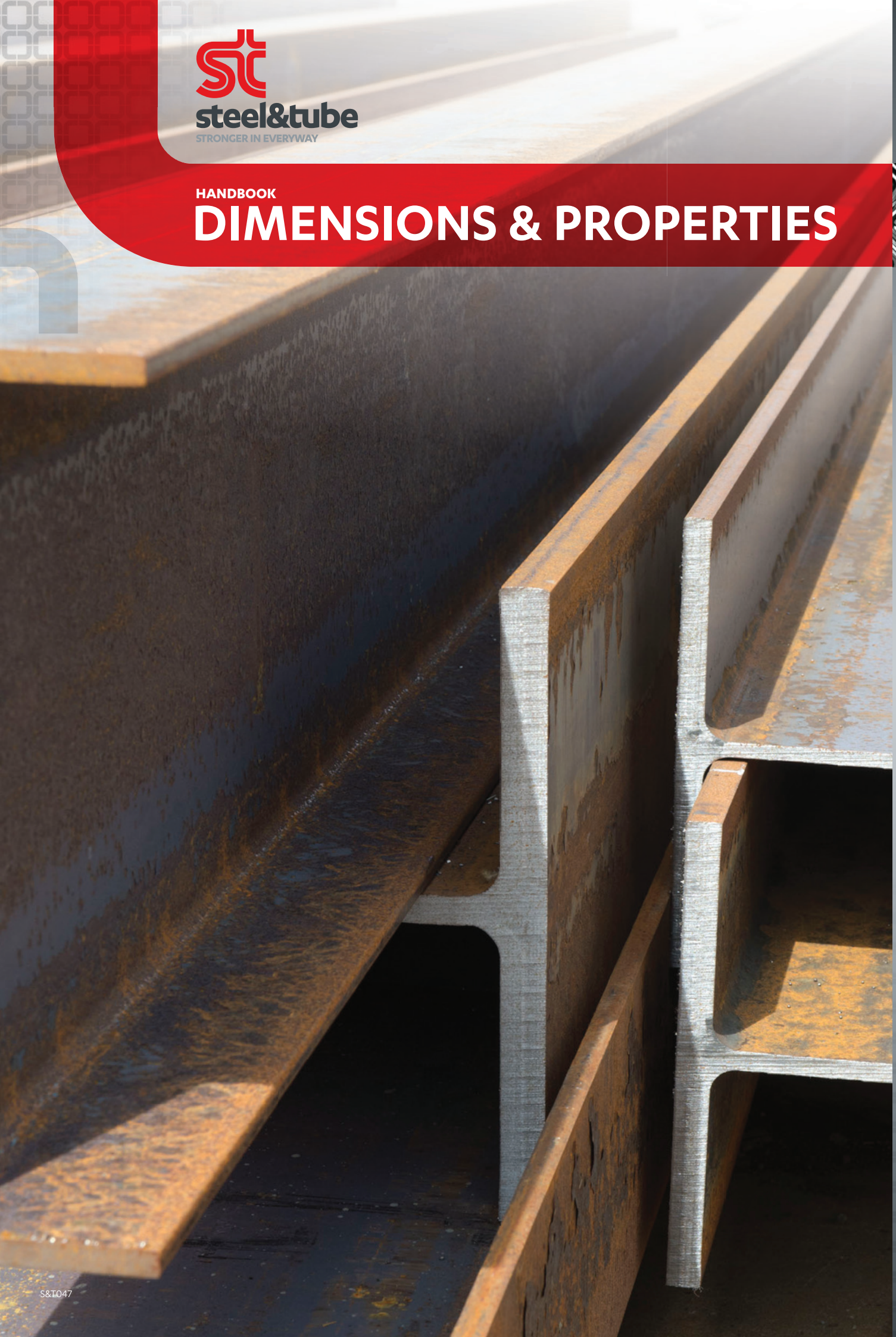
steel&tube
STRONGER IN EVERYWAY

HANDBOOK

DIMENSIONS & PROPERTIES



STEEL

DIMENSIONS & PROPERTIES HANDBOOK

JAN 2013

S&T047

Introduction

Steel & Tube takes great pleasure in providing this **Dimensions & Properties Handbook** for your use. We endeavour to carry all popular products and sizes ex-stock, on a continuous basis. This latest edition of the Steel & Tube Dimensions and Properties Handbook generally lists those sizes which we carry ex-stock. However, there are some sizes that we offer on an indent basis only.

There are also many products that we carry, which do not feature in this particular publication. Please contact your local Steel & Tube branch for further information on our comprehensive range of steel products, or visit our web site **www.steelandtube.co.nz**, which features extensive product information.

Please note: This document is in the process of being updated.

Indent Service: Steel & Tube's indent service can offer considerable savings when ordering product to certain quantity or lead-time requirements. For specialist, non-standard products, talk to us about bout global sourcing network 0800 478 335.

Telarc Limited/ISO 9001

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Disclaimer: In compiling this publication we have been obliged to extract information from a wide range of sources, both local and overseas, and whilst every precaution has been taken to ensure its accuracy we do not accept any responsibility for errors or omissions which may be contained in this handbook.

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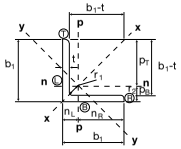
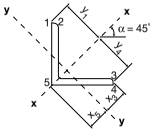


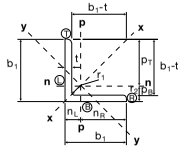


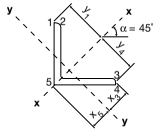
Designation Leg-size	Nominal Thick-ness	Mass per metre	Actual Thick-ness	Radii Root	Radii Toe		Gross Area of Cross-Section	Coordinate of Centroid		About x-axis					About y-axis						Torsion Constant
						(b1-t)		nL=	nR=		y1=	Zx1=									
b1 x b1			t	r1	r2	t	Ag	pB	pT	Ix	y4	Zx4	Sx	rx	Iy	x3	Zy3	x5	Zy5	Sy	ry	J
mm mm	mm	kg/m	mm	mm	mm		mm2	mm	mm	10^6 mm^4	mm	10^3 mm^3	10^3 mm^3	mm	10^6 mm^4	mm	10^3 mm^3	mm	10^3 mm^3	10^3 mm^3	mm	10^3 mm^4
200 x 200 x	26 EA	76.8	26.0	18.0	5.0	6.69	9780	59.3	141	56.8	141	402	643	76.2	14.9	73.9	202	83.8	178	329	39.0	2250
	20 EA	60.1	20.0	18.0	5.0	9.00	7660	57.0	143	45.7	141	323	511	77.2	11.8	72.9	162	80.6	147	260	39.3	1060
	18 EA	54.4	18.0	18.0	5.0	10.1	6930	56.2	144	41.7	141	295	464	77.6	10.8	72.6	149	79.5	136	236	39.4	778
	16 EA	48.7	16.0	18.0	5.0	11.5	6200	55.4	145	37.6	141	266	417	77.9	9.72	72.3	135	78.4	124	212	39.6	554
	13 EA	40.0	13.0	18.0	5.0	14.4	5090	54.2	146	31.2	141	221	344	78.3	8.08	71.9	112	76.6	105	176	39.8	304
150 x 150 x	19 EA	42.1	19.0	13.0	5.0	6.89	5360	44.2	106	17.6	106	166	265	57.2	4.60	54.9	83.8	62.6	73.5	135	29.3	657
	16 EA	35.4	15.8	13.0	5.0	8.49	4520	43.0	107	15.1	106	142	225	57.8	3.91	54.3	71.9	60.8	64.2	115	29.4	386
	12 EA	27.3	12.0	13.0	5.0	11.5	3480	41.5	108	11.9	106	112	175	58.4	3.06	53.7	56.9	58.7	52.1	89.3	29.6	174
	10 EA	21.9	9.5	13.0	5.0	14.8	2790	40.5	109	9.61	106	90.6	141	58.7	2.48	53.4	46.4	57.3	43.3	72.0	29.8	88.9
125 x 125 x	16 EA	29.1	15.8	10.0	5.0	6.91	3710	36.8	88.2	8.43	88.4	95.4	153	47.7	2.20	45.4	48.5	52.1	42.3	77.8	24.4	313
	12 EA	22.5	12.0	10.0	5.0	9.42	2870	35.4	89.6	6.69	88.4	75.7	120	48.3	1.73	44.7	38.6	50.1	34.5	60.8	24.5	141
	10 EA	18.0	9.5	10.0	5.0	12.2	2300	34.4	90.6	5.44	88.4	61.6	96.5	48.7	1.40	44.4	31.5	48.7	28.8	49.0	24.7	71.9
	8 EA	14.9	7.8	10.0	5.0	15.0	1900	33.7	91.3	4.55	88.4	51.5	80.2	48.9	1.17	44.2	26.5	47.7	24.5	40.8	24.8	40.6
100 x 100 x	12 EA	17.7	12.0	8.0	5.0	7.33	2260	29.2	70.8	3.29	70.7	46.6	74.5	38.2	0.857	35.8	23.9	41.3	20.8	37.9	19.5	110
	10 EA	14.2	9.5	8.0	5.0	9.53	1810	28.2	71.8	2.70	70.7	38.2	60.4	38.6	0.695	35.4	19.6	39.9	17.4	30.7	19.6	56.2
	8 EA	11.8	7.8	8.0	5.0	11.8	1500	27.5	72.5	2.27	70.7	32.0	50.3	38.8	0.582	35.2	16.5	38.9	14.9	25.6	19.7	31.7
	6 EA	9.16	6.0	8.0	5.0	15.7	1170	26.8	73.2	1.78	70.7	25.2	39.3	39.1	0.458	35.0	13.1	37.9	12.1	20.0	19.8	14.8
90 x 90 x	10 EA	12.7	9.5	8.0	5.0	8.47	1620	25.7	64.3	1.93	63.6	30.4	48.3	34.5	0.500	31.9	15.7	36.4	13.8	24.6	17.6	50.5
	8 EA	10.6	7.8	8.0	5.0	10.5	1350	25.0	65.0	1.63	63.6	25.6	40.4	34.8	0.419	31.7	13.2	35.4	11.8	20.5	17.6	28.6
	6 EA	8.22	6.0	8.0	5.0	14.0	1050	24.3	65.7	1.28	63.6	20.1	31.6	35.0	0.330	31.5	10.5	34.3	9.62	16.1	17.8	13.4
75 x 75 x	10 EA	10.5	9.5	8.0	5.0	6.89	1340	22.0	53.0	1.08	53.0	20.4	32.8	28.4	0.282	26.6	10.6	31.1	9.09	16.8	14.5	41.9
	8 EA	8.73	7.8	8.0	5.0	8.62	1110	21.3	53.7	0.913	53.0	17.2	27.5	28.7	0.237	26.4	8.99	30.1	7.87	14.0	14.6	23.8
	6 EA	6.81	6.0	8.0	5.0	11.5	867	20.5	54.5	0.722	53.0	13.6	21.6	28.9	0.187	26.2	7.15	29.0	6.44	11.0	14.7	11.2
	5 EA	5.27	4.6	8.0	5.0	15.3	672	19.9	55.1	0.563	53.0	10.6	16.7	29.0	0.147	26.1	5.62	28.1	5.22	8.61	14.8	5.28

Equal Angles - *continued*

x- and y-axes

Dimensions and Properties



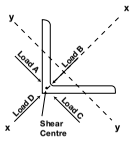


Designation Leg-size $b_1 \times b_1$	Nominal Thickness	Mass per metre	Actual Thickness	Radii Root	Radii Toe	(b_1-t)	Gross Area of Cross-Section	Coordinate of Centroid $n_L=$	Coordinate of Centroid $n_R=$	About x-axis				About y-axis							Torsion Constant
											$y_1=$	$z_{x1}=$									
			t	r_1	r_2	t	A_g	p_B	p_T	I_x	y_4	z_{x4}	S_x	r_x	I_y	x_3	z_{y3}	x_5	z_{y5}	S_y	r_y	J
mm mm	mm	kg/m	mm	mm	mm		mm^2	mm	mm	10^6mm^4	mm	10^3mm^3	10^3mm^3	mm	10^6mm^4	mm	10^3mm^3	mm	10^3mm^3	10^3mm^3	mm	10^3mm^4
65 x 65 x	10 EA	9.02	9.5	6.0	3.0	5.84	1150	19.6	45.4	0.691	46.0	15.0	24.3	24.5	0.183	23.7	7.71	27.7	6.60	12.5	12.6	35.1
	8 EA	7.51	7.8	6.0	3.0	7.33	957	19.0	46.0	0.589	46.0	12.8	20.5	24.8	0.154	23.4	6.56	26.8	5.73	10.5	12.7	20.0
	6 EA	5.87	6.0	6.0	3.0	9.83	748	18.3	46.7	0.471	46.0	10.2	16.2	25.1	0.122	23.1	5.26	25.8	4.71	8.25	12.8	9.37
	5 EA	4.56	4.6	6.0	3.0	13.1	581	17.7	47.3	0.371	46.0	8.08	12.7	25.3	0.0959	23.0	4.18	25.0	3.83	6.46	12.9	4.36
55 x 55 x	6 EA	4.93	6.0	6.0	3.0	8.17	628	15.8	39.2	0.278	38.9	7.14	11.4	21.0	0.0723	19.6	3.69	22.3	3.24	5.82	10.7	7.93
	5 EA	3.84	4.6	6.0	3.0	11.0	489	15.2	39.8	0.220	38.9	5.66	8.93	21.2	0.0571	19.4	2.94	21.5	2.66	4.57	10.8	3.71
50 x 50 x	8 EA	5.68	7.8	6.0	3.0	5.41	723	15.2	34.8	0.253	35.4	7.16	11.7	18.7	0.0675	18.1	3.73	21.5	3.14	6.00	9.66	15.2
	6 EA	4.46	6.0	6.0	3.0	7.33	568	14.5	35.5	0.205	35.4	5.79	9.30	19.0	0.0536	17.8	3.01	20.5	2.61	4.76	9.71	7.21
	5 EA	3.48	4.6	6.0	3.0	9.87	443	13.9	36.1	0.163	35.4	4.61	7.32	19.2	0.0424	17.6	2.40	19.7	2.15	3.75	9.78	3.38
	3 EA	2.31	3.0	6.0	3.0	15.7	295	13.2	36.8	0.110	35.4	3.11	4.90	19.3	0.0289	17.6	1.65	18.7	1.55	2.53	9.90	1.01
45 x 45 x	6 EA	3.97	6.0	5.0	3.0	6.50	506	13.3	31.7	0.146	31.8	4.59	7.41	17.0	0.0383	16.0	2.39	18.8	2.04	3.79	8.71	6.32
	5 EA	3.10	4.6	5.0	3.0	8.78	394	12.7	32.3	0.117	31.8	3.66	5.84	17.2	0.0303	15.8	1.91	18.0	1.68	2.99	8.76	2.96
	3 EA	2.06	3.0	5.0	3.0	14.0	263	12.0	33.0	0.0790	31.8	2.48	3.92	17.3	0.0206	15.7	1.31	17.0	1.21	2.02	8.85	0.875
40 x 40 x	6 EA	3.50	6.0	5.0	3.0	5.67	446	12.0	28.0	0.0997	28.3	3.53	5.75	15.0	0.0265	14.3	1.86	17.0	1.55	2.95	7.71	5.60
	5 EA	2.73	4.6	5.0	3.0	7.70	348	11.5	28.5	0.0801	28.3	2.83	4.55	15.2	0.0209	14.0	1.49	16.2	1.29	2.33	7.75	2.63
	3 EA	1.83	3.0	5.0	3.0	12.3	233	10.8	29.2	0.0545	28.3	1.93	3.06	15.3	0.0142	13.9	1.02	15.3	0.930	1.58	7.82	0.785
30 x 30 x	6 EA	2.56	6.0	5.0	3.0	4.00	326	9.53	20.5	0.0387	21.2	1.83	3.06	10.9	0.0107	10.7	0.993	13.5	0.790	1.59	5.72	4.16
	5 EA	2.01	4.6	5.0	3.0	5.52	256	8.99	21.0	0.0316	21.2	1.49	2.45	11.1	0.00839	10.5	0.799	12.7	0.660	1.26	5.72	1.98
	3 EA	1.35	3.0	5.0	3.0	9.00	173	8.30	21.7	0.0218	21.2	1.03	1.67	11.2	0.00573	10.3	0.554	11.7	0.488	0.862	5.76	0.605
25 x 25 x	6 EA	2.08	6.0	5.0	3.0	3.17	266	8.28	16.7	0.0210	17.7	1.19	2.03	8.89	0.00600	8.97	0.669	11.7	0.513	1.07	4.75	3.44
	5 EA	1.65	4.6	5.0	3.0	4.43	210	7.75	17.3	0.0173	17.7	0.980	1.65	9.07	0.00469	8.73	0.537	11.0	0.428	0.849	4.72	1.66
	3 EA	1.12	3.0	5.0	3.0	7.33	143	7.07	17.9	0.0121	17.7	0.685	1.13	9.22	0.00319	8.56	0.373	9.99	0.319	0.583	4.73	0.515

Equal Angles

x- and y-axes

Properties for Assessing Section Capacity

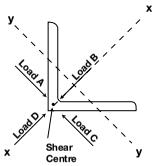


Designation		Yield Stress	Form Factor	About x-axis	About y-axis		Yield Stress	Form Factor	About x-axis	About y-axis	
				Load A or C	Load B	Load D			Load A or C	Load B	Load D
		f_y	k_f	Z_{ex}	Z_{ey}	Z_{ey}	f_y	k_f	Z_{ex}	Z_{ey}	Z_{ey}
mm mm	mm	MPa		10^3mm^3	10^3mm^3	10^3mm^3	MPa		10^3mm^3	10^3mm^3	10^3mm^3
				*300PLUS**					*AS/NZS 3679.1-350*		
200 x 200 x	26 EA	280	1.00	602	267	267	340	1.00	602	267	267
	20 EA	280	1.00	479	218	220	340	1.00	469	214	220
	18 EA	280	1.00	427	196	204	340	1.00	417	192	204
	16 EA	300	1.00	369	172	186	340	1.00	362	169	186
	13 EA	300	1.00	285	136	158	340	0.956	278	132	158
150 x 150 x	19 EA	280	1.00	248	110	110	340	1.00	248	110	110
	16 EA	300	1.00	212	95.7	96.3	340	1.00	209	94.5	96.3
	12 EA	300	1.00	155	72.3	78.1	340	1.00	152	70.9	78.1
	10 EA	320	0.958	114	54.5	64.9	360	0.906	111	53.1	64.9
125 x 125 x	16 EA	300	1.00	143	63.4	63.4	340	1.00	143	63.4	63.4
	12 EA	300	1.00	110	50.3	51.7	340	1.00	109	49.6	51.7
	10 EA	320	1.00	83.2	38.9	43.1	360	1.00	81.6	38.1	43.1
	8 EA	320	0.943	64.3	30.7	36.8	360	0.892	62.7	29.9	36.8
100 x 100 x	12 EA	300	1.00	69.9	31.1	31.1	340	1.00	69.9	31.1	31.1
	10 EA	320	1.00	55.1	25.2	26.1	360	1.00	54.4	24.8	26.1
	8 EA	320	1.00	43.7	20.4	22.4	360	1.00	42.9	20.0	22.4
	6 EA	320	0.906	30.9	14.8	18.1	360	0.856	30.0	14.4	18.1
90 x 90 x	10 EA	320	1.00	45.0	20.4	20.6	360	1.00	44.5	20.1	20.6
	8 EA	320	1.00	36.0	16.7	17.8	360	1.00	35.4	16.4	17.8
	6 EA	320	1.00	25.9	12.4	14.4	360	0.954	25.3	12.1	14.4
75 x 75 x	10 EA	320	1.00	30.5	13.6	13.6	360	1.00	30.5	13.6	13.6
	8 EA	320	1.00	25.4	11.6	11.8	360	1.00	25.1	11.5	11.8
	6 EA	320	1.00	18.7	8.85	9.66	360	1.00	18.4	8.70	9.66
	5 EA	320	0.927	13.2	6.47	7.82	360	0.876	12.8	6.30	7.82

Equal Angles - *continued*

x- and y-axes

Properties for Assessing Section Capacity



Designation		Yield Stress	Form Factor	About x-axis	About y-axis		Yield Stress	Form Factor	About x-axis	About y-axis	
				Load A or C	Load B	Load D			Load A or C	Load B	Load D
		f_y	k_f	Z_{ex}	Z_{ey}	Z_{ey}	f_y	k_f	Z_{ex}	Z_{ey}	Z_{ey}
mm mm	mm	MPa		10^3mm^3	10^3mm^3	10^3mm^3	MPa		10^3mm^3	10^3mm^3	10^3mm^3
				300PLUS*					***AS/NZS 3679.1-350***		
65 x 65 x	10 EA	320	1.00	22.5	9.90	9.90	360	1.00	22.5	9.90	9.90
	8 EA	320	1.00	19.2	8.59	8.59	360	1.00	19.2	8.59	8.59
	6 EA	320	1.00	14.7	6.76	7.07	360	1.00	14.5	6.66	7.07
	5 EA	320	1.00	10.6	5.05	5.75	360	1.00	10.4	4.94	5.75
55 x 55 x	6 EA	320	1.00	10.7	4.84	4.86	360	1.00	10.5	4.78	4.86
	5 EA	320	1.00	7.88	3.70	3.98	360	1.00	7.75	3.64	3.98
50 x 50 x	8 EA	320	1.00	10.7	4.71	4.71	360	1.00	10.7	4.71	4.71
	6 EA	320	1.00	8.69	3.92	3.92	360	1.00	8.69	3.92	3.92
	5 EA	320	1.00	6.60	3.08	3.22	360	1.00	6.50	3.03	3.22
	3 EA	320	0.907	3.82	1.90	2.32	360	0.858	3.71	1.85	2.32
45 x 45 x	6 EA	320	1.00	6.88	3.06	3.06	360	1.00	6.88	3.06	3.06
	5 EA	320	1.00	5.39	2.47	2.52	360	1.00	5.32	2.44	2.52
	3 EA	320	1.00	3.19	1.55	1.81	360	0.954	3.12	1.52	1.81
40 x 40 x	6 EA	320	1.00	5.29	2.33	2.33	360	1.00	5.29	2.33	2.33
	5 EA	320	1.00	4.25	1.93	1.93	360	1.00	4.22	1.92	1.93
	3 EA	320	1.00	2.59	1.25	1.40	360	1.00	2.54	1.23	1.40
30 x 30 x	6 EA	320	1.00	2.74	1.19	1.19	360	1.00	2.74	1.19	1.19
	5 EA	320	1.00	2.23	0.990	0.990	360	1.00	2.23	0.990	0.990
	3 EA	320	1.00	1.50	0.714	0.732	360	1.00	1.48	0.705	0.732
25 x 25 x	6 EA	320	1.00	1.78	0.769	0.769	360	1.00	1.78	0.769	0.769
	5 EA	320	1.00	1.47	0.642	0.642	360	1.00	1.47	0.642	0.642
	3 EA	320	1.00	1.03	0.479	0.479	360	1.00	1.03	0.479	0.479

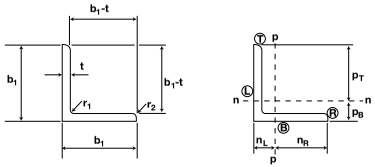
Notes:

1. For OneSteel-300PLUS sections the tensile strength (f_u) is 440 MPa.
2. For Grade 350 sections the tensile strength (f_u) is 480 MPa.
3. OneSteel-300PLUS hot rolled sections are produced to exceed the minimum requirements of AS/NZS 3679.1-300.
4. OneSteel-300PLUS replaced Grade 250 as the base grade for these sections in 1994.

Equal Angles

n- and p-axes

Dimensions and Properties

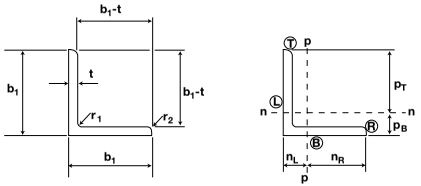


Designation	About n-axis and p-axis							Product of 2nd Moment of Area
	$I_{n=}I_p$	$n_{L=}P_B$	$Z_{nB=}Z_{pL}$	$n_{R=}P_T$	$Z_{nT=}Z_{pR}$	$S_{n=}S_p$	$r_{n=}r_p$	I_{np}
mm mm mm	10^6mm^4	mm	10^3mm^3	mm	10^3mm^3	10^3mm^3	mm	10^6mm^4
200 x 200 x 26 EA	35.8	59.3	605	141	255	460	60.5	-20.9
20 EA	28.8	57.0	505	143	201	363	61.3	-16.9
18 EA	26.3	56.2	467	144	183	330	61.5	-15.5
16 EA	23.7	55.4	427	145	164	296	61.8	-14.0
13 EA	19.7	54.2	363	146	135	243	62.2	-11.6
150 x 150 x 19 EA	11.1	44.2	250	106	105	189	45.4	-6.48
16 EA	9.48	43.0	220	107	88.7	160	45.8	-5.58
12 EA	7.46	41.5	180	108	68.8	124	46.3	-4.40
10 EA	6.04	40.5	149	109	55.2	99.9	46.6	-3.56
125 x 125 x 16 EA	5.32	36.8	144	88.2	60.3	109	37.9	-3.11
12 EA	4.21	35.4	119	89.6	47.0	85.0	38.3	-2.48
10 EA	3.42	34.4	99.4	90.6	37.8	68.4	38.6	-2.02
8 EA	2.86	33.7	84.9	91.3	31.3	56.8	38.8	-1.69
100 x 100 x 12 EA	2.08	29.2	71.1	70.8	29.3	53.2	30.3	-1.22
10 EA	1.70	28.2	60.1	71.8	23.6	42.9	30.6	-1.00
8 EA	1.42	27.5	51.7	72.5	19.6	35.7	30.8	-0.842
6 EA	1.12	26.8	41.8	73.2	15.3	27.8	31.0	-0.661
90 x 90 x 10 EA	1.22	25.7	47.3	64.3	18.9	34.4	27.4	-0.716
8 EA	1.02	25.0	40.9	65.0	15.7	28.7	27.6	-0.604
6 EA	0.805	24.3	33.2	65.7	12.3	22.4	27.7	-0.475
75 x 75 x 10 EA	0.681	22.0	31.0	53.0	12.8	23.4	22.6	-0.399
8 EA	0.575	21.3	27.0	53.7	10.7	19.6	22.7	-0.338
6 EA	0.455	20.5	22.1	54.5	8.35	15.3	22.9	-0.268
5 EA	0.355	19.9	17.9	55.1	6.44	11.8	23.0	-0.208

Equal Angles - *continued*

n- and p-axes

Dimensions and Properties

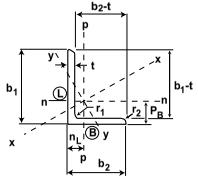


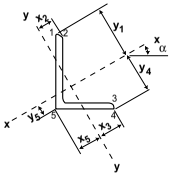
Designation	About n-axis and p-axis							Product of 2nd Moment of Area
	$I_{n=I_p}$	$n_{L=PB}$	$Z_{nB=Z_{pL}}$	$n_{R=PT}$	$Z_{nT=Z_{pR}}$	$S_{n=S_p}$	$r_{n=r_p}$	I_{np}
mm mm mm	10^6mm^4	mm	10^3mm^3	mm	10^3mm^3	10^3mm^3	mm	10^6mm^4
65 x 65 x 10 EA	0.437	19.6	22.3	45.4	9.62	17.4	19.5	-0.254
8 EA	0.371	19.0	19.6	46.0	8.07	14.6	19.7	-0.218
6 EA	0.296	18.3	16.2	46.7	6.34	11.5	19.9	-0.175
5 EA	0.234	17.7	13.2	47.3	4.94	8.97	20.1	-0.138
55 x 55 x 6 EA	0.175	15.8	11.1	39.2	4.46	8.11	16.7	-0.103
5 EA	0.139	15.2	9.12	39.8	3.48	6.34	16.8	-0.0814
50 x 50 x 8 EA	0.160	15.2	10.5	34.8	4.61	8.38	14.9	-0.0928
6 EA	0.129	14.5	8.90	35.5	3.64	6.63	15.1	-0.0756
5 EA	0.103	13.9	7.36	36.1	2.85	5.19	15.2	-0.0602
3 EA	0.0694	13.2	5.25	36.8	1.89	3.46	15.3	-0.0405
45 x 45 x 6 EA	0.0922	13.3	6.93	31.7	2.91	5.30	13.5	-0.0538
5 EA	0.0734	12.7	5.76	32.3	2.28	4.16	13.6	-0.0432
3 EA	0.0498	12.0	4.14	33.0	1.51	2.77	13.8	-0.0292
40 x 40 x 6 EA	0.0631	12.0	5.24	28.0	2.26	4.12	11.9	-0.0366
5 EA	0.0505	11.5	4.39	28.5	1.77	3.24	12.0	-0.0296
3 EA	0.0344	10.8	3.19	29.2	1.18	2.17	12.2	-0.0201
30 x 30 x 6 EA	0.0247	9.53	2.59	20.5	1.21	2.22	8.71	-0.0140
5 EA	0.0200	8.99	2.22	21.0	0.951	1.76	8.83	-0.0116
3 EA	0.0138	8.30	1.66	21.7	0.635	1.18	8.93	-0.00804
25 x 25 x 6 EA	0.0135	8.28	1.63	16.7	0.807	1.49	7.13	-0.00750
5 EA	0.0110	7.75	1.42	17.3	0.638	1.19	7.23	-0.00632
3 EA	0.00765	7.07	1.08	17.9	0.426	0.802	7.33	-0.00446

