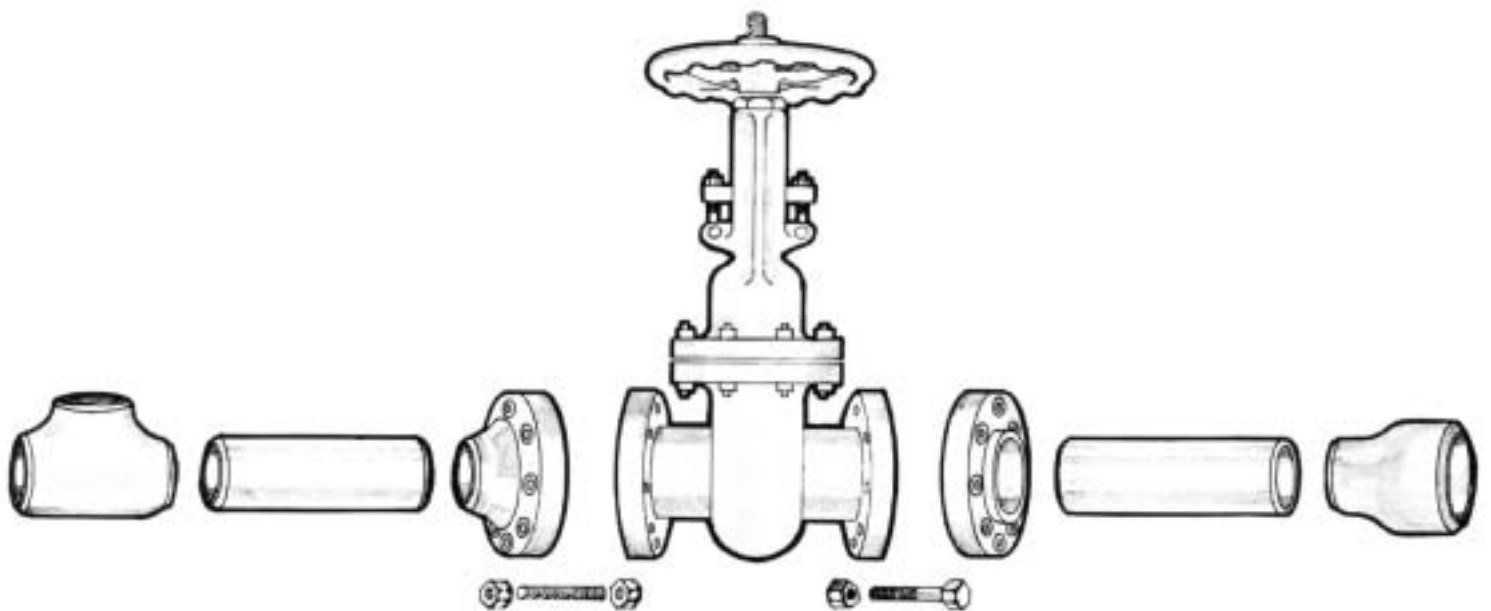


# Piping Systems Data Charts

RRP \$10.00

# onesteel



OneSteel Trading Pty Limited  
ABN 50 007 519 646

Face side of Chart

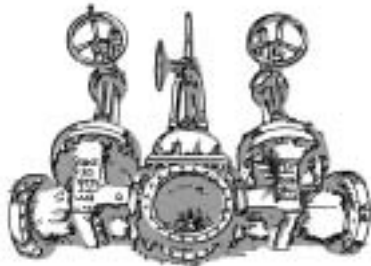
Reverse side of Chart

# YOUR TOTAL PIPING PACKAGE

OneSteel is Australia's largest distributor of Pipes, Pipe Fittings, Valves and associated accessories. The OneSteel distribution network offers more than 100 outlets throughout Australia, comprising:

OneSteel Piping Systems	Capital cities and selected regional centres
OneSteel Building Services	Capital cities, specialising in fire and associated plumbing services
OneSteel Metaland	Regional Cities and towns in all states

This data chart is part of a comprehensive series of catalogues, brochures and data sheets which are provided to our customers and associated industry groups.



## VALVES

<b>Types</b>	<ul style="list-style-type: none"><li>• Gate • Globe • Check • Plug • Ball • Butterfly Diaphragm • Knifegate</li><li>• Regulating • Safety Relief • Pressure &amp; Temperature Control • Actuators</li><li>• Accessories &amp; Instrumentation • Strainers • Steam Equipment</li></ul>
<b>Materials</b>	<ul style="list-style-type: none"><li>• Brass • Bronze • Cast Iron • Ductile Iron • Stainless Steel • Alloy Steel • PVC</li><li>• Urethane Lined • Rubber Lined</li><li>• Turnflo • Kitz • Audco • Saunders • Emico • SRI • Bonney • Stockham</li><li>• Neway • VAAS • Bettis • Elomatic</li></ul>

## PIPE

<b>Types</b>	<ul style="list-style-type: none"><li>• Aust Standard Painted and Galvanized • Seamless Linepipe • ERW Linepipe</li><li>• SAW • Plain end • Threaded • Grooved • Shouldered</li></ul>
<b>Materials</b>	<ul style="list-style-type: none"><li>• Carbon Steel • Stainless Steel • Alloy Steel • Polyethylene • PVC</li></ul>
<b>Brands</b>	<ul style="list-style-type: none"><li>• OneSteel • NSC • NKK • Seah • Sumitomo • Iscor • Dalmine</li><li>• Vinidex • TPCO</li></ul>

