National Pipeline Supplies

NPSI
NATIONAL PIPELINE SUPPLIES

pipe, flange and fitting data charts

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NPSI NATIONAL PIPELINE SUPPLIES

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AMERICAN STANDARD STEEL PIPE ASME B36.10

Nominal Size		Outside Diameter	Nominal Wall Thickness & Weight for Welded & Seamless Steel Pipe ASME B36.10												Dimensions (mm) *Weight (kg/m)*	
DN	NPS	mm	STD	EXTRA STRONG	XX STRONG	SCHED. 10	SCHED. 20	SCHED. 30	SCHED. 40	SCHED. 60	SCHED. 80	SCHED. 100	SCHED. 120	SCHED. 140	SCHED. 160
6	1/8	10.3	1.73 *0.37*	2.41 *0.47*	-	-	-	-	SAME AS STANDARD W.T. (Std. W.T.)	-	SAME AS EXTRA STRONG W.T. (X.S.)	-	-	-	-
8	1/4	13.7	2.24 *0.63*	3.02 *0.80*	-	-	-	-		-		-	-	-	-
10	3/8	17.1	2.31 *0.84*	3.20 *1.10*	-	-	-	-		-		-	-	-	-
15	1/2	21.3	2.77 *1.27*	3.73 *1.62*	7.47 *2.55*	-	-	-		-		-	-	-	4.78 *1.95*
20	3/4	26.7	2.87 *1.69*	3.91 *2.20*	7.82 *3.64*	-	-	-		-		-	-	-	5.56 *2.90*
25	1	33.4	3.38 *2.50*	4.55 *3.24*	9.09 *5.45*	-	-	-		-		-	-	-	6.35 *4.24*
32	1 - 1/4	42.2	3.56 *3.39*	4.85 *4.47*	9.7 *7.77*	-	-	-		-		-	-	-	6.35 *5.61*
40	1 - 1/2	48.3	3.68 *4.05*	5.08 *5.41*	10.15 *9.56*	-	-	-		-		-	-	-	7.14 *7.25*
50	2	60.3	3.91 *5.44*	5.54 *7.48*	11.07 *13.44*	-	-	-		-		-	-	-	8.74 *11.11*
65	2 - 1/2	73.0	5.16 *8.63*	7.01 *11.41*	14.02 *20.39*	-	-	-		-		-	-	-	9.53 *14.92*
80	3	88.9	5.49 *11.29*	7.62 *15.27*	15.24 *27.67*	-	-	-		-		-	-	-	11.13 *21.35*
90	3 - 1/2	101.6	5.74 *13.57*	8.08 *18.63*	-	-	-	-		-		-	-	-	-
100	4	114.3	6.02 *16.07*	8.56 *22.32*	17.12 *41.03*	-	-	-		-		-	11.13 *28.32*	-	13.49 *33.54*
125	5	141.3	6.55 *21.77*	9.53 *30.97*	19.05 *57.43*	-	-	-		-		-	12.7 *40.28*	-	15.88 *49.11*
150	6	168.3	7.11 *28.26*	10.97 *42.56*	21.95 *79.22*	-	-	-		-		-	14.27 *54.20*	-	18.26 *67.56*
200	8	219.1	8.18 *42.55*	12.7 *64.64*	22.23 *107.92*	-	6.35 *33.31*	7.04 *36.81*		10.31 *53.08*		15.09 *75.92*	18.26 *90.44*	20.62 *100.92*	23.01 *111.27*
250	10	273.1	9.27 *60.31*	12.7 *81.55*	25.4 *155.15*	-	6.35 *41.77*	7.8 *51.03*		XS *81.55*	15.09 *96.01*	18.26 *114.75*	21.44 *133.06*	XXS *155.15*	28.58 *172.33*
300	12	323.9	9.53 *73.88*	12.7 *97.46*	25.4 *186.97*	-	6.35 *49.73*	8.38 *65.20*	10.31 *79.73*	14.27 *108.96*	17.48 *132.08*	21.44 *159.91*	XXS *186.97*	28.58 *208.14*	33.32 *238.76*
350	14	355.6	9.53 *81.33*	12.7 *107.10*	-	6.35 *54.59*	7.92 *67.90*	Std.W.T. *81.33*	11.13 *94.55*	15.09 *126.70*	19.05 *158.10*	23.83 *194.96*	27.79 *224.65*	31.75 *253.56*	35.71 *281.70*
400	16	406.4	9.53 *93.27*	12.7 *123.30*	-	6.35 *62.64*	7.92 *77.83*	Std.W.T. *93.27*	XS *123.30*	16.66 *160.12*	21.44 *203.53*	26.19 *245.56*	30.96 *286.64*	36.53 *333.19*	40.49 *365.35*
450	18	457	9.53 *105.16*	12.7 *139.15*	-	6.35 *70.57*	7.92 *87.71*	11.13 *122.38*	14.27 *155.80*	19.05 *205.74*	23.83 *254.55*	29.36 *309.62*	34.93 *363.56*	39.67 *408.26*	45.24 *459.37*
500	20	508	9.53 *117.15*	12.7 *155.12*	-	6.35 *78.55*	Std.W.T. *117.15*	XS *155.12*	15.09 *183.42*	20.62 *247.83*	26.19 *311.17*	32.54 *381.53*	38.1 *441.49*	44.45 *508.11*	50.01 *564.81*
550	22	559	9.53 *129.13*	12.7 *171.09*	-	6.35 *86.54*	Std.W.T. *129.13*	XS *171.09*	-	22.23 *294.25*	28.58 *373.83*	34.93 *451.42*	41.28 *527.05*	47.63 *600.63*	53.98 *672.26*
600	24	610	9.53 *141.12*	12.7 *187.06*	-	6.35 *94.53*	Std.W.T. *141.12*	14.27 *209.64*	17.48 *255.41*	24.61 *355.26*	30.96 *442.08*	38.89 *547.71*	46.02 *640.03*	52.37 *720.15*	59.54 *808.22*
650	26	660	9.53 *152.87*	12.7 *202.72*	-	7.92 *127.36*	XS *202.72*	-	-	-	-	-	-	-	-
700	28	711	9.53 *164.85*	12.7 *218.69*	-	7.92 *137.32*	XS *218.69*	15.88 *271.21*	-	-	-	-	-	-	-
750	30	762	9.53 *176.84*	12.7 *234.67*	-	7.92 *147.28*	XS *234.67*	15.88 *292.18*	-	-	-	-	-	-	-
800	32	813	9.53 *188.82*	12.7 *250.64*	-	7.92 *157.24*	XS *250.64*	15.88 *312.15*	17.48 *342.91*	-	-	-	-	-	-
850	34	864	9.53 *200.31*	12.7 *266.61*	-	7.92 *167.20*	XS *266.61*	15.88 *332.12*	17.48 *364.90*	-	-	-	-	-	-
900	36	914	9.53 *212.56*	12.7 *282.27*	-	7.92 *176.96*	XS *282.27*	15.88 *351.7*	19.05 *420.42*	-	-	-	-	-	-
1050	42	1067	9.53 *248.52*	12.7 *330.19*	-	-	-	-	-	-	-	-	-	-	-

Formula used to attain approximate mass in kilograms per metre (kg/m) for Steel Round Pipe and Tubing

$m = (D - t) \times t \times 0.02466$

Where: m = mass to the nearest 0.01 kg/m
D = Outside Diameter in millimetres
(To nearest 0.1mm for OD up to 406.4mm)
(To nearest 1.0mm for OD 457mm and above)
t = Wall Thickness to nearest 0.01mm

EXAMPLE:
Nominal Size
DN300 NPS12
OD = 323.9mm
W.T. = 9.53mm

Step 1. 323.9 - 9.53 = 314.37
Step 2. 314.37 x 9.53 = 2995.9461
Step 3. 2995.9461 x 0.024 66
= 73.88kg/m

CARBON STEEL BUTTWELD FITTINGS TO ASME B16.9, B16.28 & BS.1640

B16.9

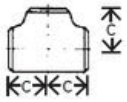
LONG RADIUS WELDING ELBOWS, RETURN BENDS & CAPS

B16.28

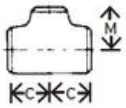
SHORT RADIUS WELDING ELBOWS & RETURN BENDS

Nom. Size DN	Pipe OD mm	Wall Thickness (mm)													A	B	K	D	V	E. Std. Wt. & Ex. Stg.	Nom. Size DN
		Sch. 10	Sch. 20	Sch. 30	Std. Wt.	Sch. 40	Sch. 60	X Stg.	Sch. 80	Sch. 100	Sch. 120	Sch. 140	Sch. 160	X.X. Stg.							
15	21.3	–	–	–	2.77	SAME AS STD. WT.	–	3.73	SAME AS X. STG.	–	–	–	4.78	7.47	38	16	47.5	–	–	25.4	15
20	26.7	–	–	–	2.87		–	3.91		–	–	–	5.56	7.82	38	19	43	19	33	25.4	20
25	33.4	–	–	–	3.38		–	4.55		–	–	–	6.35	9.09	38	22	55.5	25.4	41	38.1	25
32	42.2	–	–	–	3.56		–	4.85		–	–	–	6.35	9.70	47.5	25.4	70	32	52	38.1	32
40	48.3	–	–	–	3.68		–	5.08		–	–	–	7.14	10.15	57	29	82.5	38	62	38.1	40
50	60.3	–	–	–	3.91		–	5.54		–	–	–	8.74	11.07	76	35	106	51	81	38.1	50
65	73.0	–	–	–	5.16		–	7.01		–	–	–	9.53	14.02	95	44.5	132	63.5	100	38.1	65
80	88.9	–	–	–	5.49		–	7.62		–	–	–	11.13	15.24	114	51	159	76	121	50.8	80
90	101.6	–	–	–	5.74		–	8.08		–	–	–	-	16.15	133	57	184	89	140	63.5	90
100	114.3	–	–	–	6.02		–	8.56		–	11.13	–	13.49	17.12	152	63.5	210	102	159	63.5	100
125	141.3	–	–	–	6.55		–	9.53		–	12.70	–	15.88	19.05	190	79	262	127	197	76.2	125
150	168.3	–	–	–	7.11		–	10.97		–	14.27	–	18.26	21.95	229	95	313	152	237	88.9	150
200	219.1	–	6.35	7.04	8.18		10.31	12.70		15.09	18.26	20.62	23.01	22.23	305	127	414	203	313	102	200
250	273.1	–	6.35	7.80	9.27		12.70	12.70	15.09	18.26	21.44	25.40	28.58	25.40	381	159	517	254	390	127	250
300	323.9	–	6.35	8.38	9.53	10.31	14.27	12.70	17.48	21.44	25.40	28.58	33.32	25.40	457	190	619	305	467	152	300
350	355.6	6.35	7.92	9.53	9.53	11.13	15.09	12.70	19.05	23.83	27.79	31.75	35.71	–	533	222	711	356	533	165	350
400	406.4	6.35	7.92	9.53	9.53	12.7	16.66	12.70	21.44	26.19	30.96	36.53	40.49	–	610	254	813	406	610	178	400
450	457	6.35	7.92	11.13	9.53	14.27	19.05	12.70	23.83	29.36	34.93	39.67	45.24	–	686	286	914	457	686	203	450
500	508	6.35	9.53	12.70	9.53	15.09	20.62	12.70	26.19	32.54	38.10	44.45	50.01	–	762	318	1016	508	762	229	500
600	610	6.35	9.53	14.27	9.53	17.48	24.61	12.70	30.96	38.89	46.02	52.37	59.54	–	914	381	1219	610	914	267	600
750	762	7.92	12.70	15.88	9.53	–	–	12.70	–	–	–	–	-	–	1143	470	1524	762	1143	267	750
900	914	7.92	12.70	15.88	9.53	19.05	–	12.70	–	–	–	–	-	–	1372	565	–	914	1372	267	900

STRAIGHT TEES (B16.9)



REDUCING TEES (B16.9)