Unequal Angles

x- and y-axes

Dimensions and Properties



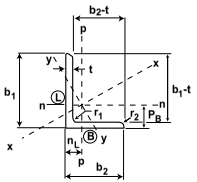


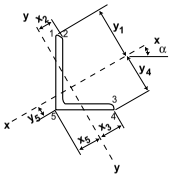
Designation Leg-size		Normal Thickness	Mass per metre	Actual Thickness	Radii		$(b_1\text{-}t)$	$(b_2\text{-}t)$	Gross Area of Cross Section	Coordinate of Centroid		About X-axis								About y-axis								Torsion Constant	Tan Alpha
					Root	Toe																								
$b_1 \times b_2$				t	r_1	r_2	t	t	A_g	p_B	n_L	I_x	y_1	Z_{x1}	y_4	Z_{x4}	y_5	Z_{x5}	S_x	r_x	I_y	x_2	Z_{y2}	x_3	Z_{y3}	x_5	Z_{y5}	S_y	r_y	J	
mm	mm	mm	kg/m	mm	mm	mm			mm^2	mm	mm	10^6mm^4	mm	10^3mm^3	mm	10^3mm^3	mm	10^3mm^3	10^3mm^3	mm	10^6mm^4	mm	10^3mm^3	mm	10^3mm^3	mm	10^3mm^3	10^3mm^3	mm	10^3mm^4	
150 x 100 x	12 UA	22.5	12.0	10.0	5.0	11.5	7.33	2870	49.1	24.3	7.51	102	73.5	75.3	99.7	35.2	213	127	51.2	1.35	27.6	48.8	52.9	25.5	42.0	32.1	51.7	21.7	141	0.438
	10 UA	18.0	9.5	10.0	5.0	14.8	9.53	2300	48.1	23.3	6.11	103	59.5	74.9	81.5	34.6	177	102	51.6	1.09	26.9	40.7	53.0	20.6	40.7	26.9	41.8	21.8	71.9	0.441
150 x 90 x	16 UA	27.9	15.8	10.0	5.0	8.49	4.70	3550	52.5	22.7	8.80	99.5	88.4	71.9	122	41.9	210	154	49.8	1.32	24.6	53.8	49.9	26.5	38.9	34.0	55.9	19.3	300	0.353
	12 UA	21.6	12.0	10.0	5.0	11.5	6.50	2750	51.0	21.2	6.97	100	69.4	71.3	97.8	40.8	171	120	50.4	1.04	23.4	44.5	50.1	20.8	37.2	28.0	43.8	19.5	136	0.360
	10 UA	17.3	9.5	10.0	5.0	14.8	8.47	2200	50.0	20.2	5.66	101	56.1	70.7	80.1	40.1	141	96.6	50.7	0.847	22.6	37.4	50.4	16.8	36.1	23.5	35.4	19.6	69.0	0.363
	8UA	14.3	7.8	10.0	5.0	18.2	10.5	1820	49.2	19.6	4.73	101	46.7	70.3	67.3	39.5	120	80.1	51.0	0.710	22.1	32.2	50.6	14.0	35.2	20.2	29.5	19.7	39.0	0.364
125 x 75 x	12 UA	17.7	12.0	8.0	5.0	9.42	5.25	2260	43.3	18.4	3.91	83.2	47.0	59.7	65.5	34.6	113	81.4	41.6	0.585	19.9	29.3	41.4	14.1	31.9	18.4	29.7	16.1	110	0.356
	10 UA	14.2	9.5	8.0	5.0	12.2	6.89	1810	42.3	17.5	3.20	83.8	38.2	59.3	53.9	33.9	94.4	65.8	42.0	0.476	19.2	24.9	41.6	11.4	30.7	15.5	24.1	16.2	56.2	0.360
	8 UA	11.8	7.8	8.0	5.0	15.0	8.62	1500	41.5	16.8	2.68	84.2	31.8	58.9	45.5	33.3	80.4	54.6	42.2	0.399	18.6	21.5	41.8	9.55	29.9	13.3	20.1	16.3	31.7	0.363
	6 UA	9.16	6.0	8.0	5.0	19.8	11.5	1170	40.7	16.0	2.10	84.7	24.8	58.5	36.0	32.8	64.1	42.4	42.5	0.315	18.0	17.5	42.1	7.47	29.0	10.8	15.7	16.4	14.8	0.364

Unequal Angles - *continued*

x- and y-axes

Dimensions and Properties

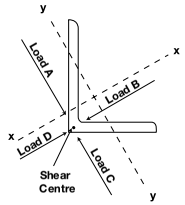




Designation Leg-size		Normal Thickness	Mass per metre	Actual Thick-ness	Radii		$(b_1\text{-}t)$	$(b_2\text{-}t)$	Gross Area of Cross Section	Coordinate of Centroid		About X-axis									About y-axis									Torsion Con-stant	Tan Alpha
					Root	Toe																									
$b_1 \times b_2$				t	r_1	r_2	t	t	A_g	p_B	n_L	I_x	y_1	Z_{x1}	y_4	Z_{x4}	y_5	Z_{x5}	S_x	r_x	I_y	x_2	Z_{y2}	x_3	Z_{y3}	x_5	Z_{y5}	S_y	r_y	J	
mm	mm	mm	kg/m	mm	mm	mm			mm^2	mm	mm	10^6mm^4	mm	10^3mm^3	mm	10^3mm^3	mm	10^3mm^3	10^3mm^3	mm	10^6mm^4	mm	10^3mm^3	mm	10^3mm^3	mm	10^3mm^3	10^3mm^3	mm	10^3mm^4	
100 x 75 x	10 UA	12.4	9.5	8.0	5.0	9.53	6.89	1580	31.8	19.4	1.89	62.9	27.3	54.5	34.6	18.6	101	46.5	34.6	0.401	22.3	18.0	36.4	11.0	32.2	12.5	21.0	16.0	49.1	0.546
	8 UA	10.3	7.8	8.0	5.0	11.8	8.62	1310	31.1	18.7	1.59	69.4	22.9	54.3	29.2	18.2	87.0	38.7	34.8	0.337	21.8	15.4	36.4	9.26	31.3	10.7	17.8	16.0	27.8	0.549
	6 UA	7.98	6.0	8.0	5.0	15.7	11.5	1020	30.3	17.9	1.25	69.7	17.9	54.0	23.1	17.9	70.0	30.1	35.1	0.265	21.4	12.4	36.5	7.27	30.3	8.75	13.9	16.2	13.0	0.551
75 x 50 x	8 UA	7.23	7.8	7.0	3.0	8.62	5.41	921	25.2	12.8	0.586	50.8	11.5	37.8	15.5	18.0	32.5	20.0	25.2	0.106	14.2	7.46	26.4	4.01	21.7	4.88	8.19	10.7	19.5	0.430
	6 UA	5.66	6.0	7.0	3.0	11.5	7.33	721	24.4	12.1	0.468	51.2	9.15	37.5	12.5	17.6	26.7	15.8	25.5	0.0842	13.6	6.17	26.5	3.18	20.8	4.04	6.48	10.8	9.21	0.435
	5 UA	4.40	4.6	7.0	3.0	15.3	9.87	560	23.8	11.5	0.370	51.5	7.17	37.2	9.93	17.2	21.5	12.3	25.7	0.0666	13.2	5.03	26.6	2.50	20.1	3.32	5.09	10.9	4.32	0.437
65 x 50 x	8 UA	6.59	7.8	6.0	3.0	7.33	5.41	840	21.1	13.6	0.421	44.9	9.37	36.3	11.6	11.6	36.4	16.1	22.4	0.0936	15.6	6.00	23.9	3.91	22.3	4.20	7.49	10.6	17.6	0.570
	6 UA	5.16	6.0	6.0	3.0	9.83	7.33	658	20.4	12.9	0.338	45.2	7.48	36.1	9.35	11.2	30.2	12.7	22.7	0.0743	15.1	4.91	23.9	3.11	21.4	3.48	5.93	10.6	8.29	0.575
	5 UA	4.02	4.6	6.0	3.0	13.1	9.87	512	19.8	12.4	0.267	45.4	5.89	35.9	7.43	10.9	24.5	9.92	22.8	0.0587	14.8	3.97	23.9	2.46	20.6	2.85	4.66	10.7	3.87	0.577

Unequal Angles

Properties for Assessing Section Capacity



Designation	Yield Stress	Form Factor	About x-axis		About y-axis		Yield Stress	Form Factor	About x-axis		About y-axis	
			Load A	Load C	Load B	Load D			Load A	Load C	Load B	Load D
	f_y	k_f	Z_{ex}	Z_{ex}	Z_{ey}	Z_{ey}	f_y	k_f	Z_{ex}	Z_{ex}	Z_{ey}	Z_{ey}
mm mm mm	MPa		10^3mm^3	10^3mm^3	10^3mm^3	10^3mm^3	MPa		10^3mm^3	10^3mm^3	10^3mm^3	10^3mm^3
			*300PLUS**						*AS/NZS 3679.1-350*			
150 x 100 x 12 UA	300	1.00	102	110	35.3	38.2	340	1.00	100	110	34.7	38.2
10 UA	320	0.975	74.8	81.7	26.0	30.9	360	0.943	73.0	78.9	25.3	30.9
150 x 90 x 16 UA	300	1.00	132	133	39.5	39.8	340	1.00	130	133	39.0	39.8
12 UA	300	1.00	96.3	104	28.8	31.1	340	1.00	94.6	104	28.3	31.1
10 UA	320	0.973	70.6	81.8	21.2	25.2	360	0.940	68.8	79.5	20.6	25.2
8 UA	320	0.863	53.1	60.3	15.9	21.0	360	0.836	51.2	57.9	15.4	21.0
125 x 75 x 12 UA	300	1.00	68.6	70.5	20.6	21.2	340	1.00	67.6	70.5	20.3	21.2
10 UA	320	1.00	51.6	57.2	15.5	17.2	360	1.00	50.6	57.2	15.2	17.2
8 UA	320	0.964	39.8	46.0	11.9	14.3	360	0.931	38.8	44.7	11.6	14.3
6 UA	320	0.824	26.8	30.1	8.07	11.2	360	0.799	25.8	28.7	7.75	11.2
100 x 75 x 10 UA	320	1.00	39.4	40.9	15.9	16.6	360	1.00	38.8	40.9	15.7	16.6
8 UA	320	1.00	31.2	33.1	12.6	13.9	360	1.00	30.6	32.1	12.4	13.9
6 UA	320	0.946	22.0	21.8	8.93	10.9	360	0.917	21.4	20.7	8.68	10.9
75 x 50 x 8 UA	320	1.00	17.0	17.3	5.93	6.02	360	1.00	16.8	17.3	5.85	6.02
6 UA	320	1.00	12.6	13.7	4.37	4.77	360	1.00	12.4	13.7	4.30	4.77
5 UA	320	0.956	8.89	9.65	3.10	3.75	360	0.926	8.66	9.30	3.02	3.75
65 x 50 x 8 UA	320	1.00	14.1	14.1	5.86	5.86	360	1.00	14.1	14.1	5.86	5.86
6 UA	320	1.00	10.7	11.2	4.46	4.67	360	1.00	10.6	11.2	4.40	4.67
5 UA	320	1.00	7.76	7.92	3.23	3.68	360	1.00	7.59	7.64	3.17	3.68

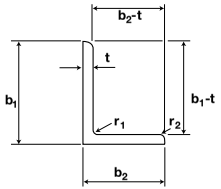
Notes:

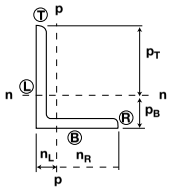
1. For OneSteel-300PLUS sections the tensile strength (f_u) is 440 MPa.
2. For Grade 350 sections the tensile strength (f_u) is 480 MPa.
3. OneSteel-300PLUS hot rolled sections are produced to exceed the minimum requirements of AS/NZS 3679.1-300.
4. OneSteel-300PLUS replaced Grade 250 as the base grade for these sections in 1994.

Unequal Angles

n- and p-axes

Dimensions and Properties

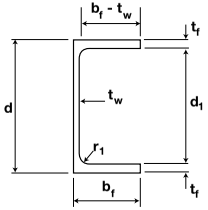


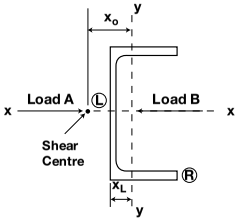


Designation	About n-axis							About p-axis							Product of 2nd Moment of Area
	l_n	p_B	Z_{nB}	p_T	Z_{nT}	S_n	r_n	l_p	n_L	Z_{pL}	n_R	Z_{pR}	S_p	r_p	I_{np}
mm mm mm	10^6mm^4	mm	10^3mm^3	mm	10^3mm^3	10^3mm^3	mm	10^6mm^4	mm	10^3mm^3	mm	10^3mm^3	10^3mm^3	mm	10^6mm^4
150 x 100 x 12 UA	6.52	49.1	133	101	64.6	117	47.7	2.34	24.3	96.2	75.7	30.9	56.0	28.6	-2.27
10 UA	5.29	48.1	110	102	51.9	94.0	48.0	1.91	23.3	81.9	76.7	24.9	44.7	28.8	-1.85
150 x 90 x 16 UA	7.97	52.5	152	97.5	81.7	145	47.4	2.15	22.7	94.9	67.3	32.0	59.5	24.6	-2.35
12 UA	6.29	51.0	123	99.0	63.5	114	47.8	1.72	21.2	81.0	68.8	25.0	45.7	25.0	-1.89
10 UA	5.10	50.0	102	100	51.0	91.5	48.2	1.41	20.2	69.5	69.8	20.2	36.5	25.3	-1.54
8 UA	4.26	49.2	86.6	101	42.3	76.0	48.4	1.18	19.6	60.4	70.4	16.8	30.1	25.5	-1.29
125 x 75 x 12 UA	3.54	43.3	81.8	81.7	43.3	77.3	39.6	0.958	18.4	52.0	56.6	16.9	31.4	20.6	-1.05
10 UA	2.88	42.3	68.2	82.7	34.9	62.5	39.9	0.789	17.5	45.2	57.5	13.7	25.1	20.9	-0.867
8 UA	2.41	41.5	58.1	83.5	28.9	52.0	40.1	0.664	16.8	39.6	58.2	11.4	20.7	21.0	-0.731
6 UA	1.89	40.7	46.5	84.3	22.5	40.6	40.3	0.524	16.0	32.7	59.0	8.89	16.0	21.2	-0.575
100 x 75 x 10 UA	1.55	31.8	48.6	68.2	22.6	41.3	31.3	0.743	19.4	38.3	55.6	13.4	24.3	21.7	-0.625
8 UA	1.30	31.1	41.8	68.9	18.8	34.4	31.5	0.626	18.7	33.5	56.3	11.1	20.2	21.9	-0.528
6 UA	1.02	30.3	33.7	69.7	14.6	26.9	31.7	0.494	17.9	27.5	57.1	8.67	15.7	22.0	-0.416
75 x 50 x 8 UA	0.511	25.2	20.3	49.8	10.3	18.5	23.6	0.181	12.8	14.1	37.2	4.86	8.96	14.0	-0.174
6 UA	0.407	24.4	16.7	50.6	8.05	14.6	23.8	0.145	12.1	12.0	37.9	3.84	6.98	14.2	-0.140
5 UA	0.321	23.8	13.5	51.2	6.27	11.4	23.9	0.115	11.5	10.0	38.5	3.00	5.41	14.3	-0.111
65 x 50 x 8 UA	0.341	21.1	16.2	43.9	7.75	14.1	20.1	0.174	13.6	12.7	36.4	4.78	8.74	14.4	-0.141
6 UA	0.272	20.4	13.4	44.6	6.10	11.1	20.3	0.140	12.9	10.8	37.1	3.77	6.85	14.6	-0.114
5 UA	0.215	19.8	10.9	45.2	4.75	8.70	20.5	0.111	12.4	8.96	37.6	2.95	5.32	14.7	-0.0903

Parallel Flange Channels

Dimensions and Properties



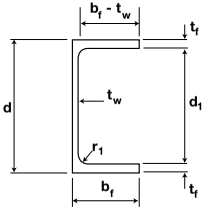


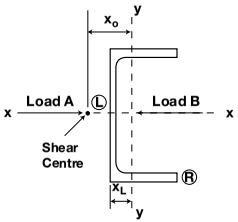
OneSteel-300PLUS

Designation	Mass per metre	Depth of Section	Flange Width	Flange Thick-ness	Web Thick-ness	Root Radii	Depth Between Flanges	$\frac{d_1}{t_w}$	$\frac{(b_f.t_w)}{2t_f}$	Gross Area of Cross Section	Coordi-nate of Centroid	Coordi-nate of Shear Centre	About x-axis				About y-axis				Torsion Constant	Warping Constant
		d	b_f	t_f	t_w	r_1	d_1			A_g	X_L	X_0	I_x	Z_x	S_x	r_x	I_y	Z_{yR}	Z_{yL}	S_y	r_y	J	I_w
		mm	mm	mm	mm	mm	mm			mm^2	mm	mm	10^6mm^4	10^3mm^3	10^3mm^3	mm	10^6mm^4	10^3mm^3	10^3mm^3	10^3mm^3	mm	10^3mm^4	10^9mm^6
380 x 100 PFC	55.2	380	100	17.5	10.0	14	345	34.5	5.14	7030	27.5	56.7	152	798	946	147.0	6.48	89.4	236.0	161.0	30.4	472.0	151.00
300 x 90 PFC	40.1	300	90	16.0	8.0	14	268	33.5	5.13	5110	27.2	56.1	72.4	483	564	119.0	4.04	64.4	148.0	117.0	28.1	290.0	58.20
250 x 90 PFC	35.5	250	90	15.0	8.0	12	220	27.5	5.47	4520	28.6	58.5	45.1	361	421	99.9	3.64	59.3	127.0	107.0	28.4	238.0	35.90
230 x 75 PFC	25.1	230	75	12.0	6.5	12	206	31.7	5.71	3200	22.6	46.7	26.8	233	271	91.4	1.76	33.6	77.8	61.0	23.5	108.0	15.00
200 x 75 PFC	22.9	200	75	12.0	6.0	12	176	29.3	5.75	2920	24.4	50.5	19.1	191	221	80.9	1.65	32.7	67.8	58.9	23.8	101.0	10.60
180 x 75 PFC	20.9	180	75	11.0	6.0	12	158	26.3	6.27	2660	24.5	50.3	14.1	157	182	72.9	1.51	29.9	61.5	53.8	23.8	81.4	7.82
150 x 75 PFC	17.7	150	75	9.5	6.0	10	131	21.8	7.26	2250	24.9	51.0	8.34	111	129	60.8	1.29	25.7	51.6	46.0	23.9	54.9	4.59
125 x 65 PFC	11.9	125	65	7.5	4.7	8	110	23.4	8.04	1520	21.8	45.0	3.97	63.5	73	51.1	0.658	15.2	30.2	27.2	20.8	23.1	1.64
100 x 50 PFC	8.31	100	50	6.7	4.2	8	86.6	20.6	6.84	1060	16.7	33.9	1.74	34.7	40.3	40.4	0.267	8.01	16.0	14.4	15.9	13.2	0.424
75 x 40 PFC	5.92	75	40	6.1	3.8	8	62.8	16.5	5.94	754	13.7	27.2	0.683	18.2	21.4	30.1	0.12	4.56	8.71	8.2	12.6	8.13	0.106

Parallel Flange Channels - *continued*

Properties for Assessing Section Capacity





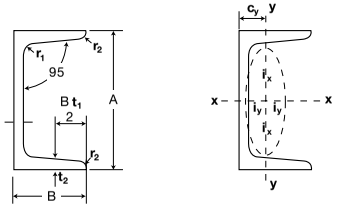
OneSteel-300PLUS				About x-axis	About y-axis		AS 3679.1-350				About x-axis	About y-axis	
Designation	Flange f_y MPa	Web f_y MPa	Form Factor k_f	Z_{ex} 10^3mm^3	Load A Z_{ey} 10^3mm^3	Load B Z_{ey} 10^3mm^3	Designation	Flange f_y MPa	Web f_y MPa	Form Factor k_f	Z_{ex} 10^3mm^3	Load A Z_{ey} 10^3mm^3	Load B Z_{ey} 10^3mm^3
380 x 100 PFC	280	320	1	946	115	134	380PFC	340	360	1	946	104	134
300 x 90 PFC	300	320	1	564	82.3	96.6	300PFC	340	360	1	564	77.2	96.6
250 x 90 PFC	300	320	1	421	88.7	89.0	250PFC	340	360	1	421	84.9	89.0
230 x 75 PFC	300	320	1	271	45.1	50.4	230PFC	340	360	1	271	42.6	50.4
200 x 75 PFC	300	320	1	221	46.7	49.1	200PFC	340	360	1	221	44.5	49.1
180 x 75 PFC	300	320	1	182	44.8	44.8	180PFC	340	360	1	182	44.1	44.8
150 x 75 PFC	320	320	1	129	38.5	38.5	150PFC	360	360	1	129	38.5	38.5
125 x 65 PFC	320	320	1	72.8	22.8	22.8	125PFC	360	360	1	72	22.5	22.8
100 x 50 PFC	320	320	1	40.3	12.0	12.0	100PFC	360	360	1	40.3	12.0	12.0
75 x 40 PFC	320	320	1	21.4	6.84	6.84	75PFC	360	360	1	21.4	6.84	6.84

Notes:

1. For OneSteel-300PLUS sections the tensile strength (f_u) is 440 MPa.
2. For Grade 350 sections the tensile strength (f_u) is 480 MPa.
3. OneSteel-300PLUS hot rolled sections are produced to exceed the minimum requirements of AS/NZS 3679.1-300.
4. OneSteel-300PLUS replaced Grade 250 as the base grade for these sections in 1994.

Taper Flange Channels

Properties for Assessing Section Capacity



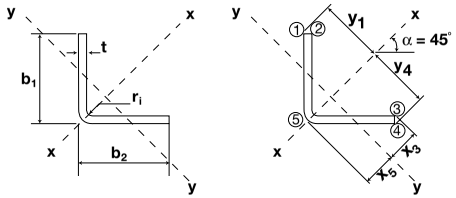
Designation A	B	Mass per metre	Thickness t_1	t_2	Corner Radius r_1	r_2	Area of Section	Centre of Gravity c_y	Moment of Inertia J_x	J_y	Radius of Gyration i_x	i_y	Modulus of Section Z_x	Z_y
mm	mm	kg/m	mm	mm	mm	mm	mm^2	mm	$10^6 mm^4$	$10^6 mm^4$	mm	mm	$10^3 mm^3$	$10^3 mm^3$
100 x 50 TFC		9.36	5	7.5	8	4	1192	15.5	1.89	0.269	39.8	15.0	37.8	7.82
70 X 40 TFC		6.92	5	7	8	4	882	12.7	0.759	0.124	29.3	11.9	20.2	4.54

DuraGal Equal Angles

x- and y-axes

Dimensions and Full Section Properties

Grade C450L0 / C400L0 (TS 100)



Designation Leg Size b_1	b_2	Nominal Thick-ness	Mass per metre	Actual Thickness t	Inside Corner Radius r_i	Co-ordinates of Centroid $y_1 = y_4$	$x_2 = x_3$	x_5	Full Area of Section A_f	About x-axis I_x	$Z_{x1} = Z_{x4}$	S_x	r_x	About y-axis I_y	$Z_{y2} = Z_{y3}$	Z_{y5}	S_y	r_y
mm	mm	mm	kg/m	mm	mm	mm	mm	mm	mm^2	$10^6 mm^4$	$10^3 mm^3$	$10^3 mm^3$	mm	$10^6 mm^4$	$10^3 mm^3$	$10^3 mm^3$	$10^3 mm^3$	mm
150 x 150 x		8.0 CA	18.0	8.0	8.0	106	53.5	51.6	2290	8.30	78.3	120	60.2	1.96	36.7	38.1	58.2	29.3
		5.0 CA	10.8	4.7	4.0	106	53.4	52.4	1380	5.04	47.6	72.4	60.6	1.23	23.0	23.4	35.6	29.9
125 x 125 x		8.0 CA	14.9	8.0	8.0	88.4	44.6	42.8	1890	4.73	53.5	82.7	50.0	1.11	24.7	25.8	39.6	24.1
		5.0 CA	8.95	4.7	4.0	88.4	44.5	43.6	1140	2.89	32.7	50.0	50.4	0.699	15.7	16.0	24.4	24.8
✦		4.0 CA	7.27	3.8	4.0	88.4	44.4	43.4	926	2.36	26.7	40.7	50.5	0.572	12.9	13.2	19.9	24.9
100 x 100 x		8.0 CA	11.7	8.0	8.0	70.7	35.8	33.9	1490	2.36	33.4	52.0	39.8	0.542	15.1	16.0	24.7	19.0
		6.0 CA	8.92	6.0	8.0	70.7	35.5	33.6	1140	1.83	25.8	39.8	40.1	0.421	11.9	12.5	19.0	19.3
90 x 90 x		8.0 CA	10.5	8.0	8.0	63.6	32.3	30.4	1330	1.70	26.7	41.7	35.7	0.386	12.0	12.7	19.7	17.0
✦		5.0 CA	6.37	4.7	4.0	63.6	32.2	31.2	811	1.06	16.6	25.5	36.1	0.252	7.83	8.06	12.4	17.6

✦ These items are not commonly stocked but are available on request. A minimum order quantity may apply on some sizes.

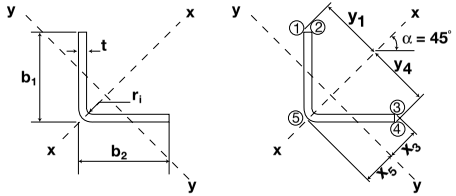
Notes:
1. Steel grade C450L0 / C400L0 / C350L0 (for $t \leq 2.5$ mm $f_y = 350$ MPa and $f_u = 400$ MPa, for 2.5 mm $< t \leq 6.0$ mm $f_y = 450$ MPa and $f_u = 500$ MPa, and for $t > 6.0$ mm $f_y = 400$ MPa and $f_u = 450$ MPa)
2. Full section properties are calculated in accordance with AS/NZS 4600.

DuraGal Equal Angles

x- and y-axes

Dimensions and Full Section Properties

Grade C450L0 / C400L0 / C350L0 (TS 100)



Designation Leg b_1	Size b_2	Nominal Thickness	Mass per metre	Actual Thickness t	Inside Corner Radius r_i	Co-ordinates of Centroid $y_1 = y_4$	$x_2 = x_3$	x_5	Full Area of Section A_f	About x-axis I_x	$Z_{x1} = Z_{x4}$	S_x	r_x	About y-axis I_y	$Z_{y2} = Z_{y3}$	Z_{y5}	S_y	r_y
mm	mm	mm	kg/m	mm	mm	mm	mm	mm	mm^2	10^6mm^4	10^3mm^3	10^3mm^3	mm	10^6mm^4	10^3mm^3	10^3mm^3	10^3mm^3	mm
75 x 75 x		8.0 CA	8.59	8.0	8.0	53.0	26.9	25.1	1090	0.957	18.0	28.4	29.6	0.213	7.89	8.46	13.2	13.9
		6.0 CA	6.56	6.0	8.0	53.0	26.7	24.8	836	0.747	14.1	21.9	29.9	0.167	6.26	6.73	10.2	14.1
		5.0 CA	5.26	4.7	4.0	53.0	26.8	25.9	670	0.601	11.3	17.5	30.0	0.142	5.29	5.48	8.44	14.6
		4.0 CA	4.29	3.8	4.0	53.0	26.7	25.8	546	0.495	9.34	14.3	30.1	0.117	4.39	4.55	6.93	14.7
65 x 65 x		6.0 CA	5.62	6.0	8.0	46.0	23.1	21.3	716	0.477	10.4	16.2	25.8	0.104	4.52	4.91	7.50	12.1
		5.0 CA	4.52	4.7	4.0	46.0	23.3	22.4	576	0.386	8.39	13.0	25.9	0.0902	3.87	4.03	6.24	12.5
		4.0 CA	3.69	3.8	4.0	46.0	23.2	22.2	470	0.318	6.93	10.7	26.0	0.0747	3.22	3.36	5.13	12.6
50 x 50 x		6.0 CA	4.21	6.0	8.0	35.4	17.8	16.0	536	0.208	5.89	9.29	19.7	0.0434	2.44	2.71	4.18	9.00
		5.0 CA	3.42	4.7	4.0	35.4	18.0	17.1	435	0.170	4.80	7.53	19.8	0.0389	2.16	2.28	3.56	9.45
		4.0 CA	2.79	3.8	4.0	35.4	17.9	16.9	356	0.141	3.99	6.20	19.9	0.0324	1.81	1.91	2.94	9.54
		2.5 CA	1.81	2.4	2.5	35.4	17.8	17.2	230	0.0930	2.63	4.04	20.1	0.0221	1.24	1.28	1.95	9.79
45 x 45 x		4.0 CA	2.50	3.8	4.0	31.8	16.1	15.2	318	0.102	3.19	4.98	17.9	0.0231	1.43	1.52	2.35	8.52
		2.5 CA	1.62	2.4	2.5	31.8	16.0	15.4	206	0.0673	2.11	3.25	18.1	0.0159	0.990	1.03	1.57	8.77
40 x 40 x		4.0 CA	2.20	3.8	4.0	28.3	14.3	13.4	280	0.0702	2.48	3.89	15.8	0.0157	1.10	1.17	1.82	7.50
		2.5 CA	1.43	2.4	2.5	28.3	14.3	13.7	182	0.0468	1.65	2.55	16.0	0.0110	0.768	0.801	1.22	7.75
30 x 30 x		2.5 CA	1.06	2.4	2.5	21.2	10.7	10.2	134	0.0191	0.902	1.40	11.9	0.00438	0.408	0.431	0.664	5.71

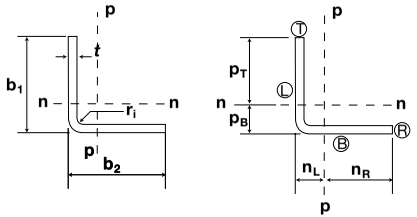
Notes:
1. Steel grade C450L0 / C400L0 / C350L0 (for $t \leq 2.5$ mm $f_y = 350$ MPa and $f_u = 400$ MPa, for 2.5 mm $< t \leq 6.0$ mm $f_y = 450$ MPa and $f_u = 500$ MPa, and for $t > 6.0$ mm $f_y = 400$ MPa and $f_u = 450$ MPa)
2. Full section properties are calculated in accordance with AS/NZS 4600.

