

## FLANGE DIMENSIONS TABLE TYPES

### OVERVIEW

In Australia the BS and AS flange standards are essentially the same but have been metricated. Consequently metric sizes are stated as 'DN' (Nominal Diameter) in mm. Equivalent imperial sizing is rounded to the nearest multiple of 25mm (for 2" and over) as below. However the actual dimensions and bore sizes have not changed. 'NB' (Nominal Bore) is also sometimes used when referring to valve sizes.

1/2"	DN15	2 1/2"	DN65	12"	DN300	24"	DN600
3/4"	DN20	3"	DN80	14"	DN350	28"	DN700
1"	DN25	4"	DN100	15"	DN375	30"	DN750
1 1/4"	DN32	5"	DN125	16"	DN400	32"	DN800
1 1/2"	DN40	8"	DN200	18"	DN450	36"	DN900
2"	DN50	10"	DN250	20"	DN500		

The most common flanging used in Australia in oil, gas and mining is now ANSI flanging to ANSI B16.5. However in general industrial, commercial and waste/water industries AS2129 Table flanging is the most common. Increasingly European PN rated flanges are also specified in BS4504 as well as AS4331 and DIN/EN 1092-1 (EN 1092-1 supersedes BS4504). PN stands for Nominal Pressure and roughly equates to the number of bar i.e. the cold working pressure of PN10 is 10 bar. Ratings range from PN2.5 to PN420. The latest Australian standard AS4331 references this rating system (PN2.5 to PN420) but specifies ASME B16.5/MSS-SP44 drilling (adopted) from ISO 7005-1. Consequently in Australia most users simply just reference to original ASME B16.5 standards as this is already in use in Australia for the Oil, Gas and Mining industries and in fact in pressures above table E it has been the predominant standard in use for the last 30 years. However, piping engineers must refer to the new AS standard AS4331 for interpretations and specification requirements.

Piping Class Ratings based on ASME B16.5 and corresponding PN rating: –

Flange Class	150	300	400	600	900	1500	2500
Flange Pressure Nominal, PN	20	50	68	100	150	250	420

PN is the rating designator followed by a designation number indicating the approximate pressure rating in *bars*.

PN ratings do not provide a proportional relationship between different PN numbers, whereas class numbers do.

### AUSTRALIAN STANDARD

AS2129 originates from BS10 and has been metricated. In some cases slightly larger bolt holes provide better clearance as metric bolts are specified in lieu of UNC bolts used by BS10. AS4087 is an update of AS2129, however AS2129 is still widely used so it has not been deleted as a standard, however, it now only covers AS table D to H.

AS4087 is the latest standard for BS table D to H, the same drilling is used but the new PN pressure rating system has been adopted. As the new pressure ratings are slightly higher the flange thicknesses have slightly increased. Also the raised face dimensions (although rarely specified, flat face is mostly used) are slightly larger. Table C, J to R, no longer exist, PN16 is the same drilling as Table D, PN21 is the same as Table F, PN35 is the same as Table H.

AS4331.1 covers PN2.5 to PN420 and the sizing and drilling used is a replication of ISO 7005-1 which in turn is a metricated equivalent of ASME B16.5 class 150 to 2500. ISO 7005 also incorporates the superseded DIN 2533 & DIN 2501 flanges which AS4331.1 also incorporates (also mirrored in EN1092).

## API6A

API6A flanging is used in Australia in oil drilling and wellhead systems. (see our oilfield slide rule [click here](#). API ratings range from 2,000 to 20,000 psi (cold working pressure). ANSI was originally born from API, consequently in class 600 to 900 and 1500 ANSI the flanges are dimensionally equivalent to API 2,000, 3,000 and 5,000 in most sizes to ANSI 300NB (12") API 13 5/8" but ANSI flanges being manufactured from lower yield strength carbon steel are rated to lower working pressure. However GSL stocks high yield carbon steel API6A 45K weld neck flanges which are compatible with ASME A234 WPB fittings and A106B/API5LB pipe. [Click here](#) to find out more.