CONCENTRIC & ECCENTRIC REDUCERS (B16.9)

Nominal Size DN		C	M	H
Large End	Small End			
20	20	28.6	-	-
	15	28.6	28.6	38.1
25	25	38.1	-	-
	20	38.1	38.1	50.8
	15	38.1	38.1	50.8
32	32	47.6	-	-
	25	47.6	47.6	50.8
	20	47.6	47.6	50.8
	15	47.6	47.6	50.8
40	40	57.2	-	-
	32	57.2	57.2	63.5
	25	57.2	57.2	63.5
	20	57.2	57.2	63.5
	15	57.2	57.2	63.5
50	50	63.5	-	-
	40	63.5	60.3	76.2
	32	63.5	57.2	76.2
	25	63.5	50.8	76.2
	20	63.5	44.5	76.2
65	65	76.2	-	-
	50	76.2	69.9	88.9
	40	76.2	66.7	88.9
	32	76.2	63.5	88.9
	25	76.2	57.2	88.9
80	80	85.7	-	-
	65	85.7	82.6	88.9
	50	85.7	76.2	88.9
	40	85.7	73.0	88.9
	32	85.7	69.9	88.9
	25	85.7	69.9	88.9
90	90	95.3	-	-
	80	95.3	92.1	102
	65	95.3	88.9	102
	50	95.3	82.6	102
	40	95.3	79.4	102

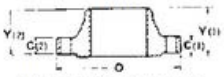
Nominal Size DN		C	M	H
Large End	Small End			
100	100	105	-	-
	90	105	102	102
	80	105	98.4	102
	65	105	95.3	102
	50	105	88.9	102
	40	105	85.7	102
125	125	124	-	-
	100	124	117	127
	90	124	114	127
	80	124	111	127
	65	124	108	127
	50	124	105	127
150	150	143	-	-
	125	143	137	140
	100	143	130	140
	90	143	127	140
	80	143	124	140
	65	143	121	140
200	200	178	-	-
	150	178	168	152
	125	178	162	152
	100	178	155	152
	80	178	152	152
250	250	216	-	-
	200	216	203	178
	150	216	194	178
	125	216	191	178
	100	216	184	178
300	300	254	-	-
	250	254	241	203
	200	254	229	203
	150	254	219	203
	100	254	210	203
350	350	279	-	-
	300	279	270	330
	250	279	257	330
	200	279	248	330
	150	279	238	330

Nominal Size DN		C	M	H
Large End	Small End			
400	400	305	-	-
	350	305	305	356
	300	305	295	356
	250	305	283	356
	200	305	273	356
	150	305	264	356
450	450	343	-	-
	400	343	330	381
	350	343	330	381
	300	343	321	381
	250	343	308	381
	200	343	298	381
500	500	381	-	-
	450	381	368	508
	400	381	356	508
	350	381	356	508
	300	381	346	508
	250	381	333	508
	200	381	324	508
600	600	432	-	-
	500	432	432	508
	450	432	419	508
	400	432	406	508
	350	432	406	508
	300	432	397	508
	250	432	384	508
750	750	559	-	-
	600	559	533	610
	500	559	508	610
	450	559	495	610
	400	559	483	610
900	900	673	-	-
	750	673	635	610
	600	673	610	610
	500	673	584	610
	450	673	572	610

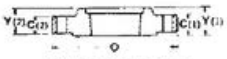
NOTE: All dimensions are in millimetres (mm)

FLANGES TO AMERICAN STANDARDS

DN 15 to 600 are to ASME B16.5 (BS 1560). DN 750 & 900 are to BS 3293 for Slip-On & Weldneck only.

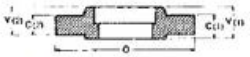


Welding Neck Flange

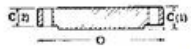


Threaded Flange

Slip-On Flange



Socket Welding (DN 15 - 80)



Blind Flanges up to DN600
(Above DN600 see notes below‡)

Nominal Size DN	PN20 (Class 150)							PN50 (Class 300)							PN100 (Class 600)							Nominal Size DN
	Dia. of Fig. 0	Thickness of Fig. Min. C(1)*	Length Thru Hub: Thrd. Slip-On Soc/ Weld Y(1)*	Length Thru Hub: Weld Neck Y(1)*	Dia. of Bolt Circle	Dia. of Bolt Holes	No. of Bolts	Dia. of Fig. 0	Thickness of Fig. Min. C(1)*	Length Thru Hub: Thrd. Slip-On Soc/ Weld Y(1)*	Length Thru Hub: Weld Neck Y(1)*	Dia. of Bolt Circle	Dia. of Bolt Holes	No. of Bolts	Dia. of Fig. 0	Thickness of Fig. Min. C(2)†	Length Thru Hub: Thrd. Slip-On Soc/ Weld Y(2)†	Length Thru Hub: Weld Neck Y(2)†	Dia. of Bolt Circle	Dia. of Bolt Holes	No. of Bolts	
15	90	11.5	16	48	60.5	16	4	95	14.5	22	52	66.5	16	4	95	14.5	22	52	66.5	16	4	15
20	100	13.0	16	52	70.0	16	4	120	16.0	25	57	82.5	20	4	120	16.0	25	57	82.5	20	4	20
25	110	14.5	17	56	79.5	16	4	125	17.5	27	62	89.0	20	4	125	17.5	27	62	89.0	20	4	25
32	120	16.0	21	57	89.0	16	4	135	19.5	27	65	98.5	20	4	135	21.0	29	67	98.5	20	4	32
40	130	17.5	22	62	98.5	16	4	155	21.0	30	68	114.5	22	4	155	22.5	32	70	114.5	22	4	40
50	150	19.5	25	64	120.5	20	4	165	22.5	33	70	127.0	20	8	165	26.5	37	73	127.0	20	8	50
65	180	22.5	29	70	139.5	20	4	190	25.5	38	76	149.0	22	8	190	29.0	41	79	149.0	22	8	65
80	190	24.0	30	70	152.5	20	4	210	29.0	43	79	168.5	22	8	210	32.0	46	83	168.5	22	8	80
90	215	24.0	32	71	178.0	20	8	230	30.5	44	81	184.0	22	8	230	35.0	49	86	184.0	26	8	90
100	230	24.0	33	76	190.5	20	8	255	32.0	48	86	200.0	22	8	275	38.5	54	102	216.0	26	8	100
125	255	24.0	36	89	216.0	22	8	280	35.0	51	98	235.0	22	8	330	44.5	60	114	267.0	30	8	125
150	280	25.5	40	89	241.5	22	8	320	37.0	52	98	270.0	22	12	355	48.0	67	117	292.0	30	12	150
200	345	29.0	44	102	298.5	22	8	380	41.5	62	111	330.0	26	12	420	55.5	76	133	349.0	33	12	200
250	405	30.5	49	102	362.0	26	12	445	48.0	67	117	387.5	30	16	510	63.5	86	152	432.0	36	16	250
300	485	32.0	56	114	432.0	26	12	520	51.0	73	130	451.0	33	16	560	66.5	92	156	489.0	36	20	300
350	535	35.0	57	127	476.0	30	12	585	54.0	76	143	514.5	33	20	605	70.0	94	165	527.0	39	20	350
400	600	37.0	64	127	540.0	30	16	650	57.5	83	146	571.5	36	20	685	76.5	106	178	603.0	42	20	400
450	635	40.0	68	140	578.0	33	16	710	60.5	89	159	628.5	36	24	745	83.0	117	184	654.0	45	20	450
500	700	43.0	73	145	635.0	33	20	775	63.5	95	162	686.0	36	24	815	89.0	127	190	724.0	45	24	500
600	815	48.0	83	152	749.5	36	20	915	70.0	106	168	813.0	42	24	940	102.0	140	203	838.0	52	24	600
750	985	54.0 ‡	89	130.2	914.0	35	28	1090	92.0	210	210	997.0	48	28	1130	114.0	248	248	1022.0	54	28	750
900	1170	60.3 ‡	95	136.5	1086.0	41	32	1270	105.0	241	241	1168.0	54	32	1315	124.0	283	283	1194.0	67	28	900

Nominal Size DN	PN150 (Class 900)							PN250 (Class 1500)							PN420 (Class 2500)							Nominal Size DN
	Dia. of Fig. 0	Thickness of Fig. Min. C(2)†	Length Thru Hub: Thrd. Slip-On Soc/ Weld Y(2)†	Length Thru Hub: Weld Neck Y(2)†	Dia. of Bolt Circle	Dia. of Bolt Holes	No. of Bolts	Dia. of Fig. 0	Thickness of Fig. Min. C(2)†	Length Thru Hub: Thrd. Slip-On Soc/Weld Y(2)†	Length Thru Hub: Weld Neck Y(2)†	Dia. of Bolt Circle	Dia. of Bolt Holes	No. of Bolts	Dia. of Fig. 0	Thickness of Fig. Min. C(2)†	Length Thru Hub: Thrd. Slip-On Soc/Weld Y(2)†	Length Thru Hub: Weld Neck Y(2)†	Dia. of Bolt Circle	Dia. of Bolt Holes	No. of Bolts	
15	USE PN250 DIMENSIONS IN THESE SIZES							120	22.5	32	60	82.5	22	4	135	30.5	40	73	89.0	22	4	15
20								130	25.5	35	70	89.0	22	4	140	32.0	43	79	95.0	22	4	20
25								150	29.0	41	73	101.5	26	4	160	35.0	48	89	108.0	26	4	25
32								160	29.0	41	73	111.0	26	4	185	38.5	52	95	130.0	30	4	32
40								180	32.0	44	83	124.0	30	4	205	44.5	60	111	146.0	33	4	40
50								215	38.5	57	102	165.0	26	8	235	51.0	70	127	171.5	30	8	50
65								245	41.5	64	105	190.5	30	8	270	57.5	79	143	197.0	33	8	65
80	240	38.5	54	102	190.5	26	8	270	48.0	73	118	203.0	33	8	305	67.0	92	168	228.5	36	8	80
100	295	44.5	70	114	235.0	32	8	310	54.0	90	124	241.5	36	8	355	76.5	108	190	273.0	42	8	100
125	350	51.0	79	127	279.5	35	8	375	73.5	105	155	292.0	42	8	420	92.5	130	229	324.0	48	8	125
150	380	56.0	86	140	317.5	32	12	395	83.0	119	171	317.5	39	12	485	108.0	152	273	368.5	56	8	150
200	470	63.5	102	162	393.5	39	12	485	92.0	143	213	393.5	45	12	550	127.0	178	318	438.0	56	12	200
250	545	70.0	108	184	470.0	39	16	585	108.0	159	254	482.5	52	12	675	165.5	229	419	539.5	68	12	250
300	610	79.5	117	200	533.5	39	20	675	124.0	181	283	571.5	56	16	760	184.5	254	464	619.0	76	12	300
350	640	86.0	130	213	559.0	42	20	750	133.5		298	635.0	60	16								350
400	705	89.0	133	216	616.0	45	20	825	146.5		311	705.0	68	16								400
450	785	102.0	152	229	686.0	52	20	915	162.0		327	774.5	76	16								450
500	855	108.0	159	248	749.5	54	20	985	178.0		356	832.0	80	16								500
600	1040	140.0	203	292	901.5	68	20	1170	203.5		406	990.5	94	16								600

All dimensions are shown in millimetres (mm)

NOTES:

* 1. The 2mm Raised Face is included in thickness C(1) and length through hub Y(1). This applies to PN20 and PN50 Pressure Ratings.

† 2. The 7mm Raised Face is not included in thickness C(2) and length through hub Y(2). PN100, 150, 250 and 420 Pressure Ratings are regularly furnished with 7mm Raised Face which is additional to the flange thickness C(2) and Y(2).

3. Always specify bore when ordering weldneck flanges. Bore dimensions shown opposite also provide inside pipe diameters.