DuraGal Equal Angles

n- and p-axes

Dimensions and Full Section Properties

Grade C450L0/C400L0 (TS 100)



Designation Leg b_1	Size b_2	Normal Thickness	Mass per metre	Actual Thickness t	Inside Corner Radius r_i	Co-ordinates of Centroid $p_{B=}n_L$	$p_{T=}n_R$	Full Area of Section A_f	About n- and p- axes $I_{n=}I_p$	$Z_{nB=}Z_{pL}$	$Z_{nT=}Z_{pR}$	$S_{n=}S_p$	$r_{n=}r_p$	Product of 2nd Moment of Area I_{np}
mm	mm	mm	kg/m	mm	mm	mm	mm	mm^2	10^6mm^4	10^3mm^3	10^3mm^3	10^3mm^3	mm	10^6mm^4
150 x 100 x		8.0 CA	18.0	8.0	8.0	41.2	109	2290	5.13	125	47.2	85.2	47.3	-3.17
		5.0 CA	10.8	4.7	4.0	39.6	110	1380	3.14	79.1	28.4	51.2	47.7	-1.91
125 x 125 x		8.0 CA	14.9	8.0	8.0	34.9	90.1	1890	2.92	83.5	32.4	58.5	39.2	-1.81
		5.0 CA	8.95	4.7	4.0	33.4	91.6	1140	1.80	53.8	19.6	35.3	39.7	-1.10
✦		4.0 CA	7.27	3.8	4.0	33.0	92.0	926	1.47	44.5	16.0	28.8	39.8	-0.896
100 x 100 x		8.0 CA	11.7	8.0	8.0	28.7	71.3	1490	1.45	50.6	20.4	36.8	31.2	-0.910
		6.0 CA	8.92	6.0	8.0	27.9	72.1	1140	1.12	40.3	15.6	28.2	31.5	-0.703
90 x 90 x		8.0 CA	10.5	8.0	8.0	26.2	63.8	1330	1.04	39.8	16.3	29.5	27.9	-0.657
✦		5.0 CA	6.37	4.7	4.0	24.6	65.4	811	0.654	26.6	10.0	18.0	28.4	-0.402

✦ These items are not commonly stocked but are available on request. A minimum order quantity may apply on some sizes.

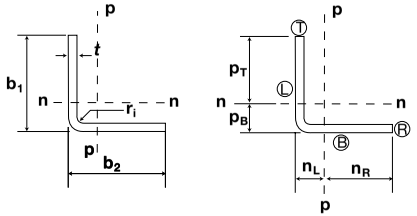
Notes:
1. Steel grade C450L0 / C400L0 / C350L0 (for $t \leq 2.5$ mm f_y = 350 MPa and f_u = 400 MPa, for 2.5 mm < $t \leq 6.0$ mm f_y = 450 MPa and f_u = 500 MPa, and for $t > 6.0$ mm f_y = 400 MPa and f_u = 450 MPa)
2. Full section properties are calculated in accordance with AS/NZS 4600.

DuraGal Equal Angles

n- and p-axes

Dimensions and Full Section Properties

Grade C450L0 / C400L0 / C350L0 (TS 100)



Designation Leg b_1	Size b_2	Nominal Thick-ness	Mass per metre	Actual Thickness t	Inside Corner Radius r_i	Co-ordinates of Centroid $p_B = n_L$	$p_T = n_R$	Full Area of Section A_f	About n- and p- axes $I_n = I_p$	$Z_{nB} = Z_{pL}$	$Z_{nT} = Z_{pR}$	$S_n = S_p$	$r_n = r_p$	Product of 2nd Moment of Area I_{np}
mm	mm	mm	kg/m	mm	mm	mm	mm	mm^2	10^6mm^4	10^3mm^3	10^3mm^3	10^3mm^3	mm	10^6mm^4
75 x 75 x		8.0 CA	8.59	8.0	8.0	22.5	52.5	1090	0.585	26.0	11.1	20.1	23.1	-0.372
		6.0 CA	6.56	6.0	8.0	21.7	53.3	836	0.457	21.1	8.57	15.5	23.4	-0.290
		5.0 CA	5.26	4.7	4.0	20.9	54.1	670	0.372	17.8	6.86	12.4	23.5	-0.230
		4.0 CA	4.29	3.8	4.0	20.5	54.5	546	0.306	14.9	5.62	10.1	23.7	-0.189
65 x 65 x		6.0 CA	5.62	6.0	8.0	19.2	45.8	716	0.291	15.2	6.35	11.5	20.2	-0.186
		5.0 CA	4.52	4.7	4.0	18.4	46.6	576	0.238	13.0	5.10	9.22	20.3	-0.148
		4.0 CA	3.69	3.8	4.0	18.0	47.0	470	0.197	10.9	4.18	7.56	20.5	-0.122
50 x 50 x		6.0 CA	4.21	6.0	8.0	15.4	34.6	536	0.126	8.15	3.64	6.59	15.3	-0.0823
		5.0 CA	3.42	4.7	4.0	14.6	35.4	435	0.104	7.14	2.95	5.33	15.5	-0.0655
		4.0 CA	2.79	3.8	4.0	14.3	35.7	356	0.0868	6.08	2.43	4.39	15.6	-0.0544
		2.5 CA	1.81	2.4	2.5	13.6	36.4	230	0.0576	4.23	1.58	2.86	15.8	-0.0355
45 x 45 x		4.0 CA	2.50	3.8	4.0	13.0	32.0	318	0.0623	4.79	1.95	3.52	14.0	-0.0392
		2.5 CA	1.62	2.4	2.5	12.4	32.6	206	0.0416	3.36	1.27	2.30	14.2	-0.0257
40 x 40 x		4.0 CA	2.20	3.8	4.0	11.8	28.2	280	0.0430	3.65	1.52	2.75	12.4	-0.0272
		2.5 CA	1.43	2.4	2.5	11.1	28.9	182	0.0289	2.60	0.999	1.80	12.6	-0.0179
30 x 30 x		2.5 CA	1.06	2.4	2.5	8.61	21.4	134	0.0118	1.37	0.550	0.994	9.35	-0.00738

Notes:

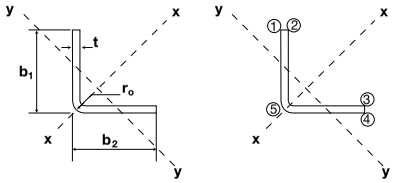
1. Steel grade C450L0 / C400L0 / C350L0 (for $t \leq 2.5$mm f_y = 350 MPa and f_u = 400 MPa, for 2.5mm < $t \leq$ 6.0mm f_y = 450 MPa and f_u = 500 MPa, and for t > 6.0mm f_y = 400 MPa and f_u = 450 MPa).
2. Full section properties are calculated in accordance with AS/NZS 4600.

DuraGal Equal Angles

x- and y-axes

Effective Section Properties

Grade C450L0 / C400L0 (TS 100)



Dimensions						Ratios		Grade	Effective Section Properties								
Designation											About x-axis		About y-axis				
Leg Size		Nominal Thick-ness	Mass per metre	Actual Thickness	Outside Corner Radius	$\frac{b_1 - r_o}{t}$	$\frac{b_2 - r_o}{t}$	Yield Stress	Effective Area of Section	$\frac{A_e}{A_f}$							
b_1	b_2			t	r_o			f_y	A_e		$I_{ex1} = I_{ex4}$	$Z_{ex1} = Z_{ex4}$	$I_{ey2,3}$	$Z_{ey2,3}$	I_{ey5}	Z_{ey5}
mm	mm	mm	kg/m	mm	mm			MPa	mm^2		$10^6 mm^4$	$10^3 mm^3$	$10^6 mm^4$	$10^3 mm^3$	$10^6 mm^4$	$10^3 mm^3$
150 x 150 x		8.0 CA	18.0	8.0	16.0	16.8	16.8	400	1610	0.701	5.74	60.8	1.56	31.4	1.96	36.7
		5.0 CA	10.8	4.7	8.7	30.1	30.1	450	572	0.416	1.99	25.3	0.544	13.2	1.23	23.0
125 x 125 x		8.0 CA	14.9	8.0	16.0	13.6	13.6	400	1530	0.809	3.90	46.9	1.05	23.9	1.11	24.7
		5.0 CA	8.95	4.7	8.7	24.7	24.7	450	560	0.491	1.34	19.4	0.368	10.2	0.699	15.7
✦		4.0 CA	7.27	3.8	7.8	30.8	30.8	450	379	0.409	0.917	14.0	0.248	7.31	0.572	12.9
100 x 100 x		8.0 CA	11.7	8.0	16.0	10.5	10.5	400	1410	0.946	2.36	33.4	0.542	15.1	0.542	15.1
		6.0 CA	8.92	6.0	14.0	14.3	14.3	450	859	0.756	1.38	21.3	0.363	10.7	0.421	11.9
90 x 90 x		8.0 CA	10.5	8.0	16.0	9.25	9.25	400	1330	1.00	1.70	26.7	0.386	12.0	0.386	12.0
✦		5.0 CA	6.37	4.7	8.7	17.3	17.3	450	530	0.654	0.672	12.2	0.185	6.33	0.252	7.83

✦ These items are not commonly stocked but are available on request. A minimum order quantity may apply on some sizes.

Notes:

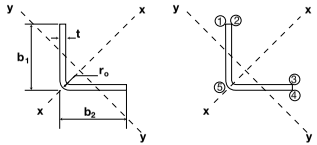
1. Steel grade C450L0 / C400L0 / C350L0 (for $t \leq 2.5$mm $f_y = 350$ MPa and $f_u = 400$ MPa, for 2.5mm $< t \leq 6.0$mm $f_y = 450$ MPa and $f_u = 500$ MPa, and for $t > 6.0$mm $f_y =$ 400 MPa and $f_u = 450$ MPa).
2. A_e is calculated for sections with uniform axial compressive stress f_y.
3. I_e and Z_e are calculated with the extreme compression or tension fibres at f_y (first yield). Z_e is calculated at the extreme tension or compression fibre of the effective section.
4. I_{ex1} and Z_{ex1} are for compression at point "1"; I_{ex4} and Z_{ex4} are for compression at point "4"; $I_{ey2,3}$ and $Z_{ey2,3}$ are for compression at points "2" and "3"; I_{ey5} and Z_{ey5} are for compression at point "5".
5. Effective section properties are calculated in accordance with AS/NZS 4600.

DuraGal Equal Angles

x- and y-axes

Effective Section Properties

Grade C450L0 / C400L0 / C350L0(TS 100)



Dimensions						Ratios		Grade			Effective Section Properties					
Designation Leg Size b_1	b_2	Nominal Thick-ness	Mass per metre	Actual Thickness t	Outside Corner Radius r_o	$\frac{b_1 - r_o}{t}$	$\frac{b_2 - r_o}{t}$	Yield Stress f_y	Effective Area of Section A_e	$\frac{A_e}{A_f}$	About x-axis		About y-axis			
											$I_{ex1} = I_{ex4}$	$Z_{ex1} = Z_{ex4}$	$I_{ey2,3}$	$Z_{ey2,3}$	I_{ey5}	Z_{ey5}
mm	mm	mm	kg/m	mm	mm			MPa	mm^2		$10^6 mm^4$	$10^3 mm^3$	$10^6 mm^4$	$10^3 mm^3$	$10^6 mm^4$	$10^3 mm^3$
75 x 75 x		8.0 CA	8.59	8.0	16.0	7.38	7.38	400	1090	1.00	0.957	18.0	0.213	7.89	0.213	7.89
		6.0 CA	6.56	6.0	14.0	10.2	10.2	450	781	0.934	0.735	13.9	0.167	6.26	0.167	6.26
		5.0 CA	5.26	4.7	8.7	14.1	14.1	450	508	0.759	0.458	9.41	0.125	4.84	0.142	5.29
		4.0 CA	4.29	3.8	7.8	17.7	17.7	450	353	0.646	0.310	6.78	0.0840	3.49	0.117	4.39
65 x 65 x		6.0 CA	5.62	6.0	14.0	8.50	8.5	450	716	1.00	0.477	10.4	0.104	4.52	0.104	4.52
		5.0 CA	4.52	4.7	8.7	12.0	12.0	450	487	0.846	0.337	7.65	0.0902	3.87	0.0902	3.87
		4.0 CA	3.69	3.8	7.8	15.1	15.1	450	342	0.727	0.230	5.54	0.0619	2.83	0.0747	3.22
50 x 50 x		6.0 CA	4.21	6.0	14.0	6.00	6.00	450	536	1.00	0.208	5.89	0.0434	2.44	0.0434	2.44
		5.0 CA	3.42	4.7	8.7	8.79	8.79	450	435	1.00	0.170	4.80	0.0389	2.16	0.0389	2.16
		4.0 CA	2.79	3.8	7.8	11.1	11.1	450	316	0.888	0.131	3.78	0.0324	1.81	0.0324	1.81
		2.5 CA	1.81	2.4	4.9	18.8	18.8	350	156	0.676	0.0615	1.98	0.0169	1.03	0.0221	1.24
45 x 45 x		4.0 CA	2.50	3.8	7.8	9.79	9.79	450	303	0.952	0.102	3.19	0.0231	1.43	0.0231	1.43
		2.5 CA	1.62	2.4	4.9	16.7	16.7	350	152	0.736	0.0494	1.71	0.0135	0.884	0.0159	0.990
40 x 40 x		4.0 CA	2.20	3.8	7.8	8.47	8.47	450	280	1.00	0.0702	2.48	0.0157	1.10	0.0157	1.10
		2.5 CA	1.43	2.4	4.9	14.6	14.6	350	147	0.806	0.0385	1.45	0.0104	0.740	0.0110	0.768
30 x 30 x		2.5 CA	1.06	2.4	4.9	10.5	10.5	350	132	0.980	0.0191	0.902	0.00438	0.408	0.00438	0.408

Notes:

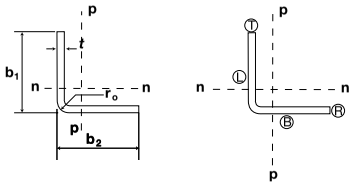
1. Steel grade C450L0 / C400L0 / C350L0 (for $t \leq 2.5$mm $f_y = 350$ MPa and $f_u = 400$ MPa, for 2.5mm $< t \leq 6.0$mm $f_y = 450$ MPa and $f_u = 500$ MPa, and for $t > 6.0$mm $f_y = 400$ MPa and $f_u = 450$ MPa).
2. A_e is calculated for sections with uniform axial compressive stress f_y.
3. I_e and Z_e are calculated with the extreme compression or tension fibres at f_y (first yield). Z_e is calculated at the extreme tension or compression fibre of the effective section.
4. I_{ex1} and Z_{ex1} are for compression at point "1"; I_{ex4} and Z_{ex4} are for compression at point "4"; $I_{ey2,3}$ and $Z_{ey2,3}$ are for compression at points "2" and "3"; I_{ey5} and Z_{ey5} are for compression at point "5".
5. Effective section properties are calculated in accordance with AS/NZS 4600.

DuraGal Equal Angles

n- and p-axes

Effective Section Properties

Grade C450L0 / C400L0 (TS 100)



Dimensions						Ratios		Grade			Effective Section Properties			
Designation Leg b_1	Size b_2	Nominal Thickness	Mass per metre	Actual Thickness t	Outside Corner Radius r_o	$\frac{b_1 - r_o}{t}$	$\frac{b_2 - r_o}{t}$	Yield Stress f_y	Effective Area of Section A_e	$\frac{A_e}{A_f}$	About n- and p- axis $I_{enT} = I_{epR}$	$Z_{enT} = Z_{epR}$	$I_{enB} = I_{epL}$	$Z_{enB} = Z_{epL}$
mm	mm	mm	kg/m	mm	mm			MPa	mm^2		$10^6 mm^4$	$10^3 mm^3$	$10^6 mm^4$	$10^3 mm^3$
150 x	150 x	8.0 CA	18.0	8.0	16.0	16.8	16.8	400	1610	0.701	3.17	33.8	5.04	46.8
		5.0 CA	10.8	4.7	8.7	30.1	30.1	450	572	0.416	0.791	11.0	2.57	25.9
125 x	125 x	8.0 CA	14.9	8.0	16.0	13.6	13.6	400	1530	0.809	2.34	27.8	2.92	32.4
		5.0 CA	8.95	4.7	8.7	24.7	24.7	450	560	0.491	0.594	9.13	1.57	18.4
✦		4.0 CA	7.27	3.8	7.8	30.8	30.8	450	379	0.409	0.357	6.01	1.20	14.5
100 x	100 x	8.0 CA	11.7	8.0	16.0	10.5	10.5	400	1410	0.946	1.45	20.4	1.45	20.4
		6.0 CA	8.92	6.0	14.0	14.3	14.3	450	859	0.756	0.782	12.1	1.12	15.6
90 x	90 x	8.0 CA	10.5	8.0	16.0	9.25	9.25	400	1330	1.00	1.04	16.3	1.04	16.3
✦		5.0 CA	6.37	4.7	8.7	17.3	17.3	450	530	0.654	0.357	6.58	0.629	9.83

✦ These items are not commonly stocked but are available on request. A minimum order quantity may apply on some sizes.

Notes:

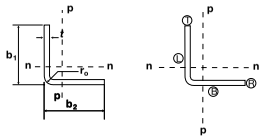
1. Steel grade C450L0 / C400L0 / C350L0 (for $t \leq 2.5$mm $f_y = 350$ MPa and $f_u = 400$ MPa, for 2.5mm $< t \leq 6.0$mm $f_y = 450$ MPa and $f_u = 500$ MPa, and for $t > 6.0$mm $f_y = 400$ MPa and $f_u = 450$ MPa).
2. A_e is calculated for sections with uniform axial compressive stress f_y.
3. I_e and Z_e are calculated with the extreme compression or tension fibres at f_y (first yield). Z_e is calculated at the extreme tension or compression fibre of the effective section.
4. I_{enT} and Z_{enT} are for compression at point "T"; I_{enB} and Z_{enB} are for compression at point "B"; I_{epR} and Z_{epR} are for compression at point "R"; I_{epL} and Z_{epL} are for compression at point "L".
5. Effective section properties are calculated in accordance with AS/NZS 4600.

DuraGal Equal Angles

n- and p-axes

Effective Section Properties

Grade C450L0 / C400L0 / C350L0(TS 100)



Dimensions							Ratios		Grade			Effective Section Properties				
Designation			Mass per metre	Actual Thickness	Outside Corner Radius				Yield Stress	Effective Area of Section		About n- and p- axis				
Leg b_1	Size b_2	Nominal Thick-ness		t	r_o		$\frac{b_1 - r_o}{t}$	$\frac{b_2 - r_o}{t}$	f_y	A_e	$\frac{A_e}{A_f}$	$I_{enT} = I_{epR}$	$Z_{enT} = Z_{epR}$	$I_{enB} = I_{epL}$	$Z_{enB} = Z_{epL}$	
mm	mm	mm	kg/m	mm	mm				MPa	mm^2		$10^6 mm^4$	$10^3 mm^3$	$10^6 mm^4$	$10^3 mm^3$	
75 x 75 x		8.0 CA	8.59	8.0	16.0		7.38	7.38	400	1090	1.00	0.585	11.1	0.585	11.1	
		6.0 CA	6.56	6.0	14.0		10.2	10.2	450	781	0.934	0.457	8.57	0.457	8.57	
		5.0 CA	5.26	4.7	8.7		14.1	14.1	450	508	0.759	0.266	5.45	0.372	6.86	
		4.0 CA	4.29	3.8	7.8		17.7	17.7	450	353	0.646	0.162	3.62	0.293	5.51	
65 x 65 x		6.0 CA	5.62	6.0	14.0		8.50	8.5	450	716	1.00	0.291	6.35	0.291	6.35	
		5.0 CA	4.52	4.7	8.7		12.0	12.0	450	487	0.846	0.208	4.65	0.238	5.10	
		4.0 CA	3.69	3.8	7.8		15.1	15.1	450	342	0.727	0.129	3.13	0.195	4.17	
50 x 50 x		6.0 CA	4.21	6.0	14.0		6.00	6.00	450	536	1.00	0.126	3.64	0.126	3.64	
		5.0 CA	3.42	4.7	8.7		8.79	8.79	450	435	1.00	0.104	2.95	0.104	2.95	
		4.0 CA	2.79	3.8	7.8		11.1	11.1	450	316	0.888	0.0821	2.34	0.0868	2.43	
		2.5 CA	1.81	2.4	4.9		18.8	18.8	350	156	0.676	0.0333	1.08	0.0560	1.56	
45 x 45 x		4.0 CA	2.50	3.8	7.8		9.79	9.79	450	303	0.952	0.0623	1.95	0.0623	1.95	
		2.5 CA	1.62	2.4	4.9		16.7	16.7	350	152	0.736	0.0281	0.972	0.0414	1.27	
40 x 40 x		4.0 CA	2.20	3.8	7.8		8.47	8.47	450	280	1.00	0.0430	1.52	0.0430	1.52	
		2.5 CA	1.43	2.4	4.9		14.6	14.6	350	147	0.806	0.0231	0.856	0.0289	0.999	
30 x 30 x		2.5 CA	1.06	2.4	4.9		10.5	10.5	350	132	0.980	0.0118	0.550	0.0118	0.550	

Notes:

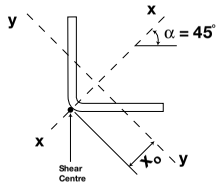
1. Steel grade C450L0 / C400L0 / C350L0 (for $t \leq 2.5$mm $f_y = 350$ MPa and $f_u = 400$ MPa, for 2.5mm $< t \leq 6.0$mm $f_y = 450$ MPa and $f_u = 500$ MPa, and for $t > 6.0$mm $f_y = 400$ MPa and $f_u = 450$ MPa).
2. A_e is calculated for sections with uniform axial compressive stress f_y.
3. I_e and Z_e are calculated with the extreme compression or tension fibres at f_y (first yield). Z_e is calculated at the extreme tension or compression fibre of the effective section.
4. I_{enT} and Z_{enT} are for compression at point "T"; I_{enB} and Z_{enB} are for compression at point "B"; I_{epR} and Z_{epR} are for compression at point "R"; I_{epL} and Z_{epL} are for compression at point "L".
5. Effective section properties are calculated in accordance with AS/NZS 4600.

DuraGal Equal Angles

x- and y-axes

Section Properties for Member Stability

Grade C450L0 / C400L0 / C350L0 (TS 100)



Designation Leg b_1	Size b_2	Nominal Thick-ness	Mass per metre	Torsion Constant J	Coordinate of Shear Centre x_0	Polar Radius of Gyration about the Shear Centre r_{01}	Monosymmetry Section Constant β_y
mm	mm	mm	kg/m	10^3mm^4	mm	mm	mm
150 x 150 x		8.0 CA	18.0	49.0	51.6	84.3	206
		5.0 CA	10.8	10.1	52.2	85.2	209
125 x 125 x		8.0 CA	14.9	40.4	42.8	69.9	171
		5.0 CA	8.95	8.39	43.4	70.8	173
✦		4.0 CA	7.27	4.46	43.5	71.1	174
100 x 100 x		8.0 CA	11.7	31.9	33.9	55.4	136
		6.0 CA	8.92	13.6	34.3	56.0	137
90 x 90 x		8.0 CA	10.5	28.5	30.4	49.7	122
✦		5.0 CA	6.37	5.97	31.0	50.6	124
75 x 75 x		8.0 CA	8.59	23.4	25.1	41.0	100
		6.0 CA	6.56	10.0	25.5	41.6	102
		5.0 CA	5.26	4.93	25.7	41.9	103
		4.0 CA	4.29	2.63	25.8	42.2	103
65 x 65 x		6.0 CA	5.62	8.59	21.9	35.8	87.7
		5.0 CA	4.52	4.24	22.2	36.2	88.6
		4.0 CA	3.69	2.26	22.3	36.4	89.2
50 x 50 x		6.0 CA	4.21	6.43	16.6	27.1	66.5
		5.0 CA	3.42	3.20	16.8	27.5	67.4
		4.0 CA	2.79	1.71	17.0	27.8	68.0
		2.5 CA	1.81	0.442	17.3	28.2	69.0
45 x 45 x		4.0 CA	2.50	1.53	15.2	24.9	61.0
		2.5 CA	1.62	0.396	15.5	25.3	61.9
40 x 40 x		4.0 CA	2.20	1.35	13.5	22.0	53.9
		2.5 CA	1.43	0.350	13.7	22.4	54.9
30 x 30 x		2.5 CA	1.06	0.258	10.2	16.6	40.7

✦ These items are not commonly stocked but are available on request. A minimum order quantity may apply on some sizes.

Notes:

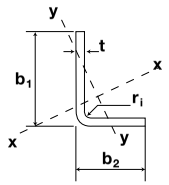
1. Steel grade C450L0 / C400L0 / C350L0 (for $t \le 2.5$mm $f_y = 350$ MPa and $f_u = 400$ MPa, for 2.5mm $< t \le 6.0$mm $f_y = 450$ MPa and $f_u = 500$ MPa, and for $t > 6.0$mm $f_y = 400$ MPa and $f_u = 450$ MPa).
2. With the exception of J, properties are calculated assuming a simplified shape where the bends are eliminated and the section is represented by straight mid-lines in accordance with Clause 2.1.2.1 of AS/NZS 4600.
3. β_x is zero for equal angles.
4. I_w is equal to zero for angles.
5. The shear centre is assumed to be located at the intersection of the centre lines of the angle legs.

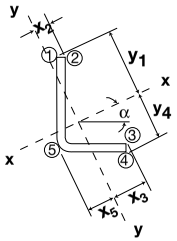
DuraGal Unequal Angles

x- and y-axes

Dimensions and Full Section Properties

Grade C450L0 (TS 100)





Designation Leg b_1	Size b_2	Nominal Thickness	Mass per metre	Actual Thickness t	Inside Corner Radius r_i	Coordinates of Centroid y_1	y_4	x_2	x_3	x_5	Tan α	Full Area of Section A_f	About x-axis I_x	Z_{x1}	Z_{x4}	S_x	r_x	About y-axis I_y	Z_{y2}	Z_{y3}	Z_{y5}	S_y	r_y
mm	mm	mm	kg/m	mm	mm	mm	mm	mm	mm	mm		mm^2	10^6mm^4	10^3mm^3	10^3mm^3	10^3mm^3	mm	10^6mm^4	10^3mm^3	10^3mm^3	10^3mm^3	10^3mm^3	mm
✦ 75 x 50 x		6.0 CA	5.38	6.0	8.0	50.0	39.2	14.9	25.3	17.8	0.472	686	0.464	9.29	11.9	15.7	26.0	0.0731	4.89	2.89	4.10	5.97	10.3
✦		5.0 CA	4.34	4.7	4.0	50.6	38.4	14.4	26.1	18.5	0.462	553	0.378	7.47	9.83	12.7	26.2	0.0631	4.38	2.42	3.42	4.96	10.7
✦		4.0 CA	3.54	3.8	4.0	50.8	38.3	14.1	26.1	18.3	0.464	451	0.312	6.15	8.15	10.4	26.3	0.0524	3.71	2.01	2.87	4.08	10.8

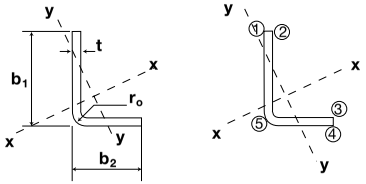
✦ DuraGal Unequal Angles are not a common stock item but sizes 100 x 75, 125 x 75, 150 x 100 in 6 or 8mm wall thickness are also available on request. A minimum order quantity may apply on some sizes. Please contact your local Steel & Tube branch for information and availability on these sizes.

Notes:

1. Steel grade C450L0 / C400L0 / C350L0 (for $t \leq 2.5$mm $f_y = 350$ MPa and $f_u = 400$ MPa, for 2.5mm $< t \leq 6.0$mm $f_y = 450$ MPa and $f_u = 500$ MPa, and for $t > 6.0$mm $f_y = 400$ MPa and $f_u = 450$ MPa).
2. Full section properties are calculated in accordance with AS/NZS 4600.

DuraGal Unequal Angles - *continued*

x- and y-axes



Effective Section Properties

Grade C450L0 (TS 100)

Dimensions						Ratios		Grade			Effective Section Properties							
Designation			Mass per metre	Actual Thickness	Outside Corner Radius			Yield Stress	Effective Area of Section		About x-axis				About y-axis			
Leg b_1	Size b_2	Nominal Thick-ness		t	r_o	$\frac{b_1 - r_o}{t}$	$\frac{b_2 - r_o}{t}$	f_y	A_e	$\frac{A_e}{A_f}$	I_{ex1}	Z_{ex1}	I_{ex4}	Z_{ex4}	$I_{ey2,3}$	$Z_{ey2,3}$	I_{ey5}	Z_{ey5}
mm	mm	mm	kg/m	mm	mm			MPa	mm^2		$10^6 mm^4$	$10^3 mm^3$	$10^6 mm^4$	$10^3 mm^3$	$10^6 mm^4$	$10^3 mm^3$	$10^6 mm^4$	$10^3 mm^3$
✦ 75	x 50	x 6.0 CA	5.38	6.0	14.0	10.2	6.00	450	658	0.960	0.464	9.29	0.464	9.29	0.0731	2.89	0.0731	2.89
✦		5.0 CA	4.34	4.7	8.7	14.1	8.79	450	472	0.854	0.286	6.17	0.378	7.47	0.0631	2.42	0.0631	2.42
✦		4.0 CA	3.54	3.8	7.8	17.7	11.1	450	334	0.741	0.185	4.30	0.309	6.10	0.0520	1.99	0.0524	2.01

✦ DuraGal Unequal Angles are not a common stock item but sizes 100 x 75, 125 x 75, 150 x 100 in 6 or 8mm wall thickness are also available on request. A minimum order quantity may apply on some sizes. Please contact your local Steel & Tube branch for information and availability on these sizes.

Notes:

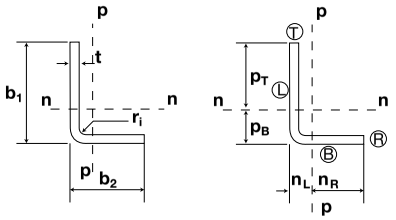
1. Steel grade C450L0 / C400L0 / C350L0 (for $t \leq 2.5$mm $f_y = 350$ MPa and $f_u = 400$ MPa, for 2.5mm $< t \leq 6.0$mm $f_y = 450$ MPa and $f_u = 500$ MPa, and for $t > 6.0$mm $f_y = 400$ MPa and $f_u = 450$ MPa).
2. A_e is calculated for sections with uniform axial compressive stress f_y.
3. I_e and Z_e are calculated with the extreme compression or tension fibres at f_y (first yield). Z_e is calculated at the extreme tension or compression fibre of the effective section.
4. I_{ex1} and Z_{ex1} are for compression at point "1"; I_{ex4} and Z_{ex4} are for compression at point "4"; $I_{ey2,3}$ and $Z_{ey2,3}$ are for compression at points "2" and "3"; I_{ey5} and Z_{ey5} are for compression at point "5".
5. Effective section properties are calculated in accordance with AS/NZS 4600.