## ANSI/ASME

ASME (American Society of Mechanical Engineers, of which Australian Pipeline Valve is a member company) is a group of standards, which are in turn covered within the American Standards Institute (ANSI), hence their flanges can be referred to as ANSI or ASME class. Class is also traditionally abbreviated CL or LB (verbally spoken as pound) or cross hash (#) but not psi as this can be misconstrued as the cold working pressure (CWP). Since ANSI 150 for instance has a CWP of 285 psi, so unlike the PN system the class is not related to CWP. AS4331 has adaptor ANSI drilling and sizes but uses PN rating classes! Consequently in some sizes flanges are thicker to bring the rating up to the required PN rating.

## ASME PRESSURE CLASSES OF FLANGES

Forged steel flanges, ASME B16.5, are made in seven primary ratings:

### 150LBS – 300LBS – 400LBS – 600LBS – 900LBS – 1500LBS – 2500LBS

A Class 300 flange is rated to a higher pressure than a Class 150 flange, because a Class 300 flange is constructed with more metal and therefore can withstand more pressure. However there are a number of factors that can impact the pressure capability of a flange.

The Pressure Class for flanges is often expressed in 'pounds'. Different names are used to indicate a Pressure Class. For example: 150 Lb or 150 Lbs or 150# or Class 150, all mean the same.

## ASME PRESSURE RATING

Flanges can withstand different pressures at different temperatures. (Refer to pressure/temperature charts at this website for various material types). As temperature increases, the pressure rating of the flange decreases. For example a Class 150 A105 flange is rated to approximately 270 PSIG (1861 KPA) at ambient temperature, 180 PSIG (1241 KPA) at approximately 400°F (204°C) 150 PSIG (1034 KPA) at approximately 600°F (315°C), and 75 PSIG (517 KPA) at approximately 800°F (426°C). Consequently when the pressure goes down, the temperature goes up and vice versa. Additional factors are that flanges can be constructed from different materials, such as stainless steel, cast and ductile iron, alloy steel, carbon steel, etc. Each material has a different pressure rating.

Here is an example of a flange NPS 12 (300NB) in all main pressure classes. This example demonstrates that diameter of the raised face are all the same; but outside diameter, bolt circle and diameter of bolt holes become larger in each higher pressure class. The bore is subject to the required schedule. Refer to our Flange Chart – 'Online Slide Rule' above for flange dimensions. The number and diameter (mm) of the bolt holes for the example below of 300NB is: 12 x 25.4mm Class 150, 16 x 32mm Class 300, 16 x 34.9 Class 400, 20 x 34.9mm Class 600, 20 x 38.1mm Class 900, 16 x 54mm Class 1500 and 12 x 73mm Class 2500.



## PRESSURE-TEMPERATURE RATINGS

Pressure/temperature ratings are maximum allowable working pressures allowed as per ASME B16.5 (published in metric and imperial). For intermediate temperatures, linear interpolation is calculated by manufacturers.

Pressure-temperature ratings apply to flanged joints which may be reduced by gaskets or studs used.

The temperature shown for a corresponding pressure rating is the temperature of the pressure-containing shell of the valve or flange. In general, this temperature is the same as that of the media in line and the external environment, whichever is greatest (but also lowest temperature of each must be factored for low temperature service). For any temperature below -29°C, the rating shall be no greater than the rating shown for -29°C, depending on materials the rating can be lower.

The below two tables are examples of two material groups according to ASTM, flange pressure-temperature ratings to ASME B16.5 – 2009.

ASTM Group 2-1.1 Materials		
Nominal Designation	Forgings	Castings
C-Si	A105 (1)	A216 Gr.WCB (1)
C-Mn-Si	A350 Gr.LF2 (1)	–
3 1/2Ni	A350 Gr.LF3	–
C-Mn-Si-V	A350 Gr.LF6 Cl 1 (3)	–
NOTES: (1) Upon prolonged exposure to temperatures above 425°C, the carbide phase of steel may be converted to graphite. Permissible but not recommended for prolonged use above 425°C. (3) Do not use over 260°C.		

ASTM Group 2-2.3 Materials		
Nominal Designation	Forgings	Castings
16Cr-12Ni-2Mo	A182 Gr.F316L	A351 CF3M
18Cr-13Ni-3Mo	A182 Gr.F317L	
18Cr-8Ni	A182 Gr.F304L (1)	A351 CF3
NOTES: (1) Do not use over 425°C.		

