



Piping Systems Data Charts

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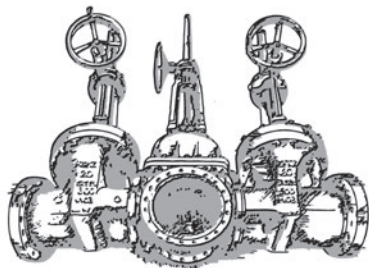
Face side of Chart

Reverse side of Chart

YOUR TOTAL PIPING PACKAGE

Steel & Tube is New Zealand's largest distributor of Pipes, Pipe Fittings, Valves and associated accessories.

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

- Types**
- Gate • Globe • Check • Plug • Ball • Butterfly Diaphragm • Knifegate
 - Regulating • Safety Relief • Pressure & Temperature Control • Actuators
 - Accessories & Instrumentation • Strainers • Steam Equipment
- Materials**
- Brass • Bronze • Cast Iron • Ductile Iron • Stainless Steel • Alloy Steel • PVC
 - Urethane Lined • Rubber Lined
- Brands**
- Turnflo • Kitz • Audco • Emico • SRI • Bonney • Victaulic® • Neway • Bettis
 - Elomatic • Hilton • Modentic • Valmatic

PIPE

- Types**
- Galvanised • Seamless Linepipe • ERW Linepipe
 - SAW • Plain end • Threaded • Grooved • Shouldered • ILG (Fireplus) • Primed
- Materials**
- Carbon Steel • Stainless Steel • Alloy Steel • Polyethylene • PVC

PIPE FITTINGS

- Types**
- Screwed BSP & NPT • Socket Weld • Buttweld Grooved • Shouldered
 - Compression • Solvent Weld • Fusion Weld • Mech Tees
- Materials**
- Malleable Iron • Mild Steel • Carbon Steel • Stainless Steel • Alloy Steel • PVC
 - CPVC • ABS • Polyethylene

FIRE SPECIALTIES

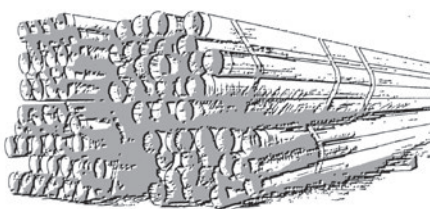
- Types**
- Landing Valves • Hanging Gear • Strut Products • Backflow Prevention Devices • Alarm Valves • Deluge Valves • Lock-open/closed Valves
 - Threaded Rod • Sprinkler Heads & Access • Double ended Droppers • Profile Sockets • Paps • H pattern Boosters • Fabricated piping products • Hardware & Tools • Pressure Gauges • Rope • Soap, etc.

ACCESSORIES

- Types**
- Pipe Supports • Kamlocks • Hose Fittings • Gaskets • Bolts • Stud Bolts
 - Thread Sealants • Pipe Coatings • Tape systems

SERVICES

- Types**
- Pipe Cutting & Grooving • Coating and Lining • Valve monitoring • Valve cataloguing • Vendor Inventory Management • E-Commerce • Project Supply Management • Indent sourcing • Booster Assembly • Valve assemblies
 - Tool and machine hire.



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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.

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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	-	-	-	-	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

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

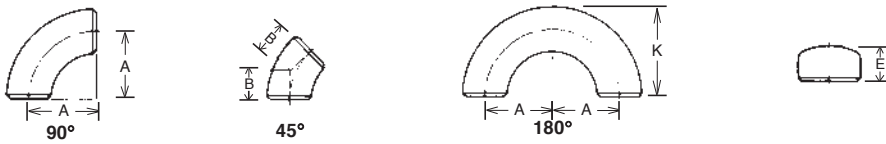
Where,
 m = mass to the nearest 0.01 kg/m
 D = Outside Diameter in millimetres
 (To nearest 0.1mm for OD up to 406.4mm)
 (To nearest 1.0mm for OD 457mm and above)
 t = Wall Thickness to nearest 0.01mm

EXAMPLE:

{	Nominal Size	{	Step 1. 323.9 – 9.53 = 314.37
	DN300 NPS12		Step 2. 314.37 x 9.53 = 2995.9461
	OD = 323.9mm		Step 3. 2995.9461 x 0.024 66
	W.T. = 9.53mm		= 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