DuraGal Unequal Angles

n- and p-axes

Dimensions and Full Section Properties

Grade C450L0 (TS 100)



	Designation Leg b_1	Size b_2	Nominal Thick-ness	Mass per metre	Dimensions: Coordinates of Centroid p_B	p_T	n_L	n_R	Full Area of Section A_f	Section Properties: About n-axis I_n	Z_{nB}	Z_{nT}	S_n	r_n	About p-axis I_p	Z_{pL}	Z_{pR}	S_p	r_p	Product of 2nd Moment of Area I_{np}
	mm	mm	mm	kg/m	mm	mm	mm	mm	mm^2	10^6mm^4	10^3mm^3	10^3mm^3	10^3mm^3	mm	10^6mm^4	10^3mm^3	10^3mm^3	10^3mm^3	mm	10^6mm^4
✦	75 x	50 x	6.0 CA	5.38	25.7	49.3	12.7	37.3	686	0.393	15.3	7.98	14.2	23.9	0.144	11.4	3.87	6.97	14.5	-0.151
✦			5.0 CA	4.34	24.8	50.2	12.0	38.0	553	0.323	13.0	6.43	11.5	24.2	0.119	9.86	3.12	5.56	14.6	-0.120
✦			4.0 CA	3.54	24.4	50.6	11.7	38.3	451	0.266	10.9	5.26	9.43	24.3	0.0983	8.44	2.57	4.54	14.8	-0.0991

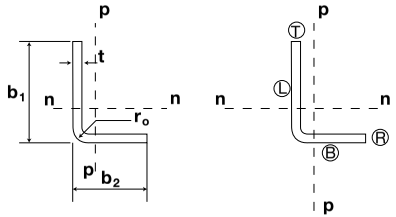
✦ DuraGal Unequal Angles are not a common stock item but sizes 100 x 75, 125 x 75, 150 x 100 in 6 or 8mm wall thickness are also available on request. A minimum order quantity may apply on some sizes. Please contact your local Steel & Tube branch for information and availability on these sizes.

Notes:

1. Steel grade C450L0 / C400L0 / C350L0 (for $t \leq 2.5$mm $f_y = 350$ MPa and $f_u = 400$ MPa, for 2.5mm $< t \leq 6.0$mm $f_y = 450$ MPa and $f_u = 500$ MPa, and for $t > 6.0$mm $f_y = 400$ MPa and $f_u = 450$ MPa).
2. Full section properties are calculated in accordance with AS/NZS 4600.

DuraGal Unequal Angles - *continued*

n- and p-axes



Effective Section Properties

Grade C450L0 (TS 100)

Designation Leg b_1	Size b_2	Nominal Thickness	Mass per metre	Actual Thickness t	Outside Corner Radius r_o	Ratios $\frac{b_1 - r_o}{t}$	Ratios $\frac{b_2 - r_o}{t}$	Grade Yield Stress f_y	Effective Area of Section A_e	$\frac{A_e}{A_f}$	Effective Section Properties About n-axis I_{enT}	Z_{enT}	I_{enB}	Z_{enB}	About p-axis I_{epR}	Z_{epR}	I_{epL}	Z_{epL}
mm	mm	mm	kg/m	mm	mm			MPa	mm^2		10^6mm^4	10^3mm^3	10^6mm^4	10^3mm^3	10^6mm^4	10^3mm^3	10^6mm^4	10^3mm^3
✦ 75 x 50 x		6.0 CA	5.38	6.0	14.0	10.2	6.00	450	658	0.960	0.393	7.98	0.393	7.98	0.144	3.87	0.144	3.87
✦		5.0 CA	4.34	4.7	8.7	14.1	8.79	450	472	0.854	0.243	5.29	0.323	6.43	0.119	3.12	0.119	3.12
✦		4.0 CA	3.54	3.8	7.8	17.7	11.1	450	334	0.741	0.153	3.59	0.266	5.26	0.0909	2.43	0.0967	2.55

✦ DuraGal Unequal Angles are not a common stock item but sizes 100 x 75, 125 x 75, 150 x 100 in 6 or 8mm wall thickness are also available on request. A minimum order quantity may apply on some sizes. Please contact your local Steel & Tube branch for information and availability on these sizes.

Notes:

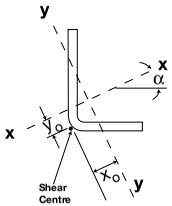
1. Steel grade C450L0 / C400L0 / C350L0 (for $t \leq 2.5$mm $f_y = 350$ MPa and $f_u = 400$ MPa, for 2.5mm $< t \leq 6.0$mm $f_y = 450$ MPa and $f_u = 500$ MPa, and for $t > 6.0$mm $f_y = 400$ MPa and $f_u = 450$ MPa).
2. A_e is calculated for sections with uniform axial compressive stress f_y.
3. I_e and Z_e are calculated with the extreme compression or tension fibres at f_y (first yield). Z_e is calculated at the extreme tension or compression fibre of the effective section.
4. I_{enT} and Z_{enT} are for compression at point "T"; I_{enB} and Z_{enB} are for compression at point "B"; I_{epR} and Z_{epR} are for compression at point "R"; I_{epL} and Z_{epL} are for compression at point "L".
5. Effective section properties are calculated in accordance with AS/NZS 4600.

DuraGal Unequal Angles

x- and y-axes

Section Properties for Member Stability

Grade C450L0 (TS 100)



Designation Leg b_1	Size b_2	Nominal Thick-ness	Mass per metre	Torsion Constant	Coordinate of Shear Centre		Polar Radius of Gyration about the Shear Centre	Monosymmetry Section Constants	
				J	x_0	y_0	r_{01}	β_x	β_y
mm	mm	mm	kg/m	10^3mm^4	mm	mm	mm	mm	mm
✦ 75 x 75 x		6.0 CA	5.38	8.23	17.3	16.2	36.6	39.2	79.2
✦		5.0 CA	4.34	4.07	17.6	16.2	36.9	39.2	80.2
✦		4.0 CA	3.54	2.17	17.7	16.2	37.2	39.3	80.8

✦ DuraGal Unequal Angles are not a common stock item but sizes 100 x 75, 125 x 75, 150 x 100 in 6 or 8mm wall thickness are also available on request. A minimum order quantity may apply on some sizes. Please contact your local Steel & Tube branch for information and availability on these sizes.

Notes:

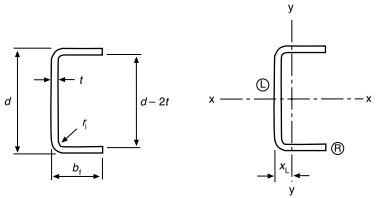
1. Steel grade C450L0 / C400L0 / C350L0 (for $t \leq 2.5$mm $f_y = 350$ MPa and $f_u = 400$ MPa, for 2.5mm $< t \leq 6.0$mm $f_y = 450$ MPa and $f_u = 500$ MPa, and for $t > 6.0$mm $f_y = 400$ MPa and $f_u = 450$ MPa).
2. With the exception of J, properties are calculated assuming a simplified shape where the bends are eliminated and the section is represented by straight mid-lines in accordance with Clause 2.1.2.1 of AS/NZS 4600.
3. β_x is zero for equal angles.
4. I_w is equal to zero for angles.
5. The shear centre is assumed to be located at the intersection of the centre lines of the angle legs.

DuraGal Channels

x- and y-axes

Dimensions and Full Section Properties

Grade C450L0 / C400L0 (TS 100)



Designation d	b_f	Nominal Thickness	Mass per metre	Actual Thickness t	Inside Corner Radius r_i	Depth Between Flanges d - 2t	Coord. of Centroid x_L	Full Area of Section A_f	About x-axis I_x	Z_x	S_x	r_x	About y-axis I_y	Z_{yR}	Z_{yL}	S_y	r_y
mm	mm	mm	kg/m	mm	mm	mm	mm	mm^2	10^6mm^4	10^3mm^3	10^3mm^3	mm	10^6mm^4	10^3mm^3	10^3mm^3	10^3mm^3	mm
300 x 90 x 8.0 CC			28.5	8.0	8.0	284	20.3	3630	44.2	294	359	110	2.44	35.0	120	62.1	25.9
		6.0 CC	21.6	6.0	8.0	288	19.5	2750	34.0	227	275	111	1.89	26.8	96.6	47.1	26.2
250 x 90 x 6.0 CC			19.2	6.0	8.0	238	21.6	2450	21.9	176	210	94.6	1.79	26.2	83.3	46.4	27.1
230 x 75 x 6.0 CC			16.9	6.0	8.0	218	17.5	2150	15.7	137	166	85.5	1.05	18.2	59.8	32.2	22.0
200 x 75 x 6.0 CC			15.5	6.0	8.0	188	18.8	1970	11.2	112	135	75.5	1.00	17.9	53.4	31.8	22.6
		5.0 CC	12.4	4.7	4.0	191	18.1	1580	9.18	91.8	109	76.4	0.812	14.3	44.9	25.3	22.7
180 x 75 x 5.0 CC			11.6	4.7	4.0	171	19.1	1480	7.16	79.5	93.7	69.5	0.787	14.1	41.2	25.1	23.1
150 x 75 x 5.0 CC			10.5	4.7	4.0	141	20.9	1340	4.67	62.3	72.5	59.0	0.743	13.7	35.6	24.8	23.5
125 x 65 x 4.0 CC			7.23	3.8	4.0	117	18.3	921	2.25	36.1	41.8	49.5	0.388	8.32	21.2	15.1	20.5
100 x 50 x 4.0 CC			5.59	3.8	4.0	92.4	14.3	712	1.08	21.7	25.4	39.0	0.174	4.86	12.2	8.78	15.6
75 x 40 x 4.0 CC			4.25	3.8	4.0	67.4	12.1	541	0.457	12.2	14.4	29.1	0.0840	3.01	6.93	5.46	12.5

Notes:

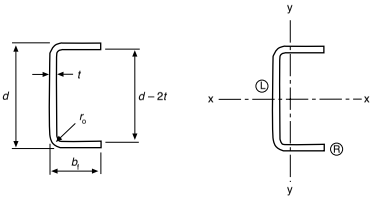
1. Steel grade C450L0 / C400L0 (for $t \leq 6.0$mm $f_y = 450$ MPa and $f_u = 500$ MPa, and for $t > 6.0$mm $f_y = 400$ MPa and $f_u = 450$ MPa).
2. Full section properties are calculated in accordance with AS/NZS 4600.

DuraGal Channels

x- and y-axes

Effective Section Properties

Grade C450L0 / C400L0 (TS 100)



Dimensions							Ratios				Grade		Effective Section Properties					
Designation													About x-axis			About y-axis		
d	b_f	Nominal Thick-ness	Mass per metre	Actual Thickness t	Outside Corner Radius r_o	Depth Between Flanges $d - 2t$	$\frac{(d-2r_o)}{t}$	$\frac{(b-r_o)}{t}$	$\frac{d_e}{(d-2r_o)}$	$\frac{b_e}{(b-r_o)}$	$\frac{A_e}{A_f}$	Yield Stress f_y	Effective Area of Section A_e	I_{ex}	Z_{ex}	I_{eyR}	Z_{eyR}	I_{eyL}	Z_{eyL}
mm	mm	mm	kg/m	mm	mm	mm						MPa	mm^2	10^6mm^4	10^3mm^3	10^6mm^4	10^3mm^3	10^6mm^4	10^3mm^3
300 x	90 x	8.0 CC	28.5	8.0	16.0	284	33.5	9.25	0.915	1.00	0.950	400	3450	44.2	294	2.44	35.0	2.44	35.0
		6.0 CC	21.6	6.0	14.0	288	45.3	12.7	0.712	0.801	0.763	450	2100	32.0	206	1.46	22.4	1.89	26.8
250 x	90 x	6.0 CC	19.2	6.0	14.0	238	37.0	12.7	0.825	0.801	0.831	450	2040	20.5	158	1.41	22.2	1.79	26.2
230 x	75 x	6.0 CC	16.9	6.0	14.0	218	33.7	10.2	0.879	0.925	0.906	450	1950	15.4	132	1.05	18.2	1.05	18.2
200 x	75 x	6.0 CC	15.5	6.0	14.0	188	28.7	10.2	0.968	0.925	0.955	450	1880	11.0	108	1.00	17.9	1.00	17.9
		5.0 CC	12.4	4.7	8.7	191	38.9	14.1	0.797	0.741	0.787	450	1240	8.37	79.5	0.560	11.0	0.812	14.3
180 x	75 x	5.0 CC	11.6	4.7	8.7	171	34.6	14.1	0.863	0.741	0.820	450	1220	6.50	68.4	0.550	11.0	0.787	14.1
150 x	75 x	5.0 CC	10.5	4.7	8.7	141	28.2	14.1	0.977	0.741	0.869	450	1160	4.22	52.9	0.532	10.9	0.743	13.7
125 x	65 x	4.0 CC	7.23	3.8	7.8	117	28.8	15.1	0.966	0.705	0.845	450	779	2.00	29.8	0.256	6.24	0.388	8.32
100 x	50 x	4.0 CC	5.59	3.8	7.8	92.4	22.2	11.1	1.00	0.875	0.944	450	672	1.04	20.1	0.164	4.67	0.174	4.86
75 x	40 x	4.0 CC	4.25	3.8	7.8	67.4	15.6	8.47	1.00	1.00	1.00	450	541	0.457	12.2	0.0840	3.01	0.0840	3.01

Notes:

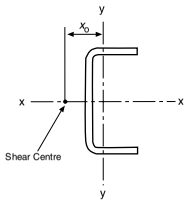
1. Steel grade C450L0 / C400L0 (for $t \leq 6.0$mm $f_y = 450$ MPa and $f_u = 500$ MPa, and for $t > 6.0$mm $f_y = 400$ MPa and $f_u = 450$ MPa).
2. d_e and b_e are the effective widths of the web and flange respectively.
3. d_e, b_e and A_e are calculated for sections with uniform axial compressive stress f_y.
4. I_{eyL} and Z_{eyL} are for compression at point "L"; I_{eyR} and Z_{eyR} are for compression at point "R";
2. Effective section properties are calculated in accordance with AS/NZS 4600.

DuraGal Channels

x- and y-axes

Section Properties for Member Stability

Grade C450L0 / C400L0 (TS 100)



Designation				Mass per metre	Torsion Constant	Warping Constant	Coordinate of Shear Centre	Polar Radius of Gyration about the Shear Centre	Monosymmetry Section Constants
	d	b_f	Nominal Thick-ness		J	I_w	x_0	r_{01}	β_y
	mm	mm	mm	kg/m	10^3mm^4	10^9mm^6	mm	mm	mm
300 x 90 x 8.0 CC				28.5	77.4	37.7	43.4	122	338
6.0 CC				21.6	33.0	29.6	44.0	123	340
250 x 90 x 6.0 CC				19.2	29.4	19.2	47.8	110	273
230 x 75 x 6.0 CC				16.9	25.8	9.48	37.8	96.7	254
200 x 75 x 6.0 CC				15.5	23.7	6.78	40.2	89.0	217
5.0 CC				12.4	11.6	5.52	40.6	89.7	218
180 x 75 x 5.0 CC				11.6	10.9	4.29	42.4	84.9	197
150 x 75 x 5.0 CC				10.5	9.87	2.77	45.4	78.3	171
125 x 65 x 4.0 CC				7.23	4.43	1.01	40.0	67.0	145
100 x 50 x 4.0 CC				5.59	3.43	0.285	30.1	51.8	113
75 x 40 x 4.0 CC				4.25	2.60	0.0760	24.4	40.1	85.9

Notes:

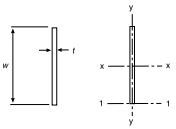
1. Steel grade C450L0 / C400L0 (for $t \leq 6.0$mm $f_y = 450$ MPa and $f_u = 500$ MPa, and for $t > 6.0$mm $f_y = 400$ MPa and $f_u = 450$ MPa).
2. With the exception of J, properties are calculated assuming a simplified shape where the bends are eliminated and the section is represented by straight mid-lines in accordance with Clause 2.1.2.1 of AS/NZS 4600.
3. β_x is zero for channels.

DuraGal Flats

x- and y-axes and baseline axis

Dimensions and Full Section Properties

Grade C400L0 / C350L0 (TS 100)



Dimensions				Grade	Section Properties										
Designation Nominal Width w	Thick-ness	Mass per metre	Actual Thickness t	Yield Stress f_y	Full Area of Section A_f	About 1-axis I_1	About x-axis I_x	Z_x	S_x	r_x	About y-axis I_y	Z_y	S_y	r_y	Torsion Constant J
mm	mm	kg/m	mm	MPa	mm^2	10^6mm^4	10^6mm^4	10^3mm^3	10^3mm^3	mm	10^6mm^4	10^3mm^3	10^3mm^3	mm	10^3mm^4
300 x	8.0 CF	18.8	8.0	350	2400	72.0	18.0	120	180	86.6	0.0128	3.20	4.80	2.31	51.2
	5.0 CF	11.1	4.7	400	1410	42.3	10.6	70.5	106	86.6	0.00260	1.10	1.66	1.36	10.4
250 x	8.0 CF	15.7	8.0	350	2000	41.7	10.4	83.3	125	72.2	0.0107	2.67	4.00	2.31	42.7
	5.0 CF	9.22	4.7	400	1180	24.5	6.12	49.0	73.4	72.2	0.00216	0.920	1.38	1.36	8.65
200 x	8.0 CF	12.6	8.0	350	1600	21.3	5.33	53.3	80.0	57.7	0.00853	2.13	3.20	2.31	34.1
	6.0 CF	9.42	6.0	400	1200	16.0	4.00	40.0	60.0	57.7	0.00360	1.20	1.80	1.73	14.4
	5.0 CF	7.38	4.7	400	940	12.5	3.13	31.3	47.0	57.7	0.00173	0.736	1.10	1.36	6.92
150 x	8.0 CF	9.42	8.0	350	1200	9.00	2.25	30.0	45.0	43.3	0.00640	1.60	2.40	2.31	25.6
	6.0 CF	7.07	6.0	400	900	6.75	1.69	22.5	33.8	43.3	0.00270	0.900	1.35	1.73	10.8
	5.0 CF	5.53	4.7	400	705	5.29	1.32	17.6	26.4	43.3	0.00130	0.552	0.828	1.36	5.19
130 x	5.0 CF	4.80	4.7	400	611	3.44	0.860	13.2	19.9	37.5	0.00112	0.479	0.718	1.36	4.50
100 x	8.0 CF	6.28	8.0	350	800	2.67	0.667	13.3	20.0	28.9	0.00427	1.07	1.60	2.31	17.1
	6.0 CF	4.71	6.0	400	600	2.00	0.500	10.0	15.0	28.9	0.00180	0.600	0.900	1.73	7.20
	5.0 CF	3.69	4.7	400	470	1.57	0.392	7.83	11.8	28.9	0.000865	0.368	0.552	1.36	3.46
	4.0 CF	2.98	3.8	400	380	1.27	0.317	6.33	9.50	28.9	0.000457	0.241	0.361	1.10	1.83
90 x	6.0 CF	4.24	6.0	400	540	1.46	0.365	8.10	12.2	26.0	0.00162	0.540	0.810	1.73	6.48
75 x	5.0 CF	2.77	4.7	400	353	0.661	0.165	4.41	6.61	21.7	0.000649	0.276	0.414	1.36	2.60
	4.0 CF	2.24	3.8	400	285	0.534	0.134	3.56	5.34	21.7	0.000343	0.181	0.271	1.10	1.37
65 x	5.0 CF	2.40	4.7	400	306	0.430	0.108	3.31	4.96	18.8	0.000562	0.239	0.359	1.36	2.25
	4.0 CF	1.94	3.8	400	247	0.348	0.0870	2.68	4.01	18.8	0.000297	0.156	0.235	1.10	1.19
55 x	5.0 CF	1.84	4.7	400	235	0.196	0.0490	1.96	2.94	14.4	0.000433	0.184	0.276	1.36	1.73
	4.0 CF	1.49	3.8	400	190	0.158	0.0396	1.58	2.38	14.4	0.000229	0.120	0.181	1.10	0.915

Notes:

1. Steel grade C400L0 / C350L0 (for $t \leq 6.0$mm $f_y = 400$ MPa and $f_u = 450$ MPa, and for $t > 6.0$mm $f_y = 350$ MPa and $f_u = 400$ MPa).
2. Section properties are calculated in accordance with AS/NZS 4600.

Plate

There are a variety of international specifications for hot rolled steel plate. Some of the more common specifications and grades, with their chemical and mechanical properties, are summarised below.

The chemical compositions are all the maximum % content. The mechanical properties relate to 12-20mm thick plates. This data is for comparison purposes only and should not be used in lieu of the actual specifications, which should always be consulted.

Mild Steel

Medium strength structural steel plate with a nominal yield strength of 250 MPa

	Chemical Composition %								
	C	Si	Mn	P	S	CE	Yield Strength	Tensile Strength	Min Elongation
AS/NZS 3678 Grade 250	0.22	0.55	1.70	0.040	0.035	0.44	250 MPa	410 MPa	22%
JIS G3101 SS400				0.050	0.050		245 MPa	400-510 MPa	17%
BS EN 10025 S275	0.18		1.50	0.040	0.040	0.40	275 MPa	410-560 MPa	22%

Medium Tensile

High strength structural steel plate with a nominal yield strength of 350 MPa

	Chemical Composition %								
	C	Si	Mn	P	S	CE	Yield Strength	Tensile Strength	Min Elongation
AS/NZS 3678 Grade 350	0.22	0.55	1.70	0.040	0.035	0.48	350 MPa	450 MPa	20%
JIS G3101 SS540	0.30		1.60	0.040	0.040		400 MPa	540 MPa	13%
BS EN 10025 S355	0.20	0.55	1.60	0.040	0.040	0.45	355 MPa	490-630 MPa	22%

High Tensile

High strength structural steel plate with a nominal yield strength of 450 MPa. Not suitable for hot forming or normalising.

	Chemical Composition %								
	C	Si	Mn	P	S	CE	Yield Strength	Tensile Strength	Min Elongation
AS/NZS 3678 Grade 450	0.22	0.55	1.80	0.040	0.035	0.48	450 MPa	520 MPa	16%

High Tensile Quenched & Tempered

High strength, low alloy steel plate with a yield stress three times that of carbon steel. Hardness 255HB.

	Chemical Composition %								
	C	Si	Mn	P	S	CE	Yield Strength	Tensile Strength	Min Elongation
BISPLATE 80	0.18	0.20	1.40	0.010	0.003	0.50	690 MPa	790-930 MPa	18%

Abrasion Resistant Quenched & Tempered

Through hardened, abrasion resistant steel plate, offering long life expectancy in high impact abrasion applications.

	Chemical Composition %									
	C	Si	Mn	P	S	CE	Yield Strength	Tensile Strength	Min Elongation	Hardness
BISPLATE 400	0.18	0.20	1.40	0.010	0.003	0.50		1350 MPa	12%	360-440HB
BISPLATE 500	0.29	0.22	0.55	0.015	0.003	0.62		1640 MPa	10%	477-534HB

Corrosion Resistant

Structural steel with improved resistance to atmospheric corrosion.

	Chemical Composition %									
	C	Si	Mn	P	S	CE	Yield Strength	Tensile Strength	Min Elongation	Copper
AS/NZS 1594 HW350	0.11	0.50	0.50	0.150	0.035	0.39	340 MPa	450 MPa	15%	0.15 to 0.50%
JIS G3125 SPA-H	0.12	0.75	0.50	0.150	0.040		345 MPa	480 MPa	22%	0.25 to 0.60%

Floor Plate

Lozenge pattern floor plate.

	Chemical Composition %								
	C	Si	Mn	P	S	CE	Yield Strength	Tensile Strength	Min Elongation
AS/NZS 1594 HA1	0.10	0.03	0.50	0.030	0.030		Commercial grade not rated for mechanical properties		
AS/NZS 1594 HA250	0.19	0.02	0.70	0.030	0.030		250 MPa	350 MPa	

Boiler Plate

A carbon-manganese steel for boiler and pressure vessel applications with a minimum tensile strength of 460 MPa.

	Chemical Composition %								
	C	Si	Mn	P	S	CE	Yield Strength	Tensile Strength	Min Elongation
AS1548-7-460R	0.20	0.60	1.70	0.040	0.030	0.45	295 MPa	460 MPa	21%

Coil

Summarised below are New Zealand and International standards for our common stock items. This data is for comparison purposes only and should not be used in lieu of the actual specifications, which should always be consulted.

Cold Rolled: NZCC-SD or JIS G 3141 SPCC, AS 1595 CA2

The following information relates to NZ Steel's Product Designation NZCC-SD

Description: Cold rolled, annealed and skinpassed steel of commercial quality, capable of moderate forming and pressing, with a surface finish suitable for exposed non-critical applications

Surface Finish: Matt finish suitable for painting and exposed non-critical applications

Applications: Filing cabinets, air conditioning, household electrical appliances, furniture and automotive parts

Typical Dimensions

Size	Thickness
2438 x 1219	0.60
2438 x 1219	0.80
2438 x 1219	1.00
2438 x 1219	1.20
2438 x 1219	1.60
2438 x 1219	2.00
2438 x 1219	2.50
2438 x 1219	3.00

Chemical Composition %

Element	Maximum
Carbon	0.080
Silicon	0.030
Manganese	0.254
Sulphur	0.030
Phosphorus	0.025

Mechanical Properties

Longitudinal tensile	Specified - Minimum
Proof stress/Yield point	160 - 240
Tensile (MPa)	290 -365
% Elongation*	34
HRB Hardness	40-60

* L_0 = 50mm

Electro Galvanised: JIS G 3313 SECC/SEHC

Description: Cold rolled and Hot rolled electro galvanised phosphate coated steel sheet

Surface Finish: Electro galvanised phosphate coated highly worked steel sheet suitable for painting and exposed non-critical appications

Applications: Domestic appliances, household furniture, vehicles and construction materials

Typical Dimensions

	Size	Thickness
Cold rolled SECC 0.4-1.2mm typically JIS G 3141 specified base metal	2438 x 1219	0.60
	2438 x 1219	0.80
	2438 x 1219	1.00
	2438 x 1219	1.20
Hot rolled SEHC 1.6mm and above typically JIS G 3131 specified base metal	2438 x 1219	1.60
	2438 x 1219	2.00
	2438 x 1219	2.50
	2438 x 1219	3.00

Chemical Composition %

Element	Maximum SPHC	Maximum SPCC
Carbon	0.15	0.12
Silicon	–	–
Manganese	0.60	0.50
Sulphur	0.050	0.040
Phosphorus	0.050	0.045

* Class designation of base metal in the relevant JIS standard:
SEHC - SPHC
SECC - SPCC

Mechanical Properties

Longitudinal tensile	Specified - Minimum	
	SECC	SEHC
Proof stress/Yield point	•	•
Tensile (MPa)	270	270
% Elongation	34-39	29-31
HRB Hardness	•	•

Note: • not specified in the standard.

Enamelling Quality: JIS G 3133 SPP

Description: Decarburized steel sheets

Surface Finish: Decarburized oiled steel sheet for the process of porcelain enamelling

Applications: White-ware manufacturing

Typical Dimensions

Size	Thickness
2438 x 1219	0.8
2438 x 1219	1.0
2438 x 1219	1.2
2438 x 1219	1.6
2438 x 1219	3.0

Chemical Composition %

Element	Maximum
Carbon	0.008
Silicon	–
Manganese	0.50
Sulphur	0.04
Phosphorus	0.04

Mechanical Properties

Longitudinal tensile	Specified - Minimum
Proof stress/Yield point	•
Tensile (MPa)	•
% Elongation	36 - 40
HRB Hardness	•

Note: • not specified in the standard.

Zincalume: AS 1397 G 300 AZ150

Description: Hot rolled and hot dipped alloy coated steel sheet with 45% zinc/55% aluminium

Surface Finish: Naturally small spangle with a coating mass of 150 g/m²

Applications: Roofing, cladding, rainwater goods, air conditioning, garage doors

Typical Dimensions

Size	Thickness
2400 x 1200	0.55
2400 x 1200	0.75
2400 x 1200	0.95

Chemical Composition %

Element	Maximum
Carbon	0.30
Silicon	–
Manganese	1.60
Sulphur	0.03
Phosphorus	0.04

Note: For grade G300 nitrogenized steel may be used for sections greater than 1.00mm thick.

Mechanical Properties

Longitudinal tensile	Specified - Minimum
Proof stress/Yield point	300
Tensile (MPa)	340
% Elongation*	20
HRB Hardness	•

* Lo = 50mm

Note: • not specified in the standard.

Galvanised: AS/NZS 1397 G 250, JIS G 3302 SGCC/SGHC Z27

The following information relates to AS/NZS 1397:1993

Description: Hot rolled,hot dipped zinc coated sheet

Surface Finish: 100% zinc coated with regular spangle and a typical coating mass of 275g/m^2 equivalent to Z275. 400g/m^2 and 600g/m^2 coating weight mass also available

Applications: Roofing,cladding,drums and tubes, purlins, girts, air conditioning, culverts, sheet metal work, concrete forming work

Typical Dimensions

Size	Thickness
2400 x 900	0.40
2400 x 900	0.55
2400 x 900	0.75
2400 x 900	0.95
2400 x 1200	0.40
2400 x 1200	0.55
2400 x 1200	0.75
2400 x 1200	0.95
2400 x 1200	1.15
2400 x 1200	1.55
2400 x 1200	2.00
2400 x 1200	2.50
2400 x 1200	3.00
3000 x 1200	3.00
3000 x 1500	0.55
3000 x 1500	0.75
3000 x 1500	0.95
3660 x 1200	0.55

Chemical Composition %

Element	Maximum
Carbon	0.12
Silicon	–
Manganese	0.50
Sulphur	0.035
Phosphorus	0.03

Mechanical Properties

Longitudinal tensile	Specified - Minimum
Proof stress/Yield point	250
Tensile (MPa)	320
% Elongation*	25
HRB Hardness	•

* L_O = 50mm

Note: • not specified in the standard.

Hot Rolled: AS 1594/HA250 (2.00 and 2.50mm)

Description: Hot rolled steel sheet

Surface Finish: Mill finished steel sheet suitable for forming and bending with good ductility and weldability

Applications: Roofing, cladding, rainwater goods, purlins, girts, air conditioning, garage doors

Typical Dimensions

Relevant standard:	Size	Thickness
AS 1594/ HA 250	2438 x 1219	2.00
	2438 x 1219	2.50

Chemical Composition %

Element	Maximum
Carbon	0.20
Silicon	0.35
Manganese	1.20
Sulphur	0.03
Phosphorus	0.04
Chromium	(Note 1)
Nickel	(Note 1)
Copper	(Note 1)
Aluminium	0.10
Titanium	0.04
Micro-alloying elements	0.01 (Note 2)

Note:

1. The following elements may be present to the limits stated, subject to a maximum total content of 0.30 percent:
   (a) Copper: 0.15 percent maximum
   (b) Nickel: 0.15 percent maximum
   (c) Chromium: 0.15 percent maximum
   (d) Molybdenum: 0.05 percent maximum
2. Applies to Niobium and Vanadium only.