## PIPE FITTINGS

<b>Types</b>	<ul style="list-style-type: none"><li>• Screwed BSP &amp; NPT • Socket Weld • Buttweld Grooved • Shouldered</li><li>• Compression • Solvent Weld • Fusion Weld • Mech Tees</li></ul>
<b>Materials</b>	<ul style="list-style-type: none"><li>• Malleable Iron • Mild Steel • Carbon Steel • Stainless Steel • Alloy Steel • PVC</li><li>• CPVC • ABS • Polyethylene</li></ul>
<b>Brands</b>	<ul style="list-style-type: none"><li>• MECH • Delcorte • Tube Fittings • Benkan • Awaji • Ulma • Interfit • TK Corp</li><li>• Mech • WNP</li></ul>

## FIRE SPECIALTIES

<b>Types</b>	<ul style="list-style-type: none"><li>• Hose Reels • Landing Valves • Hanging Gear • Strut Products • Backflow Prevention Devices • Alarm Valves • Deluge Valves • Lock-open/closed Valves</li><li>• Threaded Rod • Sprinkler Heads &amp; Access • Double ended Droppers • Profile Sockets • Paps • H pattern Boosters • Fabricated piping products • Hardware &amp; Tools • Pressure Gauges • Rope • Soap, etc.</li></ul>
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## ACCESSORIES

<b>Types</b>	<ul style="list-style-type: none"><li>• Pipe Supports • Kamlocks • Hose Fittings • Gaskets • Bolts • Stud Bolts</li><li>• Thread Sealants • Pipe Coatings • Tape systems</li></ul>
<b>Brands</b>	<ul style="list-style-type: none"><li>• Erico • Denso • OME • Klinger</li></ul>

## SERVICES

<b>Types</b>	<ul style="list-style-type: none"><li>• Pipe Cutting &amp; Grooving • Coating and Lining • Valve monitoring • Valve cataloguing • Vendor Inventory Management • E-Commerce • Project Supply Management • Indent sourcing • Booster Assembly • Valve assemblies</li><li>• Tool and machine hire.</li></ul>
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OneSteel provides the information contained in this data chart as a guide only for your information. OneSteel has taken reasonable care to ensure the accuracy of the material but you should not rely on the whole or any part of the information. OneSteel expressly disclaims all liability whatsoever for (including any direct or indirect loss or damage, costs or expenses howsoever incurred by any person) or reliance on the whole or any part of the information contained in or omitted from this brochure. OneSteel recommends that you verify any information regarding products with your independent expert adviser and rely solely on that adviser's recommendations.

**Notes on Metric Conversion** Many international industry groups have retained imperial measurement as their standard unit of measure. In metricating international standards we have rounded to nearest full units in certain cases. Should dimensional accuracy be critical to your requirements we suggest that reference be made to the appropriate original standards.

NOMINAL SIZE		OUT-SIDE DIAM. mm	NOMINAL WALL THICKNESS FOR WELDED & SEAMLESS STEEL PIPE ASME B36.10													
DN	NPS		STAN-DARD	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	2.41	-	-	-	-	↑ SAME AS STANDARD W.T. (Std. W.T.) ↓	-	↑ SAME AS EXTRA STRONG W.T. (X.S.) ↓	-	-	-	-	
8	1/4	13.7	2.24	3.02	-	-	-	-		-		-	-	-	-	-
10	3/8	17.1	2.31	3.20	-	-	-	-		-		-	-	-	-	-
15	1/2	21.3	2.77	3.73	7.47	-	-	-		-		-	-	-	-	4.78
20	3/4	26.7	2.87	3.91	7.82	-	-	-		-		-	-	-	-	5.56
25	1	33.4	3.38	4.55	9.09	-	-	-		-		-	-	-	-	6.35
32	1-1/4	42.2	3.56	4.85	9.70	-	-	-		-		-	-	-	-	6.35
40	1-1/2	48.3	3.68	5.08	10.15	-	-	-		-		-	-	-	-	7.14
50	2	60.3	3.91	5.54	11.07	-	-	-		-		-	-	-	-	8.74
65	2-1/2	73.0	5.16	7.01	14.02	-	-	-		-		-	-	-	-	9.53
80	3	88.9	5.49	7.62	15.24	-	-	-	-	-	-	-	-	11.13		
90	3-1/2	101.6	5.74	8.08	-	-	-	-	-	-	-	-	-	-		
100	4	114.3	6.02	8.56	17.12	-	-	-	-	-	-	-	11.13	13.49		
125	5	141.3	6.55	9.53	19.05	-	-	-	-	-	-	-	12.70	15.88		
150	6	168.3	7.11	10.97	21.95	-	-	-	-	-	-	-	14.27	18.26		
200	8	219.1	8.18	12.70	22.23	-	6.35	7.04	-	10.31	-	15.09	18.26	20.62	23.01	
250	10	273.1	9.27	12.70	25.40	-	6.35	7.80	-	XS	15.09	18.26	21.44	XXS	28.58	
300	12	323.9	9.53	12.70	25.40	-	6.35	8.38	10.31	14.27	17.48	21.44	XXS	28.58	33.32	
350	14	355.6	9.53	12.70	-	6.35	7.92	Std.W.T.	11.13	15.09	19.05	23.83	27.79	31.75	35.71	
400	16	406.4	9.53	12.70	-	6.35	7.92	Std.W.T.	XS	16.66	21.44	26.19	30.96	36.53	40.49	
450	18	457	9.53	12.70	-	6.35	7.92	11.13	14.27	19.05	23.83	29.36	34.93	39.67	45.24	
500	20	508	9.53	12.70	-	6.35	Std.W.T.	XS	15.09	20.62	26.19	32.54	38.10	44.45	50.01	
550	22	559	9.53	12.70	-	6.35	Std.W.T.	XS	-	22.23	28.58	34.93	41.28	47.63	53.98	
600	24	610	9.53	12.70	-	6.35	Std.W.T.	14.27	17.48	24.61	30.96	38.89	46.02	52.37	59.54	
650	26	660	9.53	12.70	-	7.92	XS	-	-	-	-	-	-	-	-	
700	28	711	9.53	12.70	-	7.92	XS	15.88	-	-	-	-	-	-	-	
750	30	762	9.53	12.70	-	7.92	XS	15.88	-	-	-	-	-	-	-	
800	32	813	9.53	12.70	-	7.92	XS	15.88	17.48	-	-	-	-	-	-	
850	34	864	9.53	12.70	-	7.92	XS	15.88	17.48	-	-	-	-	-	-	
900	36	914	9.53	12.70	-	7.92	XS	15.88	19.05	-	-	-	-	-	-	
1050	42	1067	9.53	12.70	-	-	-	-	-	-	-	-	-	-	-	