LARGE DIAMETER FLANGES ABOVE DN 600

‡ For Blind Flanges refer to MSS SP44.
BS 3293 covers Slip-On and Weldneck but excludes Blind Flanges.
MSS SP44 covers Blind and Weldneck but excludes Slip-On Flanges.
BS 3293 Weldneck PN20 flange thickness, C(1), is less than MSS SP44 equivalents.
API - 605 Dimensions for Large Diameter Flanges vary considerably from both BS 3293 and MSS SP44 – Details on request.

Raised Face Diam. All Press. Ratings mm	Nominal Size DN	O.D. of Pipe mm	Approximate Welding Neck Flange Bores - mm												
			SCH. 10	SCH. 20	SCH. 30	STD. WT.	SCH. 40	SCH. 60	EXT. STG.	SCH. 80	SCH. 100	SCH. 120	SCH. 140	SCH. 160	X.X STG.
35	15	21.3				15.8	Same as STD. WT.		13.9	Same as EXT. STG.				11.8	6.4
43	20	26.7				20.9			18.9					15.5	11.0
51	25	33.4				26.6			24.3					20.7	15.2
64	32	42.2				35.1			32.5					29.5	22.8
73	40	48.3				40.9			38.1					34.0	27.9
92	50	60.3				52.5			49.2					42.9	38.2
105	65	73.0				62.7			59.0					54.0	45.0
127	80	88.9				77.9			73.7					66.7	58.4
140	90	101.6				90.1			85.4					--	--
157	100	114.3				102.3			97.2			92.1		87.3	80.1
186	125	141.3				128.2			122.3			115.9		109.6	103.2
216	150	168.3				154.1			146.3			139.7		131.8	124.4
270	200	219.1		206.4	205.0	202.7		198.5	193.7		188.9	182.6	177.8	173.1	174.6
324	250	273.1		260.3	257.5	254.5		247.7	247.7	242.9	236.5	230.2	222.3	215.9	222.3
381	300	323.9		311.1	307.1	304.8	303.2	295.3	298.5	288.9	281.0	273.1	266.7	257.2	273.1
413	350	355.6	342.9	339.8	336.6	336.6	333.3	325.4	330.2	317.5	307.9	300.0	292.1	284.2	
470	400	406.4	393.7	390.6	387.4	387.4	381.0	373.1	381.0	363.5	354.0	344.5	333.3	325.4	
533	450	457.0	444.5	441.4	434.9	438.2	428.7	419.1	431.8	409.5	398.5	387.4	377.9	366.7	
584	500	508.0	495.3	489.0	482.6	489.0	477.8	466.8	482.6	455.6	442.9	431.8	419.1	408.0	
692	600	610.0	596.9	590.6	581.1	590.6	574.6	560.4	584.2	547.7	531.8	517.6	504.9	490.5	
857	750	762.0	746.2	736.6	730.2	743.0			736.6						
1022	900	914.0	898.6	889.0	882.6	895.4	876.3		889.0						

AMERICAN STANDARD FLANGES TEMPERATURE/PRESSURE RATINGS

Temperature / Pressure Ratings						
Carbon Steel Pipe Flanges to ANSI / ASME 16.5 - 1988 (BS 1560) Forgings to ASTM A105 and A350 - LF2 Forgings to ASTM A181 Grade II for Class 150 and 300 Only						
Temperature (°C)	Maximum Working Pressure in kPa by Classes (for approximate PSI divide by 7)					
	Class 150 (PN20)	Class 300 (PN50)	Class 600 (PN100)	Class 900 (PN150)	Class 1500 (PN250)	Class 2500 (PN420)
-29 to 38	1960	5110	10210	15320	25530	42550
50	1920	5010	10020	15020	25040	41730
100	1770	4640	9280	13910	23190	38650
150	1580	4520	9050	13570	22610	37690
200	1400	4380	8760	13150	21910	36520
250	1210	4170	8340	12520	20860	34770
300	1020	3870	7750	11620	19370	32280
350	840	3700	7390	11090	18480	30800
375	740	3650	7290	10940	18230	30390
400	650	3450	6900	10350	17250	28750
425	560	2880	5750	8630	14380	23960
450	470	2000	4010	6010	10020	16690
475	370	1350	2710	4060	6770	11290
500	280	880	1760	2640	4400	7330
525	190	520	1040	1550	2590	4320
540	130	330	650	980	1630	2720

Flanges above 600 NPA are not included in ANSI B16.5 and the class designations in these large diameters do not imply specific temperature / pressure ratings.

STEEL PIPE, BUTTWELD FITTINGS & FLANGES TO ASME STANDARDS

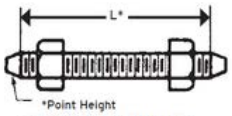
ASME B36.10 Steel Pipe Dimensions					Approximate Mass of Popular Sizes											
					Pipe	Buttweld Fittings			A.S.M.E Flanges							
	Outside Diam. mm	Inside Diam. mm	Identification		Steel Pipe kg/m	90° L/R Elbows kg/ea	Tees Equal kg/ea	Con. & Ecc. Red. kg/ea	PN20 (150)			PN50 (300)			PN100 (600)	PN150 (900)
			Std. X.S	Sch. No.					SOW/SW Thrded kg/ea	W/N kg/ea	Blind kg/ea	SOW/SW Thrded kg/ea	W/N kg/ea	Blind kg/ea	W/N kg/ea	W/N kg/ea
15	21.3	15.8 13.9	Std. XS	40 80	1.27 1.62	0.08 0.10	0.16 0.21	- -	0.45	0.79	0.57	0.73	0.91	0.79	0.91	2.00
20	26.7	20.9 18.9	Std. XS	40 80	1.69 2.20	0.08 0.11	0.21 0.27	0.07 0.10	0.68	0.86	0.91	1.25	1.41	1.13	1.59	2.72
25	33.4	26.6 24.3	Std. XS	40 80	2.50 3.24	0.17 0.21	0.34 0.43	0.14 0.18	0.95	1.09	1.09	1.36	1.81	1.77	1.86	3.86
32	42.2	35.1 32.5	Std. XS	40 80	3.39 4.47	0.28 0.39	0.64 0.75	0.18 0.23	1.13	1.41	1.25	2.04	2.27	2.68	2.72	4.54
40	48.3	40.9 38.1	Std. XS	40 80	4.05 5.41	0.39 0.50	0.95 1.13	0.27 0.32	1.36	1.81	1.70	2.81	3.06	2.83	3.74	6.35
50	60.3	52.5 49.2	Std. XS	40 80	5.44 7.48	0.68 1.00	1.45 1.72	0.41 0.54	2.22	2.83	2.77	3.13	3.74	3.52	4.65	10.89
65	73.0	62.7 59.0	Std. XS	40 80	8.63 11.41	1.39 1.82	2.45 2.95	0.68 0.91	3.82	4.42	4.04	4.54	5.56	5.44	6.44	16.33
80	88.9	77.9 73.7	Std. XS	40 80	11.29 15.27	2.18 2.86	3.45 4.30	0.91 1.27	4.08	5.22	5.44	6.12	7.37	7.26	8.50	14.51
90	101.6	90.1 85.4	Std. XS	40 80	13.57 18.63	3.05 4.1	4.5 5.9	1.36 1.81	4.99	5.44	6.35	7.71	9.53	9.98	12.25	--
100	114.3	102.3 97.2	Std. XS	40 80	16.07 22.32	4.2 5.7	5.7 7.3	1.59 2.18	5.94	7.48	7.37	9.53	11.79	11.79	17.24	23.13
125	141.3	128.2 122.3	Std. XS	40 80	21.77 30.97	6.8 10.0	9.1 11.8	2.7 3.8	6.12	9.53	9.07	12.70	15.42	15.88	30.84	39.01
150	168.3	154.1 146.3	Std. XS	40 80	28.26 42.56	10.9 16.3	13.6 19.0	3.9 5.4	8.16	11.34	12.70	16.33	19.96	20.87	34.02	49.90
200	219.1	202.7 193.7	Std. XS	40 80	42.55 64.64	21.8 33.1	25 33.5	5.9 8.6	12.70	19.05	21.77	25.40	32.21	38.10	52.16	84.82
250	273.1	254.5 247.7	Std. XS	40 60	60.31 81.55	38.6 52	41 54	10 14	17.24	25.40	31.75	35.38	44.00	53.34	90.36	121.56
300	323.9	304.8 298.5	Std. XS	- -	73.88 97.46	57 75	57 77	15 20	27.22	38.10	45.36	50.80	64.41	86.18	101.60	168.74
350	355.6	336.6 330.2	Std. XS	30 -	81.33 107.39	73 97	73 93	28 37	35.38	51.26	58.97	74.39	84.37	107.05	157.40	254.92
400	406.4	387.4 381.0	Std. XS	30 40	93.27 123.30	98 130	91 120	35 46	42.18	63.50	77.11	101.60	111.58	145.15	209.11	310.71
450	457	438.2 431.8	Std. XS	- -	105.16 139.15	120 165	135 190	40 53	52.62	68.04	102.51	126.10	138.35	181.89	217.27	419.12
500	508	489.0 482.6	Std. XS	20 30	117.15 155.12	150 200	168 245	61 82	65.32	81.65	123.38	149.69	174.63	231.33	312.98	527.98
600	610	590.6 584.2	Std. XS	20 -	141.12 187.06	220 280	240 350	77 95	91.63	118.84	203.21	222.26	247.21	342.92	443.16	680.39
750	762	743.0 736.6	Std. XS	- 20	176.84 234.67	332 440	388 484	107 143	142.88	163.29	326.59	367.41	421.84	680.39	589.67	975.22
900	914	895.4 889.0	Std. XS	- 20	212.56 282.27	481 638	588 731	129 172	217.72	235.87	510.29	544.31	589.67	1031.92	793.79	1564.89
← DIMENSIONS →					← MASS IN KILOGRAMS (kg) →											

APPROXIMATE MASS PER UNIT FOR AUSTENITIC STAINLESS STEEL PIPE AND FITTINGS CAN BE OBTAINED BY APPLYING A FACTOR OF 1.015

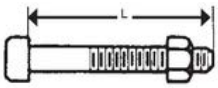
BOLTS & STUDS FOR ASME B16.5 FLANGES

BOLTING

To suit R.F. Flange sizes DN 15 to 600 to ASME – B16.5 (BS. 1560) and DN 750 & 900 to BS. 3293



STUD BOLT WITH NUTS



MACHINE BOLT WITH NUT

Diameter of Bolts is shown in inches. For nominal diameters 1 inch and smaller, threads are U.N.C.; nominal diameters 1 - 1/8 inch and larger threads are 8 U.N. (8 T.P.I).

Length of Bolts (L) is shown in millimetres rounded to the nearest 5mm. Stud Bolt lengths (L*) do not include the height of points. Machine Bolt lengths (L) include the height of point. The length shown includes the height of the Raised Face in all cases.