Mechanical Properties

Longitudinal tensile	Specified - Minimum
	HA250
Proof stress/Yield point	250
Tensile (MPa)	350
% Elongation	22*
HRB Hardness	•

* L_O = 50mm

Note: • not specified in the standard.

Aluminised: ASTM A463 CQ T1-40 Chromated and Oiled

Description: Aluminium coated steel sheet

Surface Finish: Hot dipped coated steel sheet with aluminium-silicon alloy containing 5-11% silicon to promote better coating adherence

Applications: Roofing and cladding

Typical Dimensions

Size	Thickness
2438 x 1219	0.6
2438 x 1219	0.8
2438 x 1219	1.0
2438 x 1219	1.2
2438 x 1219	1.6

Chemical Composition %

Element	Maximum
Carbon	0.15
Silicon	–
Manganese	0.60
Sulphur	0.04
Phosphorus	0.35

Mechanical Properties

Longitudinal tensile	Specified - Minimum
Proof stress/Yield point	•
Tensile (MPa)	•
% Elongation	•
HRB Hardness	•

Note: • not specified in the standard.

Wire and Sheet Metal Gauges

Gauge Number	Sheet		Wire			
	Birmingham Gauge		Birmingham Gauge		Imperial Standard Gauge	
	inches	mm	inches	mm	inches	mm
7/0					0.5	12.700
6/0					0.464	11.786
5/0			0.5	12.700	0.432	10.973
4/0			0.454	11.532	0.400	10.160
3/0			0.425	10.795	0.372	9.449
2/0			0.380	9.652	0.348	8.839
0			0.340	8.636	0.324	8.230
1			0.300	7.620	0.300	7.620
2			0.284	7.214	0.276	7.010
3			0.259	6.579	0.252	6.401
4			0.238	6.045	0.232	5.893
5			0.220	5.588	0.212	5.385
6			0.203	5.156	0.192	4.877
7			0.180	4.572	0.176	4.470
8			0.165	4.191	0.160	4.064
9			0.148	3.759	0.144	3.658
10	0.1250	3.175	0.134	3.404	0.128	3.251
11	0.1113	2.827	0.120	3.048	0.116	2.946
12	0.0991	2.517	0.109	2.769	0.104	2.642
13	0.0882	2.240	0.095	2.413	0.092	2.337
14	0.0785	1.994	0.083	2.108	0.080	2.032
15	0.0699	1.775	0.072	1.829	0.072	1.829
16	0.0625	1.588	0.065	1.651	0.064	1.626
17	0.0556	1.412	0.058	1.473	0.056	1.422

Gauge Number	Sheet		Wire			
	Birmingham Gauge		Birmingham Gauge		Imperial Standard Gauge	
	inches	mm	inches	mm	inches	mm
18	0.0495	1.257	0.049	1.245	0.048	1.219
19	0.0440	1.118	0.042	1.067	0.040	1.016
20	0.0392	0.996	0.035	0.889	0.036	0.914
21	0.0349	0.886	0.032	0.813	0.032	0.813
22	0.0313	0.794	0.030	0.762	0.028	0.711
23	0.0278	0.707	0.025	0.635	0.024	0.610
24	0.0248	0.629	0.022	0.559	0.022	0.559
25	0.0220	0.560	0.020	0.508	0.020	0.508
26	0.0196	0.498	0.018	0.457	0.018	0.457
27	0.0175	0.443	0.016	0.406	0.0164	0.417
28	0.0156	0.397	0.014	0.356	0.0148	0.376
29	0.0139	0.353	0.0131	0.333	0.0136	0.345
30	0.0123	0.312	0.0120	0.305	0.0124	0.315

Reinforcing

Pacific Steel, New Zealand's only producer of hot rolled Reinforcing Steel has a reinforcing bar range which complies with the standard AS/NZS 4671: 2001 Steel Reinforcing Material. There are two grades of steel reinforcing bars designated as Seismic 300® and Seismic 500®. Pacific Steel manufactures a Seismic 500E® bar through two different manufacturing methods.

Chemical & Mechanical Properties

Steel Grade	Carbon Equiv.	Carbon %	Sulphur & Phos. %	Yield Strength MPa*	Tensile Strength Ratio*		Elongation %*
	max.	max.	max.	min.	min.	max.	min.
300	0.43	0.22	0.05	300-380	1.15	1.50	15 (uniform)
Seismic 500E MA®	0.49	0.22	0.05	500-600	1.15	1.40	10 (uniform)
Seismic 500E QT®	0.49	0.22	0.05	500-600	1.15	1.40	10 (uniform)

* Characteristic values

Dimensional Requirement Table

Bar Designation		Normal Dimensions			Mass kg/m
Plain	Deformed	Diameter mm	Area mm^2	Perimeter mm	
R6		6	28.3	18.8	0.222
R10	D10	10	78.5	31.4	0.617
R12	D12	12	113.0	37.7	0.888
R16	D16	16	201.0	50.3	1.578
R20	D20	20	314.0	62.8	2.466
R25	D25	25	491.0	78.5	3.85
	D28	28	616.0	88.0	4.834
	D32	32	804.0	101.0	6.313
	D40	40	1260.0	126.0	9.865

Identifying the bar on site

SEISMIC 500E MA®

SEISMIC 500E QT®

Manufacturing process

1) Seismic 500E MA® – This is a bar that is manufactured by the microalloy process where an additive called vanadium is added to the bar to give it its strength and ductility. By following the correct procedure a microalloy bar can be rebent, welded, threaded or galvanised without changing the mechanical properties of the bar. The bar itself can be recognised by its deformations and the words Seismic 500E MA .
2) Seismic 500E QT® – This bar is manufactured by a Quench and Tempered process. This means that the bar gets its strength from the heat treatment. Any changes to the bar through welding or heating will compromise the strength of the bar. A quench and tempered bar can be recognised by its deformations and the words Seismic 500E QT.

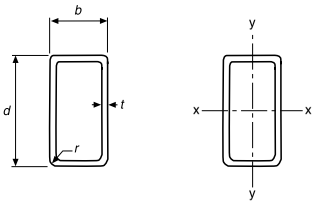
Handling Characteristics

	Seismic 500E MA®	Seismic 500E QT®
REBENDING	Yes – with preheating and following correct procedure	Not recommended
WELDING	Yes – following correct procedure	Not recommended
THREADING	Yes – loss of strength proportional to loss of cross-sectional area	Not advised – loss of strength disproportional to loss of area
CERTIFIED TO AS/NZS 4671	Yes- long term quality assured	Yes – long term quality assured

Rectangular Hollow Sections

Dimensions and Properties

Grade C350L0 (AS 1163)



Designation			Mass per metre	External Surface Area		b-2t	d-2t	Gross Section Area	About x-axis				About y-axis				Torsion Constant	Torsion Modulus	Form Factor	About x-axis			About y-axis		
d	b	t		per m	per t	t	t	A_g	I_x	Z_x	S_x	r_x	I_y	Z_y	S_y	r_y	J	C	k_f	λ_{ex}	Compact-ness[3]	Z_{ex}	λ_{ey}	Compact-ness[3]	Z_{ey}
mm	mm	mm	kg/m	m²/m	m²/t			mm²	10^6mm⁴	10^3mm³	10^3mm³	mm	10^6mm⁴	10^3mm³	10^3mm³	mm	10^6mm⁴	10^3mm³			(C,N,S)	10^3mm³		(C,N,S)	10^3mm³
✦ 250	150	9.0 RHS	51.8	0.761	14.7	14.7	25.8	6600	53.7	430	533	90.2	24.3	324	375	60.7	56.0	554	1.00	17.4	C	533	30.5	N	373
		6.0 RHS	35.6	0.774	21.8	23.0	39.7	4530	38.4	307	374	92.0	17.5	233	264	62.2	39.0	395	0.907	27.2	C	374	46.9	S	208
✦		5.0 RHS	29.9	0.779	26.0	28.0	48.0	3810	32.7	262	317	92.6	15.0	199	224	62.6	33.0	337	0.814	33.1	N	300	56.8	S	156
200	100	9.0 RHS	37.7	0.561	14.9	9.11	20.2	4800	22.8	228	293	68.9	7.64	153	180	39.9	19.9	272	1.00	10.8	C	293	23.9	C	180
		6.0 RHS	26.2	0.574	22.0	14.7	31.3	3330	16.7	167	210	70.8	5.69	114	130	41.3	14.2	200	1.00	17.4	C	210	37.1	N	119
		5.0 RHS	22.1	0.579	26.2	18.0	38.0	2810	14.4	144	179	71.5	4.92	98.3	111	41.8	12.1	172	0.925	21.3	C	179	45.0	S	90.1
✦		4.0 RHS	17.9	0.583	32.5	23.0	48.0	2280	11.9	119	147	72.1	4.07	81.5	91.0	42.3	9.89	142	0.801	27.2	C	147	56.8	S	63.1
152	76	6.0 RHS	19.4	0.431	22.2	10.7	23.4	2480	6.97	91.4	117	53.0	2.35	61.7	71.9	30.8	6.03	109	1.00	12.7	C	117	27.7	C	71.9
		5.0 RHS	16.5	0.436	26.4	13.2	28.5	2100	6.06	79.5	100	53.7	2.06	54.0	62.0	31.3	5.18	94.9	1.00	15.7	C	100	33.7	N	59.0
150	100	9.0 RHS	30.6	0.461	15.1	9.11	14.7	3900	10.9	145	185	52.9	5.77	115	140	38.5	13.2	197	1.00	10.8	C	185	17.4	C	140
		6.0 RHS	21.4	0.474	22.1	14.7	23.0	2730	8.17	109	134	54.7	4.36	87.3	102	40.0	9.51	147	1.00	17.4	C	134	27.2	C	102
		5.0 RHS	18.2	0.479	26.3	18.0	28.0	2310	7.07	94.3	115	55.3	3.79	75.7	87.3	40.4	8.12	127	1.00	21.3	C	115	33.1	N	83.6
✦		4.0 RHS	14.8	0.483	32.7	23.0	35.5	1880	5.87	78.2	94.6	55.9	3.15	63.0	71.8	40.9	6.64	105	0.971	27.2	C	94.6	42.0	S	60.9

✦ These items are not commonly stocked but are available on request.

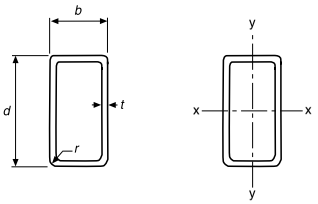
Notes:

1. This table is calculated in accordance with AS 4100 using design yield stress f_y = 350 MPa and design tensile strength f_u = 430 MPa as per AS 4100 table 2.1 for AS 1163 grade C350L0.
2. Grade C350L0 is cold formed and therefore is allocated the CF residual stresses classification in AS 4100.
3. C = Compact Section; N = Non-compact Section; S = Slender Section; as defined in AS 4100.
4. For Square and Rectangular Hollow Sections the outside corner radius r used in calculating the section properties is equal to $2t$ for sections with thickness $t \leq 3.0$mm and $2.5t$ for sections with $t > 3.0$mm.

Rectangular Hollow Sections - *continued*

Dimensions and Properties

Grade C350L0 (AS 1163)



Designation			Mass per metre	External Surface Area		b-2t	d-2t	Gross Section Area	Properties										Properties for Design to AS 4100								
									About x-axis				About y-axis				Torsion Constant	Torsion Modulus	Form Factor	About x-axis			About y-axis		
d	b	t		per m	per t	t	t	A_g	I_x	Z_x	S_x	r_x	I_y	Z_y	S_y	r_y	J	C	k_f	λ_{ex}	Compact-ness[3]	Z_{ex}	λ_{ey}	Compact-ness[3]	Z_{ey}
mm	mm	mm	kg/m	m^2/m	m^2/t			mm^2	10^6mm^4	10^3mm^3	10^3mm^3	mm	10^6mm^4	10^3mm^3	10^3mm^3	mm	10^6mm^4	10^3mm^3			(C,N,S)	10^3mm^3		(C,N,S)	10^3mm^3
150	50	6.0 RHS	16.7	0.374	22.4	6.33	23.0	2130	5.06	67.5	91.2	48.7	0.860	34.4	40.9	20.1	2.63	64.3	1.00	7.49	C	91.2	27.2	C	40.9
		5.0 RHS	14.2	0.379	26.6	8.00	28.0	1810	4.44	59.2	78.9	49.5	0.765	30.6	35.7	20.5	2.30	56.8	1.00	9.47	C	78.9	33.1	N	34.1
		4.0 RHS	11.6	0.383	32.9	10.5	35.5	1480	3.74	49.8	65.4	50.2	0.653	26.1	29.8	21.0	1.93	48.2	0.963	12.4	C	65.4	42.0	S	25.1
		3.0 RHS	8.96	0.390	43.5	14.7	48.0	1140	2.99	39.8	51.4	51.2	0.526	21.1	23.5	21.5	1.50	38.3	0.776	17.4	C	51.4	56.8	S	16.0
		2.5 RHS	7.53	0.391	52.0	18.0	58.0	959	2.54	33.9	43.5	51.5	0.452	18.1	19.9	21.7	1.28	32.8	0.685	21.3	C	43.5	68.6	S	11.9
		2.0 RHS	6.07	0.393	64.7	23.0	73.0	774	2.08	27.7	35.3	51.8	0.372	14.9	16.3	21.9	1.04	26.9	0.595	27.2	C	34.3	86.4	S	8.32
127	51	6.0 RHS	14.7	0.330	22.5	6.50	19.2	1868	3.28	51.6	68.9	41.9	0.761	29.8	35.8	20.2	2.20	54.9	1.00	8.72	C	68.9	25.7	C	35.8
		5.0 RHS	12.5	0.335	26.7	8.20	23.4	1594	2.89	45.6	59.9	42.6	0.679	26.6	31.3	20.6	1.93	48.6	1.00	11.0	C	59.9	31.4	N	30.6
		3.5 RHS	9.07	0.341	37.6	12.6	34.3	1155	2.20	34.7	44.6	43.7	0.526	20.6	23.4	21.3	1.44	37.2	0.905	16.9	C	44.6	46.0	S	18.5
✦ 125	75	6.0 RHS	16.7	0.374	22.4	10.5	18.8	2130	4.16	66.6	84.2	44.2	1.87	50.0	59.1	29.6	4.44	86.2	1.00	12.4	C	84.2	22.3	C	59.1
		5.0 RHS	14.2	0.379	26.6	13.0	23.0	1810	3.64	58.3	72.7	44.8	1.65	43.9	51.1	30.1	3.83	75.3	1.00	15.4	C	72.7	27.2	C	51.1
		4.0 RHS	11.6	0.383	32.9	16.8	29.3	1480	3.05	48.9	60.3	45.4	1.39	37.0	42.4	30.6	3.16	63.0	1.00	19.8	C	60.3	34.6	N	39.9
		3.0 RHS	8.96	0.390	43.5	23.0	39.7	1140	2.43	38.9	47.3	46.1	1.11	29.5	33.3	31.1	2.43	49.5	0.908	27.2	C	47.3	46.9	S	26.3

✦ These items are not commonly stocked but are available on request.

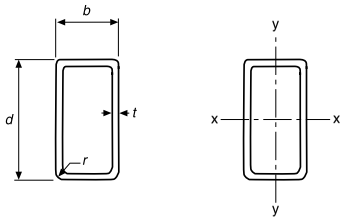
Notes:

1. This table is calculated in accordance with AS 4100 using design yield stress f_y = 350 MPa and design tensile strength f_u = 430 MPa as per AS 4100 table 2.1 for AS 1163 grade C350L0.
2. Grade C350L0 is cold formed and therefore is allocated the CF residual stresses classification in AS 4100.
3. C = Compact Section; N = Non-compact Section; S = Slender Section; as defined in AS 4100.
4. For Square and Rectangular Hollow Sections the outside corner radius r used in calculating the section properties is equal to $2t$ for sections with thickness $t \leq 3.0$mm and $2.5t$ for sections with $t > 3.0$mm.

Rectangular Hollow Sections

Dimensions and Properties

Grade C350L0 (AS 1163)



Designation			Mass per metre	External Surface Area		b-2t	d-2t	Gross Section Area	About x-axis				About y-axis				Torsion Constant	Torsion Modulus	Form Factor	About x-axis			About y-axis		
d	b	t		per m	per t	t	t	A_g	I_x	Z_x	S_x	r_x	I_y	Z_y	S_y	r_y	J	C	k_f	λ_{ex}	Compactness[3]	Z_{ex}	λ_{ey}	Compactness[3]	Z_{ey}
mm	mm	mm	kg/m	m^2/m	m^2/t			mm^2	10^6mm^4	10^3mm^3	10^3mm^3	mm	10^6mm^4	10^3mm^3	10^3mm^3	mm	10^6mm^4	10^3mm^3			(C,N,S)	10^3mm^3		(C,N,S)	10^3mm^3
❖ 102 x 76 x		6.0 RHS	14.7	0.330	22.5	10.7	15.0	1868	2.52	49.4	61.9	36.7	1.59	42.0	50.5	29.2	3.38	69.8	1.00	14.3	C	61.9	20.1	C	50.5
❖		5.0 RHS	12.5	0.335	26.7	13.2	18.4	1594	2.22	43.5	53.7	37.3	1.41	37.0	43.9	29.7	2.91	61.2	1.00	17.7	C	53.7	24.7	C	43.9
❖		3.5 RHS	9.07	0.341	37.6	19.7	27.1	1155	1.68	33.0	39.9	38.2	1.07	28.2	32.6	30.5	2.14	46.1	1.00	26.4	C	39.9	36.4	N	29.8
▲ 100 x 50 x		6.0 RHS	12.0	0.274	22.8	6.33	14.7	1530	1.71	34.2	45.3	33.4	0.567	22.7	27.7	19.2	1.53	40.9	1.00	7.49	C	45.3	17.4	C	27.7
▲		5.0 RHS	10.3	0.279	27.0	8.00	18.0	1310	1.53	30.6	39.8	34.1	0.511	20.4	24.4	19.7	1.35	36.5	1.00	9.47	C	39.8	21.3	C	24.4
▲		4.0 RHS	8.49	0.283	33.3	10.5	23.0	1080	1.31	26.1	33.4	34.8	0.441	17.6	20.6	20.2	1.13	31.2	1.00	12.4	C	33.4	27.2	C	20.6
▲		3.0 RHS	6.60	0.290	43.9	14.7	31.3	841	1.06	21.3	26.7	35.6	0.361	14.4	16.4	20.7	0.886	25.0	1.00	17.4	C	26.7	37.1	N	15.0
▲ 75 x 50 x		6.0 RHS	9.67	0.224	23.2	6.33	10.5	1230	0.800	21.3	28.1	25.5	0.421	16.9	21.1	18.5	1.01	29.3	1.00	7.49	C	28.1	12.4	C	21.1
▲		5.0 RHS	8.35	0.229	27.4	8.00	13.0	1060	0.726	19.4	24.9	26.1	0.384	15.4	18.8	19.0	0.891	26.4	1.00	9.47	C	24.9	15.4	C	18.8
▲		4.0 RHS	6.92	0.233	33.7	10.5	16.8	881	0.630	16.8	21.1	26.7	0.335	13.4	16.0	19.5	0.754	22.7	1.00	12.4	C	21.1	19.8	C	16.0
▲		3.0 RHS	5.42	0.240	44.2	14.7	23.0	691	0.522	13.9	17.1	27.5	0.278	11.1	12.9	20.0	0.593	18.4	1.00	17.4	C	17.1	27.2	C	12.9

❖ Dualgrade C350L0/C450L0 hollow sections have a minimum yield stress of 450MPa (f_u = 450 MPa), a minimum tensile strength of 500 MPa (f_y = 500 MPa) and a minimum elongation equal to 16%, ie. the strength of AS 1163 grade C450L0 and the elongation of AS 1163 grade C350L0.

▲ Available Dualgrade 350L0/450L0 - please refer to page 44 "DuraGal Rectangular Hollow Sections" for the *Properties for Design to AS 4100*.

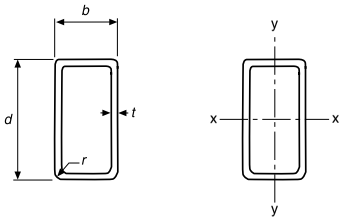
Notes:

1. This table is calculated in accordance with AS 4100 using design yield stress f_y = 350 MPa and design tensile strength f_u = 430 MPa as per AS 4100 table 2.1 for AS 1163 grade C350L0.
2. Grade C350L0 is cold formed and therefore is allocated the CF residual stresses classification in AS 4100.
3. C = Compact Section; N = Non-compact Section; S = Slender Section; as defined in AS 4100.
4. For Square and Rectangular Hollow Sections the outside corner radius *r* used in calculating the section properties is equal to 2*t* for sections with thickness $t \leq$ 3.0mm and 2.5*t* for sections with $t >$ 3.0mm.

Rectangular Hollow Sections - *continued*

Dimensions and Properties

Grade C350L0 (AS 1163)



Dimension and Ratios									Properties									Properties for Design to AS 4100								
Designation				Mass per metre	External Surface Area		*b-2t*	*d-2t*	Gross Section Area	About x-axis				About y-axis				Torsion Constant	Torsion Modulus	Form Factor	About x-axis			About y-axis		
d	*b*	*t*			per m	per t	*t*	*t*	A_g	I_x	Z_x	S_x	r_x	I_y	Z_y	S_y	r_y	*J*	*C*	k_f	λ_{ex}	Compactness[3]	Z_{ex}	λ_{ey}	Compactness[3]	Z_{ey}
mm	mm	mm		kg/m	m^2/m	m^2/t			mm^2	10^6mm^4	10^3mm^3	10^3mm^3	mm	10^6mm^4	10^3mm^3	10^3mm^3	mm	10^6mm^4	10^3mm^3			(C,N,S)	10^3mm^3		(C,N,S)	10^3mm^3
▲	75 x 40 x 4.0		RHS	6.29	0.213	33.85	8.00	16.8	801	0.53	14.06	18.37	25.7	0.20	9.78	11.84	15.6	0.504	17.4	1.00	10.73	C	18.37	22.47	C	11.84
▲		3.0	RHS	4.95	0.220	44.37	11.33	23.0	631	0.44	11.83	14.94	26.5	0.17	8.25	9.62	16.2	0.402	14.3	1.00	15.21	C	14.94	30.86	N	6.24
▲		2.5	RHS	4.19	0.221	52.83	14.00	28.0	534	0.38	10.23	12.79	26.8	0.14	7.18	8.25	16.4	0.344	12.4	1.00	18.78	C	12.79	37.57	N	6.70
▲	65 x 35 x 4.0		RHS	5.35	0.183	34.2	6.75	14.3	681	0.328	10.1	13.3	22.0	0.123	7.03	8.58	13.4	0.320	12.5	1.00	7.99	C	13.3	16.9	C	8.58
▲		3.0	RHS	4.25	0.190	44.7	9.67	19.7	541	0.281	8.65	11.0	22.8	0.106	6.04	7.11	14.0	0.259	10.4	1.00	11.4	C	11.0	23.3	C	7.11
▲		2.5	RHS	3.60	0.191	53.1	12.0	24.0	459	0.244	7.52	9.45	23.1	0.0926	5.29	6.13	14.2	0.223	9.10	1.00	14.2	C	9.45	28.4	C	6.13
▲	50 x 25 x 3.0		RHS	3.07	0.140	45.5	6.33	14.7	391	0.112	4.47	5.86	16.9	0.0367	2.93	3.56	9.69	0.0964	5.18	1.00	7.49	C	5.86	17.4	C	3.56
▲		2.5	RHS	2.62	0.141	54.0	8.00	18.0	334	0.0989	3.95	5.11	17.2	0.0328	2.62	3.12	9.91	0.0843	4.60	1.00	9.47	C	5.11	21.3	C	3.12
▲		2.0	RHS	2.15	0.143	66.6	10.5	23.0	274	0.0838	3.35	4.26	17.5	0.0281	2.25	2.62	10.1	0.0706	3.92	1.00	12.4	C	4.26	27.2	C	2.62

❖ Dualgrade C350L0/C450L0 hollow sections have a minimum yield stress of 450MPa (f_y = 450 MPa), a minimum tensile strength of 500 MPa (f_u = 500 MPa) and a minimum elongation equal to 16%, ie. the strength of AS 1163 grade C450L0 and the elongation of AS 1163 grade C350L0.

▲ Available Dualgrade 350L0/450L0 - please refer to page 44 "DuraGal Rectangular Hollow Sections" for the *Properties for Design to AS 4100*.

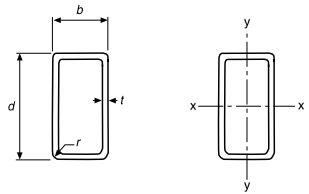
Notes:

1. This table is calculated in accordance with AS 4100 using design yield stress f_y = 350 MPa and design tensile strength f_u = 430 MPa as per AS 4100 table 2.1 for AS 1163 grade C350L0.
2. Grade C350L0 is cold formed and therefore is allocated the CF residual stresses classification in AS 4100.
3. C = Compact Section; N = Non-compact Section; S = Slender Section; as defined in AS 4100.
4. For Square and Rectangular Hollow Sections the outside corner radius *r* used in calculating the section properties is equal to 2*t* for sections with thickness $t \leq 3.0$mm and 2.5*t* for sections with $t > 3.0$mm.

DuraGal Rectangular Hollow Sections

Dimensions and Properties

Grade C450L0 (AS 1163)



Designation			Mass per metre	External Surface Area		b-2t	d-2t	Gross Section Area	About x-axis				About y-axis				Torsion Constant	Torsion Modulus	Form Factor	About x-axis			About y-axis		
d	b	t		per m	per t	t	t	A_g	I_x	Z_x	S_x	r_x	I_y	Z_y	S_y	r_y	J	C	k_f	λ_{ex}	Compactness[3]	Z_{ex}	λ_{ey}	Compactness[3]	Z_{ey}
mm	mm	mm	kg/m	m^2/m	m^2/t			mm^2	10^6mm^4	10^3mm^3	10^3mm^3	mm	10^6mm^4	10^3mm^3	10^3mm^3	mm	10^6mm^4	10^3mm^3			(C,N,S)	10^3mm^3		(C,N,S)	10^3mm^3
150 x 50 x		6.0 RHS	16.7	0.374	22.4	6.33	23.0	2130	5.06	67.5	91.2	48.7	0.860	34.4	40.9	20.1	2.63	64.3	1.00	8.50	C	91.2	30.9	N	40.4
		5.0 RHS	14.2	0.379	26.6	8.00	28.0	1810	4.44	59.2	78.9	49.5	0.765	30.6	35.7	20.5	2.30	56.8	1.00	10.7	C	78.9	37.6	N	31.8
✦		4.0 RHS	11.6	0.383	32.9	10.5	35.5	1480	3.74	49.8	65.4	50.2	0.653	26.1	29.8	21.0	1.93	48.2	0.877	14.1	C	65.4	47.6	S	22.7
		3.0 RHS	8.96	0.390	43.5	14.7	48.0	1140	2.99	39.8	51.4	51.2	0.526	21.1	23.5	21.5	1.50	38.3	0.713	19.7	C	51.4	64.4	S	14.5
		2.5 RHS	7.53	0.391	52.0	18.0	58.0	959	2.54	33.9	43.5	51.5	0.452	18.1	19.9	21.7	1.28	32.8	0.633	24.1	C	43.5	77.8	S	10.9
✦		2.0 RHS	6.07	0.393	64.7	23.0	73.0	774	2.08	27.7	35.3	51.8	0.372	14.9	16.3	21.9	1.04	26.9	0.553	30.9	N	31.6	97.9	S	7.64
✦ 125 x 75 x		6.0 RHS	16.7	0.374	22.4	10.5	18.8	2130	4.16	66.6	84.2	44.2	1.87	50.0	59.1	29.6	4.44	86.2	1.00	14.1	C	84.2	25.3	C	59.1
		5.0 RHS	14.2	0.379	26.6	13.0	23.0	1810	3.64	58.3	72.7	44.8	1.65	43.9	51.1	30.1	3.83	75.3	1.00	17.4	C	72.7	30.9	N	50.5
		4.0 RHS	11.6	0.383	32.9	16.8	29.3	1480	3.05	48.9	60.3	45.4	1.39	37.0	42.4	30.6	3.16	63.0	1.00	22.5	C	60.3	39.2	N	37.4
		3.0 RHS	8.96	0.390	43.5	23.0	39.7	1140	2.43	38.9	47.3	46.1	1.11	29.5	33.3	31.1	2.43	49.5	0.845	30.9	N	46.5	53.2	S	24.2
		2.5 RHS	7.53	0.391	52.0	28.0	48.0	959	2.07	33.0	40.0	46.4	0.942	25.1	28.2	31.4	2.05	42.1	0.763	37.6	N	34.7	64.4	S	18.2
✦		2.0 RHS	6.07	0.393	64.7	35.5	60.5	774	1.69	27.0	32.5	46.7	0.771	20.6	22.9	31.6	1.67	34.4	0.624	47.6	S	24.8	81.2	S	13.0

✦ These items are not commonly stocked but are available on request. Minimum order quantities may apply on some sizes.

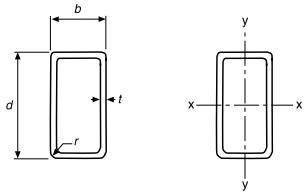
Notes:

1. This table is calculated in accordance with AS 4100 using design yield stress f_y = 450 MPa and design tensile strength f_u = 500 MPa as per AS 4100 table 2.1 for AS 1163 grade C450L0.
2. Grade C450L0 is cold formed and therefore is allocated the CF residual stresses classification in AS 4100.
3. C = Compact Section; N = Non-compact Section; S = Slender Section; as defined in AS 4100.
4. For Square and Rectangular Hollow Sections the outside corner radius r used in calculating the section properties is equal to $2t$ for sections with thickness $t \leq 3.0$mm and $2.5t$ for sections with $t > 3.0$mm.
5. DuraGal Dualgrade C350L0/C450L0 hollow sections have a minimum yield stress of 450MPa (f_y = 450MPa), a minimum tensile strength of 500MPa (f_u = 500 MPa) and a minimum elongation equal to 16%, ie. the strength of AS 1163 grade C450L0 and the elongation of AS 1163 grade C350L0.