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

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

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

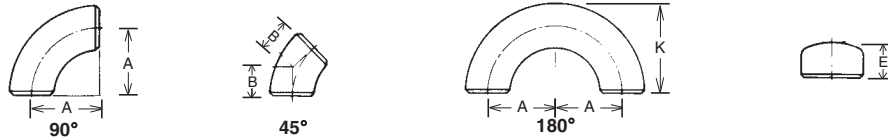
Step 2. 314.37 x 9.53 = 2995.9461

Step 3. 2995.9461 x 0.024 66

= 73.88kg/m

NOMINAL SIZE DN	OUT-SIDE DIAM. mm	NOMINAL WALL THICKNESS & INSIDE DIAMETER – millimetres							
		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	–	–	–	–

B16.9  
LONG RADIUS WELDING ELBOWS, RETURN BENDS & CAPS

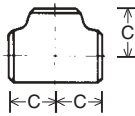


B16.28  
SHORT RADIUS WELDING ELBOWS & RETURN BENDS

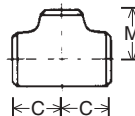


Nom. Size DN	PIPE OD mm	WALL THICKNESS — MILLIMETRES (mm)													A	B	K	D	V	E. Std.Wt. & Ex.Stg.	Nom. Size DN		
		Sch. 10	Sch. 20	Sch. 30	Std. Wt.	Sch. 40	Sch. 60	X Stg.	Sch. 80	Sch. 100	Sch. 120	Sch. 140	Sch. 160	X.X. Stg.									
15	21.3	—	—	—	2.77	↑ SAME AS STD. WT. ↓	—	3.73	↑ SAME AS X. STG. ↓	—	—	—	—	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	22.23	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	—	12.70	—	10.31	12.70	—	—	20.62	23.01	305	127	414	203	313	102	200		
250	273.1	—	6.35	7.80	9.27	—	12.70	15.09	12.70	17.48	15.09	18.26	21.44	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	12.70	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)