Nom Flge Size DN	PN 20 (Class 150)				PN 50 (Class 300)				PN 100 (Class 600)			PN 150 (Class 900)			PN 250 (Class 1500)			PN 420 (Class 2500)			Nom Flge Size DN
	No. Bolts	Dia. Bolts ins.	L Stud Bolts mm	L Mach. Bolts mm	No. Bolts	Dia. Bolts ins.	L Stud Bolts mm	L Mach. Bolts mm	No. Bolts	Dia. Bolts ins.	L Stud Bolts mm	No. Bolts	Dia. Bolts ins.	L Stud Bolts mm	No. Bolts	Dia. Bolts ins.	L Stud Bolts mm	No. Bolts	Dia. Bolts ins.	L Stud Bolts mm	
15	4	1/2	60	45	4	1/2	65	55	4	1/2	80				4	3/4	105	4	3/4	125	15
20	4	1/2	65	50	4	5/8	75	60	4	5/8	90				4	3/4	115	4	3/4	125	20
25	4	1/2	65	55	4	5/8	80	65	4	5/8	90				4	7/8	125	4	7/8	140	25
32	4	1/2	70	55	4	5/8	80	65	4	5/8	100				4	7/8	125	4	1	150	32
40	4	1/2	70	60	4	3/4	90	75	4	3/4	105				4	1	140	4	1 1/8	170	40
50	4	5/8	80	65	8	5/8	90	75	8	5/8	105				8	7/8	145	8	1	175	50
65	4	5/8	90	75	8	3/4	100	85	8	3/4	120				8	1	160	8	1 1/8	195	65
80	4	5/8	90	75	8	3/4	110	90	8	3/4	125	8	7/8	145	8	1 1/8	180	8	1 1/4	220	80
90	8	5/8	90	75	8	3/4	110	95	8	7/8	140	-	-	-	-	-	-	-	-	-	90
100	8	5/8	90	75	8	3/4	110	95	8	7/8	145	8	1 1/8	170	8	1 1/4	195	8	1 1/2	255	100
125	8	3/4	90	80	8	3/4	120	100	8	1	165	8	1 1/4	190	8	1 1/2	250	8	1 3/4	300	125
150	8	3/4	100	85	12	3/4	125	105	12	1	170	12	1 1/8	195	12	1 3/8	260	8	2	345	150
200	8	3/4	110	90	12	7/8	140	110	12	1 1/8	195	12	1 3/8	220	12	1 5/8	290	12	2	380	200
250	12	7/8	115	95	16	1	155	130	16	1 1/4	215	16	1 3/8	235	12	1 7/8	335	12	2 1/2	485	250
300	12	7/8	120	100	16	1 1/8	170	145	20	1 1/4	220	20	1 3/8	255	16	2	375	12	2 3/4	540	300
350	12	1	130	110	20	1 1/8	175	150	20	1 3/8	235	20	1 1/2	275	16	2 1/4	405				350
400	16	1	135	115	20	1 1/4	190	160	20	1 1/2	255	20	1 5/8	285	16	2 1/2	445				400
450	16	1 1/8	150	125	24	1 1/4	195	170	20	1 5/8	275	20	1 7/8	325	16	2 3/4	495				450
500	20	1 1/8	160	135	24	1 1/4	205	180	24	1 5/8	290	20	2	345	16	3	540				500
600	20	1 1/4	175	145	24	1 1/2	230	195	24	1 7/8	330	20	2 1/2	435	16	3 1/2	615				600
750	28	1 1/4	190	160	28	1 3/4	290	250	28	2	355	PN150, 250 & 420 - NOT LISTED IN BS 3293									750
900	32	1 1/2	215	180	32	2	325	280	28	2 1/2	400										900

USE PN250 DIMENSIONS IN THESE SIZES

Raised Face height of 2 mm for PN20 & 50 and 7 mm for PN100, 150, 250 & 420 is included in dimension L (Bolt Length).

MATERIAL SPECIFICATIONS

ASTM A193 Grade B7	Standard specification for alloy steel and stainless steel bolting materials for high temperature service.
ASTM A194 Grade 2H	Standard specification for carbon and alloy steel nuts for bolts for high pressure and high temperature service.
ASTM A320	Standard specification for alloy steel bolting materials for low temperature service. Grade L7 covers alloy steel stud bolts. Grade L4 covers alloy steel nuts to suit Grade L7 stud bolts.

Inch/ Metric Bolting interchangeable for ASME B16.5 flanges as below	
FOR	USE
1/2"	M14
5/8"	M16
3/4"	M20
7/8"	M24
1"	M27
1 1/8"	M30
1 1/4"	M33
1 3/8"	M36
1 1/2"	M39
1 5/8"	M42
1 3/4"	M45
1 7/8"	M48
2"	M52
2 1/4"	M56
2 1/2"	M64
2 3/4"	M72

FLANGE IDENTIFICATION CHART

A guide to the key dimensions of popular steel flange types

Size (mm)	Table / Class	Diam. of Flange	Bolt Circle Diam.	No. of Bolts	Diam. / Length Bolts / Studs Steel Flanges	Diam. Holes	Flange Thickness Cast / Forged Steel
15	Table D	95	67	4	M12 x 45	14	5*
	Table E	95	67	4	M12 x 45	14	6*
	Table H	115	83	4	M16 x 60	18	13
	ANSI 150	89	60.3	4	1/2 x 60	16	11.5
	ANSI 300	95	66.7	4	1/2 x 65	16	14.5
	ANSI 600	95	66.7	4	1/2 x 80	16	14.5
	PN 16	95	65	4	--	14	--
20	Table D	100	73	4	M12 x 45	14	5*
	Table E	100	73	4	M12 x 45	14	6*
	Table H	115	83	4	M16 x 60	18	13
	ANSI 150	98	69.8	4	1/2 x 65	16	14
	ANSI 300	117	82.5	4	5/8 x 75	20	16
	ANSI 600	117	82.5	4	5/8 x 90	20	16
	PN 16	105	75	4	--	14	--
25	Table D	115	83	4	M12 x 45	14	5*
	Table E	115	83	4	M12 x 45	14	7*
	Table H	120	87	4	M16 x 60	18	14
	ANSI 150	108	79.4	4	1/2 x 65	16	14
	ANSI 300	124	88.9	4	5/8 x 80	20	18
	ANSI 600	124	88.9	4	5/8 x 105	20	18
	PN 16	115	85	4	--	14	--
32	Table D	120	87	4	M12 x 50	14	6*
	Table E	120	87	4	M12 x 50	14	8*
	Table H	135	98	4	M16 x 65	18	17
	ANSI 150	117	88.9	4	1/2 x 70	16	16
	ANSI 300	133	98.4	4	5/8 x 80	20	22
	ANSI 600	133	98.4	4	5/8 x 100	20	22
	PN 16	140	100	4	--	18	--
40	Table D	135	98	4	M12 x 50	14	6*
	Table E	135	98	4	M12 x 50	14	9*
	Table H	140	105	4	M16 x 65	18	17
	ANSI 150	127	98.4	4	1/2 x 70	16	17
	ANSI 300	156	114.3	4	3/4 x 90	23	22
	ANSI 600	156	114.3	4	3/4 x 105	23	22
	PN 16	150	110	4	--	18	--
50	Table D	150	114	4	M16 x 60	18	8*
	Table E	150	114	4	M16 x 60	18	10*
	Table H	165	127	4	M16 x 75	18	19
	ANSI 150	152	120.6	4	5/8 x 80	20	20
	ANSI 300	165	127	8	5/8 x 90	20	22
	ANSI 600	165	127	8	5/8 x 105	20	26
	PN 16	165	125	4	--	16	--
65	Table D	165	127	4	M16 x 60	18	8*
	Table E	165	127	4	M16 x 60	18	10*
	Table H	185	146	8	M16 x 75	18	19
	ANSI 150	178	139.7	4	5/8 x 90	20	23
	ANSI 300	191	149.2	8	3/4 x 100	23	26
	ANSI 600	191	149.2	8	3/4 x 120	23	30
	PN 16	185	145	4	--	18	--
80	Table D	185	146	4	M16 x 60	18	10*
	Table E	185	146	4	M16 x 60	18	11*
	Table H	205	165	8	M16 x 75	18	22
	ANSI 150	191	152.4	4	5/8 x 90	20	24
	ANSI 300	210	168.3	8	3/4 x 110	23	32
	ANSI 600	210	168.3	8	3/4 x 125	23	32
	PN 16	200	160	8	--	18	--
100	Table D	215	178	4	M16 x 65	18	10*
	Table E	215	178	8	M16 x 65	18	13
	Table H	230	191	8	M16 x 85	18	25
	ANSI 150	229	190.5	8	5/8 x 90	20	24
	ANSI 300	254	200	8	3/4 x 110	23	32
	ANSI 600	273	215.9	8	7/8 x 145	26	38
	PN 16	220	180	8	--	18	--

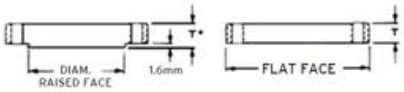
*It is impractical to use thickness less than 12.00mm for plate flanges.
Dimensions AS 2129 - ANSI/ASME B16.5

FLANGE IDENTIFICATION CHART

Size (mm)	Table / Class	Diam. of Flange	Bolt Circle Diam.	No. of Bolts	Diam. / Length Bolts / Studs Steel Flanges	Diam. Holes	Flange Thickness Cast / Forged Steel
125	Table D	255	210	8	M16 x 65	18	22
	Table E	255	210	8	M16 x 65	18	14
	Table H	280	235	8	M20 x 95	22	29
	ANSI 150	254	215.9	8	3/4 x 90	23	24
	ANSI 300	279	234.9	8	3/4 x 120	23	35
	ANSI 600	330	266.7	8	1 x 165	29	45
	PN 16	250	210	8	--	18	--
150	Table D	280	235	8	M16 x 65	18	13
	Table E	280	235	8	M20x 65	22	17
	Table H	305	260	12	M20 x 95	22	29
	ANSI 150	279	241.3	8	3/4 x 100	23	26
	ANSI 300	318	269.9	12	3/4 x 125	23	37
	ANSI 600	356	292.1	12	1 x 170	29	48
	PN 16	285	240	8	--	22	--
200	Table D	335	292	8	M16 x 65	18	13
	Table E	335	292	8	M20 x 65	22	19
	Table H	370	324	12	M20 x 100	22	32
	ANSI 150	343	298.4	8	3/4 x 110	23	29
	ANSI 300	381	330.2	12	7/8 x 140	26	41
	ANSI 600	419	349.2	12	1 1/8 x 195	32	56
	PN 10	340	295	8	--	22	--
	PN 16	340	280	12	--	22	--
250	Table D	405	356	8	M20 x 75	22	--
	Table E	405	356	12	M20 x 75	22	22
	Table H	430	381	12	M24 x 120	26	35
	ANSI 150	406	361.9	12	7/8 x 115	29	30
	ANSI 600	510	431.8	16	1 1/4 x 215	35	64
	PN 10	395	350	8	--	22	--
	PN 16	405	350	12	--	22	--
300	Table D	455	406	12	M20 x 85	22	22
	Table E	455	406	12	M24 x 85	26	25
	Table H	490	438	16	M24 x 110	26	41
	ANSI 150	483	431.8	12	7/8 x 120	26	32
	ANSI 300	520	450.8	16	1 1/8 x 170	32	51
	PN 10	445	400	12	--	22	--
	PN 16	450	410	12	--	25	--
350	Table D	525	470	12	M24 x 95	26	25
	Table E	525	470	12	M24 x 95	26	29
	Table H	550	495	16	M27 x 130	30	48
	ANSI 150	535	476.2	12	1 x 130	29	35
	ANSI 300	585	514.3	20	1 1/8 x 175	32	54
375	Table D	550	495	12	M24 x 95	26	22
	Table E	550	495	12	M24 x 95	26	32
400	Table D	580	521	12	M24 x 95	26	22
	Table E	580	521	12	M24 x 100	26	32
	Table H	610	552	20	M27 x 140	30	54
	ANSI 150	597	539.7	16	1 x 130	29	37
	ANSI 300	650	571.5	20	1 1/4 x 190	35	57
450	Table D	640	584	12	M24 x 95	26	25
	Table E	640	584	16	M24 x 120	26	35
	Table H	675	610	20	M30 x 160	33	60
	ANSI 150	635	577.8	16	1 1/8 x 150	32	40
	ANSI 300	710	628.6	24	1 1/4 x 195	35	60
500	Table D	705	641	16	M24 x 110	26	29
	Table E	705	641	16	M24 x 110	26	38
	Table H	735	673	24	M30 x 170	33	67
	ANSI 150	700	635	20	1 1/8 x 160	32	43
	ANSI 300	775	685.8	24	1 1/4 x 205	35	64
600	Table D	825	756	16	M27 x 120	30	32
	Table E	825	756	16	M30 x 140	33	48
	Table H	850	781	24	M33 x 200	36	76
	ANSI 150	815	749.3	20	1 1/4 x 175	35	48
	ANSI 300	915	812.8	24	1 1/2 x 230	42	70

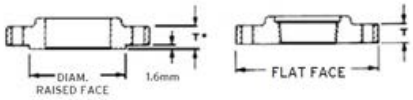
*It is impractical to use thickness less than 12.00mm for plate flanges.
Dimensions AS 2129 - ANSI/ASME B16.5

AUSTRALIAN STANDARD FLANGES



BLANK OR BLIND FLANGE

DIMENSIONS FOR LOOSE FLANGES



BOSS FLANGE - SLIP ON WELD OR SCR. B.S.P.