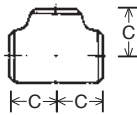


B16.28 SHORT RADIUS WELDING ELBOWS & RETURN BENDS

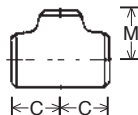


Nom. Size DN	PIPE OD mm	WALL THICKNESS – MILLIMETRES (mm)													A	B	K	D	V	E. Std. Wt. & Ex. Stg.	Nom. Size DN	
		Sch. 10	Sch. 20	Sch. 30	Std. Wt.	Sch. 40	Sch. 60	X Stg.	Sch. 80	Sch. 100	Sch. 120	Sch. 140	Sch. 160	X.X. Stg.								
15	21.3	—	—	—	2.77	↑ SAME AS STD. WT.	—	3.73	↑ SAME AS X. STG.	—	—	—	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	↓ SAME AS STD. WT.	—	5.54	↓ SAME AS X. STG.	—	—	—	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	12.70	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)

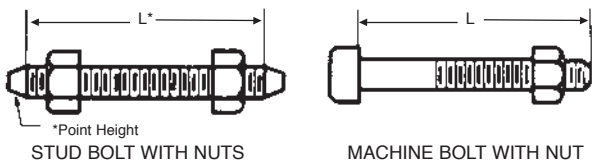


NOMINAL SIZE DN		C	M	H	NOMINAL SIZE DN		C	M	H	NOMINAL SIZE DN		C	M	H
Large End	Small End				Large End	Small End				Large End	Small End			
20	20	28.6	—	—	100	100	105	—	—	400	400	305	—	—
	15	28.6	28.6	38.1		90	105	102	102		350	305	305	356
25	25	38.1	—	—	100	80	105	98.4	102	400	300	305	295	356
	20	38.1	38.1	50.8		65	105	95.3	102		250	305	283	356
32	32	47.6	—	—	125	125	124	—	—	450	450	343	—	—
	25	47.6	47.6	50.8		100	124	117	127		400	343	330	381
40	40	57.2	—	—	125	90	124	114	127	450	350	343	330	381
	32	57.2	57.2	63.5		80	124	111	127		300	343	321	381
50	50	63.5	—	—	150	150	143	—	—	500	500	381	—	—
	40	63.5	60.3	76.2		100	143	137	140		450	381	368	508
65	65	76.2	—	—	200	200	178	—	—	600	600	432	—	—
	50	76.2	69.9	88.9		150	178	168	152		500	432	432	508
80	80	85.7	—	—	250	250	216	—	—	750	750	559	—	—
	65	85.7	82.6	88.9		200	216	203	178		600	559	533	610
90	90	95.3	—	—	300	300	254	—	—	900	900	673	—	—
	80	95.3	92.1	102		250	254	241	203		750	673	635	610
400	400	406.4	—	—	350	350	279	—	—	900	600	673	610	610
	300	355.6	305	356		250	279	270	330		500	673	584	610
500	500	508	—	—	400	400	299	—	—	900	450	673	572	610
	350	355.6	305	356		200	299	248	330		450	673	572	610
600	600	610	—	—	450	450	279	—	—	900	450	673	572	610
	400	406.4	305	356		150	279	238	330		450	673	572	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		No. Bolts	Dia. Bolts ins.	L Bolts mm
			Stud Bolts mm	Mach. Bolts mm			Stud Bolts mm	Mach. Bolts mm																
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	145	8	1 1/4	180	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	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		

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 $\sqrt{S_0}$ 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	TYPE OF SERVICE										
	Water & Inert Oil		LPG	Fuel Oil				Other Applications (including Steam & Compressed Air)			
	Med.	Heavy	Med. & Heavy	Medium Press	Temp	Heavy Press	Temp	Medium Press	Temp	Heavy Press	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	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 2.6 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 galvanised 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 galvanised (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 $\sqrt{S_0}$	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

GALVANISING

Grade C350 pipe is manufactured and tested to meet the requirement of AS 4792 Galvanised 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 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	

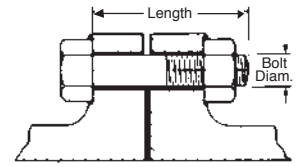
Notes: 1. LT = Light, 2. XL = Extra Light

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

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

A guide to the key dimensions of popular steel flange types

Thickness Size		Diam. of	Bolt Circle	No. of	Diam./Length	Diam.	Flang
					Bolts/Studs		Cast/Forged
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	—