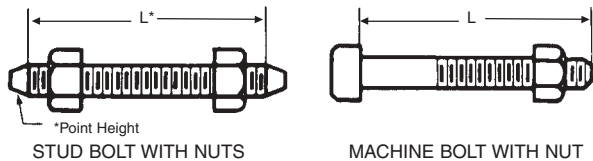
NOMINAL SIZE DN		C	M	H	NOMINAL SIZE DN		C	M	H	NOMINAL SIZE DN		C	M	H	
Large End	Small End				Large End	Small End				Large End	Small End				
20	20	28.6	—	—	100	100	105	—	—	400	400	305	—	—	
	15	28.6	28.6	38.1		90	105	102	102		350	305	305	305	356
	25	38.1	—	—		80	105	98.4	102		300	305	295	356	356
25	20	38.1	38.1	50.8	100	65	105	95.3	102	400	250	305	283	356	
	15	38.1	38.1	50.8		50	105	88.9	102		200	305	273	356	356
	32	47.6	—	—		40	105	85.7	102		150	305	264	356	356
32	25	47.6	47.6	50.8	125	125	124	—	—	450	450	343	—	—	
	20	47.6	47.6	50.8		100	124	117	127		400	343	330	381	381
	15	47.6	47.6	50.8		90	124	114	127		350	343	330	381	381
40	40	57.2	—	—	125	80	124	111	127	450	300	343	321	381	
	32	57.2	57.2	63.5		65	124	108	127		250	343	308	381	381
	25	57.2	57.2	63.5		50	124	105	127		200	343	298	381	381
50	50	63.5	—	—	150	150	143	—	—	500	500	381	—	—	
	40	63.5	60.3	76.2		125	143	137	140		450	381	368	508	508
	32	63.5	57.2	76.2		100	143	130	140		400	381	356	508	508
65	25	63.5	50.8	76.2	150	90	143	127	140	500	350	381	356	508	
	20	63.5	44.5	76.2		80	143	124	140		300	381	346	508	508
	65	76.2	—	—		65	143	121	140		250	381	333	508	508
80	65	76.2	—	—	200	200	178	—	—	600	600	381	324	508	
	50	76.2	69.9	88.9		150	178	168	152		450	432	432	508	508
	40	76.2	66.7	88.9		125	178	162	152		400	432	419	508	508
90	32	76.2	63.5	88.9	200	100	178	155	152	600	400	432	406	508	
	25	76.2	57.2	88.9		80	178	152	152		350	432	406	508	508
	80	85.7	—	—		250	216	—	—		300	432	397	508	508
90	65	85.7	82.6	88.9	250	200	216	203	178	750	750	559	—	—	
	50	85.7	76.2	88.9		150	216	194	178		600	559	533	610	610
	40	85.7	73.0	88.9		125	216	191	178		500	559	508	610	610
90	32	85.7	69.9	88.9	250	100	216	184	178	750	450	559	495	610	
	25	85.7	66.9	88.9		300	254	—	—		400	559	483	610	610
	80	85.7	—	—		250	254	241	203		300	432	384	508	508
90	90	95.3	—	—	300	200	254	229	203	900	900	673	—	—	
	65	95.3	92.1	102		150	254	219	203		750	673	635	610	610
	50	95.3	82.6	102		100	254	210	203		600	673	610	610	610
900	40	95.3	79.4	102	350	350	279	—	—	900	500	673	584	610	
	300	279	—	—		250	279	270	330		450	673	572	610	610
	200	279	248	330		150	279	248	330		300	673	572	610	610

NOTE: All dimensions are in millimetres — (mm)



**BOLTING**

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



**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 5 mm. 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	PN20 (CLASS 150)				PN50 (CLASS 300)				PN100 (CLASS 600)			PN150 (CLASS 900)			PN250 (CLASS 1500)			PN420 (CLASS 2500)			NOM FLGE SIZE  DN
	No. Bolts	Dia. Bolts ins.	L		No. Bolts	Dia. Bolts ins.	L		No. Bolts	Dia. Bolts ins.	L Bolts mm	No. Bolts	Dia. Bolts ins.	L Bolts mm	No. Bolts	Dia. Bolts ins.	L Bolts mm	No. Bolts	Dia. Bolts ins.	L Bolts mm	
			Stud Bolts mm	Mach. Bolts mm			Stud Bolts mm	Mach. Bolts mm													
	USE PN250 DIMENSIONS IN THESE SIZES																				
15	4	1/2	60	45	4	1/2	65	55	4	1/2	80	USE PN250 DIMENSIONS IN THESE SIZES			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	140	8	1 1/8	180	80			
90	8	5/8	90	75	8	3/4	110	95	8	7/8	140	8	1 1/8	170	8	1 1/4	195	90			
100	8	5/8	90	75	8	3/4	110	95	8	7/8	145	8	1 1/8	170	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	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	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	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	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	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

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

ASME B36.10 STEEL PIPE DIMENSIONS					APPROXIMATE MASS OF POPULAR SIZES											
NOMINAL PIPE SIZE  DN	Outside Diam.  mm	Inside Diam.  mm	Identification		Steel Pipe  kg/m	BUTTWELD FITTINGS			A.S.M.E. FLANGES							
			Std.  X.S.	Sch.  No.		90° L/R Elbows  kg/ea	Tees Equal  kg/ea	Con. & Ecc. Red.  kg/ea	PN20 (150)			PN50 (300)			PN100 (600)	PN150 (900)
									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	— —	.45	.79	.57	.73	.91	.79	.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	.68	.86	.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	.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	1.36 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

**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).

**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	} Refer to Australian standards
Thickness Tolerance	
Dimension Tolerance	
Standard Length	6.5m
Length Tolerance	+50mm/-0mm

**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.

**WORKING PRESSURES – THREADED JOINTS TAPER/PARALLEL THREAD**

Nom. Size DN (mm)	TYPE OF SERVICE										
	Water & Inert Oil		LPG	Fuel Oil				Other Applications (including Steam & Compressed Air)			
	Med. kPa	Heavy kPa	Med. & Heavy kPa	Medium Press kPa	Temp °C	Heavy Press kPa	Temp °C	Medium Press kPa	Temp °C	Heavy Press kPa	Temp °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 <sub>o</sub> t	Nominal Size DN	Bundle Dimensions mm	Lengths Per Bundle	Metres Per Bundle	Nominal Mass				Mass per Bundle		
					kg/m		m/tonne		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 4.0 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	1.50	
114.3 x 4.5 CHS	100 M	571 509	19	123.5	12.2	12.4	82.2	79.8	1.50	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	1.40	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	

NOTES: 1. M = Medium, H = Heavy

Note: The term "tube" is synonymous with the term "pipe"

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 54792 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	} Refer to Australian standards
Thickness Tolerance	
Dimension Tolerance	
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/m<sup>2</sup>