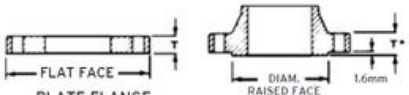


PLATE FLANGE SLIP ON WELD

WELD NECK FLANGE

COPPER ALLOY
T.3 - Plate or Boss or Blank
T.10 - Plate or Boss
T.11 - Blank

FORGED OR PLATE STEEL
T.6 - Plate or Boss or Blank, or Weldneck (except for valves)
T.18- Plate or Blank or Weldneck (except for valves)

Nominal Size DN	Table D						Table E							Table F							Nominal Size DN
	Flange			Drilling			Flange				Drilling			Flange				Drilling			
	OD mm	Thickness T3 mm	Thickness ** T6 mm	Bolt Circle Dia. mm	No. of Bolts	Dia. of Bolts mm	OD mm	Thickness T10 mm	Thickness T11 mm	Thickness ** T6 mm	Bolt Circle Dia. mm	No. of Bolts	Dia. of Bolts mm	OD mm	Thickness T10 mm	Thickness T11 mm	Thickness ** T6 mm	Bolt Circle Dia. mm	No. of Bolts	Dia. of Bolts mm	
15	95	6	5	67	4	M12	95	6	6	6	67	4	M12	95	8	8	10	67	4	M12	15
20	100	6	5	73	4	M12	100	6	6	6	73	4	M12	100	8	8	10	73	4	M12	20
25	115	8	5	83	4	M12	115	8	8	7	83	4	M12	120	10	10	10	87	4	M16	25
32	120	8	6	87	4	M12	120	8	8	8	87	4	M12	135	10	10	13	98	4	M16	32
40	135	10	6	98	4	M12	135	10	10	9	98	4	M12	140	11	11	13	105	4	M16	40
50	150	10	8	114	4	M16	150	10	10	10	114	4	M16	165	11	12	16	127	4	M16	50
65	165	11	8	127	4	M16	165	11	11	10	127	4	M16	185	13	13	16	146	8	M16	65
80	185	13	10	146	4	M16	185	13	13	11	146	4	M16	205	14	15	16	165	8	M16	80
100	215	16	10	178	4	M16	215	16	16	13	178	8	M16	230	17	17	19	191	8	M16	100
125	255	17	13	210	8	M16	255	17	17	14	210	8	M16	280	19	20	22	235	8	M20	125
150	280	17	13	235	8	M16	280	17	17	17	235	8	M20	305	22	23	22	260	12	M20	150
200	335	19	13	292	8	M16	335	19	20	19	292	8	M20	370	25	28	25	324	12	M20	200
250	405	19	16	356	8	M20	405	22	25	22	356	12	M20	430	25	32	29	381	12	M24	250
300	455	22	19	406	12	M20	455	25	28	25	406	12	M24	490	29	37	32	438	16	M24	300
350	525	25	22	470	12	M24	525	25	32	29	470	12	M24	550	32	42	35	495	16	M27	350
400	580	25	22	521	12	M24	580	25	36	32	521	12	M24	610	32	47	41	552	20	M27	400
450	640	29	25	584	12	M24	640	29	41	35	584	16	M24	675	35	52	44	610	20	M30	450
500	705	32	29	641	16	M24	705	32	46	38	641	16	M24	735	38	57	51	673	24	M30	500
600	825	35	32	756	16	M27	825	38	-	48	756	16	M30	850	41	68	57	781	24	M33	600
700	910	-	35	845	20	M27	910	-	-	51	845	20	M30	935	-	-	60	857	24	M33	700
750	995	-	41	927	20	M30	995	-	-	54	927	20	M33	1015	-	-	67	940	28	M33	750
800	1060	-	41	984	20	M33	1060	-	-	54	984	20	M33	1060	-	-	68	984	28	M33	800
900	1175	-	48	1092	24	M33	1175	-	-	64	1092	24	M33	1185	-	-	76	1105	32	M36	900
1000	1255	-	51	1175	24	M33	1255	-	-	67	1175	24	M36	1275	-	-	83	1194	36	M36	1000
1200	1490	-	60	1410	32	M33	1490	-	-	79	1410	32	M36	1530	-	-	95	1441	40	M39	1200

Nominal Size DN	Table H								Table J						Table R						Nominal Size DN
	Flange				Drilling				Flange		Drilling				Flange		Drilling				
	OD mm	Thickness T10 mm	Thickness T11 mm	Thickness * T6 mm	† Dia. R/F mm	Bolt Circle Dia. mm	No. of Bolts	Dia. of Bolts mm	OD mm	Thickness * T6 mm	Dia. R/F mm	Bolt Circle Dia. mm	No. of Bolts	Dia. of Bolts mm	OD mm	Thickness * T18 mm	Dia. R/F mm	Bolt Circle Dia. mm	No. of Bolts	Dia. of Bolts mm	
15	115	10	11	13	57	83	4	M16	115	16	57	83	4	M16	115	19	64	83	4	M16	15
20	115	10	11	13	57	83	4	M16	115	16	57	83	4	M16	115	19	64	83	4	M16	20
25	120	11	12	14	64	87	4	M16	120	19	64	87	4	M16	125	22	76	95	4	M16	25
32	135	11	13	17	76	98	4	M16	135	19	76	98	4	M16	135	22	76	98	4	M16	32
40	140	13	14	17	83	105	4	M16	140	22	83	105	4	M16	150	25	89	114	4	M20	40
50	165	13	16	19	102	127	4	M16	165	25	102	127	4	M20	165	25	102	127	8	M16	50
65	185	14	17	19	114	146	8	M16	185	25	114	146	8	M20	185	29	114	146	8	M20	65
80	205	16	19	22	127	165	8	M16	205	32	127	165	8	M20	205	32	127	165	8	M20	80
100	230	19	23	25	152	191	8	M16	230	35	152	191	8	M20	240	35	152	197	8	M24	100
125	280	22	27	29	178	235	8	M20	280	38	178	235	8	M24	280	41	178	235	12	M24	125
150	305	25	30	29	210	260	12	M20	305	38	210	260	12	M24	305	44	210	260	12	M24	150
200	370	32	39	32	260	324	12	M20	370	41	260	324	12	M24	370	51	260	324	12	M27	200
250	430	35	45	35	311	381	12	M24	430	48	311	381	12	M27	430	60	311	387	16	M27	250
300	490	38	52	41	362	438	16	M24	490	51	362	438	16	M27	510	70	362	457	16	M30	300
350	550	41	58	48	419	495	16	M27	550	57	419	495	16	M30	585	79	419	527	16	M33	350
400	610	44	64	54	483	552	20	M27	610	64	483	552	20	M30	640	89	483	584	20	M33	400
450	675	48	71	60	533	610	20	M30	675	70	533	610	20	M33	735	98	572	673	20	M36	450
500	735	51	78	67	597	673	24	M30	735	79	597	673	24	M33	805	105	622	730	20	M39	500
600	850	57	92	76	699	781	24	M33	850	92	699	781	24	M36	-	-	-	-	-	-	-

NOTES:

(1) All dimensions are in millimetres (mm).
(2) Only metric preferred sizes listed, except for DN 750 which is a Non-preferred size.
* * (3) It is impractical to use flange thickness less than 12mm for Steel Plate Flanges.
* (4) Thickness includes 1.6mm height for the Raised Face.
† (5) The Raised Face is non-preferred for Table "H".
(6) It is normal practice to supply Steel Flanges to Tables A, D, C, E, F and H. – Flat Faced.
(7) All copper alloy flanges shall be Flat Faced.
(8) All flanges shall be drilled to Standard Tables unless otherwise specified. (For Bolt dimensions see separate page).

IMPORTANT: For DN 150 and DN 200 Flanges, the O.D. of pipe being used must be specified. Dimensions for Flange Tables A, C, K, S and T on application.

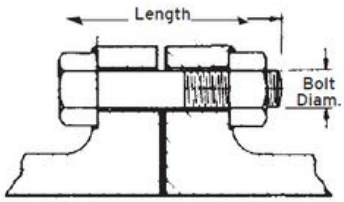
I.S.O. METRIC HEXAGON STEEL BOLTS FOR USE WITH AS.2129 FLANGES

Steel hexagon Bolts and Nuts (XOX) are recommended for use within a temperature range of -50°C to +300°C. Outside of this temperature range, Stud Bolts should be used as recommended in AS.2528.

A quick reference chart for sizing bolts and nuts for a range of regularly used standard flanges is given below:

APPLICABLE TO PLATE & FORGED STEEL LOOSE FLANGES ONLY

Note: Integral valve flanges quite often differ in thickness to equivalent loose flanges. When integral flanges are involved due allowance should be made to bolt lengths.



Flat faced joint illustrated

Nominal Flange Size DN	Table D		Table E		Table F		Table H	
	No. Bolts Per Flange	XOX Bolt & Nut dia. x lgth	No. Bolts Per Flange	XOX Bolt & Nut dia. x lgth	No. Bolts Per Flange	XOX Bolt & Nut dia. x lgth	No. Bolts Per Flange	XOX Bolt & Nut dia. x lgth
15	4	M12 x 40mm*	4	M12 x 40mm*	4	M12 X 40mm*	4	M16 x 45mm*
20	4	M12 x 40mm*	4	M12 x 40mm*	4	M12 X 40mm*	4	M16 x 45mm*
25	4	M12 x 40mm*	4	M12 x 40mm*	4	M16 X 45mm*	4	M16 x 50mm*
32	4	M12 x 40mm*	4	M12 x 40mm*	4	M16 X 45mm*	4	M16 x 55mm*
40	4	M12 x 40mm*	4	M12 x 40mm*	4	M16 X 45mm*	4	M16 x 55mm*
50	4	M16 x 45mm*	4	M16 x 45mm*	4	M16 X 50mm*	4	M16 x 60mm*
65	4	M16 x 45mm*	4	M16 x 45mm*	8	M16 X 50mm*	8	M16 x 60mm*
80	4	M16 x 45mm*	4	M16 x 45mm*	8	M16 X 50mm*	8	M16 x 65mm*
100	4	M16 x 45mm*	8	M16 x 45mm*	8	M16 X 60mm*	8	M16 x 70mm*
125	8	M16 x 45mm*	8	M16 x 50mm*	8	M20 X 70mm*	8	M20 x 80mm*
150	8	M16 x 45mm*	8	M20 x 60mm*	12	M20 X 70mm*	12	M20 x 80mm*
200	8	M16 x 45mm*	8	M20 x 60mm*	12	M20 X 75mm*	12	M20 x 90mm*
250	8	M20 x 55mm*	12	M20 x 70mm*	12	M24 X 85mm*	12	M24 x 100mm*
300	12	M20 x 60mm*	12	M24 x 80mm*	16	M24 X 100mm*	16	M24 x 110mm*
350	12	M24 x 75mm*	12	M24 x 85mm*	16	M27 X 100mm*	16	M27 x 130mm*
400	12	M24 x 75mm*	12	M24 x 100mm*	20	M27 X 120mm*	20	M27 x 140mm*
450	12	M24 x 80mm*	16	M24 x 100mm*	20	M30 X 130mm*	20	M30 x 160mm*
500	16	M24 x 85mm*	16	M24 x 110mm*	24	M30 X 140mm*	24	M30 x 170mm*
600	16	M27 x 100mm*	16	M30 x 130mm*	24	M33 X 150mm*	24	M33 x 190mm*
700	20	M27 x 100mm*	20	M30 x 140mm*	24	M33 X 160mm*		
750	20	M30 x 120mm*	20	M33 x 150mm*	28	M33 X 170mm*		
800	20	M33 x 120mm*	20	M33 x 150mm*	28	M33 X 180mm*		
900	24	M33 x 140mm*	24	M33 x 170mm*	32	M36 X 200mm*		
1000	24	M33 x 140mm*	24	M36 x 180mm*	36	M36 X 220mm*		
1200	32	M33 x 160mm*	32	M36 x 200mm*	40	M39 X 240mm*		

Notes

- All dimensions are in millimetres (mm).
- High strength structural bolts to AS 1252 may be substituted for property class 8.8 bolts if agreed to by the purchaser.
- Bolts to AS 1252 are heavy hexagon series and the selection of such bolts would be subject to space being available on the relevant flange.

