300	2 000	1 800	1 200	7 000

TABLE 2.8
TEMPERATURE/PRESSURE RATINGS FOR
FLANGES OF DUCTILE IRON (SEE NOTE)

Flange Table	Temperature, °C							Maximum allowable hydrostatic test pressure
	–18 to 232	250	275	300	325	350	375	
								kPa
D	700	660	610	570	540	490	440	1 400
E	1 400	1 300	1 200	1 100	1 000	950	900	2 800
F	2 100	2 000	1 800	1 700	1 600	1 400	1 300	4 200
H	3 500	3 300	3 100	2 900	2 600	2 400	2 200	7 000

NOTE: For temperature/pressure rating of Table A ductile iron flanges, see Table 2.6.

TABLE 2.9
TEMPERATURE/PRESSURE RATINGS FOR
FLANGES OF COPPER ALLOY DN 15
TO DN 80 INCLUSIVE

Flange Table	Pressure, kPa							Maximum allowable hydrostatic test pressure
	Temperature, °C							
	–200 to 120	150	175	200	225	232	250	kPa
A	350	170	170	170	170	170	—	525
D	700	650	650	570	500	450	400	1 050
E	1 400	1 400	1 400	1 200	1 000	900	750	2 100
F	2 100	2 100	2 100	1 800	1 400	1 350	1 200	3 150
H	3 500	3 500	3 500	2 900	2 400	2 300	1 900	5 250
J	3 800	3 600	3 600	3 100	2 800	2 700	2 500	5 700
K	4 800	4 600	4 600	4 000	3 600	3 500	3 200	7 200

TABLE 2.10
TEMPERATURE/PRESSURE RATINGS FOR FLANGES OF
COPPER ALLOY DN 90 AND LARGER

Flange Table	Pressure, kPa									Maximum allowable hydrostatic test pressure
	Temperature, °C									
	–200 to 120			150	175	200	225	232	250	
	Nominal size									
	DN 90 to DN 200	DN 250 to DN 600	DN 650 to DN 1200	DN 90 to DN 200						kPa
A	350	350	—	170	170	170	170	170	—	525
D	700	700	—	650	600	550	500	450	400	1 050
E	1 200	1 200	—	1 100	1 100	950	850	800	750	1 800
F	1 700	1 700	—	1 700	1 500	1 400	1 200	1 250	1 100	2 550
H	2 800	2 800	—	2 600	2 400	2 200	2 000	1 900	1 800	4 200
J	3 800	—	—	3 600	3 400	3 100	2 800	2 700	2 500	5 700
K	4 800	—	—	4 600	4 300	3 900	3 600	3 500	3 200	7 200

S E C T I O N 3 M A T E R I A L S

3.1 SELECTION OF MATERIALS Materials shall be appropriate to the method of manufacture and shall be selected according to the temperature, pressure and service conditions of the flange.

3.2 MATERIALS FOR FLANGES Materials for flanges shall comply with the appropriate standard and grade shown in Tables 3.1 to 3.5, and shall be sound and free from injurious segregation, laminations, cracks or surface flaws.

NOTE: Materials for bolts are given in Appendix A.

3.3 LIMITATIONS ON THE USE OF PARTICULAR MATERIALS

3.3.1 Limitations based on temperature Specific materials and grades shall be used within the temperature ranges shown in Tables 3.1 to 3.5.

3.3.2 Limitations based on pressure Specific materials and grades shown in Tables 3.1 to 3.5 shall be used at pressures which are appropriate for the temperatures, and shall not exceed those shown in Tables 2.1 to 2.10.

3.3.3 Limitations based on service Specific materials and grades shown in Tables 3.1 to 3.5 shall be used within the limitations specified in Clause 1.7 and those in the appropriate application Standard.

3.4 ALTERNATIVE MATERIAL SPECIFICATIONS Where a material conforming to one of the specifications listed in Clause 3.2 is not available or an alternative is desired, alternative materials may be used provided they comply with the requirements of AS/NZS 1200 for new or alternative materials.