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

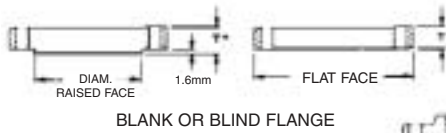
**WELDING**

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

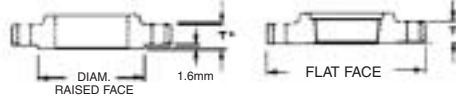
CHS Grade C250 MASS AND BUNDLING DATA – Calculated in accordance with AS 1163											
DIMENSIONS			BUNDLING			MASS					
Designation d <sub>o</sub> t	Nominal Size DN	Bundle Dimensions mm	Lengths Per Bundle	Metres Per Bundle	Nominal Mass				Mass per Bundle		
					kg/m		m/tonne		tonnes		
(mm)	(mm)	W 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	660 451	10	65	13.95	14.40	71.7	69.4	0.907	0.936	

Notes: 1. LT = Light, 2. XL = Extra Light



BLANK OR BLIND FLANGE

DIMENSIONS FOR LOOSE FLANGES



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

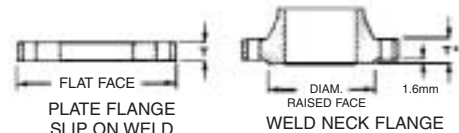


PLATE FLANGE SLIP ON WELD

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	THICKNESS		Bolt Circle Dia.	No. of Bolts	Dia. of Bolts	OD	THICKNESS			Bolt Circle Dia.	No. of Bolts	Dia. of Bolts	OD	THICKNESS			Bolt Circle Dia.		No. of Bolts	Dia. of Bolts
		T3	T6					T10	T11	T6					T10	T11	T6				
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	THICKNESS			† Dia. R/F	Bolt Circle Dia.	No. of Bolts	Dia. of Bolts	OD	Thick-ness * T6	Dia. R/F	Bolt Circle Dia.	No. of Bolts	Dia. of Bolts	OD	Thick-ness * T18	Dia. R/F	Bolt Circle Dia.	No. of Bolts	Dia. of Bolts					
		T10	T11	* T6																					
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).

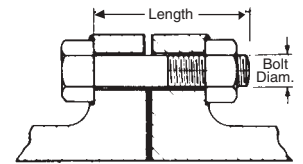
**IMPORTANT:** For DN 150 and DN 200 Flanges, the O.D. of pipe being used must be specified. Dimensions for Flange Tables A, C, K, S and T on application.

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.



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.

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*		

All dimensions are in millimetres (mm).

**Notes**

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.

XOX BOLTING		
Temp. Range: -50°C to +300°C		
Flange Table	Specifications	
	Bolts	Nuts
D, E, & F	AS 1110 Gr.4.6 or AS 1111 Gr.4.6	AS1112 Gr.5
H	AS 1110 Gr.8.8	AS 1112 Gr.8

The SI unit of MASS is the KILOGRAM – Symbol kg

The **mass** of an object is the quantity of matter it contains and is constant irrespective of the location or altitude.

The **weight** of an object is the force exerted on it by gravity and thus varies from place to place and according to height above sea level or the distance from the Earth's centre. (Hence weightlessness of astronauts in outer space).

MASS CONVERSION CHART

- (A) To use, locate "given mass" in "given mass" column (coloured GREY) whether lbs. or kg.
- (B) If "given mass" is in pounds (lbs.), read **kilograms (kg)** in right hand column.
- (C) If "given mass" is in kilograms (kg), read **pounds (lbs.)** in left hand column.
- (D) **Example:** (i) Given mass is **70 lbs = 31.75 kg** from right hand column  
 (ii) Given mass is **70 kg = 154.32 lbs.** from left hand column