Temperature / Pressure Ratings for Carbon Steel Flanges				
Temp in °C	Maximum Allowable Pressure in kPa by Flange Tables (For approximate PSI divide by 7)			
	D	E	F	H
-50 to 232	700	1400	2100	3500
250	650	1300	2000	3300
275	600	1200	1800	3100
300	570	1100	1700	2900
325	550	1000	1600	2600
350	500	950	1400	2400
375	450	900	1300	2200
400	400	800	1200	2000
425	350	700	1000	1700
450				1300
475				900
Max. Hydrostatic Test Pressure kPa	1050	2100	3150	5250

Bolt lengths listed apply to flat-faced or 1.6mm raised face flanges with allowance for 1.6mm gasket thickness.

*For approximate Stud Bolt Lengths take the XOX Bolt Length and add the metric diameter in mm rounded to the nearest 5mm increment up.

Note: (This does not include length of point)

This chart shows bolt diameters as recommended in AS.2129. Some of these are Non-preferred sizes e.g. (M27), (M33) and (M39) which are not readily available in Australia.

Stud Bolts should be used as alternatives to bolts where the size is greater than M24 and it is therefore suggested that Stud Bolts as specified in AS.2528 or BS.4882 should be used.

Inch series bolts interchangeable as follows:

FOR ↓	USE ↓	FOR ↓	USE ↓
1/4"	M6	7/8"	M24
5/16"	M8	1"	(M27)
3/8"	M10	1 1/8"	M30
1/2"	M12	1 1/4"	(M33)
5/8"	M16	1 3/8"	M36
3/4"	M20	1 1/2"	(M39)

BOLT HOLE DIAMETERS

For bolts to M24, clearance hole 2mm larger.

Above M24, clearance hole 3mm larger.

XOX BOLTS & NUTS

XOX is the trade term used for H.R.H. commercial steel bolts and nuts.

H.R.H. denotes Hexagon Head x Round Shank x Hexagon Nut.

XOX Bolting		
Temp. Range: -50°C to +300°C		
Flange Specifications		
Table	Bolts	Nuts
D, E, F	AS 1110 Gr.4.6 or AS 1111 Gr.4.6	AS 1112 Gr.5
H	AS 1110 Gr8.8	AS 1112 Gr.8

LIGHT/EXTRA LIGHT PIPE TO AUSTRALIAN STANDARDS

Grade C350 pipe is a lightweight, high strength pipe for general mechanical and structural applications.

C350 is manufactured by cold-forming and high frequency electric resistance welding.

C350 is available in black, ILG and galvanized finishes.

Also available with one or both ends swaged as follows:

NB	XL	L
20	✔	X
25	✔	✔
32	✔	✔
40	✔	✔
50	✔	X

SPECIFICATION

Grade C350 pipe is manufactured and tested to meet the requirement of the following specifications:

- AS 1163 Structural Steel Hollow Sections (Grade C350, C350L0).
- AS/NZ 4792 Hot dip galvanized (zinc) coatings on ferrous hollow sections by a continuous or a specialised process.

MECHANICAL PROPERTIES

Minimum Yield Strength	350MPa
Minimum Tensile Strength	450MPa
Minimum Elongation in 5.65 √So	20%

SUPPLY CONDITIONS

Surface Finish	Black/ILG/Galvanized
Straightness, Thickness Tolerance, Dimension Tolerance	Refer to Australian Standards
Standard Length	6.5m
Length Tolerance	+50mm/-0mm

GALVANIZING

Grade C350 pipe is manufactured and tested to meet the requirement of AS 4792 Galvanized Coatings.

Min. Ave Coating Mass 300g/m²

The coating adherence of the galvanizing is satisfactory for the pipe to be bent to a radius 6 times the diameter of the pipe.

WELDING

The following consumables are recommended by AS 1554.1 when welding C350 sections.

Manual metal-arc (MMAW) E41XX, E48XX

Gas metal-arc (MIG) (GMAW) W50X

Mass and Bundling Data - Calculated in accordance with AS 1163

Dimensions		Bundling			Mass					
Designation d_o t	Nominal Size DN	Bundle Dimenions mm	Lengths Per Bundle	Metres Per Bundle	Nominal Mass kg/m		Nominal Mass m/tonne		Mass per Bundle tonnes	
(mm) (mm)	(mm)	W x H	6.5m	m	Black	Galv.	Black	Galv.	Black	Galv.
26.9 x 2.0 CHS	20 XL	350 306	127	825.5	1.23	1.29	814	767	1.010	1.070
2.3 CHS	20 LT	350 306	127	825.5	1.40	1.46	717	680	1.150	1.200
33.7 x 2.0 CHS	25 XL	372 327	91	591.5	1.56	1.64	640	602	0.920	0.970
2.6 CHS	25 LT	372 327	91	591.5	1.99	2.07	501	497	1.180	1.230
42.4 x 2.0 CHS	32 XL	383 337	61	396.5	1.99	2.10	502	473	0.790	0.830
2.6 CHS	32 LT	383 337	61	396.5	2.55	2.65	392	374	1.010	1.050
48.3 x 2.3 CHS	40 XL	436 384	61	396.5	2.61	2.73	383	364	1.030	1.080
2.9 CHS	40 LT	436 384	61	396.5	3.25	3.36	308	295	1.290	1.330
60.3 x 2.3 CHS	50 XL	422 374	37	240.5	3.29	3.44	304	288	0.790	0.830
2.9 CHS	50 LT	422 374	37	240.5	4.11	4.25	244	234	0.990	1.020
76.1 x 2.3 CHS	65 XL	533 472	37	240.5	4.19	4.33	239	231	1.007	1.040
3.2 CHS	65 LT	533 472	37	240.5	5.75	5.94	174	167	1.380	1.430
88.9 x 2.6 CHS	80 XL	445 397	19	123.5	5.53	5.75	181	174	0.683	0.710
3.2 CHS	80 LT	445 397	19	123.5	6.76	6.98	148	143	0.840	0.860
101.6 x 2.6 CHS	90 XL	508 454	19	123.5	6.35	6.60	158	152	0.784	0.815
3.2 CHS	90 LT	508 454	19	123.5	7.70	8.04	129	124	0.960	0.990
114.3 x 3.2 CHS	100 XL	572 510	19	123.5	8.77	9.05	114	110	1.083	1.118
3.6 CHS	100 LT	572 510	19	123.5	9.83	10.11	102	98.6	1.214	1.249
139.7 x 3.0 CHS	125 XL	698 382	13	84.5	10.11	10.50	98.9	95.2	0.855	0.887
3.5 CHS	125 LT	698 382	13	84.5	11.76	12.10	85.1	82.4	0.993	1.022
165.1 x 3.5 CHS 150 LT	150 LT	660 451	10	65	13.95	14.40	71.7	69.4	0.907	0.936

Notes:
LT = Light, XL = Extra Light
The term "tube" is synonymous with the term "pipe".

MEDIUM & HEAVY PIPE AUSTRALIAN STANDARDS

SPECIFICATION

C250 pipe is manufactured and tested to meet the requirement of the following specifications:

- AS 1074 Steel tubes and tubulars for ordinary service.
- AS 1163 Structural steel hollow sections (Grade C250, C250L0).

WORKING PRESSURES – WELDED JOINTS

Where AS 1074 pipe is used in pressure piping covered by AS 4041, the maximum pressure shall not exceed 1210 kPa for AS 1074 pipe up to and including DN 100 and 1030 kPa for AS 1074 pipe exceeding DN 100.

END PROCESSING OPTIONS

- Plain End
- Roll Grooved
- Shouldered
- Threaded

THREADED PIPE

Screwed on one or both ends in accordance with AS 1074. The tapered Whitworth thread used complies with the requirements of AS 1722, Part 1 and is suitable for both parallel and taper threaded sockets.

MECHANICAL PROPERTIES

Minimum Yield Strength	250MPa
Minimum Tensile Strength	320MPa
Minimum Elongation in 5.65 √So	20%

SUPPLY CONDITIONS

Surface Finish	Black/Painted/Galvanized/ILG
Straightness Thickness Tolerance Dimension Tolerance	Refer to Australian Standards
Standard Length	6.5m
Length Tolerance	+50mm/-0mm

WORKING PRESSURES - THREADED JOINTS TAPER/PARALLEL THREAD

Nom. Size DN	Type of Service										
	Water & Inert Oil		LPG	Fuel Oil				Other Applications (including Steam & Compressed Air)			
	Med.	Heavy	Med. & Heavy	Medium Press	Medium Temp	Heavy Press	Heavy Temp	Medium Press	Medium Temp	Heavy Press	Heavy Temp
(mm)	kPa	kPa	kPa	kPa	°C	kPa	°C	kPa	°C	kPa	°C
25	2070	2410	140	1030	100	1210	192	1210	100	1210	192
32	1720	2070	140	1030	100	1030	192	1030	100	1030	192
40	1720	2070	140	1030	100	1030	192	1030	100	1030	192
50	1380	1720	140	860	100	860	192	860	100	860	192
65	1380	1720	-	860	100	860	192	860	100	860	192
80	1380	1720	-	860	100	860	192	860	100	860	192
100	1030	1380	-	690	100	850	192	690	100	690	192
125	1030	1380	-	-	-	-	-	-	-	-	-
150	860	1030	-	-	-	-	-	-	-	-	-

CHS Grade C250	Mass and Bundling Data - Calculated in accordance with AS 1163									
Dimensions		Bundling			Mass					
Designation d_o t	Nominal Size DN	Bundle Dimenions mm	Lengths Per Bundle	Metres Per Bundle	Nominal Mass kg/m		Nominal Mass m/tonne		Mass per Bundle tonnes	
(mm) (mm)	(mm)	W x H	6.5m	m	Black	Galv.	Black	Galv.	Black	Galv.
26.9 x 2.6 CHS	20 M	350 306	127	825.5	1.56	1.62	642	613	1.29	1.32
3.2 CHS	20 H	350 306	127	825.5	1.87	1.93	535	522	1.54	1.59
33.7 x 3.2 CHS	25 M	372 327	91	591.5	2.41	2.49	415	406	1.43	1.47
4.0 CHS	25 H	372 327	91	591.5	2.94	3.02	340	330	1.74	1.78
42.4 x 3.2 CHS	32 M	383 337	61	396.5	3.10	3.20	322	310	1.23	1.27
4.0 CHS	32 H	383 337	61	396.5	3.80	3.90	263	255	1.51	1.54
48.3 x 3.2 CHS	40 M	436 384	61	396.5	3.57	3.68	280	270	1.41	1.46
4.0 CHS	40 H	436 384	61	396.5	4.38	4.49	228	221	1.74	1.78
60.3 x 3.6 CHS	50 M	422 374	37	240.5	5.03	5.18	199	192	1.21	1.25
4.5 CHS	50 H	422 374	37	240.5	6.19	6.33	161	157	1.49	1.52
76.1 x 3.6 CHS	65 M	533 472	37	240.5	6.43	6.61	156	150	1.55	1.59
4.5 CHS	65 H	533 472	37	240.5	7.93	8.12	126	123	1.91	1.95
88.9 x 4 CHS	80 M	445 397	19	123.5	8.37	8.58	120	116	1.03	1.06
4.9 CHS	80 H	445 397	19	123.5	10.3	10.5	96.8	94.4	1.28	1.30
101.6 x 4.0 CHS	90 M	508 454	19	123.5	9.63	9.88	104	100	1.19	1.22
4.9 CHS	90 H	508 454	19	123.5	11.9	12.2	84	81.7	1.47	1.5
114.3 x 4.5 CHS	100 M	571 509	19	123.5	12.2	12.4	82.2	79.8	1.5	1.54
5.4 CHS	100 H	571 509	19	123.5	14.5	14.3	69.1	67.4	1.79	1.82
139.7 x 5.0 CHS	125 M	698 382	13	84.5	16.6	16.9	60.2	58.6	1.4	1.43
5.4 CHS	125 H	698 382	13	84.5	17.9	18.2	55.9	54.6	1.51	1.54
165.1 x 5.0 CHS	150 M	660 451	10	65	19.7	20.1	50.7	49.3	1.28	1.31
5.4 CHS	150 H	660 451	10	65	21.7	21.57	45.9	46	1.38	1.41