DuraGal Rectangular Hollow Sections - *continued*

Dimensions and Properties

Grade C450L0 (AS 1163)



Designation			Mass per metre	External Surface Area		b-2t	d-2t	Gross Section Area	About x-axis				About y-axis				Torsion Constant	Torsion Modulus	Form Factor	About x-axis			About y-axis		
d	b	t		per m	per t	t	t	A_g	I_x	Z_x	S_x	r_x	I_y	Z_y	S_y	r_y	J	C	k_f	λ_{ex}	Compactness[3]	Z_{ex}	λ_{ey}	Compactness[3]	Z_{ey}
mm	mm	mm	kg/m	m^2/m	m^2/t			mm^2	10^6mm^4	10^3mm^3	10^3mm^3	mm	10^6mm^4	10^3mm^3	10^3mm^3	mm	10^6mm^4	10^3mm^3			(C,N,S)	10^3mm^3		(C,N,S)	10^3mm^3
100 x	50 x	6.0 RHS	12.0	0.274	22.8	6.33	14.7	1530	1.71	34.2	45.3	33.4	0.567	22.7	27.7	19.2	1.53	40.9	1.00	8.50	C	45.3	19.7	C	27.7
		5.0 RHS	10.3	0.279	27.0	8.00	18.0	1310	1.53	30.6	39.8	34.1	0.511	20.4	24.4	19.7	1.35	36.5	1.00	10.7	C	39.8	24.1	C	24.4
		4.0 RHS	8.49	0.283	33.3	10.5	23.0	1080	1.31	26.1	33.4	34.8	0.441	17.6	20.6	20.2	1.13	31.2	1.00	14.1	C	33.4	30.9	N	20.3
✦		3.5 RHS	7.53	0.285	37.9	12.3	26.6	959	1.18	23.6	29.9	35.1	0.400	16.0	18.5	20.4	1.01	28.2	1.00	16.5	C	29.9	35.6	N	17.1
		3.0 RHS	6.60	0.290	43.9	14.7	31.3	841	1.06	21.3	26.7	35.6	0.361	14.4	16.4	20.7	0.886	25.0	0.967	19.7	C	26.7	42.0	S	13.9
✦		2.5 RHS	5.56	0.291	52.4	18.0	38.0	709	0.912	18.2	22.7	35.9	0.311	12.4	14.0	20.9	0.754	21.5	0.856	24.1	C	22.7	51.0	S	10.4
		2.0 RHS	4.50	0.293	65.1	23.0	48.0	574	0.750	15.0	18.5	36.2	0.257	10.3	11.5	21.2	0.616	17.7	0.746	30.9	N	18.2	64.4	S	7.33
✦		1.6 RHS	3.64	0.295	81.0	29.3	60.5	463	0.613	12.3	15.0	36.4	0.211	8.43	9.33	21.3	0.501	14.5	0.661	39.2	N	12.5	81.2	S	5.19

✦ These items are not commonly stocked but are available on request. Minimum order quantities may apply on some sizes.

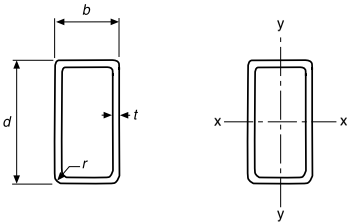
Notes:

1. This table is calculated in accordance with AS 4100 using design yield stress f_y = 450 MPa and design tensile strength f_u = 500 MPa as per AS 4100 table 2.1 for AS 1163 grade C450L0.
2. Grade C450L0 is cold formed and therefore is allocated the CF residual stresses classification in AS 4100.
3. C = Compact Section; N = Non-compact Section; S = Slender Section; as defined in AS 4100.
4. For Square and Rectangular Hollow Sections the outside corner radius r used in calculating the section properties is equal to $2t$ for sections with thickness $t \leq 3.0$mm and $2.5t$ for sections with $t > 3.0$mm.
5. DuraGal Dualgrade C350L0/C450L0 hollow sections have a minimum yield stress of 450MPa (f_y = 450MPa), a minimum tensile strength of 500MPa (f_u = 500 MPa) and a minimum elongation equal to 16%, ie. the strength of AS 1163 grade C450L0 and the elongation of AS 1163 grade C350L0.

DuraGal Rectangular Hollow Sections

Dimensions and Properties

Grade C450L0 (AS 1163)



Designation			Mass per metre	External Surface Area		b-2t	d-2t	Gross Section Area	About x-axis				About y-axis				Torsion Constant	Torsion Modulus	Form Factor	About x-axis			About y-axis		
d	b	t		per m	per t	t	t	A_g	I_x	Z_x	S_x	r_x	I_y	Z_y	S_y	r_y	J	C	k_f	λ_{ex}	Compact-ness[3]	Z_{ex}	λ_{ey}	Compact-ness[3]	Z_{ey}
mm	mm	mm	kg/m	m²/m	m²/t			mm²	10^6mm⁴	10^3mm³	10^3mm³	mm	10^6mm⁴	10^3mm³	10^3mm³	mm	10^6mm⁴	10^3mm³			(C,N,S)	10^3mm³		(C,N,S)	10^3mm³
✦ 75 x 50 x		6.0 RHS	9.67	0.224	23.2	6.33	10.5	1230	0.800	21.3	28.1	25.5	0.421	16.9	21.1	18.5	1.01	29.3	1.00	8.50	C	28.1	14.1	C	21.1
		5.0 RHS	8.35	0.229	27.4	8.00	13.0	1060	0.726	19.4	24.9	26.1	0.384	15.4	18.8	19.0	0.891	26.4	1.00	10.7	C	24.9	17.4	C	18.8
✦		4.0 RHS	6.92	0.233	33.7	10.5	16.8	881	0.630	16.8	21.1	26.7	0.335	13.4	16.0	19.5	0.754	22.7	1.00	14.1	C	21.1	22.5	C	16.0
		3.0 RHS	5.42	0.240	44.2	14.7	23.0	691	0.522	13.9	17.1	27.5	0.278	11.1	12.9	20.0	0.593	18.4	1.00	19.7	C	17.1	30.9	N	12.8
✦		2.5 RHS	4.58	0.241	52.7	18.0	28.0	584	0.450	12.0	14.6	27.7	0.240	9.60	11.0	20.3	0.505	15.9	1.00	24.1	C	14.6	37.6	N	9.95
		2.0 RHS	3.72	0.243	65.4	23.0	35.5	474	0.372	9.91	12.0	28.0	0.199	7.96	9.06	20.5	0.414	13.1	0.904	30.9	N	11.8	47.6	S	7.07
✦		1.6 RHS	3.01	0.245	81.3	29.3	44.9	383	0.305	8.14	9.75	28.2	0.164	6.56	7.40	20.7	0.337	10.8	0.799	39.2	N	8.26	60.2	S	5.01
75 x 25 x		2.5 RHS	3.60	0.191	53.1	8.00	28.0	459	0.285	7.60	10.1	24.9	0.0487	3.89	4.53	10.3	0.144	7.14	1.00	10.7	C	10.1	37.6	N	4.05
✦		2.0 RHS	2.93	0.193	65.8	10.5	35.5	374	0.238	6.36	8.31	25.3	0.0414	3.31	3.77	10.5	0.120	6.04	0.878	14.1	C	8.31	47.6	S	2.88
		1.6 RHS	2.38	0.195	81.7	13.6	44.9	303	0.197	5.26	6.81	25.5	0.0347	2.78	3.11	10.7	0.0993	5.05	0.746	18.3	C	6.81	60.2	S	2.02

✦ These items are not commonly stocked but are available on request. Minimum order quantities may apply on some sizes.

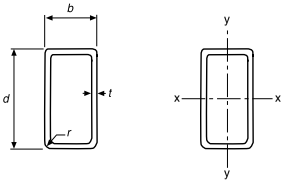
Notes:

1. This table is calculated in accordance with AS 4100 using design yield stress f_y = 450 MPa and design tensile strength f_u = 500 MPa as per AS 4100 table 2.1 for AS 1163 grade C450L0.
2. Grade C450L0 is cold formed and therefore is allocated the CF residual stresses classification in AS 4100.
3. C = Compact Section; N = Non-compact Section; S = Slender Section; as defined in AS 4100.
4. For SHS and RHS the outside corner radius r used in calculating the section properties is equal to $2t$ for sections with thickness $t \leq 3.0$mm and $2.5t$ for sections with $t > 3.0$mm.
5. DuraGal Dualgrade C350L0/C450L0 hollow sections have a minimum yield stress of 450MPa (f_y = 450MPa), a minimum tensile strength of 500MPa (f_u = 500 MPa) and a minimum elongation equal to 16%, ie. the strength of AS 1163 grade C450L0 and the elongation of AS 1163 grade C350L0.

DuraGal Rectangular Hollow Sections - *continued*

Dimensions and Properties

Grade C450L0 (AS 1163)



Designation			Mass per metre	External Surface Area		b-2t	d-2t	Gross Section Area	Properties								Torsion Constant	Torsion Modulus	Form Factor	Properties for Design to AS 4100					
									About x-axis				About y-axis							About x-axis			About y-axis		
d	b	t		per m	per t	t	t	A_g	I_x	Z_x	S_x	r_x	I_y	Z_y	S_y	r_y	J	C	k_f	λ_{ex}	Compact-ness[3]	Z_{ex}	λ_{ey}	Compact-ness[3]	Z_{ey}
mm	mm	mm	kg/m	m²/m	m²/t			mm²	10^6mm⁴	10^3mm³	10^3mm³	mm	10^6mm⁴	10^3mm³	10^3mm³	mm	10^6mm⁴	10^3mm³			(C,N,S)	10^3mm³		(C,N,S)	10^3mm³
65 x 35 x 4.0 RHS			5.35	0.183	34.2	6.75	14.3	681	0.328	10.1	13.3	22.0	0.123	7.03	8.58	13.4	0.320	12.5	1.00	9.06	C	13.3	19.1	C	8.58
		3.0 RHS	4.25	0.190	44.7	9.67	19.7	541	0.281	8.65	11.0	22.8	0.106	6.04	7.11	14.0	0.259	10.4	1.00	13.0	C	11.0	26.4	C	7.11
		2.5 RHS	3.60	0.191	53.1	12.0	24.0	459	0.244	7.52	9.45	23.1	0.0926	5.29	6.13	14.2	0.223	9.10	1.00	16.1	C	9.45	32.2	N	5.95
		2.0 RHS	2.93	0.193	65.8	15.5	30.5	374	0.204	6.28	7.80	23.4	0.0778	4.44	5.07	14.4	0.184	7.62	0.985	20.8	C	7.80	40.9	S	4.37
50 x 25 x 3.0 RHS			3.07	0.140	45.5	6.33	14.7	391	0.112	4.47	5.86	16.9	0.0367	2.93	3.56	9.69	0.0964	5.18	1.00	8.50	C	5.86	19.7	C	3.56
		2.5 RHS	2.62	0.141	54.0	8.00	18.0	334	0.0989	3.95	5.11	17.2	0.0328	2.62	3.12	9.91	0.0843	4.60	1.00	10.7	C	5.11	24.1	C	3.12
		2.0 RHS	2.15	0.143	66.6	10.5	23.0	274	0.0838	3.35	4.26	17.5	0.0281	2.25	2.62	10.1	0.0706	3.92	1.00	14.1	C	4.26	30.9	N	2.58
		1.6 RHS	1.75	0.145	82.5	13.6	29.3	223	0.0702	2.81	3.53	17.7	0.0237	1.90	2.17	10.3	0.0585	3.29	1.00	18.3	C	3.53	39.2	N	1.92
50 x 20 x 3.0 RHS			2.83	0.130	45.8	4.67	14.7	361	0.0951	3.81	5.16	16.2	0.0212	2.12	2.63	7.67	0.0620	3.88	1.00	6.26	C	5.16	19.7	C	2.63
		2.5 RHS	2.42	0.131	54.2	6.00	18.0	309	0.0848	3.39	4.51	16.6	0.0192	1.92	2.32	7.89	0.0550	3.49	1.00	8.05	C	4.51	24.1	C	2.32
		2.0 RHS	1.99	0.133	66.8	8.00	23.0	254	0.0723	2.89	3.78	16.9	0.0167	1.67	1.96	8.11	0.0466	3.00	1.00	10.7	C	3.78	30.9	N	1.93
		1.6 RHS	1.63	0.135	82.7	10.5	29.3	207	0.0608	2.43	3.14	17.1	0.0142	1.42	1.63	8.29	0.0389	2.55	1.00	14.1	C	3.14	39.2	N	1.44

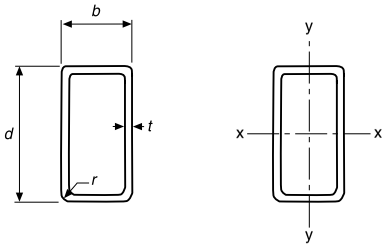
Notes:

1. This table is calculated in accordance with AS 4100 using design yield stress f_y = 450 MPa and design tensile strength f_u = 500 MPa as per AS 4100 table 2.1 for AS 1163 grade C450L0.
2. Grade C450L0 is cold formed and therefore is allocated the CF residual stresses classification in AS 4100.
3. C = Compact Section; N = Non-compact Section; S = Slender Section; as defined in AS 4100.
4. For SHS and RHS the outside corner radius r used in calculating the section properties is equal to $2t$ for sections with thickness $t \leq 3.0$mm and $2.5t$ for sections with $t > 3.0$mm.
5. DuraGal Dualgrade C350L0/C450L0 hollow sections have a minimum yield stress of 450MPa (f_y = 450MPa), a minimum tensile strength of 500MPa (f_u = 500 MPa) and a minimum elongation equal to 16%, ie. the strength of AS 1163 grade C450L0 and the elongation of AS 1163 grade C350L0.

Galtube Plus Rectangular Hollow Sections

Dimensions and Properties

Grade C350L0 (Tubeline 350L0 - Type 1)



Designation			Mass per metre	External Surface Area		b-2r	d-2r	Full Section Area	Full Section Properties								Torsion Constant	Torsion Modulus	Effective Section Area	Effective Section Properties			
									About x-axis				About y-axis							About x- and y- axis			
d	b	t		per m	per t	t	t	A_f	I_x	Z_x	S_x	r_x	I_y	Z_y	S_y	r_y	J	C	A_e	I_{ex}	Z_{ex}	I_{ey}	Z_{ey}
mm	mm	mm	kg/m	m^2/m	m^2/t			mm^2	10^6mm^4	10^3mm^3	10^3mm^3	mm	10^6mm^4	10^3mm^3	10^3mm^3	mm	10^6mm^4	10^3mm^3	mm^2	10^6mm^4	10^3mm^3	10^6mm^4	10^3mm^3
✦ 75 x 25 x 2.5 RHS			3.60	0.191	53.1	27.3	6.42	442	0.276	7.37	9.72	25.0	0.0473	3.78	4.38	10.3	0.139	6.93	442	0.276	7.37	0.0473	3.78
✦		1.6 RHS	2.38	0.195	81.7	47.7	13.2	276	0.181	4.83	6.23	25.6	0.0320	2.56	2.85	10.8	0.0911	4.65	227	0.181	4.83	0.0251	2.01
✦ 50 x 25 x 2.5 RHS			2.62	0.141	54.0	16.8	6.42	322	0.0960	3.84	4.94	17.3	0.0319	2.55	3.02	9.95	0.0817	4.47	322	0.0960	3.84	0.0319	2.55
		1.6 RHS	1.75	0.145	82.5	30.5	13.2	204	0.0647	2.59	3.23	17.8	0.0219	1.75	2.00	10.4	0.0537	3.04	204	0.0647	2.59	0.0219	1.75
✦ 50 x 20 x 2.5 RHS			2.42	0.131	54.2	16.8	4.33	298	0.0824	3.30	4.37	16.6	0.0188	1.88	2.25	7.93	0.0534	3.40	298	0.0824	3.30	0.0188	1.88
		1.6 RHS	1.63	0.135	82.7	30.5	9.79	189	0.0561	2.25	2.88	17.2	0.0132	1.32	1.50	8.35	0.0359	2.36	189	0.0561	2.25	0.0132	1.32

✦ These items are not commonly stocked but are available on request. Minimum order quantities may apply on some sizes.

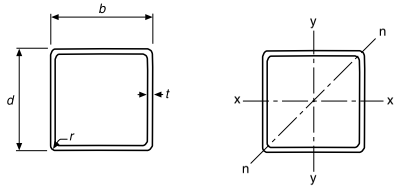
Notes:

1. This table is calculated in accordance with AS/NZS 4600 using design yield stress f_y = 350 MPa and design tensile strength f_u = 380 MPa.
2. Effective section properties are calculated in accordance with AS/NZS 4600.
3. All columns of the table (except for "Mass per metre" and External Surface Area") are calculated using design thicknesses of 1.45mm and 2.4mm rather than the respective thicknesses *t* of 1.6mm and 2.5mm. This is to comply with clause 1.5.1.6 of AS/NZS4600.
4. For Square and Rectangular Hollow Sections the outside corner radius *r* used in calculating the section properties is equal to 2*t* for sections with thickness $t \leq$ 3.0mm and 2.5*t* for sections with $t >$ 3.0mm.

Square Hollow Sections

Dimensions and Properties

Grade C350L0 (AS 1163)



Designation			Mass per metre	External Surface Area		(b-2t)	Gross Section Area	Properties								Properties for Design to AS 4100		
								About x-, y- and n-axis					Torsion Constant	Torsion Modulus	Form Factor	About x- and y-axis		
d	b	t		per m	per t	t	A_g	I_x	Z_x	Z_n	S_x	r_x	J	C	k_f	λ_e	Compactness[3]	Z_e
mm	mm	mm	kg/m	m^2/m	m^2/t		mm^2	10^6mm^4	10^3mm^3	10^3mm^3	10^3mm^3	mm	10^6mm^4	10^3mm^3			(C,N,S)	10^3mm^3
250	250	9.0 SHS	65.9	0.961	14.6	25.8	8400	79.8	639	477	750	97.5	129	972	1.00	30.5	N	744
		6.0 SHS	45.0	0.974	21.7	39.7	5730	56.2	450	330	521	99.0	88.7	681	0.853	46.9	S	409
200	200	9.0 SHS	51.8	0.761	14.7	20.2	6600	39.2	392	297	465	77.1	64.5	599	1.00	23.9	C	465
		6.0 SHS	35.6	0.774	21.8	31.3	4530	28.0	280	207	327	78.6	44.8	425	1.00	37.1	N	294
		5.0 SHS	29.9	0.779	26.0	38.0	3810	23.9	239	175	277	79.1	37.8	362	0.890	45.0	S	223
150	150	9.0 SHS	37.7	0.561	14.9	14.7	4800	15.4	205	159	248	56.6	26.1	316	1.00	17.4	C	248
		6.0 SHS	26.2	0.574	22.0	23.0	3330	11.3	150	113	178	58.2	18.4	229	1.00	27.2	C	178
		5.0 SHS	22.1	0.579	26.2	28.0	2810	9.70	129	96.1	151	58.7	15.6	197	1.00	33.1	N	144
125	125	9.0 SHS	30.6	0.461	15.1	11.9	3900	8.38	134	106	165	46.4	14.5	208	1.00	14.1	C	165
		6.0 SHS	21.4	0.474	22.1	18.8	2730	6.29	101	76.5	120	48.0	10.4	154	1.00	22.3	C	120
		5.0 SHS	18.2	0.479	26.3	23.0	2310	5.44	87.1	65.4	103	48.5	8.87	133	1.00	27.2	C	103
		4.0 SHS	14.8	0.483	32.7	29.3	1880	4.52	72.3	53.6	84.5	49.0	7.25	110	1.00	34.6	N	78.9

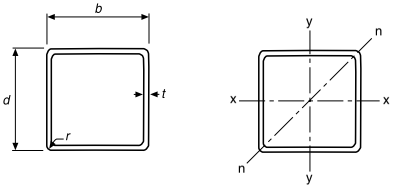
Notes:

1. This table is calculated in accordance with AS 4100 using design yield stress f_y = 350 MPa and design tensile strength f_u = 430 MPa as per AS 4100 table 2.1 for AS 1163 grade C350L0.
2. Grade C350L0 is cold formed and therefore is allocated the CF residual stresses classification in AS 4100.
3. C = Compact Section; N = Non-compact Section; S = Slender Section; as defined in AS 4100.
4. For Square and Rectangular Hollow Sections the outside corner radius r used in calculating the section properties is equal to $2t$ for sections with thickness $t \leq 3.0$mm and $2.5t$ for sections with $t > 3.0$mm.

Square Hollow Sections - *continued*

Dimensions and Properties

Grade C350L0 (AS 1163)



Designation				Dimension and Ratios					Properties									Properties for Design to AS 4100		
				Mass per metre	External Surface Area		(b-2t)	Gross Section Area	About x-, y- and n-axis					Torsion Constant	Torsion Modulus	Form Factor	About x- and y-axis		
	d	b	t		per m	per t	t	A_g	I_x	Z_x	Z_n	S_x	r_x	J	C	k_f	λ_e	Compactness[3]	Z_e
	mm	mm	mm	kg/m	m^2/m	m^2/t		mm^2	10^6mm^4	10^3mm^3	10^3mm^3	10^3mm^3	mm	10^6mm^4	10^3mm^3			(C,N,S)	10^3mm^3
	100	100	9.0 SHS	23.5	0.361	15.4	9.11	3000	3.91	78.1	63.6	98.6	36.1	7.00	123	1.00	10.8	C	98.6
▲			6.0 SHS	16.7	0.374	22.4	14.7	2130	3.04	60.7	47.1	73.5	37.7	5.15	93.6	1.00	17.4	C	73.5
▲			5.0 SHS	14.2	0.379	26.6	18.0	1810	2.66	53.1	40.5	63.5	38.3	4.42	81.4	1.00	21.3	C	63.5
▲			4.0 SHS	11.6	0.383	32.9	23.0	1480	2.23	44.6	33.5	52.6	38.8	3.63	68.0	1.00	27.2	C	52.6
▲			3.0 SHS	8.96	0.390	43.5	31.3	1140	1.77	35.4	26.0	41.2	39.4	2.79	53.2	1.00	37.1	N	37.1
▲	89	89	6.0 SHS	14.6	0.330	22.5	12.8	1870	2.06	46.2	36.3	56.6	33.2	3.54	71.6	1.00	15.2	C	56.6
▲			5.0 SHS	12.5	0.334	26.7	15.8	1590	1.81	40.7	31.4	49.1	33.7	3.05	62.7	1.00	18.7	C	49.1
▲			3.5 SHS	9.06	0.341	37.6	23.4	1150	1.37	30.9	23.2	36.5	34.5	2.24	47.1	1.00	27.7	C	36.5
▲	75	75	6.0 SHS	12.0	0.274	22.8	10.5	1530	1.16	30.9	24.7	38.4	27.5	2.04	48.2	1.00	12.4	C	38.4
▲			5.0 SHS	10.3	0.279	27.0	13.0	1310	1.03	27.5	21.6	33.6	28.0	1.77	42.6	1.00	15.4	C	33.6
▲			4.0 SHS	8.49	0.283	33.3	16.8	1080	0.882	23.5	18.0	28.2	28.6	1.48	36.1	1.00	19.8	C	28.2
▲			3.0 SHS	6.60	0.290	43.9	23.0	841	0.716	19.1	14.2	22.5	29.2	1.15	28.7	1.00	27.2	C	22.5
▲			2.5 SHS	5.56	0.291	52.4	28.0	709	0.614	16.4	12.0	19.1	29.4	0.971	24.6	1.00	33.1	N	18.3

▲ Available as Dualgrade 350L0/450L0 - please refer to page 44 "DuraGal Rectangular Hollow Sections" for the *Properties for Design to AS 4100*.

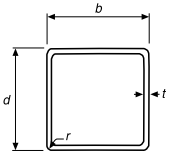
Notes:

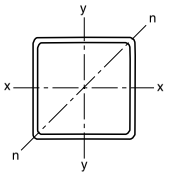
1. This table is calculated in accordance with AS 4100 using design yield stress f_y = 350 MPa and design tensile strength f_u = 430 MPa as per AS 4100 table 2.1 for AS 1163 grade C350L0.
2. Grade C350L0 is cold formed and therefore is allocated the CF residual stresses classification in AS 4100.
3. C = Compact Section; N = Non-compact Section; S = Slender Section; as defined in AS 4100.
4. For Square and Rectangular Hollow Sections the outside corner radius r used in calculating the section properties is equal to $2t$ for sections with thickness $t \leq 3.0$mm and $2.5t$ for sections with $t > 3.0$mm.

Square Hollow Sections

Dimensions and Properties

Grade C350L0 (AS 1163)





Designation			Mass per metre	External Surface Area		(b-2t)	Gross Section Area	Properties								Properties for Design to AS 4100		
								About x-, y- and n-axis					Torsion Constant	Torsion Modulus	Form Factor	About x- and y-axis		
d	b	t		per m	per t	t	A_g	I_x	Z_x	Z_n	S_x	r_x	J	C	k_f	λ_e	Compactness(3)	Z_e
mm	mm	mm	kg/m	m²/m	m²/t		mm²	10^6mm⁴	10^3mm³	10^3mm³	10^3mm³	mm	10^6mm⁴	10^3mm³			(C,N,S)	10^3mm³
65 x 65 x		6.0 SHS	10.1	0.234	23.1	8.83	1290	0.706	21.7	17.8	27.5	23.4	1.27	34.2	1.00	10.5	C	27.5
▲		5.0 SHS	8.75	0.239	27.3	11.0	1110	0.638	19.6	15.6	24.3	23.9	1.12	30.6	1.00	13.0	C	24.3
▲		4.0 SHS	7.23	0.243	33.6	14.3	921	0.552	17.0	13.2	20.6	24.5	0.939	26.2	1.00	16.9	C	20.6
▲		3.0 SHS	5.66	0.250	44.1	19.7	721	0.454	14.0	10.4	16.6	25.1	0.733	21.0	1.00	23.3	C	16.6
▲		2.5 SHS	4.78	0.251	52.6	24.0	609	0.391	12.0	8.91	14.1	25.3	0.624	18.1	1.00	28.4	C	14.1
50 x 50 x		6.0 SHS	7.32	0.174	23.8	6.33	932	0.275	11.0	9.45	14.5	17.2	0.518	17.7	1.00	8.50	C	14.5
▲		5.0 SHS	6.39	0.179	27.9	8.00	814	0.257	10.3	8.51	13.2	17.8	0.469	16.3	1.00	9.47	C	13.2
▲		4.0 SHS	5.35	0.183	34.2	10.5	681	0.229	9.15	7.33	11.4	18.3	0.403	14.3	1.00	12.4	C	11.4
▲		3.0 SHS	4.25	0.190	44.7	14.7	541	0.195	7.79	5.92	9.39	19.0	0.321	11.8	1.00	17.4	C	9.39
▲		2.5 SHS	3.60	0.191	53.1	18.0	459	0.169	6.78	5.09	8.07	19.2	0.275	10.2	1.00	21.3	C	8.07
		1.6 SHS	2.38	0.195	81.7	29.3	303	0.117	4.68	3.44	5.46	19.6	0.185	7.03	1.00	34.6	N	5.10

▲Available as Dualgrade 350L0/450L0 - please refer to page 44 “DuraGal Rectangular Hollow Sections” for the *Properties for Design to AS 4100*.

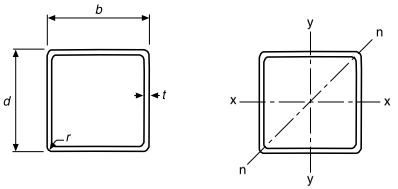
Notes:

1. This table is calculated in accordance with AS 4100 using design yield stress f_y = 350 MPa and design tensile strength f_u = 430 MPa as per AS 4100 table 2.1 for AS 1163 grade C350L0.
2. Grade C350L0 is cold formed and therefore is allocated the CF residual stresses classification in AS 4100.
3. C = Compact Section; N = Non-compact Section; S = Slender Section; as defined in AS 4100.
4. For Square and Rectangular Hollow Sections the outside corner radius r used in calculating the section properties is equal to $2t$ for sections with thickness $t \leq 3.0$mm and $2.5t$ for sections with $t > 3.0$mm.

Square Hollow Sections - *continued*

Dimensions and Properties

Grade C350L0 (AS 1163)



	Designation			Dimension and Ratios: Mass per metre	External Surface Area: per m	External Surface Area: per t	(b-2t)	Gross Section Area	Properties: About x-, y- and n-axis					Torsion Constant	Torsion Modulus	Form Factor	Properties for Design to AS 4100: About x- and y-axis		
	d	*b*	*t*				*t*	A_g	I_x	Z_x	Z_n	S_x	r_x	*J*	*C*	k_f	λ_e	Compactness[3]	Z_e
	mm	mm	mm	kg/m	m²/m	m²/t		mm²	10^6mm⁴	10^3mm³	10^3mm³	10^3mm³	mm	10^6mm⁴	10^3mm³			(C,N,S)	10^3mm³
▲	40 x 40 x		4.0 SHS	4.09	0.143	34.9	8.00	521	0.105	5.26	4.36	6.74	14.2	0.192	8.33	1.00	9.47	C	6.74
▲			3.0 SHS	3.30	0.150	45.3	11.3	421	0.0932	4.66	3.61	5.72	14.9	0.158	7.07	1.00	13.4	C	5.72
▲			2.5 SHS	2.82	0.151	53.7	14.0	359	0.0822	4.11	3.13	4.97	15.1	0.136	6.21	1.00	16.6	C	4.97
▲			2.0 SHS	2.31	0.153	66.4	18.0	294	0.0694	3.47	2.61	4.13	15.4	0.113	5.23	1.00	21.3	C	4.13
▲	35 x 35 x		4.0 SHS	3.46	0.123	35.48	6.75	441	0.06	3.68	3.16	4.86	12.1	0.121	5.94	1.00	See note ▲ below		
▲			3.0 SHS	2.83	0.130	45.8	9.67	361	0.0595	3.40	2.67	4.23	12.8	0.102	5.18	1.00	11.4	C	4.23
▲			2.5 SHS	2.42	0.131	54.2	12.0	309	0.0529	3.02	2.33	3.69	13.1	0.0889	4.58	1.00	14.2	C	3.69
▲	25 x 25 x		3.0 SHS	1.89	0.0897	47.4	6.33	241	0.0184	1.47	1.21	1.91	8.74	0.0333	2.27	1.00	7.49	C	1.91
▲			2.5 SHS	1.64	0.0914	55.7	8.00	209	0.0169	1.35	1.08	1.71	8.99	0.0297	2.07	1.00	9.47	C	1.71
▲			2.0 SHS	1.36	0.0931	68.3	10.5	174	0.0148	1.19	0.926	1.47	9.24	0.0253	1.80	1.00	12.4	C	1.47
			1.6 SHS	1.12	0.0945	84.1	13.6	143	0.0128	1.02	0.780	1.24	9.44	0.0212	1.54	1.00	16.1	C	1.24

▲Available as Dualgrade 350L0/450L0 - please refer to page 44 "DuraGal Rectangular Hollow Sections" for the *Properties for Design to AS 4100*.