1 to 65			66 to 130			131 to 375			380 to 700			705 to 1500		
lbs.	Given Mass	kg	lbs.	Given Mass	kg	lbs.	Given Mass	kg	lbs.	Given Mass	kg	lbs.	Given Mass	kg
2.20	1	0.45	145.50	66	29.94	288.80	131	59.42	838	380	172.37	1554	705	319.79
4.41	2	0.91	147.71	67	30.39	291.01	132	59.88	849	385	174.64	1565	710	322.06
6.61	3	1.36	149.91	68	30.84	293.21	133	60.33	860	390	176.90	1576	715	324.32
8.82	4	1.81	152.12	69	31.30	295.42	134	60.78	871	395	179.17	1587	720	326.59
11.02	5	2.27	154.32	70	31.75	297.62	135	61.24	882	400	181.44	1598	725	328.86
13.23	6	2.72	156.53	71	32.21	299.83	136	61.69	893	405	183.71	1609	730	331.13
15.43	7	3.18	158.73	72	32.66	302.03	137	62.14	904	410	185.98	1620	735	333.40
17.64	8	3.63	160.94	73	33.11	304.24	138	62.60	915	415	188.24	1631	740	335.66
19.84	9	4.08	163.35	74	33.57	306.44	139	63.05	926	420	190.51	1642	745	337.93
22.05	10	4.54	165.35	75	34.02	308.64	140	63.50	937	425	192.78	1653	750	340.20
24.25	11	4.99	167.55	76	34.47	310.85	141	63.96	948	430	195.05	1664	755	342.47
26.46	12	5.44	169.75	77	34.93	313.05	142	64.41	959	435	197.32	1676	760	344.74
28.66	13	5.90	171.96	78	35.38	315.26	143	64.87	970	440	199.58	1687	765	347.00
30.86	14	6.35	174.16	79	35.83	317.46	144	65.32	981	445	201.85	1698	770	349.27
33.07	15	6.80	176.37	80	36.29	319.67	145	65.77	992	450	204.12	1709	775	351.54
35.27	16	7.26	178.57	81	36.74	321.87	146	66.23	1003	455	206.39	1720	780	353.81
37.48	17	7.71	180.78	82	37.20	324.08	147	66.68	1014	460	208.66	1731	785	356.08
39.68	18	8.16	182.98	83	37.65	326.28	148	67.13	1025	465	210.92	1742	790	358.34
41.89	19	8.62	185.19	84	38.10	328.49	149	67.59	1036	470	213.19	1753	795	360.61
44.09	20	9.07	187.39	85	38.56	330.69	150	68.04	1047	475	215.46	1764	800	362.88
46.30	21	9.53	189.60	86	39.01	341.71	155	70.31	1058	480	217.73	1775	805	365.15
48.50	22	9.98	191.80	87	39.46	352.74	160	72.58	1069	485	220.00	1786	810	367.42
50.71	23	10.43	194.00	88	39.92	363.76	165	74.84	1080	490	222.26	1797	815	369.68
52.91	24	10.89	196.21	89	40.37	374.78	170	77.11	1091	495	224.53	1808	820	371.95
55.12	25	11.34	198.41	90	40.82	385.80	175	79.38	1102	500	226.80	1819	825	374.22
57.32	26	11.79	200.62	91	41.28	396.83	180	81.65	1113	505	229.07	1830	830	376.49
59.52	27	12.25	202.82	92	41.73	407.85	185	83.92	1124	510	231.34	1841	835	378.76
61.73	28	12.70	205.03	93	42.18	418.87	190	86.18	1135	515	233.60	1852	840	381.02
63.93	29	13.15	207.23	94	42.64	429.90	195	88.45	1146	520	235.87	1863	845	383.29
66.14	30	13.61	209.44	95	43.09	440.92	200	90.72	1157	525	238.14	1874	850	385.56
68.34	31	14.06	211.64	96	43.55	451.94	205	92.99	1168	530	240.41	1885	855	387.83
70.55	32	14.52	213.85	97	44.00	462.97	210	95.26	1179	535	242.68	1896	860	390.10
72.75	33	14.97	216.05	98	44.45	473.99	215	97.52	1190	540	244.94	1907	865	392.36
74.96	34	15.42	218.26	99	44.91	485.01	220	99.79	1202	545	247.21	1918	870	394.63
77.16	35	15.88	220.46	100	45.36	496.04	225	102.06	1213	550	249.48	1929	875	396.90
79.37	36	16.33	222.67	101	45.81	507.06	230	104.33	1224	555	251.75	1940	880	399.17
81.57	37	16.78	224.87	102	46.28	518.08	235	106.60	1235	560	254.02	1951	885	401.44
83.77	38	17.24	227.07	103	46.72	529.10	240	108.86	1246	565	256.28	1962	890	403.70
85.98	39	17.69	229.28	104	47.17	540.13	245	111.13	1257	570	258.55	1973	895	405.97
88.18	40	18.14	231.48	105	47.63	551.15	250	113.40	1268	575	260.82	1984	900	408.24
90.39	41	18.60	233.69	106	48.08	562.17	255	115.67	1279	580	263.09	1995	905	410.51
92.59	42	19.05	235.89	107	48.54	573.20	260	117.94	1290	585	265.36	2006	910	412.78
94.80	43	19.50	238.10	108	48.99	584.22	265	120.20	1301	590	267.62	2017	915	415.04
97.00	44	19.96	240.30	109	49.44	595.24	270	122.47	1312	595	269.89	2028	920	417.31
99.21	45	20.41	242.51	110	49.90	606.27	275	124.74	1323	600	272.16	2039	925	419.58
101.41	46	20.87	244.71	111	50.35	617.30	280	127.01	1334	605	274.43	2050	930	421.85
103.62	47	21.32	246.92	112	50.80	628.31	285	129.28	1345	610	276.70	2061	935	424.12
105.82	48	21.77	249.12	113	51.26	639.33	290	131.54	1356	615	278.96	2072	940	426.38
108.03	49	22.23	251.32	114	51.71	650.36	295	133.81	1367	620	281.23	2083	945	428.65
110.23	50	22.68	253.53	115	52.16	661.38	300	136.08	1378	625	283.50	2094	950	430.92
112.43	51	23.13	255.73	116	52.62	672.40	305	138.35	1389	630	285.77	2105	955	433.19
114.64	52	23.59	257.94	117	53.07	683.43	310	140.62	1400	635	288.04	2116	960	435.46
116.84	53	24.04	260.14	118	53.53	694.45	315	142.88	1411	640	290.30	2127	965	437.72
119.05	54	24.49	262.35	119	53.98	705.47	320	145.15	1422	645	292.57	2138	970	439.99
121.25	55	24.95	264.55	120	54.43	716.50	325	147.42	1433	650	294.84	2149	975	442.26
123.46	56	25.40	266.76	121	54.89	727.52	330	149.69	1444	655	297.11	2161	980	444.53
125.66	57	25.86	268.96	122	55.34	738.54	335	151.96	1455	660	299.38	2172	985	446.80
127.87	58	26.31	271.17	123	55.79	749.56	340	154.22	1466	665	301.64	2183	990	449.06
130.07	59	26.76	273.37	124	56.25	760.59	345	156.49	1477	670	303.91	2194	995	451.33
132.28	60	27.22	275.58	125	56.70	771.61	350	158.76	1488	675	306.18	2205	1000	453.60
134.48	61	27.67	277.78	126	57.15	782.63	355	161.03	1499	680	308.45	2216	1100	498.96
136.69	62	28.12	279.98	127	57.61	793.66	360	163.30	1510	685	310.72	2227	1200	544.32
138.89	63	28.58	282.19	128	58.06	804.68	365	165.56	1521	690	312.98	2238	1300	589.68
141.09	64	29.03	284.39	129	58.51	815.70	370	167.83	1532	695	315.25	2249	1400	635.04
143.30	65	29.48	286.60	130	58.97	826.73	375	170.10	1543	700	317.52	2260	1500	680.40