M = Medium, H = Heavy

STAINLESS STEEL PIPES TO AMERICAN STANDARD ASME B36.19

Nominal Size DN	Outside Diameter (mm)	Nominal Wall Thickness & Inside Diameter (mm)							
		Schedule 5S		Schedule 10S		Schedule 40S		Schedule 80S	
		Wall Thickness	Inside Diameter	Wall Thickness	Inside Diameter	Wall Thickness	Inside Diameter	Wall Thickness	Inside Diameter
6	10.29	-	-	1.24	7.81	1.73	6.83	2.41	5.47
8	13.72	-	-	1.65	10.42	2.24	9.24	3.02	7.68
10	17.15	-	-	1.65	13.85	2.31	12.53	3.20	10.75
15	21.34	1.65	18.04	2.11	17.12	2.77	15.80	3.73	13.88
20	26.67	1.65	23.37	2.11	22.45	2.87	20.93	3.91	18.85
25	33.40	1.65	30.10	2.77	27.86	3.38	26.64	4.55	24.30
32	42.16	1.65	38.86	2.77	36.62	3.56	35.04	4.85	32.46
40	48.26	1.65	44.96	2.77	42.72	3.68	40.90	5.08	38.10
50	60.33	1.65	57.03	2.77	54.79	3.91	52.51	5.54	49.25
65	73.03	2.11	68.81	3.05	66.93	5.16	62.71	7.01	59.01
80	88.90	2.11	84.68	3.05	82.80	5.49	77.92	7.62	73.66
100	114.30	2.11	110.08	3.05	108.20	6.02	102.26	8.56	97.18
125	141.30	2.77	135.76	3.40	134.50	6.55	128.19	9.52	122.25
150	168.28	2.77	162.74	3.40	161.47	7.11	154.05	10.97	146.33
200	219.08	2.77	213.54	3.76	211.56	8.18	202.72	12.70	193.68
250	273.05	3.40	266.24	4.19	264.67	9.27	254.51	12.70	247.65
300	323.85	3.96	315.93	4.57	314.71	9.52	304.08	12.70	298.45
350	355.60	3.96	347.68	4.78	346.05	-	-	-	-
400	406.40	4.19	398.02	4.78	396.85	-	-	-	-
450	457.20	4.19	448.82	4.78	447.65	-	-	-	-
500	508.00	4.78	498.45	5.54	496.93	-	-	-	-
600	609.60	5.54	598.53	6.35	596.90	-	-	-	-
750	762.00	6.35	749.30	7.92	746.16	-	-	-	-

PRESSURE CONVERSION TABLE

The SI unit of pressure and stress is the NEWTON PER SQUARE METRE which has been given the special name PASCAL - Symbol Pa.
The pascal is too small for most normal uses and suitable multiple units preferred for Australia are:

kilopascal: Symbol - kPa (= 1000 Pa) (1 N/m^2 = 0.000145 lbf/in^2 = 1Pa)

megapascal: Symbol - MPa (= 1,000,000 Pa) (1 N/mm^2 = 145 lbf/in^2 = 1MPa)

PSI (lbf/in^2) to kPa • PRESSURE - STRESS CONVERSION CHART

(A) To use, locate "given pressure" in "given pressure" column (coloured blue) whether lbf/in^2 or kPa.
(B) If "given pressure" is in pounds force per square inch (lbf/in^2), read kilopascals (kPa) in right hand column.
(C) If "given pressure" is in kilopascals (kPa), read pounds force per square inch (lbf/in^2) in left hand column.
(D) Example: (i) Given pressure is 100 lbf/in^2 = 689 kPa from right hand column
(ii) Given pressure is 100kPa = 14.50 lbf/in^2 from left hand column

1 to 35			36 to 70			71 to 125			130 to 80,000				
lbf/in^2	Given Pressure	kPa	lbf/in^2	Given Pressure	kPa	lbf/in^2	Given Pressure	kPa	lbf/in^2	Given Pressure	kPa	=	MPa
0.15	1	6.89	5.22	36	248.21	10.30	71	490	18.85	130	896	=	0.90
0.29	2	13.79	5.37	37	255.11	10.44	72	496	19.58	135	931	=	0.93
0.44	3	20.68	5.51	38	262.00	10.59	73	503	20.31	140	965	=	0.97
0.58	4	27.58	5.66	39	268.9	10.73	74	510	21.03	145	1000	=	1.00
0.73	5	34.47	5.80	40	275.79	10.88	75	517	21.76	150	1034	=	1.03
0.87	6	41.37	5.95	41	282.69	11.02	76	524	22.48	155	1069	=	1.07
1.02	7	48.26	6.09	42	289.58	11.17	77	531	23.21	160	1103	=	1.10
1.16	8	55.16	6.24	43	296.48	11.31	78	538	23.93	165	1138	=	1.14
1.31	9	62.05	6.38	44	303.37	11.46	79	545	24.61	170	1172	=	1.17
1.45	10	68.95	6.53	45	310.26	11.60	80	552	25.38	175	1207	=	1.21
1.60	11	75.84	6.67	46	317.16	11.75	81	558	26.11	180	1241	=	1.24
1.74	12	82.74	6.82	47	324.05	11.89	82	565	26.83	185	1276	=	1.28
1.89	13	89.63	6.96	48	330.95	12.04	83	572	27.56	190	1310	=	1.31
2.03	14	96.53	7.11	49	337.84	12.18	84	579	28.28	195	1344	=	1.34
2.18	15	103.42	7.25	50	344.74	12.33	85	586	29.01	200	1379	=	1.38
2.32	16	110.32	7.40	51	351.63	12.47	86	593	36.26	250	1724	=	1.73
2.47	17	117.21	7.54	52	358.53	12.62	87	600	43.51	300	2068	=	2.07
2.61	18	124.11	7.69	53	365.42	12.70	88	607	58.02	400	2758	=	2.76
2.76	19	131.00	7.83	54	372.32	12.91	89	614	72.52	500	3447	=	3.45
2.90	20	137.90	7.98	55	379.21	13.05	90	621	108.78	750	5171	=	5.17
3.05	21	144.79	8.12	56	386.11	13.20	91	627	145.04	1000	6894	=	6.89
3.19	22	151.69	8.27	57	393.00	13.34	92	634	217.56	1500	10,342	=	10.34
3.34	23	158.58	8.41	58	399.90	13.49	93	641	290.08	2000	13,790	=	13.79
3.48	24	165.47	8.56	59	406.79	13.63	94	648	435.11	3000	20,684	=	20.68
3.63	25	172.37	8.70	60	413.69	13.78	95	655	580.15	4000	27,579	=	27.58
3.77	26	179.26	8.85	61	420.58	13.92	96	662	725.19	5000	34,473	=	34.47
3.92	27	186.16	8.99	62	427.48	14.07	97	669	1,450.38	10,000	68,948	=	68.95
4.06	28	193.05	9.14	63	434.37	14.21	98	676	2,175.57	15,000	103,421	=	103.4
4.21	29	199.95	9.28	64	441.26	14.34	99	683	2,900.76	20,000	137,895	=	137.9
4.35	30	206.84	9.43	65	448.16	14.50	100	689	4,351.14	30,000	206,843	=	206.8
4.50	31	213.74	9.57	66	455.05	15.23	105	724	5,801.52	40,000	275,790	=	275.8
4.64	32	220.63	9.72	67	461.95	15.95	110	758	7,251.90	50,000	344,738	=	344.7
4.79	33	227.53	9.86	68	468.84	16.68	115	793	8,702.28	60,000	413.686	=	413.7
4.93	34	234.42	10.01	69	475.74	17.40	120	827	10,152.70	70,000	482,633	=	482.6
5.08	35	241.32	10.15	70	482.63	18.13	125	862	11,603.00	80,000	551,581	=	551.6

NOTE: IT IS USUAL FOR PRESSURES IN EXCESS OF 1000 kPa TO BE EXPRESSED IN MEGAPASCALS - MPa
1 megapascal (MPa) = 1000 kilopascals (kPa) = 1 newton per mm^2 (N/mm^2) = 145 lbf/in^2

USEFUL CONVERSION FACTORS - APPROXIMATE

MULTIPLY → BY → TO OBTAIN		
TO OBTAIN ← BY ← DIVIDE		
Bars	1.0197	kg f/cm^2
	100.0	kPa
	14.504	lbf/in^2
	0.1	MPa
kg f/cm^2	14.223	lbf/in^2
	98.07	kPa
	0.09807	MPa
kg f/mm^2	1422.33	lbf/in^2
	9.807	MPa
	0.635	ton f/in^2

MULTIPLY → BY → TO OBTAIN		
TO OBTAIN ← BY ← DIVIDE		
lb f/in^2 (PSI)	6.895	kPa
	0.00689	MPa
ton f/in^2	15.444	MPa

APPROXIMATE EQUIVALENTS
1 Atmosphere (atm) = 14.696 lbf/in^2
1 bar = 14.50 lbf/in^2
1 kg f/cm^2 = 14.22 lbf/in^2
100 kPa (1 bar) = 14.50 lbf/in^2

NOTE: lbf/in^2 (pounds force per square inch) is often expressed as PSI (pounds per square inch)

TEMPERATURE CONVERSION TABLE

The SI Unit of thermodynamic temperature is the KELVIN - Symbol K. For most practical purposes of temperature measurement and most calculations involving temperatures, DEGREE CELSIUS, symbol °C will be used. The name CELSIUS was adopted internationally in 1948 instead of Centigrade, to avoid possible confusion with the identically named unit of angle used in some European countries.