The following 2 tables show pressure/temperature ratings for ANSI/ASME class 150 to 2500LB for group 2-1.1 and 2-2.3

Pressure-Temperature Ratings for ASTM Group 2-1.1 Materials							
Working pressure by Classes, BAR							
Temp.°C	150	300	400	600	900	1500	2500
-29 to 38	19.6	51.1	68.1	102.1	153.2	255.3	425.5
50	19.2	50.1	66.8	100.2	150.4	250.6	417.7
100	17.7	46.6	62.1	93.2	139.8	233	388.3
150	15.8	45.1	60.1	90.2	135.2	225.4	375.6
200	13.8	43.8	58.4	87.6	131.4	219	365
250	12.1	41.9	55.9	83.9	125.8	209.7	349.5
300	10.2	39.8	53.1	79.6	119.5	199.1	331.8
325	9.3	38.7	51.6	77.4	116.1	193.6	322.6
350	8.4	37.6	50.1	75.1	112.7	187.8	313
375	7.4	36.4	48.5	72.7	109.1	181.8	303.1
400	6.5	34.7	46.3	69.4	104.2	173.6	289.3
425	5.5	28.8	38.4	57.5	86.3	143.8	239.7
450	4.6	23	30.7	46	69	115	191.7
475	3.7	17.4	23.2	34.9	52.3	87.2	145.3
500	2.8	11.8	15.7	23.5	35.3	58.8	97.9
538	1.4	5.9	7.9	11.8	17.7	29.5	49.2

Pressure-Temperature Ratings for ASTM Group 2-2.3 Materials							
Working pressure by Classes, BAR							
Temp.°C	150	300	400	600	900	1500	2500
-29 to 38	15.9	41.4	55.2	82.7	124.1	206.8	344.7
50	15.3	40	53.4	80	120.1	200.1	333.5
100	13.3	34.8	46.4	69.6	104.4	173.9	289.9
150	12	31.4	41.9	62.8	94.2	157	261.6
200	11.2	29.2	38.9	58.3	87.5	145.8	243
250	10.5	27.5	36.6	54.9	82.4	137.3	228.9
300	10	26.1	34.8	52.1	78.2	130.3	217.2
325	9.3	25.5	34	51	76.4	127.4	212.3
350	8.4	25.1	33.4	50.1	75.2	125.4	208.9
375	7.4	24.8	33	49.5	74.3	123.8	206.3
400	6.5	24.3	32.4	48.6	72.9	121.5	202.5
425	5.5	23.9	31.8	47.7	71.6	119.3	198.8
450	4.6	23.4	31.2	46.8	70.2	117.1	195.1

LB is the origin of the Latin word Libra (weighing scale) a Roman unit of mass similar to a pound, hence this has been adopted as another way of saying Class. Never say PSI as this can be confused with API 6B flanges which are rated by PSI (CWP).

Temperature - Pressure Ratings for Carbon Steel Plate Flanges													
Pressure - kPa, Temperature - °C													
"Flange table"	-18°	-50°	250	275	300	325	350	375	400	425	450	475	Maximum hydrostatic test pressure kPa
	to 120	to 232											
D		700	650	600	570	550	500	450	400	350			1 050
C	1 200												1 800
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	1 100			3 150
H		3 500	3 300	3 100	2 900	2 600	2 400	2 000	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

AS2129 still in use but now only covers Table D to H (Table C now obsolete), Table J to T have now been replaced by AS4331 which is a replication of ISO 7005-1 & 7005-2 which has adopted the old DIN 2501 PN ratings & drillings. ISO 7005-1 also mirrors ASME B16.5/MSS SP44 flanges which have been assigned equivalent PN ratings. AS4331.1 (steel flanges) is the same as ISO 7005-1. AS4331.2 is the same as ISO 7005-2. AS4087 is the new standard covering Table D, F and H. Table D, F and H drilling is specified but the PN rating system is used (PN14 to PN35). Table E drilling is no longer used.

For ANSI 150 to 2500 class flange pressure/temperature ratings refer to the forged pressure/temperature ratings shown in the following [link](#).



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