CONVERSION FACTORS

1 Pound (lb.) x 0.4536 = kilograms (kg)    1 kilogram (kg) x 2.2046 = pounds (lbs.)

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	—

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

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)**
- megapascal: Symbol – MPa (= 1,000,000 Pa)**
- (1 N/m<sup>2</sup> = 0.000145 lbf/in<sup>2</sup> = 1Pa)
- (1 N/mm<sup>2</sup> = 145 lbf/in<sup>2</sup> = 1MPa)

**PSI (lbf/in<sup>2</sup>) to kPa • PRESSURE – STRESS CONVERSION CHART**

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

1 to 35			36 to 70			71 to 125			130 to 80,000				
lbf/in <sup>2</sup>	Given Pressure	kPa	lbf/in <sup>2</sup>	Given Pressure	kPa	lbf/in <sup>2</sup>	Given Pressure	kPa	lbf/in <sup>2</sup>	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	268.90	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	10,152.7	70,000	482,633	=	482.6
5.08	35	241.32	10.15	70	482.63	18.13	125	862	11,603.0	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<sup>2</sup> (N/mm<sup>2</sup>) = 145 lbf/in<sup>2</sup>

**USEFUL CONVERSION FACTORS – APPROXIMATE**

MULTIPLY	BY	TO OBTAIN
TO OBTAIN	BY	DIVIDE
bars	1.0197	kg f/cm <sup>2</sup>
	100.0	kPa
	14.504	lbf/in <sup>2</sup>
	0.1	MPa
kg f/cm <sup>2</sup>	14.223	lbf/in <sup>2</sup>
	98.07	kPa
	0.09807	MPa
kg f/mm <sup>2</sup>	1422.33	lbf/in <sup>2</sup>
	9.807	MPa
	0.635	ton f/in <sup>2</sup>

MULTIPLY	BY	TO OBTAIN
TO OBTAIN	BY	DIVIDE
lb f/in <sup>2</sup> (PSI)	6.895	kPa
	0.00689	MPa
ton f/in <sup>2</sup>	15.444	MPa

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

**NOTE: lbf/in<sup>2</sup> (pounds force per square inch) is often expressed as PSI (pounds per square inch)**

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 GREY) 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  
 $(°C \times 9/5) + 32 = °F$