TABLE 3.1
CARBON STEEL, CARBON-MANGANESE STEEL AND LOW ALLOY STEEL FOR FLANGES FOR
TEMPERATURES BETWEEN -100°C AND 525°C

Flange Table	Material standard and grade					
	Temperature range, °C					
	-100 to -18*	-50 to -18*	-30 to -18*	-18 to 400	-18 to 482	-18 to 525
A D E F H J	Plates BS/EN 10028.4:503 LT100	AS 1548 7-430 L40 7-460 L40 7-490 L40 BS/EN 10028.3: P275 NL2	AS 1548: 7-430 L20, 7-460 L20, 7-490 L20	AS/NZS 3678: -200, -250, -300, -350 -400 BS/EN 10028.2: P235 GH, P265 GH,	AS 1548: 7-430, 7-460, 7-490	—
	Castings ASTM A352LC3	AS 2074: L3A ASTM A352: LCB BS EN 10213	—	AS 2074: C3 BS EN 10213	AS 2074: L5A	—
	Forgings BS 1503: 503-490 LT80 ASTM A350LF3	BS 1503: 223-410 LT50, -430 LT40, 224-410 LT50, -430 LT40,	BS 1503: 223-410 LT20, -460 LT20	—	BS 1503: 221-430, -460, -490 ASTM A105	—
K R S T	Plates BS/EN 10028.4:503 LT100	AS 1548: 7-430 L40, 7-460 L40, 7-490 L40 BS/EN 10028.3: P275 NL2	AS 1548: 7-430 L20, 7-460 L20, 7-490 L20	BS/EN 10028.2: P235,GH, P265,GH	AS 1548: 7-430, 7-460, 7-490	—
	Castings BS EN 10213.3: G9Ni 14l ASTM A352: LC3	AS 2074: L3A BS EN 10213.3 G9Ni 14l ASTM A352: LCB	ASTM A352: LCA	AS 2074: C3	AS 2074: L5A ASTM A216 WCA	—
	Forgings BS 1503:503-490 LT80 ASTM A350: LF3	BS 1503: 224-410 LT50 ASTM A350: LF2	BS 1503: 224-430 LT40 ASTM A350: LF1	BS 1503: 221-430, 221-460, 221-490	BS 1503: 221-430, 221-460, 221-490 ASTM A182: F1	—

(continued)

TABLE 3.1 (*continued*)

Flange Table	Material standard and grade					
	Temperature range, °C					
	-100 to -18*	-50 to -18*	-30 to -18*	-18 to 400	-18 to 482	-18 to 525
H J K R S T	Plates —	—	—	—	—	BS/EN 10028.4: 620 ASTM A387: 9, 11, 12
	Casting —	—	—	—	—	AS 2074: L5B ASTM A216: WCB, WCC
	Forgings —	—	—	—	—	BS 1503: 620-440 ASTM A182: F11, F12

* Materials nominated in these temperature ranges may be used to higher temperatures within the scope of the material standards.

TABLE 3.2
STAINLESS STEEL FLANGES FOR TEMPERATURES BETWEEN
–200°C AND 475°C

Flange Table	Material standard and grade	
	Temperature range, °C	
	–200 to 425	–200 to 475
D E F	Plates ASTM A240: 304, 304L, 309S, 310S, 316, 316L, 321, 347, 348	—
	Forgings ASTM A182: F304, F304L, F310, F316, F316L, F321, F347, F348	—
	Castings ASTM: A351: CF3, CF3M, CF8M, CF8C, CH8, CH20, CK20	—
H	Plates —	ASTM A240: 304, 304L, 309, 310, 316, 316L, 321, 347, 348
	Forgings —	ASTM A182: F304, F304L, F310, F316, F316L, F321, F347, F348
	Castings —	ASTM A351: CF3, CF3M, CF8M, CF8C, CH8, CH20, CK20

TABLE 3.3
GREY IRON AND MALLEABLE IRON
FOR FLANGES FOR TEMPERATURE
BETWEEN –18°C AND 220°C

Flange Table	Material standard and grade	
	Temperature range, °C	
	–18 to 220	
A	AS 1830: T-180, T-220, T-260	
	AS 1832: W400-5, W350-4, B350-10, B300-6	
	BS/EN 1561: –200, –250	
D E F H	AS 1830: T-180, T-220, T-260	
	BS/EN 1561: –200, –250	