Thickness Size		Diam. of	Bolt Circle	No. of	Diam./Length		Flang
					Bolts/Studs	Diam.	
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	$\frac{3}{4}$ x 90	23	24
	ANSI 300	279	234.9	8	$\frac{3}{4}$ 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	$\frac{3}{4}$ x 100	23	26
	ANSI 300	318	269.9	12	$\frac{3}{4}$ 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	$\frac{3}{4}$ x 110	23	29
	ANSI 300	381	330.2	12	$\frac{7}{8}$ x 140	26	41
	ANSI 600	419	349.2	12	$1\frac{1}{8}$ x 195	32	56
	PN 10	340	295	8	—	22	—
PN 16	340	295	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	$\frac{7}{8}$ x 115	29	30
	ANSI 300	510	431.8	16	$1\frac{1}{4}$ x 215	35	64
	PN 10	395	350	8	—	22	—
	PN 16	405	355	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	$\frac{7}{8}$ x 120	26	32
	ANSI 300	520	450.8	16	$1\frac{1}{8}$ x 170	32	51
	PN 10	445	400	12	—	22	—
	PN 16	460	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	$1\frac{1}{8}$ 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	$1\frac{1}{4}$ 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	$1\frac{1}{8}$ x 150	32	40
	ANSI 300	710	628.6	24	$1\frac{1}{4}$ 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	$1\frac{1}{8}$ x 160	32	43
	ANSI 300	775	685.8	24	$1\frac{1}{4}$ 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	$1\frac{1}{4}$ x 175	35	48
	ANSI 300	915	812.8	24	$1\frac{1}{2}$ 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/m² = 0.000145 lbf/in² = 1Pa) (1 N/mm² = 145 lbf/in² = 1MPa)

PSI (lbf/in²) to kPa • PRESSURE – STRESS CONVERSION CHART

- (A) To use, locate “given pressure” in “given pressure” column (coloured GREY) whether lbf/in² or kPa.
- (B) If “given pressure” is in pounds force per square inch (lbf/in²), read kilopascals (kPa) in right hand column.
- (C) If “given pressure” is in kilopascals (kPa), read pounds force per square inch (lbf/in²) in left hand column.
- (D) **Example:** (i) Given pressure is **100 lbf/in² = 689 kPa** from right hand column
 (ii) Given pressure is **100kPa = 14.50 lbf/in²** 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	268.90	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	12.76	88	607	50.76	350	2413	=	2.41
2.76	19	131.00	7.83	54	372.32	12.91	89	614	58.01	400	2758	=	2.76
2.90	20	137.90	7.98	55	379.21	13.05	90	621	65.26	450	3103	=	3.10
3.05	21	144.79	8.12	56	386.11	13.20	91	627	72.51	500	3448	=	3.44
3.19	22	151.69	8.27	57	393.00	13.34	92	634	79.76	550	3793	=	3.79
3.34	23	158.58	8.41	58	399.90	13.49	93	641	87.01	600	4138	=	4.13
3.48	24	165.47	8.56	59	406.79	13.63	94	648	94.26	650	4483	=	4.48
3.63	25	172.37	8.70	60	413.69	13.78	95	655	101.51	700	4828	=	4.82
3.77	26	179.26	8.85	61	420.58	13.92	96	662	108.76	750	5173	=	5.17
3.92	27	186.16	8.99	62	427.48	14.07	97	669	116.01	800	5518	=	5.51
4.06	28	193.05	9.14	63	434.37	14.21	98	676	123.26	850	5863	=	5.86
4.21	29	199.95	9.28	64	441.26	14.36	99	683	130.51	900	6208	=	6.20
4.35	30	206.84	9.43	65	448.16	14.50	100	689	137.76	950	6553	=	6.55
4.50	31	213.74	9.57	66	455.05	15.23	105	724	145.01	1000	6898	=	6.89
4.64	32	220.63	9.72	67	461.95	15.95	110	758	152.26	10500	7243	=	7.24
4.79	33	227.53	9.86	68	468.84	16.68	115	793	159.51	11000	7588	=	7.58
4.93	34	234.42	10.01	69	475.74	17.40	120	827	166.76	11500	7933	=	7.93
5.08	35	241.32	10.15	70	482.63	18.13	125	862	174.01	12000	8278	=	8.27

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 mm² (N/mm²) = 145 lbf/in²

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/in² (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
 $(°F - 32) \times \frac{5}{9} = °C$