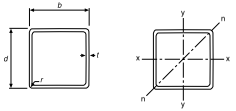
Notes:

1. This table is calculated in accordance with AS 4100 using design yield stress f_y = 350 MPa and design tensile strength f_u = 430 MPa as per AS 4100 table 2.1 for AS 1163 grade C350L0.
2. Grade C350L0 is cold formed and therefore is allocated the CF residual stresses classification in AS 4100.
3. C = Compact Section; N = Non-compact Section; S = Slender Section; as defined in AS 4100.
4. For Square and Rectangular Hollow Sections the outside corner radius *r* used in calculating the section properties is equal to 2*t* for sections with thickness $t \leq 3.0$mm and 2.5*t* for sections with $t > 3.0$mm.

DuraGal Square Hollow Sections

Dimensions and Properties

Grade C450L0 (AS 1163)



Designation	Mass per metre	External Surface Area		(b-2t)	Gross Section Area	Properties								Properties for Design to AS 4100		
						About x-, y- and n-axis					Torsion Constant	Torsion Modulus	Form Factor	About x- and y-axis		
d b t		per m	per t	t	A_g	I_x	Z_x	Z_n	S_x	r_x	J	C	k_f	λ_e	Compactness[3]	Z_e
mm mm mm	kg/m	m²/m	m²/t		mm²	10^6mm⁴	10^3mm³	10^3mm³	10^3mm³	mm	10^6mm⁴	10^3mm³			(C,N,S)	10^3mm³
100 x 100 x 6.0 SHS	16.7	0.374	22.4	14.7	2130	3.04	60.7	47.1	73.5	37.7	5.15	93.6	1.00	19.7	C	73.5
5.0 SHS	14.2	0.379	26.6	18.0	1810	2.66	53.1	40.5	63.5	38.3	4.42	81.4	1.00	24.1	C	63.5
4.0 SHS	11.6	0.383	32.9	23.0	1480	2.23	44.6	33.5	52.6	38.8	3.63	68.0	1.00	30.9	N	51.9
3.0 SHS	8.96	0.390	43.5	31.3	1140	1.77	35.4	26.0	41.2	39.4	2.79	53.2	0.952	42.0	S	34.4
90 x 90 x 2.5 SHS	6.74	0.351	52.1	34.0	859	1.09	24.1	17.6	28.0	35.6	1.70	36.2	0.878	45.6	S	22.3
2.0 SHS	5.45	0.353	64.8	43.0	694	0.889	19.7	14.3	22.8	35.8	1.38	29.6	0.696	57.7	S	16.0
✦ 75 x 75 x 6.0 SHS	12.0	0.274	22.8	10.5	1530	1.16	30.9	24.7	38.4	27.5	2.04	48.2	1.00	14.1	C	38.4
5.0 SHS	10.3	0.279	27.0	13.0	1310	1.03	27.5	21.6	33.6	28.0	1.77	42.6	1.00	17.4	C	33.6
4.0 SHS	8.49	0.283	33.3	16.8	1080	0.882	23.5	18.0	28.2	28.6	1.48	36.1	1.00	22.5	C	28.2
3.0 SHS	6.60	0.290	43.9	23.0	841	0.716	19.1	14.2	22.5	29.2	1.15	28.7	1.00	30.9	N	22.2
2.5 SHS	5.56	0.291	52.4	28.0	709	0.614	16.4	12.0	19.1	29.4	0.971	24.6	1.00	37.6	N	17.0
✦ 65 x 65 x 6.0 SHS	10.1	0.234	23.1	8.83	1290	0.706	21.7	17.8	27.5	23.4	1.27	34.2	1.00	11.9	C	27.5
5.0 SHS	8.75	0.239	27.3	11.0	1110	0.638	19.6	15.6	24.3	23.9	1.12	30.6	1.00	14.8	C	24.3
4.0 SHS	7.23	0.243	33.6	14.3	921	0.552	17.0	13.2	20.6	24.5	0.939	26.2	1.00	19.1	C	20.6
3.0 SHS	5.66	0.250	44.1	19.7	721	0.454	14.0	10.4	16.6	25.1	0.733	21.0	1.00	26.4	C	16.6
✦ 2.5 SHS	4.78	0.251	52.6	24.0	609	0.391	12.0	8.91	14.1	25.3	0.624	18.1	1.00	32.2	N	13.7

✦ These items are not commonly stocked but are available on request. Minimum order quantities may apply on some sizes.

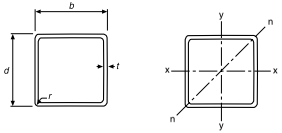
Notes:

1. This table is calculated in accordance with AS 4100 using design yield stress f_y = 450 MPa and design tensile strength f_u = 500 MPa as per AS 4100 table 2.1 for AS 1163 grade C450L0.
2. Grade C450L0 is cold formed and therefore is allocated the CF residual stresses classification in AS 4100.
3. C = Compact Section; N = Non-compact Section; S = Slender Section; as defined in AS 4100.
4. For Square and Rectangular Hollow Sections the outside corner radius r used in calculating the section properties is equal to $2t$ for sections with thickness $t \leq 3.0$mm and $2.5t$ for sections with $t > 3.0$mm.
5. DuraGal Dualgrade C350L0/C450L0 hollow sections have a minimum yield stress of 450 MPa (f_y = 450 MPa), a minimum tensile strength of 500 MPa (f_u = 500 MPa) and a minimum elongation equal to 16%, ie. the strength of AS 1163 grade C450L0 and the elongation of AS 1163 grade C350L0.

DuraGal Square Hollow Sections

Dimensions and Properties

Grade C450L0 (AS 1163)



	Designation	Mass per metre	External Surface Area		(b-2t)	Gross Section Area	Properties								Properties for Design to AS 4100		
							About x-, y- and n-axis					Torsion Constant	Torsion Modulus	Form Factor	About x- and y-axis		
	d b t		per m	per t	t	A_g	I_x	Z_x	Z_n	S_x	r_x	J	C	k_f	λ_e	Compactness[3]	Z_e
	mm mm mm	kg/m	m^2/m	m^2/t		mm^2	10^6mm^4	10^3mm^3	10^3mm^3	10^3mm^3	mm	10^6mm^4	10^3mm^3			(C,N,S)	10^3mm^3
	50 x 50 x 5.0 SHS	6.39	0.179	27.9	8.00	814	0.257	10.3	8.51	13.2	17.8	0.469	16.3	1.00	10.7	C	13.2
	4.0 SHS	5.35	0.183	34.2	10.5	681	0.229	9.15	7.33	11.4	18.3	0.403	14.3	1.00	14.1	C	11.4
	3.0 SHS	4.25	0.190	44.7	14.7	541	0.195	7.79	5.92	9.39	19.0	0.321	11.8	1.00	19.7	C	9.39
	2.5 SHS	3.60	0.191	53.1	18.0	459	0.169	6.78	5.09	8.07	19.2	0.275	10.2	1.00	24.1	C	8.07
✦	1.6 SHS	2.38	0.195	81.7	29.3	303	0.117	4.68	3.44	5.46	19.6	0.185	7.03	1.00	39.2	N	4.74
	40 x 40 x 4.0 SHS	4.09	0.143	34.9	8.00	521	0.105	5.26	4.36	6.74	14.2	0.192	8.33	1.00	10.7	C	6.74
	3.0 SHS	3.30	0.150	45.3	11.3	421	0.0932	4.66	3.61	5.72	14.9	0.158	7.07	1.00	15.2	C	5.72
	2.5 SHS	2.82	0.151	53.7	14.0	359	0.0822	4.11	3.13	4.97	15.1	0.136	6.21	1.00	18.8	C	4.97
✦	35 x 35 x 3.0 SHS	2.83	0.130	45.8	9.67	361	0.0595	3.40	2.67	4.23	12.8	0.102	5.18	1.00	13.0	C	4.23
	2.5 SHS	2.42	0.131	54.2	12.0	309	0.0529	3.02	2.33	3.69	13.1	0.0889	4.58	1.00	16.1	C	3.69
	2.0 SHS	1.99	0.133	66.8	15.5	254	0.0451	2.58	1.95	3.09	13.3	0.0741	3.89	1.00	20.8	C	3.09
	1.6 SHS	1.63	0.135	82.7	19.9	207	0.0379	2.16	1.62	2.57	13.5	0.0611	3.26	1.00	26.7	C	2.57
✦	25 x 25 x 3.0 SHS	1.89	0.0897	47.4	6.33	241	0.0184	1.47	1.21	1.91	8.74	0.0333	2.27	1.00	8.50	C	1.91
	2.5 SHS	1.64	0.0914	55.7	8.00	209	0.0169	1.35	1.08	1.71	8.99	0.0297	2.07	1.00	10.7	C	1.71
	2.0 SHS	1.36	0.0931	68.3	10.5	174	0.0148	1.19	0.926	1.47	9.24	0.0253	1.80	1.00	14.1	C	1.47
	1.6 SHS	1.12	0.0945	84.1	13.6	143	0.0128	1.02	0.780	1.24	9.44	0.0212	1.54	1.00	18.3	C	1.24

✦ These items are not commonly stocked but are available on request. Minimum order quantities may apply on some sizes.

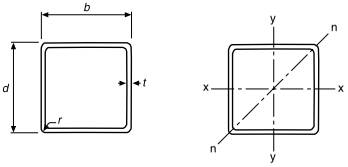
Notes:

1. This table is calculated in accordance with AS 4100 using design yield stress f_y = 450 MPa and design tensile strength f_u = 500 MPa as per AS 4100 table 2.1 for AS 1163 grade C450L0.
2. Grade C450L0 is cold formed and therefore is allocated the CF residual stresses classification in AS 4100.
3. C = Compact Section; N = Non-compact Section; S = Slender Section; as defined in AS 4100.
4. For SHS and RHS the outside corner radius r used in calculating the section properties is equal to $2t$ for sections with thickness $t \leq 3.0$mm and $2.5t$ for sections with $t > 3.0$mm.
5. DuraGal Dualgrade C350L0/C450L0 Hollow Sections have a minimum yield stress of 450 MPa (f_y = 450 MPa), a minimum tensile strength of 500 MPa (f_u = 500 MPa) and a minimum elongation equal to 16%, ie. the strength of AS 1163 grade C450L0 and the elongation of AS 1163 grade C350L0.

Galtube Plus Square Hollow Sections

Dimensions and Properties

Grade C350L0 (Tubeline 350L0 – Type 1)



	Designation			Mass per metre	External Surface Area		(b-2r)	Full Section Area	Full Section Properties					Torsion Constant	Torsion Modulus	Effective Section Area	Effective Section Properties		
									About x-, y- and n-axis								About x- and y-axis		
	d	b	t		per m	per t	t	A_f	I_x	Z_x	Z_n	S_x	r_x	J	C	A_e	I_{ex}	Z_{ex}	Z_{en}
	mm	mm	mm	kg/m	m^2/m	m^2/t		mm^2	10^6mm^4	10^3mm^3	10^3mm^3	10^3mm^3	mm	10^6mm^4	10^3mm^3	mm^2	10^6mm^4	10^3mm^3	10^3mm^3
	65 x 65 x 2.5 SHS			4.78	0.251	52.6	23.1	586	0.378	11.6	8.59	13.6	25.4	0.601	17.5	586	0.378	11.6	8.59
✦			1.6 SHS	3.13	0.255	81.2	40.8	363	0.243	7.46	5.42	8.61	25.8	0.377	11.2	308	0.215	6.61	5.42
✦	50 x 50 x 2.5 SHS			3.60	0.191	53.1	16.8	442	0.164	6.56	4.92	7.80	19.3	0.266	9.89	442	0.164	6.56	4.92
			1.6 SHS	2.38	0.195	81.7	30.5	276	0.107	4.30	3.14	4.99	19.7	0.169	6.45	276	0.107	4.30	3.14
✦	40 x 40 x 2.5 SHS			2.82	0.151	53.7	12.7	346	0.0797	3.99	3.03	4.81	15.2	0.132	6.02	346	0.0797	3.99	3.03
			1.6 SHS	1.88	0.155	82.3	23.6	218	0.0534	2.67	1.97	3.13	15.6	0.0848	4.01	218	0.0534	2.67	1.97
✦	35 x 35 x 2.5 SHS			2.42	0.131	54.2	10.6	298	0.0514	2.94	2.26	3.58	13.1	0.0860	4.45	298	0.0514	2.94	2.26
			1.6 SHS	1.63	0.135	82.7	20.1	189	0.0350	2.00	1.48	2.36	13.6	0.0561	3.01	189	0.0350	2.00	1.48
	30 x 30 x 1.6 SHS			1.38	0.115	83.3	16.7	160	0.0214	1.43	1.07	1.69	11.6	0.0346	2.15	160	0.0214	1.43	1.07
	25 x 25 x 1.6 SHS			1.12	0.0945	84.1	13.2	131	0.0119	0.949	0.720	1.14	9.51	0.0195	1.43	131	0.0119	0.949	0.720
	20 x 20 x 1.6 SHS			0.873	0.0745	85.4	9.79	102	0.00570	0.570	0.440	0.697	7.47	0.00959	0.864	102	0.00570	0.570	0.440

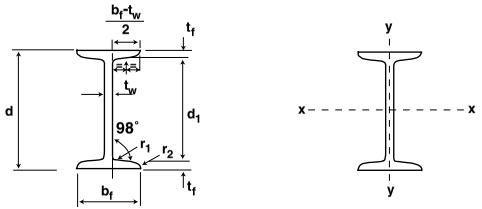
✦ These items are not commonly stocked but are available on request. Minimum order quantities may apply on some sizes.

Notes:

1. This table is calculated in accordance with AS/NZS 4600 using design yield stress f_y = 350 MPa and design tensile strength f_u = 380 MPa.
2. Effective section properties are calculated in accordance with AS/NZS 4600.
3. All columns of the table (except for "Mass per metre" and "External Surface Area") are calculated using design thicknesses of 1.45mm and 2.4mm rather than respective thicknesses t of 1.6mm and 2.5mm. This is to comply with clause 1.5.1.6 of AS/NZS 4600.
4. For Square and Rectangular Hollow Sections the outside corner radius r used in calculating the section properties is equal to $2t$ for sections with thickness $t \leq 3.0$mm and $2.5t$ for sections with $t > 3.0$mm.

Joists – Taper Flange Beams

Dimensions and Properties



OneSteel-300PLUS

Designation	Mass per metre	Depth of Section	Flange Width	Flange Thickness	Web Thickness	Root Radii	Toe Radii	Depth Between Flanges			Gross Area of Cross Section	About x-axis				About y-axis				Torsion Constant	Warping Constant
		d	b_f	t_f	t_w	r_1	r_2	d_1	t_w	$(b_f\text{-}t_w)$ $2t_f$	A_g	I_x	Z_x	S_x	r_x	I_y	Z_y	S_y	r_y	J	I_w
	kg/m	mm	mm	mm	mm	mm	mm				mm^2	10^6mm^4	10^3mm^3	10^3mm^3	mm	10^6mm^4	10^3mm^3	10^3mm^3	mm	10^3mm^4	10^9mm^6
125 x 65 TFB	13.1	125	65	8.5	5.0	8.0	4.0	108	21.6	3.53	1670	4.34	69.4	80.3	50.9	0.337	10.4	17.2	14.2	40.2	1.14
100 x 45 TFB	7.2	100	45	6.0	4.0	7.0	3.0	88	22.0	3.42	917	1.46	29.2	34.1	39.9	0.0795	3.53	6.0	9.31	11.6	0.0176

Properties for Assessing Section Capacity

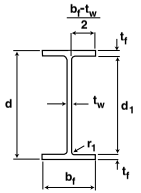
OneSteel-300PLUS				About x-axis		About y-axis		AS 3679.1-350				About x-axis		About y-axis	
Designation	Flange f_y	Web f_y	Form Factor	Compactness	Z_{ex}	Compactness	Z_{ey}	Designation	Flange f_y	Web f_y	Form Factor	Compactness	Z_{ex}	Compactness	Z_{ey}
	MPa	MPa	k_f		10^3mm^3		10^3mm^3		MPa	MPa	k_f		10^3mm^3		10^3mm^3
125 x 65 TFB	320	320	1	C	80.3	C	15.6	125 x 65 TFB	360	360	1	C	80.3	C	15.6
100 x 45 TFB	320	320	1	C	34.1	C	5.3	100 x 45 TFB	360	360	1	C	34.1	C	5.3

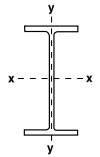
Notes:

1. For OneSteel-300PLUS sections the tensile strength (f_u) is 440 MPa.
2. For Grade 350 sections the tensile strength (f_u) is 480 MPa.
3. C = Compact Section; N = Non-compact Section; S = Slender Section.
4. OneSteel-300PLUS hot rolled sections are produced to exceed the minimum requirements of AS/NZS 3679.1-300.
5. OneSteel-300PLUS replaced Grade 250 as the base grade for these sections in 1994.

Universal Beams

Dimensions and Properties



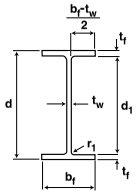


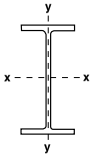
OneSteel-300PLUS

Designation	Mass per metre	Depth of Section	Flange Width	Flange Thickness	Web Thickness	Root Radii	Depth Between Flanges	$\frac{d_1}{t_w}$	$\frac{(b_f.t_w)}{2t_f}$	Gross Area of Cross Section	About x-axis				About y-axis				Torsion Constant	Warping Constant
		d	b_f	t_f	t_w	r_1	d_1			A_g	I_x	Z_x	S_x	r_x	I_y	Z_y	S_y	r_y	J	I_w
	kg/m	mm	mm	mm	mm	mm	mm			mm^2	10^6mm^4	10^3mm^3	10^3mm^3	mm	10^6mm^4	10^3mm^3	10^3mm^3	mm	10^3mm^4	10^9mm^6
610UB	125.0	612	229	19.6	11.9	14.0	572	48.1	5.54	16000	986.00	3230	3680	249.0	39.300	343.0	536.0	49.6	1560.0	3450.00
610UB	113.0	607	228	17.3	11.2	14.0	572	51.1	6.27	14500	875.00	2880	3290	246.0	34.300	300.0	469.0	48.7	1140.0	2980.00
610UB	101.0	602	228	14.8	10.6	14.0	572	54	7.34	13000	761.00	2530	2900	242.0	29.300	257.0	402.0	47.5	790.0	2530.00
530UB	92.4	533	209	15.6	10.2	14.0	502	49.2	6.37	11800	554.00	2080	2370	217.0	23.800	228.0	355.0	44.9	775.0	1590.00
530UB	82.0	528	209	13.2	9.6	14.0	502	52.3	7.55	10500	477.00	1810	2070	213.0	20.100	193.0	301.0	43.8	526.0	1330.00
460UB	82.1	460	191	16.0	9.9	11.4	428	43.3	5.66	10500	372.00	1610	1840	188.0	18.600	195.0	303.0	42.2	701.0	919.00
460UB	74.6	457	190	14.5	9.1	11.4	428	47.1	6.24	9520	335.00	1460	1660	188.0	16.600	175.0	271.0	41.8	530.0	815.00
460UB	67.1	454	190	12.7	8.5	11.4	428	50.4	7.15	8580	296.00	1300	1480	186.0	14.500	153.0	238.0	41.2	378.0	708.00
410UB	59.7	406	178	12.8	7.8	11.4	381	48.8	6.65	7640	216.00	1060	1200	168.0	12.100	135.0	209.0	39.7	337.0	467.00
410UB	53.7	403	178	10.9	7.6	11.4	381	50.1	7.82	6890	188.00	933	1060	165.0	10.300	115.0	179.0	38.6	234.0	394.00
360UB	56.7	359	172	13.0	8.0	11.4	333	41.6	6.31	7240	161.00	899	1010	149.0	11.000	128.0	198.0	39.0	338.0	330.00
360UB	50.7	356	171	11.5	7.3	11.4	333	45.6	7.12	6470	142.00	798	897	148.0	9.600	112.0	173.0	38.5	241.0	284.00
360UB	44.7	352	171	9.7	6.9	11.4	333	48.2	8.46	5720	121.00	689	777	146.0	8.100	94.7	146.0	37.6	161.0	237.00
310UB	46.2	307	166	11.8	6.7	11.4	284	42.3	6.75	5930	100.00	354	729	130.0	9.01	109.0	166.0	39.0	233.0	197.00
310UB	40.4	304	165	10.2	6.1	11.4	284	46.5	7.79	5210	86.40	569	633	129.0	7.650	92.7	142.0	38.3	157.0	165.00
310UB	32.0	298	149	8.0	5.5	13.0	282	51.3	8.97	4080	63.20	424	475	124.0	4.420	59.3	91.8	32.9	86.5	92.90

Universal Beams - *continued*

Dimensions and Properties



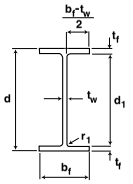


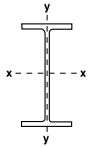
OneSteel-300PLUS

Designation	Mass per metre	Depth of Section	Flange Width	Flange Thickness	Web Thickness	Root Radii	Depth Between Flanges	$\frac{d_1}{t_w}$	$\frac{(b_f-t_w)}{2t_f}$	Gross Area of Cross Section	About x-axis				About y-axis				Torsion Constant	Warping Constant
		d	b_f	t_f	t_w	r_1	d_1			A_g	I_x	Z_x	S_x	r_x	I_y	Z_y	S_y	r_y	J	I_w
	kg/m	mm	mm	mm	mm	mm	mm			mm^2	10^6mm^4	10^3mm^3	10^3mm^3	mm	10^6mm^4	10^3mm^3	10^3mm^3	mm	10^3mm^4	10^9mm^6
250UB	37.3	256	146	10.9	6.4	8.9	234	36.6	6.40	4750	55.70	435	486	108.0	5.660	77.5	119.0	34.5	158.0	85.20
250UB	31.4	252	146	8.6	6.1	8.9	234	38.4	8.13	4010	44.50	354	397	105.0	4.470	61.2	94.2	33.4	89.3	65.90
250UB	25.7	248	124	8.0	5.0	12.0	232	46.4	7.44	3270	35.4	285	319	104.0	2.550	41.1	63.6	27.9	67.4	36.7
200UB	29.8	207	134	9.6	6.3	8.9	188	29.8	6.65	3820	29.10	281	316	87.3	3.860	57.5	88.4	31.8	105.0	37.60
200UB	25.4	203	133	7.8	5.8	8.9	188	32.3	8.15	3230	23.60	232	260	85.4	3.060	46.1	70.9	30.8	62.7	29.20
200UB	22.3	202	133	7.0	5.0	8.9	188	37.5	9.14	2870	21.00	208	231	85.5	2.750	41.3	63.4	31.0	45.0	26.00
200UB	18.2	198	99	7.0	4.5	11.0	184	40.9	6.75	2320	15.80	160	180	82.6	1.140	23.0	35.7	22.1	38.6	10.40
180UB	22.2	179	90	10.0	6.0	8.9	159	26.5	4.20	2820	15.30	171	195	73.6	1.220	27.1	42.3	20.8	81.6	8.71
180UB	18.1	175	90	8.0	5.0	8.9	159	31.8	5.31	2300	12.10	139	157	72.6	0.975	21.7	33.7	20.6	44.8	6.80
180UB	16.1	173	90	7.0	4.5	8.9	159	35.3	6.11	2040	10.60	123	138	72.0	0.853	19.0	29.4	20.4	31.5	5.88
150UB	18.0	155	75	9.5	6.0	8.0	136	22.7	3.63	2300	9.05	117	135	62.8	0.672	17.9	28.2	17.1	60.5	3.56
150UB	14.0	150	75	7.0	5.0	8.0	136	27.2	5.00	1780	6.66	88.8	102	61.1	0.495	13.2	20.8	16.6	28.1	2.53

Universal Beams

Properties for Design





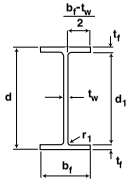
OneSteel-300PLUS					About x-axis		About y-axis		AS 3679.1-350				About x-axis		About y-axis	
Designation	Mass per metre	Flange f_y	Web f_y	Form Factor	Compactness	Z_{ex}	Compactness	Z_{ey}	Designation	Flange f_y	Web f_y	Form Factor	Compactness	Z_{ex}	Compactness	Z_{ey}
	kg/m	MPa	MPa	k_f		10^3mm^3		10^3mm^3		MPa	MPa	k_f		10^3mm^3		10^3mm^3
610UB	125.0	280	300	0.950	C	3680	C	515.0	610UB	340	340	0.916	C	3680	C	515.0
610UB	113.0	280	300	0.926	C	3290	C	451.0	610UB	340	340	0.891	C	3290	C	451.0
610UB	101.0	300	320	0.888	C	2900	C	386.0	610UB	340	360	0.867	C	2900	C	386.0
530UB	92.4	300	320	0.928	C	2370	C	342.0	530UB	340	360	0.907	C	2370	C	342.0
530UB	82.0	300	320	0.902	C	2070	C	289.0	530UB	340	360	0.880	C	2070	C	289.0
460UB	82.1	300	320	0.979	C	1840	C	292.0	460UB	340	360	0.956	C	1840	C	292.0
460UB	74.6	300	320	0.948	C	1660	C	262.0	460UB	340	360	0.926	C	1660	C	262.0
460UB	67.1	300	320	0.922	C	1480	C	230.0	460UB	340	360	0.901	C	1480	C	230.0
410UB	59.7	300	320	0.938	C	1200	C	203.0	410UB	340	360	0.918	C	1200	C	203.0
410UB	53.7	320	320	0.913	C	1060	C	173.0	410UB	360	360	0.894	N	1050	N	172.0
360UB	56.7	300	320	0.996	C	1010	C	193.0	360UB	340	360	0.974	C	1010	C	193.0
360UB	50.7	300	320	0.963	C	897	C	168.0	360UB	340	360	0.943	C	897	C	168.0
360UB	44.7	320	320	0.930	N	770	N	140.0	360UB	360	360	0.911	N	762	N	139.0
310UB	46.2	300	320	0.991	C	729	C	163.0	310UB	340	360	0.972	C	729	C	163.0
310UB	40.4	320	320	0.952	C	633	C	139.0	310UB	360	360	0.936	N	629	N	138.0
310UB	32.0	320	320	0.915	N	467	N	86.9	310UB	360	360	0.898	N	462	N	85.7

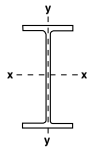
Notes:

1. For OneSteel-300PLUS sections the tensile strength (f_u) is 440 MPa.
2. For Grade 350 sections the tensile strength (f_u) is 480 MPa.
3. C = Compact Section; N = Non-compact Section; S = Slender Section.
4. OneSteel-300PLUS hot rolled sections are produced to exceed the minimum requirements of AS/NZS 3679.1-300.
5. OneSteel-300PLUS replaced Grade 250 as the base grade for these sections in 1994.

Universal Beams - *continued*

Properties for Design





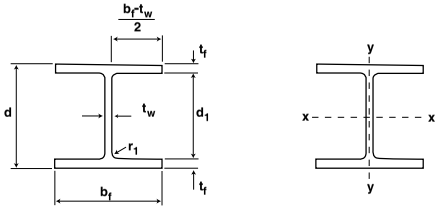
OneSteel-300PLUS					About x-axis		About y-axis		AS 3679.1-350				About x-axis		About y-axis	
Designation	Mass per metre	Flange f_y	Web f_y	Form Factor	Compactness	Z_{ex}	Compactness	Z_{ey}	Designation	Flange f_y	Web f_y	Form Factor	Compactness	Z_{ex}	Compactness	Z_{ey}
	kg/m	MPa	MPa	k_f		10^3mm^3		10^3mm^3		MPa	MPa	k_f		10^3mm^3		10^3mm^3
250UB	37.3	320	320	1.000	C	486	C	116.0	250UB	360	360	1.000	C	486	C	116.0
250UB	31.4	320	320	1.000	N	395	N	91.4	250UB	360	360	0.991	N	392	N	90.3
250UB	25.7	320	320	0.949	C	319	C	61.7	250UB	360	360	0.932	C	319	C	61.7
200UB	29.8	320	320	1.000	C	316	C	86.3	200UB	360	360	1.000	C	316	C	86.3
200UB	25.4	320	320	1.000	N	259	N	68.8	200UB	360	360	1.000	N	257	N	68.0
200UB	22.3	320	320	1.000	N	227	N	60.3	200UB	360	360	1.000	N	225	N	59.4
200UB	18.2	320	320	0.990	C	180	C	34.4	200UB	360	360	0.970	C	180	C	34.4
180UB	22.2	320	320	1.000	C	195	C	40.7	180UB	360	360	1.000	C	195	C	40.7
180UB	18.1	320	320	1.000	C	157	C	32.5	180UB	360	360	1.000	C	157	C	32.5
180UB	16.1	320	320	1.000	C	138	C	28.4	180UB	360	360	1.000	C	138	C	28.4
150UB	18.0	320	320	1.000	C	135	C	26.9	150UB	360	360	1.000	C	135	C	26.9
150UB	14.0	320	320	1.000	C	102	C	19.8	150UB	360	360	1.000	C	102	C	19.8

Notes:

1. For OneSteel-300PLUS sections the tensile strength (f_u) is 440 MPa.
2. For Grade 350 sections the tensile strength (f_u) is 480 MPa.
3. C = Compact Section; N = Non-compact Section; S = Slender Section.
4. OneSteel-300PLUS hot rolled sections are produced to exceed the minimum requirements of AS/NZS 3679.1-300.
5. OneSteel-300PLUS replaced Grade 250 as the base grade for these sections in 1994.