“SI” denotes the INTERNATIONAL SYSTEM of Metric Units adopted in Australia

MULTIPLY COLUMN “A” BY COLUMN “B” TO OBTAIN COLUMN “C” ALTERNATIVELY DIVIDE COLUMN “C” BY COLUMN “B” TO OBTAIN COLUMN “A”								
REMARKS	A MULTIPLY	B BY	C TO OBTAIN	REMARKS	A MULTIPLY	B BY	C TO OBTAIN	
<b>AREA: Symbol m<sup>2</sup></b> The SI unit of AREA is the SQUARE METRE.	Square inches	645.16	mm <sup>2</sup>	<b>POWER: Symbol W</b> The SI unit of POWER is the WATT.	Btu per hour (Btu/hr)	0.2931	W	
	Square feet	0.929	m <sup>2</sup>		horsepower (hp)	0.7457	kW	
	Square yards	0.836	m <sup>2</sup>		ton of refrigeration	3.517	kW	
	Acre	4047	m <sup>2</sup>		<b>PRESSURE: Symbol Pa</b> The SI unit of PRESSURE or stress is the NEWTON PER SQUARE METRE which has been given the name PASCAL. 1 N/m <sup>2</sup> = 1 Pa = 0.000145 lbf/in <sup>2</sup> 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 <sup>2</sup>	6.895	kPa
	Hectare (ha)	10 000	m <sup>2</sup>			kip/in <sup>2</sup> (1000 psi)	6.895	MPa
<b>DENSITY: Symbol kg/m<sup>3</sup></b> The SI unit of DENSITY is the kilogram per cubic metre.	lb/in <sup>3</sup>	27.68	t/m <sup>3</sup>	lbf/ft <sup>2</sup>		47.88	Pa	
	lb/ft <sup>3</sup>	16.02	kg/m <sup>3</sup>	kgf/cm <sup>2</sup>		98.07	kPa	
	lb/yd <sup>3</sup>	0.5933	kg/m <sup>3</sup>	bar		100	kPa	
	<b>ENERGY: Symbol J</b> 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.	<b>1. ELECTRICAL ENERGY</b> kilowatt hour (kW.h)		MJ	Vertical column (head) of water. (H <sub>2</sub> O at 20°C)	metres of water	9.79	kPa
		<b>2. HEAT ENERGY</b> British thermal unit (Btu)		kJ	feet of water	2.984	kPa	
Btu/gal		0.2321	kJ/L ††	torr (vacuum)	0.1333	kPa		
Btu/ft <sup>3</sup>		37.26	kJ/m <sup>3</sup>	1 mm Hg. (mercury)	0.1333	kPa		
1 in. Hg. (mercury)		3.386	kJ/m <sup>3</sup>	1 in. Hg. (mercury)	3.386	kPa		
<b>FORCE: Symbol N (NEWTON)</b> The SI unit of FORCE (kg.m/s <sup>2</sup> ) 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.	<b>3. MECHANICAL ENERGY</b> <u>foot poundal</u> ft.pdl		J	atmosphere (atm)	101.325	kPa		
	<u>inch pound-force</u> in.lbf		J	microns	0.133	Pa		
	<u>foot pound-force</u> ft.lbf		J	<b>TORQUE: Symbol N.m (Moment of force)</b> 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	<u>poundal-foot</u> pdl.ft	.04214	N.m	
	<u>foot ton force</u> ft.tonf		kJ		<u>pound-force inch</u> lbf.inch	0.1130	N.m	
	<u>Metre kilogram force</u> m.kgf		J		<u>lbf.inch</u>	1.152	kgf.cm	
Poundal (pdl)		0.1383	N		<u>pound-force feet</u> lbf.ft	1.356	N.m	
Pound-force (lbf)		4.448	N		<u>lbf.ft</u>	13.83	kgf.cm	
<b>FORCE PER UNIT LENGTH:</b> The SI unit is NEWTON PER METRE: <b>Symbol N/m</b>	ton-force (tonf)		kN	<u>ton-force feet</u> tonf.ft	3.037	kN.m		
	*kilogram-force (kgf)		N	<u>kilogram-force</u> kgf.m	9.807	N.m		
	*also known as kilopond (kp)		N	<u>kgf.cm</u>	0.09807	N.m		
	pounds-force per inch (lbf/in)		175.1	N/m	<b>VELOCITY: Symbol m/s</b> The SI unit of VELOCITY is the METRE PER SECOND.	ft. per second (ft/s)	0.3048	m/s
	pounds-force per foot (lbf/ft)		14.59	N/m		ft. per minute (ft/min)	0.00508	m/s
ton-force per foot (ton/ft)		32.69	kN/m	miles per hour		0.4470	m/s	
inches		25.4	millimetres (mm)	miles per hour		1.609	km/h	
feet		0.3048	metres (m)	<b>VOLUME: CAPACITY: Symbol m<sup>3</sup></b> The SI unit of VOLUME is the CUBIC METRE.		<b>DRY:</b> cubic inch (in <sup>3</sup> )	16387	mm <sup>3</sup>
yards		0.9144	metres (m)		cubic foot (ft <sup>3</sup> )	0.02832	m <sup>3</sup>	
chain		20.12	metres (m)		cubic yard (yd <sup>3</sup> )	0.7646	m <sup>3</sup>	
mile		1609	metres (m)		litre (L) ††	1 000 000	mm <sup>3</sup>	
mile		1.609	kilometres (km)		litre (L) ††	0.001	m <sup>3</sup>	
<b>MASS: Symbol kg</b> The SI unit of MASS is the KILOGRAM.	ton-force per foot (ton/ft)		kN/m	gallons (Imp.)	0.004546	m <sup>3</sup>		
	pounds per foot (lb/ft)		1.488	kg/m	<b>IMPERIAL LIQUID</b> 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 kilograms (kg)			
	pounds per yard (lb/yd)		0.4961	kg/m				
	ounce		28.35	grams (g)				
	pound		0.4536	kilograms (kg)				
slug		14.59	kg					
<b>LENGTH: Symbol m</b> The SI unit of LENGTH is the METRE.	ton (2240 lb)		kg	<b>VOLUME: RATE OF FLOW Symbol m<sup>3</sup>/s</b> The SI unit of VOLUME RATE OF FLOW is the CUBIC METRE PER SECOND.	Imp. gal. per minute (gal/min)	.0000758	m <sup>3</sup> /s	
	short ton (2000 lb)		kg		Imp. gal. per minute	0.272765	m <sup>3</sup> /hr	
	ton (2240 lb)		tonne (t)		Imp. gal. per minute	.0758	litre per second (L/s)	
	pounds per foot (lb/ft)		1.488		kg/m	Imp. gal. per minute	.000472	m <sup>3</sup> /s
	pounds per yard (lb/yd)		0.4961		kg/m	cubic ft. per minute	0.00472	litre per second (L/s) 1 m <sup>3</sup> = 1 kL
				<b>SUNDRY ITEMS:</b>	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  
 $(°F - 32) \times \frac{5}{9} = °C$

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

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