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

“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	
AREA: Symbol m² The SI unit of AREA is the SQUARE METRE.	Square inches	645.16	mm ²	POWER: Symbol W The SI unit of POWER is the WATT.	Btu per hour (Btu/hr)	0.2931	W	
	Square feet	0.929	m ²		horsepower (hp)	0.7457	kW	
	Square yards	0.836	m ²		ton of refrigeration	3.517	kW	
	Acre	4047	m ²					
DENSITY: Symbol kg/m³ The SI unit of DENSITY is the kilogram per cubic metre.	Hectare (ha)	10 000	m ²	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 = 1 Pa = 0.000145 lbf/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	
	lb/in ³	27.68	t/m ³		kip/in ² (1000 psi)	6.895	MPa	
	lb/ft ³	16.02	kg/m ³		lbf/ft ²	47.88	Pa	
	lb/yd ³	0.5933	kg/m ³		kgf/cm ²	98.07	kPa	
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)		MJ	Vertical column (head) of water. (H ₂ O at 20°C) metres of water feet of water torr (vacuum) 1 mm Hg. (mercury) 1 in. Hg. (mercury) atmosphere (atm) microns		9.79	kPa	
	2. HEAT ENERGY British thermal unit (Btu) Btu/gal Btu/ft ³					2.984	kPa	
	3. MECHANICAL ENERGY <u>foot poundal</u> ft.pdl		J			0.1333	kPa	
	<u>inch pound-force</u> in.lbf		J			0.1333	kPa	
	<u>foot pound-force</u> ft.lbf		J			3.386	kPa	
	<u>foot ton force</u> ft.tonf		kJ			101.325	kPa	
	<u>Metre kilogram force</u> m.kgf		J			0.133	Pa	
	Poundal (pdl)		N					
	Pound-force (lbf)		N					
	ton-force (tonf)		kN					
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.	*kilogram-force (kgf)		N	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	<u>poundal-foot</u> pdl.ft	.04214	N.m	
	*also known as kilopond (kp)		N			<u>pound-force inch</u> lbf.inch	0.1130	N.m
			N			lbf.inch	1.152	kgf.cm
			N			<u>pound-force feet</u> lbf.ft	1.356	N.m
FORCE PER UNIT LENGTH: The SI unit is NEWTON PER METRE: Symbol N/m	pounds-force per inch (lbf/in)		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	
	pounds-force per foot (lbf/ft)		N/m			ft. per minute (ft/min)	0.00508	m/s
	ton-force per foot (ton/ft)		kN/m			miles per hour	0.4470	m/s
LENGTH: Symbol m The SI unit of LENGTH is the METRE.	*kilogram-force (kgf)		N	VOLUME: CAPACITY: Symbol m³ The SI unit of VOLUME is the CUBIC METRE.	miles per hour	1.609	km/h	
	inches		millimetres (mm)			DRY: cubic inch (in ³)	16387	mm ³
	feet		metres (m)			cubic foot (ft ³)	0.02832	m ³
	yards		metres (m)			cubic yard (yd ³)	0.7646	m ³
	chain		metres (m)			litre (L) ††	1 000 000	mm ³
	mile		metres (m)			litre (L) ††	0.001	m ³
MASS: Symbol kg The SI unit of MASS is the KILOGRAM.	mile		kilometres (km)	NOTE: †† Capital “L” is now the legal preferred symbol for litre in Australia.	gallons (Imp.)	0.004546	m ³	
	ounce		grams (g)			IMPERIAL LIQUID fluid ounce	28.41	millilitre (ml)
	pound		kilograms (kg)			pint (20 fl. oz)	568.3	millilitre (ml)
	slug		kg			quart (2 pints)	1.137	litre (L) ††
	ton (2240 lb)		kg			gallon (Imp.)	4.546	litre (L) ††
	short ton (2000 lb)		kg			gallon (US)	3.785	litre (L) ††
	ton (2240 lb)		tonne (t)			litre (water 4°C)	1.000	kilogram (kg)
	pounds per foot (lb/ft)		kg/m			Imp. gallons (water 20°C)	4.536	kilograms (kg)
	pounds per yard (lb/yd)		kg/m					
			kg/m					
VOLUME: RATE OF FLOW Symbol m³/s The SI unit of VOLUME RATE OF FLOW is the CUBIC METRE PER SECOND.				SUNDRY ITEMS:	Imp. gal. per minute (gal/min)	.0000758	m ³ /s	
						Imp. gal. per minute	0.272765	m ³ /hr
						Imp. gal. per minute	.0758	litre per second (L/s)
						cubic ft. per minute	.000472	m ³ /s
						cubic ft. per minute	0.472	litre per second (L/s) 1 m ³ = 1 kL

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
 $(°C \times \frac{9}{5}) + 32 = °F$