TEMPERATURE CONVERSION CHART

(A) To use, locate "given temperature" in "given temperature" column (coloured blue) whether °C or °F.
(B) If "given temperature" is in degrees Celsius (°C), read degrees Fahrenheit (°F) in right hand column.
(C) If "given temperature" is in degrees Fahrenheit (°F), read degrees Celsius (°C) in left hand column.
(D) Example: (i) Given temperature is 35°C = 95°F from right hand column
(ii) Given temperature is 35°F = 1.7°C from left hand column

-320 to 27			28 to 77			78 to 235			240 to 485			490 to 2400		
°C	Given Temp.	°F	°C	Given Temp.	°F	°C	Given Temp.	°F	°C	Given Temp.	°F	°C	Given Temp.	°F
-196	-320	--	- 2.2	28	82.4	25.6	78	172.4	116	240	464	254	490	914
-184	-300	--	- 1.7	29	84.2	26.1	79	174.2	118	245	473	257	495	923
-173	-280	--	- 1.1	30	86.0	26.7	80	176.0	121	250	482	260	500	932
-162	-260	-436	- 0.6	31	87.8	27.2	81	177.8	124	255	491	266	510	950
-151	-240	-400	0.0	32	89.6	27.8	82	179.6	127	260	500	271	520	968
-140	-220	-364	0.6	33	91.4	28.3	83	181.4	129	265	509	277	530	986
-129	-200	-328	1.1	34	93.2	28.9	84	183.2	132	270	518	282	540	1004
-115	-175	-283	1.7	35	95.0	29.4	85	185.0	135	275	527	288	550	1022
-101	-150	-238	2.2	36	96.8	30.0	86	186.8	138	280	536	293	560	1040
- 90	-130	-202	2.8	37	98.6	30.6	87	188.6	141	285	545	299	570	1058
- 84	-120	-184	3.3	38	100.4	31.1	88	190.4	143	290	554	304	580	1076
- 79	-110	-166	3.9	39	102.2	31.7	89	192.2	146	295	563	310	590	1094
- 73	-100	-148	4.4	40	104.0	32.2	90	194.0	149	300	572	316	600	1112
- 68	- 90	-130	5.0	41	105.8	32.8	91	195.8	152	305	581	321	610	1130
- 62	- 80	-112	5.6	42	107.6	33.3	92	197.6	154	310	590	327	620	1148
- 57	- 70	- 94	6.1	43	109.4	33.9	93	199.4	157	315	599	332	630	1166
- 51	- 60	- 76	6.7	44	111.2	34.4	94	201.2	160	320	608	338	640	1184
- 46	- 50	- 58	7.2	45	113.0	35.0	95	203.0	163	325	617	343	650	1202
- 40	- 40	- 40	7.8	46	114.8	35.6	96	204.8	166	330	626	349	660	1220
- 34	- 30	- 22	8.3	47	116.6	36.1	97	206.6	168	335	635	354	670	1238
- 29	- 20	- 4	8.9	48	118.4	36.7	98	208.4	171	340	644	360	680	1256
- 23	- 10	14	9.4	49	120.2	37.2	99	210.2	174	345	653	366	690	1274
- 17.8	0	32	10.0	50	122.0	37.8	100	212.0	177	350	662	371	700	1292
- 17.2	1	33.8	10.6	51	123.8	41	105	221	179	355	671	377	710	1310
- 16.7	2	35.6	11.1	52	125.6	43	110	230	182	360	680	382	720	1328
- 16.1	3	37.4	11.7	53	127.4	46	115	239	185	365	689	388	730	1346
- 15.6	4	39.2	12.2	54	129.2	49	120	248	188	370	698	393	740	1364
- 15.0	5	41.0	12.8	55	131.0	52	125	257	191	375	707	399	750	1382
- 14.4	6	42.8	13.3	56	132.8	54	130	266	193	380	716	404	760	1400
- 13.9	7	44.6	13.9	57	134.6	57	135	275	196	385	725	410	770	1418
- 13.3	8	46.4	14.4	58	136.4	60	140	284	199	390	734	416	780	1436
- 12.8	9	48.2	15.0	59	138.2	63	145	293	202	395	743	421	790	1454
- 12.2	10	50.0	15.6	60	140.0	66	150	302	204	400	752	427	800	1472
- 11.7	11	51.8	16.1	61	141.8	68	155	311	207	405	761	432	810	1490
- 11.1	12	53.6	16.7	62	143.6	71	160	320	210	410	770	438	820	1508
- 10.6	13	55.4	17.2	63	145.4	74	165	329	213	415	779	443	830	1526
- 10.0	14	57.2	17.8	64	147.2	77	170	338	216	420	788	454	850	1562
- 9.4	15	59.0	18.3	65	149.0	79	175	347	218	425	797	468	875	1607
- 8.9	16	60.8	18.9	66	150.8	82	180	356	221	430	806	482	900	1652
- 8.3	17	62.6	19.4	67	152.6	85	185	365	224	435	815	510	950	1742
- 7.8	18	64.4	20.0	68	154.4	88	190	374	227	440	824	538	1000	1832
- 7.2	19	66.2	20.6	69	156.2	91	195	383	229	445	833	566	1050	1922
- 6.7	20	68.0	21.1	70	158.0	93	200	392	232	450	842	593	1100	2012
- 6.1	21	69.8	21.7	71	159.8	96	205	401	235	455	851	621	1150	2102
- 5.6	22	71.6	22.2	72	161.6	99	210	410	238	460	860	649	1200	2192
- 5.0	23	73.4	22.8	73	163.4	102	215	419	241	465	869	704	1300	2372
- 4.4	24	75.2	23.3	74	165.2	104	220	428	243	470	878	760	1400	2552
- 3.9	25	77.0	23.9	75	167.0	107	225	437	246	475	887	816	1500	2732
- 3.3	26	78.8	24.4	76	168.8	110	230	446	249	480	896	1093	2000	3632
- 2.8	27	80.6	25.0	77	170.6	113	235	455	252	485	905	1316	2400	4352

CONVERSION FACTORS

DEGREES FAHRENHEIT TO CELSIUS
$(°F - 32) \times 5/9 = °C$

DEGREES CELSIUS TO FAHRENHEIT
$(°C \times 9/5) + 32 = °F$

CONVERSION FACTORS - IMPERIAL TO METRIC (Approx.)

"SI" denotes the International System of Metric Units adopted in Australia
This table may be used in two ways: (1) Multiply Column A by Column B to obtain Column C; or (2) Divide Column C by Column B to obtain Column A.

Remarks	A Multiply	B By	C To Obtain
AREA: Symbol m^2 The SI unit of AREA is the SQUARE METRE.	Square Inches	645.16	mm^2
	Square Feet	0.929	m^2
	Square Yards	0.836	m^2
	Acre	4047	m^2
	Hectare (ha)	10000	m^2
DENSITY: Symbol kg/m^3 The SI unit of DENSITY is the kilogram per cubic metre.	lb/in^3	27.68	t/m^3
	lb/ft^3	16.02	kg/m^3
	lb/yd^3	0.5933	kg/m^3
ENERGY: Symbol J The SI unit of ENERGY is the JOULE. 1 J = 1 N.m A joule is the energy expended or the work done when a force of one newton moves the point of application a distance of one metre in the direction of that force.	**1. ELECTRICAL ENERGY**		
	kilowatt hour (kW.h)	3.6	MJ
	2.HEAT ENERGY		
	British thermal unit (Btu)	1.055	kJ
	Btu/gal	0.2321	kJ/L ††
	Btu/ft^3	37.26	kJ/m^3
	3.MECHANICAL ENERGY		
	foot poundal (ft.pdl)	.04214	J
	inch pound-force (in.lbf)	0.1130	J
	foot pound-force (ft.lbf)	1.356	J
	foot ton force (ft.tonf)	3.037	kJ
	Metre kilogram force (m.kgf)	9.807	J
FORCE: Symbol N (NEWTON) The SI unit of FORCE ($kg.m/s^2$) has been given the special name - NEWTON. The newton is the force which when applied to a body having a mass of one kilogram, causes an acceleration of one metre per second in the direction of application of the force.	Poundal (pdl)	0.1383	N
	Pound-force (lbf)	4.448	N
	ton-force (tonf)	9.964	kN
	*kilogram-force (kgf)	9.807	N
	*also known as kilopond (kp)		
FORCE PER UNIT LENGTH: The SI unit is NEWTON PER METRE: **Symbol N/m**	pounds-force per inch lbf/in	175.1	N/m
	pounds-force per foot lbf/ft	14.59	N/m
	ton-force per foot ton/ft	32.69	kN/m
LENGTH: Symbol m The SI unit of LENGTH is the METRE.	inches	25.4	millimetres (mm)
	feet	0.3048	metres (m)
	yards	0.9144	metres (m)
	chain	20.12	metres (m)
	mile	1609	metres (m)
	mile	1.609	kilometres (km)
MASS: Symbol kg The SI unit of MASS is the KILOGRAM.	ounce	28.35	grams (g)
	pound	0.4536	kilograms (kg)
	slug	14.59	kg
	ton (2240 lb)	1016.05	kg
	short ton (2000 lb)	907.2	kg
	ton (2240 lb)	1.016	tonne (t)
	pounds per foot (lb/ft)	1.488	kg/m
	pounds per yard (lb/yd)	0.4961	kg/m
POWER: Symbol W The SI unit of POWER is the WATT.	Btu per hour (Btu/hr)	0.2931	W
	horsepower (hp)	0.7457	kW
	ton of refrigeration	3.517	kW

Remarks	A Multiply	B By	C To Obtain
PRESSURE: Symbol Pa The SI unit of PRESSURE or stress is the NEWTON PER SQUARE METRE which has been given the name PASCAL. 1 N/m^2 = 1Pa = 0.000145lbf/in^2 A pascal is the pressure or stress which arises when a force of one newton is applied uniformly over an area of one square metre.	lbf/in^2	6.895	kPa
	kip/in^2 (1000 psi)	6.895	MPa
	lbf/ft^2	47.88	Pa
	kgf/cm^2	98.07	kPa
	bar	100	kPa
	Vertical column (head) of water. (H_2O at 20°C)		
	metres of water	9.79	kPa
	feet of water	2.984	kPa
	torr (vacuum)	0.1333	kPa
	1mm Hg. (mercury)	0.1333	kPa
	1in. Hg. (mercury)	3.386	kPa
	atmosphere (atm)	101.325	kPa
	microns	0.133	Pa
TORQUE: Symbol N.m (Moment of force) The SI unit of TORQUE is the NEWTON METRE. The newton metre is the work done when a force of one newton moves the point of application a distance of one metre in the direction of that force. 1 N.m = 1 J	Poundal-foot pdl.ft	0.04214	N.m
	pound-force inch lbf.inch	0.1130	N.m
	lbf.inch	1.152	kgf.cm
	pound-force feet lbf.ft	1.356	N.m
	lbf.ft	13.83	kgf.cm
	ton-force feet tonf.ft	3.037	kN.m
	kilogram-force kgf.m	9.807	N.m
	kgf.cm	0.09807	N.m
VELOCITY: Symbol m/s The SI unit of VELOCITY is the METRE PER SECOND.	ft. per second (ft/s)	0.3048	m/s
	ft. per minute (ft/min)	0.00508	m/s
	miles per hour	0.4470	m/s
	miles per hour	1.609	km/h
VOLUME: CAPACITY: Symbol m^3 The SI unit of VOLUME is the CUBIC METRE. NOTE: †† Capital "L" is now the legal preferred symbol for litre in Australia.	**DRY:**		
	cubic inch (in^3)	16387	mm^3
	cubic foot (ft^3)	0.02832	m^3
	cubic yard (yd^3)	0.7646	m^3
	litre (L) ††	1 000 000	mm^3
	litre (L) ††	0.001	m^3
	gallons (Imp.)	0.004546	m^3
	IMPERIAL LIQUID		
	fluid ounce	28.41	millilitre (ml)
	pint (20 fl. oz)	568.3	millilitre (ml)
	quart (2 pints)	1.137	litre (L) ††
	gallon (Imp.)	4.546	litre (L) ††
	gallon (US)	3.785	litre (L) ††
	litre (water 4°C)	1.000	kilogram (kg)
	Imp. gallons (water 20°C)	4.536	kilogram (kg)
VOLUME: RATE OF FLOW Symbol m^3/s The SI unit of VOLUME RATE OF FLOW is the CUBIC METRE PER SECOND.	Imp. gal. per minute (gal/min)	0.0000758	m^3/s
	Imp. gal. per minute	0.272765	m^3/hr
	Imp. gal. per minute	0.0758	litre per second (L/s)
	cubic ft. per minute	0.000472	m^3/s
	cubic ft. per minute	0.472	litre per second (L/s) 1 m^3 = 1 kL
SUNDRY ITEMS:	miles per gallon	0.3540	km per litre
	gallons per mile	2.825	litres per km

TEMPERATURE
The SI unit of TEMPERATURE is the KELVIN - Symbol K

For most practical purposes of temperature measurement and most calculations involving temperatures, degrees Celsius, symbol °C will be used.

DEGREES FAHRENHEIT TO CELSIUS: (°F - 32) x 5/9 = °C

DEGREES CELSIUS TO FAHRENHEIT: (°C x 9/5) + 32 = °F

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