Universal Columns

Dimensions and Properties

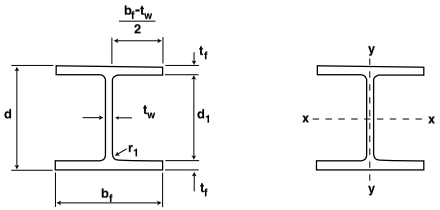


OneSteel-300PLUS

Designation	Mass per metre	Depth of Section	Flange Width	Flange Thickness	Web Thickness	Root Radii	Depth Between Flanges	$\frac{d_1}{t_w}$	$\frac{(b_f.t_w)}{2t_f}$	Gross Area of Cross Section	About x-axis				About y-axis				Torsion Constant	Warping Constant
		d	b_f	t_f	t_w	r_1	d_1			A_g	I_x	Z_x	S_x	r_x	I_y	Z_y	S_y	r_y	J	I_w
	kg/m	mm	mm	mm	mm	mm	mm			mm^2	$10^6 mm^4$	$10^3 mm^3$	$10^3 mm^3$	mm	$10^6 mm^4$	$10^3 mm^3$	$10^3 mm^3$	mm	$10^3 mm^4$	$10^9 mm^6$
310UC	158.0	327	311	25.0	15.7	16.5	277	17.7	5.91	20100	388.00	2370.0	2680.0	139.0	125.00	807.0	1230.0	78.9	3810.0	2860.0
310UC	137.0	321	309	21.7	13.8	16.5	277	20.1	6.80	17500	329.00	2050.0	2300.0	137.0	107.00	691.0	1050.0	78.2	2520.0	2390.0
310UC	118.0	315	307	18.7	11.9	16.5	277	23.3	7.89	15000	277.00	1760.0	1960.0	136.0	90.20	588.0	893.0	77.5	1630.0	1980.0
310UC	96.8	308	305	15.4	9.9	16.5	277	28.0	9.58	12400	223.00	1450.0	1600.0	134.0	72.90	478.0	725.0	76.7	928.0	1560.0
250UC	89.5	260	256	17.3	10.5	14.0	225	21.5	7.10	11400	143.00	1100.0	1230.0	112.0	48.40	378.0	575.0	65.2	1040.0	713.0
250UC	72.9	254	254	14.2	8.6	14.0	225	26.2	8.64	9320	114.00	897.0	992.0	111.0	38.80	306.0	463.0	64.5	586.0	557.0
200UC	59.5	210	205	14.2	9.3	11.4	181	19.5	6.89	7620	61.30	584.0	656.0	89.7	20.40	199.0	303.0	51.7	477.0	195.0
200UC	52.2	206	204	12.5	8.0	11.4	181	22.7	7.84	6660	52.80	512.0	570.0	89.1	17.70	174.0	264.0	51.5	325.0	166.0
200UC	46.2	203	203	11.0	7.3	11.4	181	24.8	8.90	5900	45.90	451.0	500.0	88.2	15.30	151.0	230.0	51.0	228.0	142.0
150UC	37.2	162	154	11.5	8.1	8.9	139	17.1	6.34	4730	22.20	274.0	310.0	68.4	7.01	91.0	139.0	38.5	197.0	39.6
150UC	30.0	158	153	9.4	6.6	8.9	139	21.0	7.79	3860	17.60	223.0	250.0	67.5	5.62	73.4	112.0	38.1	109.0	30.8
150UC	23.4	152	152	6.8	6.1	8.9	139	22.8	10.70	2980	12.60	166.0	184.0	65.1	3.98	52.4	80.2	36.6	50.2	21.1
100UC	14.8	97	99	7.0	5.0	10.0	83	16.6	6.71	1890	3.18	65.6	74.4	41.1	1.14	22.9	35.2	24.5	34.9	2.3

Universal Columns

Properties for Design



OneSteel-300PLUS					About x-axis		About y-axis		AS 3679.1-350				About x-axis		About y-axis	
Designation	Mass per metre	Flange f_y	Web f_y	Form Factor	Compactness	Z_{ex}	Compactness	Z_{ey}	Designation	Flange f_y	Web f_y	Form Factor	Compactness	Z_{ex}	Compactness	Z_{ey}
	kg/m	MPa	MPa	k_f		10^3mm^3		10^3mm^3		MPa	MPa	k_f		10^3mm^3		10^3mm^3
310UC	158.0	280	300	1	C	2680.0	C	1210.0	310UC	340	340	1	C	2680.0	C	1210.0
310UC	137.0	280	300	1	C	2300.0	C	1040.0	310UC	340	340	1	C	2300.0	C	1040.0
310UC	118.0	280	300	1	C	1960.0	C	882.0	310UC	340	340	1	N	1950.0	N	878.0
310UC	96.8	300	320	1	N	1560.0	N	694.0	310UC	340	360	1	N	1550.0	N	684.0
250UC	89.5	280	320	1	C	1230.0	C	567.0	250UC	340	360	1	C	1230.0	C	567.0
250UC	72.9	300	320	1	N	986.0	N	454.0	250UC	340	360	1	N	977.0	N	448.0
200UC	59.5	300	320	1	C	656.0	C	299.0	200UC	340	360	1	C	656.0	C	299.0
200UC	52.2	300	320	1	C	570.0	C	260.0	200UC	340	360	1	N	569.0	N	260.0
200UC	46.2	300	320	1	N	494.0	N	223.0	200UC	340	360	1	N	490.0	N	220.0
150UC	37.2	300	320	1	C	310.0	C	137.0	150UC	340	360	1	C	310.0	C	137.0
150UC	30.0	320	320	1	C	250.0	C	110.0	150UC	360	360	1	N	248.0	N	109.0
150UC	23.4	320	320	1	N	176.0	N	73.5	150UC	360	360	1	N	174.0	N	72.3
100UC	14.8	320	320	1	C	74.4	C	34.4	100UC	360	360	1	C	74.4	C	34.4

Notes:

1. For OneSteel-300PLUS sections the tensile strength (f_u) is 440 MPa.
2. For Grade 350 sections the tensile strength (f_u) is 480 MPa.
3. C = Compact Section; N = Non-compact Section; S = Slender Section.
4. OneSteel-300PLUS hot rolled sections are produced to exceed the minimum requirements of AS/NZS 3679.1-300.
5. OneSteel-300PLUS replaced Grade 250 as the base grade for these sections in 1994.

Tube and Pipe

The following pages provide a schedule of the descriptions, outside diameters, and wall thicknesses of pipe and tube, normally available from our stock or obtainable from our overseas suppliers.

These tables have been prepared as a quick reference guide to assist you to obtain the greatest benefit from our extensive stock range of material, and we hope it will enable you to specify to your requirements more exactly in cases where the outside diameters are not mentioned in the normal descriptions of our stock material. Mechanical property data has also been added for those instances where the pipe or tube is intended for a structural application. In instances where mechanical property data has not been included. Should you require this information, please contact us on 0800 478 335.

Standards for this Section

BS 1387 Steel Tubes and Tubulars Suitable for Screwing to BS 21 Pipe Threads
Applies to welded, plain end, screwed and socketed tubes from 6NB to 150NB. It describes the quality of material, workmanship and testing together with galvanising, packaging and marking. The weights and dimensions of tube to BS 1387 are also in accordance with ISO R65. AS 1074 is the Australian equivalent.

BS 3059: 1987 Steel Boiler and Superheater Tubes
This standard is in two parts. Part 1 is for low tensile carbon steel tubes without specified elevated temperature properties. Part 2 covers Carbon, alloy and austenitic stainless steel tubes with specified elevated temperature properties. (There is no Australian Standard equivalent to BS 3059 but tubes of equal properties are covered by AS 1835 and AS 1836.)

BS 3601: 1987 Steel Pipes and Tubes for Pressure Purposes
Carbon steel with specified room temperature properties.
Specifies the material properties and tests for different methods of manufacture. These pipes are intended for use in pipelines or similar services and are subject to the pressure and temperature limitations shown in the appropriate application standard. (There is no direct Australian equivalent but tubes of equal qualities are covered by AS 1835 and AS 1836.)

BS 3602: 1987 Steel Pipes and Tubes for Pressure Purposes
Carbon and carbon manganese steel with specified elevated temperature properties.
This standard covers the same technical requirements as BS 3601 but makes special mention of values at elevated temperatures and stress rupture values. (Some tubes in AS 1836 will meet the requirements of BS 3602.)

ASTM A106 Seamless Line & API 5LB ERW Line Pipe
Covers manufacturing, heat treatment, marking and chemical and tensile requirements. ASTM A106 is the American equivalent to Seamless BS 3602 and is intended primarily for pressure temperature applications.

API 5L Specification for Line pipe is a comprehensive standard which covers everything from testing down to dimensions and as its title implies is intended for pipe line reticulation of oil and gas. In certain specific areas it can be used for pressure temperature duties.

ERW Tube AS 1450-1983 Steel Tubes for Mechanical Purposes
This standard specifies the technical requirements for the production and supply of carbon and carbon-manganese steel tubes of round, square, rectangular or other non-circular cross-section, produced by either cold-forming or hot-forming, and intended for use in mechanical applications.

ERW Welded Tube

Technical Specifications

The following mechanical properties quoted are for the mild steel strip prior to being manufactured into tubular sections.

When forming steel strip into tubular sections, the mechanical properties are affected. The extent of this effect depends on the specific dimensions of tube being produced and particularly the tube diameter to thickness ratio. In general during tube forming, the yield stress will be substantially increased, the tensile strength slightly increased and elongation reduced.

Specified Mechanical Properties of Strip

Yield stress	160 MPa (min.)	215 MPa (max.)
Tensile stress	285 MPa (min.)	340 MPa (max.)
Elongation (min.)	0.6 < 1.0mm = 41%, 1.0 < 1.6mm = 43%, 1.6mm + = 45%	

Normal range of Mechanical Properties of strip

Yield stress	165 to 205 MPa
Tensile stress	290 to 330 MPa
Elongation	41 to 55%

Specified Chemical Composition - (Ladle Analysis)

Carbon	C	0.02 to 0.064% max.
Manganese	Mn	0.17 to 0.24% max.
Phosphorous	P	0.022% max.
Sulphur	S	0.030 max.
Vanadium	V	0.010% max.
Silicon	Si	0.010% max.

ERW Size Range

ERW Square Tube

Size (mm)	LN (m)	Kg/m
9.5 x 9.5 x 1.2	5.5	0.34
9.5 x 9.5 x 1.6	5.5	0.40
12.7 x 12.7 x 1.2	5.5	0.49
12.7 x 12.7 x 1.6	5.5	0.58
16.0 x 16.0 x 1.2	5.5	0.55
16.0 x 16.0 x 1.6	5.5	0.72
16.0 x 16.0 x 2.0	5.5	0.92
19.0 x 19.0 x 1.2	5.5	0.68
19.0 x 19.0 x 1.6	5.5	0.89
19.0 x 19.0 x 2.0	5.5	1.11
22.2 x 22.2 x 1.2	5.5	0.81
22.2 x 22.2 x 1.6	5.5	1.07
22.2 x 22.2 x 2.0	5.5	1.31
25.4 x 25.4 x 1.2	5.5	0.91
25.4 x 25.4 x 1.4	5.5	1.05
25.4 x 25.4 x 1.6	5.5	1.19
25.4 x 25.4 x 2.0	5.5	1.47
31.8 x 31.8 x 1.2	5.5	1.16
31.8 x 31.8 x 1.6	5.5	1.53
31.8 x 31.8 x 2.0	5.5	1.89
35.0 x 35.0 x 1.2	5.5	1.37
35.0 x 35.0 x 1.6	5.5	1.64
35.0 x 35.0 x 2.0	5.5	2.03
38.0 x 38.0 x 1.2	5.5	1.37
38.0 x 38.0 x 2.0	5.5	2.25
51.0 x 51.0 x 1.6	5.5	2.44

ERW Rectangular Tube

Size (mm)	LN (m)	Kg/m
25.4 x 12.7 x 1.2	5.5	0.68
25.4 x 12.7 x 1.6	5.5	0.89
31.8 x 16.0 x 1.6	5.5	1.19
35.0 x 19.0 x 1.2	5.5	0.97
35.0 x 19.0 x 1.6	5.5	1.27
35.0 x 19.0 x 2.0	5.5	1.57
38.0 x 25.4 x 1.6	5.5	1.87
51.0 x 25.4 x 1.2	5.5	1.37
51.0 x 25.4 x 1.6	5.5	1.82
51.0 x 25.4 x 2.0	5.5	2.25
63.5 x 38.0 x 2.0	5.5	3.03

ERW Round Tube

Refer to Tube and Pipe Quick Reference Tables

Hollow Bar

Mechanical Properties

		Hot Rolled condition	Normalised condition
Ultimate Tensile		N/mm^2	N/mm^2
Strength Rm		600/750	550/700
Yield Stress	Wall thickness	N/mm^2	N/mm^2
Rp 0.2 min.	≤ 16mm	480	430
	> 16-30mm	460	410
	> 30mm	440	400
Elongation A min. 5.65 √So		18%	20%
Hardness		200-240 BHN	180-220 BHN
Longitudinal Charpy ISO "V" impact test		20 Joules min. at +20°C	40 Joules min. at -20°C

Tolerances

	Hot Rolled		Cold Reduced	
Outside Diameter	< 75mm	+ 1.00mm - 0	< 45mm	+ 0.25mm - 0
	75-100mm	+ 1.20mm - 0	> 45mm	+ 0.30mm - 0
	> 100mm	+ 1.40% - 0		
Wall	Minimum thickness not more than 5% below nominal thickness		Minimum thickness not more than 5% below nominal thickness	
Straightness	Straightness - 1 in 1000 measured over the total length		Straightness - 1 in 1500 measured over the total length	

Identification of Tube Wall Thicknesses

ANSI B36.10

Units used = millimetres

Nom. Pipe	O.D.	Schedule			Std Wt	Schedule		Extra Strong	Schedule					Double Extra Strong	Nom. Pipe
mm	mm	10	20	30		40	60		80	100	120	140	160		mm
6	10.3				1.73	1.73		2.41	2.41						6
8	13.7				2.24	2.24		3.02	3.02						8
10	17.1				2.31	2.31		3.20	3.20						10
15	21.3				2.77	2.77		3.73	3.73				4.78	7.47	15
20	26.7	2.11			2.87	2.87		3.91	3.91				5.56	7.82	20
25	33.4	2.77			3.38	3.38		4.55	4.55				6.35	9.09	25
32	42.2	2.77			3.56	3.56		4.85	4.85				6.35	9.70	32
40	48.3	2.77			3.68	3.68		5.08	5.08				7.14	10.15	40
50	60.3	2.77			3.91	3.91		5.54	5.54				8.74	11.07	50
65	73.0	3.05			5.16	5.16		7.01	7.01				9.53	14.02	65
80	88.9	3.05			5.49	5.49		7.62	7.62				11.13	15.24	80
100	114.3	3.05			6.02	6.02		8.56	8.56		11.13		13.49	17.12	100
125	141.3	3.40			6.55	6.55		9.53	9.53		12.70		15.88	19.05	125
150	168.3				7.11	7.11		10.97	10.97		14.27		18.26	21.95	150
200	219.1		6.35	7.04	8.18	8.18	10.31	12.70	12.70	15.09	18.26	20.62	23.01	22.23	200
250	273.0		6.35	7.80	9.27	9.27	12.70	12.70	15.09	18.26	21.44	25.40	28.58	25.40	250
300	323.8		6.35	8.38	9.53	10.31	14.27	12.70	17.48	21.44	25.40	28.58	33.34	25.40	300
350	355.6	6.35	7.92	9.53	9.53	11.13	15.09	12.70	19.05	23.82	27.79	31.75	35.71		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		400
450	457.2	6.35	7.92	11.13	9.53	14.27	19.05	12.70	23.83	29.36	34.93	39.67	45.24		450

Identification of Tube Wall Thicknesses - *continued*

ANSI B36.10

Units used = millimetres

Nom. Pipe	O.D.	Schedule			Std Wt	Schedule		Extra Strong	Schedule					Double Extra Strong	Nom. Pipe
mm	mm	10	20	30		40	60		80	100	120	140	160		mm
500	508.0	6.35	9.53	12.70	9.53	15.09	20.62	12.70	26.19	32.54	38.10	44.45	50.01		500
550	558.8	6.35	9.53	12.70	9.53	15.88	22.23	12.70	28.58	34.93	41.28	47.63	53.98		550
600	609.6	6.35	9.53	14.27	9.53	17.48	24.61	12.70	30.96	38.89	46.02	52.37	59.54		600
650	660.4	7.92	12.70		9.53			12.70							650
700	711.2	7.92	12.70	15.88	9.53			12.70							700
750	762.0	7.92	12.70	15.88	9.53			12.70							750
800	812.8	7.92	12.70	15.88	9.53	17.48		12.70							800
850	863.6	7.92	12.70	15.88	9.53	17.48		12.70							850
900	914.1	7.92	12.70	15.88	9.53	19.05		12.70							900

Maximum Safe Working Pressures

Medium & Heavy Pressure Pipe – Specification: AS 1074 / BS 1387

Nominal Size (DN)	Quality	Outside Diameter	Wall Thick-ness	Mass per Metre Black Plain Ends & Grooved	Maximum Recommended Test Pressure at Ambient Temp		Maximum Safe Working Pressure Metal Temperature °C															
							-45°C to 50°C		100		150		200		250		300		350		400	
		mm	mm	kg/m	MPa	P.S.I.	MPa	P.S.I.	MPa	P.S.I.	MPa	P.S.I.	MPa	P.S.I.	MPa	P.S.I.	MPa	P.S.I.	MPa	P.S.I.	MPa	P.S.I.
8	Medium	13.5	2.3	0.641	42.0	6100	28.0	4070	25.6	3720	23.3	3380	20.9	3030	18.5	2690	16.6	2410	15.3	2220	14.7	2130
	Heavy	13.5	2.9	0.765	55.6	8070	37.1	5380	33.9	4930	30.8	4470	27.7	4020	24.5	3560	22.0	3190	20.2	2940	19.4	2810
10	Medium	17.2	2.3	0.839	31.7	4610	21.2	3070	19.4	2810	17.6	2550	15.8	2290	14.0	2030	12.5	1820	11.6	1680	11.1	1610
	Heavy	17.2	2.9	1.02	41.5	6020	27.7	4020	25.3	3680	23.0	3340	20.6	3000	18.3	2660	16.4	2380	15.1	2190	14.5	2100
15	Medium	21.3	2.6	1.21	28.6	4160	19.1	2770	17.5	2540	15.9	2300	14.2	2070	12.6	1830	11.3	1640	10.4	1510	9.99	1450
	Heavy	21.3	3.2	1.44	36.3	5270	24.2	3510	22.1	3210	20.1	2920	18.0	2620	16.0	2320	14.3	2080	13.2	1920	12.7	1840
20	Medium	26.9	2.6	1.56	22.1	3210	14.7	2140	13.5	1960	12.2	1780	11.0	1600	9.75	1420	8.73	1270	8.05	1170	7.71	1120
	Heavy	26.9	3.2	1.87	27.8	4040	18.5	2690	17.0	2460	15.4	2240	13.8	2010	12.3	1780	11.0	1590	10.1	1470	9.70	1410
25	Medium	33.7	3.2	2.41	21.7	3150	14.5	2100	13.2	1920	12.0	1740	10.8	1570	9.56	1390	8.56	1240	7.90	1150	7.56	1100
	Heavy	33.7	4.0	2.94	27.8	4030	18.5	2690	16.9	2460	15.4	2230	13.8	2000	12.2	1780	11.0	1590	10.1	1470	9.68	1400
32	Medium	42.4	3.2	3.10	16.9	2450	11.3	1640	10.3	1500	9.37	1360	8.41	1220	7.46	1080	6.68	969	6.16	894	5.90	856
	Heavy	42.4	4.0	3.80	21.5	3120	14.4	2080	13.1	1910	11.9	1730	10.7	1550	9.50	1380	8.50	1230	7.84	1140	7.51	1090
40	Medium	48.3	3.2	3.57	14.7	2140	9.81	1420	8.98	1300	8.15	1180	7.32	1060	6.49	942	5.81	843	5.36	778	5.13	745
	Heavy	48.3	4.0	4.38	18.7	2710	12.5	1810	11.4	1660	10.4	1500	9.30	1350	8.24	1200	7.38	1070	6.80	988	6.52	946

Notes:

1. The above maximum recommended test and working pressures are applicable only to the pipe, if and only if
   - The applied loads are only from internal pressure in straight pipe. The pipeline should be supported so that bending and external loads are avoided. The pipeline must also be set up with suitable freedom of angular movement at joints and bends and with provision to accommodate thermal expansion.
   - The maximum working pressure is based on a design strength of 130 MPa at 50°C, and 90% of the nominal wall thickness to allow for the minimum thickness tolerance of the relevant standard.
   - AS 4041 limits the maximum pressure of this type of pipe (Class 2) to 10 MPa when carrying Very Harmful Fluids (fluid type 2) and for Harmful gases (fluid type 3). This should be considered when designing pipelines. See the OneSteel publication 'Fluid type and classes for pressure piping systems' for information on fluid types.
   - Use of this pipe is prohibited where the pipe contents are Lethal (AS 4041 fluid type 1). See the OneSteel publication 'Fluid type and classes for pressure piping systems' for information on fluid types.
2. The piping system working pressures can be limited by the type of couplings or the welding class used in the design of the pipeline.
3. AS 3920.1 gives information on the hazard level of pressure piping and other pressure equipment and the QA required to certify design, manufacture and installation.
4. Pressures have been calculated in accordance with AS 4041-1998 and the draft revision ME/1/8/00-28. $p=2feMt_f/(D-t_f)$ where
   p = Safe working pressure.
   f = Design strengths from table D2 of AS 4041 for AS 1074 product.
   e = 0.85 Weld joint factor from table 3.12.2 of AS 4041 for AS 1074 ERW product.
   M = 0.7 Class design factor from AS 4041 table 3.12.3 for class 2.
   t_f = 0.9 x wall thickness, in mm.
   D = Outside diameter, in mm.
5. No allowance has been made for corrosion, threading, grooving or machining.

Maximum Safe Working Pressures - *continued*

Medium & Heavy Pressure Pipe – Specification: AS 1074 / BS 1387

Nominal Size (DN)	Quality	Outside Diameter	Wall Thick-ness	Mass per Metre Black Plain Ends & Grooved	Maximum Recommended Test Pressure at Ambient Temp		Maximum Safe Working Pressure Metal Temperature °C															
					-45°C to 50°C		100		150		200		250		300		350		400			
		mm	mm	kg/m	MPa	P.S.I.	MPa	P.S.I.	MPa	P.S.I.	MPa	P.S.I.	MPa	P.S.I.	MPa	P.S.I.	MPa	P.S.I.	MPa	P.S.I.	MPa	P.S.I.
50	Medium	60.3	3.6	5.03	13.2	1910	8.78	1270	8.04	1170	7.30	1060	6.55	951	5.81	843	5.20	755	4.80	696	4.59	667
	Heavy	60.3	4.5	6.19	16.7	2420	11.1	1620	10.2	1480	9.25	1340	8.31	1210	7.37	1070	6.60	958	6.08	883	5.83	846
65	Medium	76.1	3.6	6.43	10.3	1500	6.88	998	6.30	914	5.72	829	5.13	745	4.55	661	4.07	591	3.76	545	3.60	522
	Heavy	76.1	4.5	7.93	13.0	1890	8.70	1260	7.96	1160	7.22	1050	6.49	942	5.75	835	5.15	748	4.75	689	4.55	660
80	Medium	88.9	4.0	8.37	9.79	1420	6.53	948	5.98	867	5.42	787	4.87	707	4.32	627	3.87	561	3.57	518	3.42	496
	Heavy	88.9	5.0	10.3	12.4	1800	8.25	1200	7.55	1100	6.85	995	6.15	893	5.46	792	4.89	709	4.50	654	4.31	626
90	Medium	101.6	4.0	9.63	8.52	1240	5.68	825	5.20	755	4.72	685	4.24	615	3.76	546	3.37	489	3.10	450	2.97	431
	Heavy	101.6	5.0	11.9	10.8	1560	7.17	1040	6.56	953	5.96	864	5.35	776	4.74	688	4.25	616	3.92	568	3.75	544
100	Medium	114.3	4.5	12.2	8.52	1240	5.68	825	5.20	755	4.72	685	4.24	615	3.76	546	3.37	489	3.10	450	2.97	431
	Heavy	114.3	5.4	14.5	10.3	1500	6.87	997	6.29	913	5.71	828	5.13	744	4.54	660	4.07	591	3.75	545	3.59	522
125	Medium	139.7	5.0	16.6	7.72	1120	5.15	747	4.71	684	4.28	621	3.84	558	3.41	494	3.05	443	2.81	408	2.69	391
	Heavy	139.7	5.4	17.9	8.36	1210	5.58	809	5.10	741	4.63	672	4.16	604	3.69	535	3.30	479	3.05	442	2.92	423
150	Medium	165.1	5.0	19.7	6.50	944	4.33	629	3.97	576	3.60	523	3.23	469	2.87	416	2.57	373	2.37	344	2.27	329
	Heavy	165.1	5.4	21.3	7.04	1020	4.69	681	4.29	623	3.90	566	3.50	508	3.10	450	2.78	403	2.56	372	2.45	356

Notes:

1. The above maximum recommended test and working pressures are applicable only to the pipe, if and only if
   - The applied loads are only from internal pressure in straight pipe. The pipeline should be supported so that bending and external loads are avoided. The pipeline must also be set up with suitable freedom of angular movement at joints and bends and with provision to accommodate thermal expansion.
   - The maximum working pressure is based on a design strength of 130 MPa at 50°C, and 90% of the nominal wall thickness to allow for the minimum thickness tolerance of the relevant standard.
   - AS 4041 limits the maximum pressure of this type of pipe (Class 2) to 10 MPa when carrying Very Harmful Fluids (fluid type 2) and for Harmful gases (fluid type 3). This should be considered when designing pipelines. See the OneSteel publication 'Fluid type and classes for pressure piping systems' for information on fluid types.
   - Use of this pipe is prohibited where the pipe contents are Lethal (AS 4041 fluid type 1). See the OneSteel publication 'Fluid type and classes for pressure piping systems' for information on fluid types.
2. The piping system working pressures can be limited by the type of couplings or the welding class used in the design of the pipeline.
3. AS 3920.1 gives information on the hazard level of pressure piping and other pressure equipment and the QA required to certify design, manufacture and installation.
4. Pressures have been calculated in accordance with AS 4041-1998 and the draft revision ME/1/8/00-28. $p = \frac{2feMt_f}{(D - t_f)}$ where
   p = Safe working pressure.
   f = Design strengths from table D2 of AS 4041 for AS 1074 product.
   e = 0.85 Weld joint factor from table 3.12.2 of AS 4041 for AS 1074 ERW product.
   M = 0.7 Class design factor from AS 4041 table 3.12.3 for class 2.
   t_f = 0.9 x wall thickness, in mm.
   D = Outside diameter, in mm.
5. No allowance has been made for corrosion, threading, grooving or machining.

Tube and Pipe Quick Reference Tables

Outside Diameter	Thickness	Mass per Metre	Usual Sales Description	Area of Section	Surface Area	Moment of Inertia	Elastic Modulus	Radius of Gyration	Yield Stress	Ultimate Tensile Strength
						I	*Z*	*r*	min	min
mm	mm	kg/m		cm^2	m^2/m	cm^4	cm^3	cm	MPa	MPa
✦ 6.3	1.6	0.187	6.3 O/D x 1.60 TS 27 Hydraulic						180	290
9.5	1.0	0.210	9.5 O/D x 1.00 Welded P.E.						150	275
	1.2	0.246	9.5 O/D x 1.20 Welded P.E.						150	275
	1.4	0.280	9.5 O/D x 1.40 Welded P.E.						150	275
✦	1.4	0.280	9.5 O/D x 1.40 TS 27 Hydraulic						180	290
✦	1.6	0.312	9.5 O/D x 1.60 TS 27 Hydraulic						180	290
✦	2.0	0.370	9.5 O/D x 2.00 TS 27 Hydraulic						180	290
✦ 11.1	1.0	0.249	11.1 O/D x 1.00 Welded P.E.						150	275
✦	1.2	0.293	11.1 O/D x 1.20 Welded P.E.						150	275
✦	1.4	0.335	11.1 O/D x 1.40 Welded P.E.						150	275
✦	1.6	0.375	11.1 O/D x 1.60 Welded P.E.						150	275
12.7	1.0	0.287	12.7 O/D x 1.00 Welded P.E.	0.369	0.040	0.063	0.100	0.415	150	275
	1.2	0.341	12.7 O/D x 1.20 Welded P.E.	0.432	0.040	0.072	0.114	0.409	150	275
	1.4	0.390	12.7 O/D x 1.40 Welded P.E.	0.494	0.040	0.081	0.127	0.402	150	275
	1.6	0.438	12.7 O/D x 1.60 Welded P.E.	0.558	0.040	0.088	0.138	0.396	150	275
✦	1.6	0.438	12.7 O/D x 1.60 TS 27 Hydraulic	0.558	0.040	0.088	0.138	0.396	180	290
✦	2.0	0.528	12.7 O/D x 2.00 TS 27 Hydraulic	0.675	0.040	0.100	0.156	0.384	180	290
13.5	2.3	0.650	8 NB Med. S&S BS 1387	0.819	0.042	0.133	0.197	0.403	195	320
✦	2.9	0.770	8 NB Heavy S&S BS 1387	0.976	0.042	0.146	0.217	0.389	195	320
✦ 14.3	1.0	0.328	14.3 O/D x 1.0 Welded P.E.	0.410	0.045	0.093	0.129	0.471	150	275
✦	1.2	0.388	14.3 O/D x 1.2 Welded P.E.	0.490	0.045	0.107	0.149	0.464	150	275
✦	1.4	0.446	14.3 O/D x 1.4 Welded P.E.	0.565	0.045	0.119	0.167	0.458	150	275
✦	1.6	0.501	14.3 O/D x 1.6 Welded P.E.	0.636	0.045	0.131	0.183	0.452	150	275

✦ These items are not commonly stocked, they are available on request. Minimum order quantities may apply. Please contact your local Steel & Tube branch.

Tube and Pipe Quick Reference Tables - *continued*

Outside Diameter	Thickness	Mass per Metre	Usual Sales Description	Area of Section	Surface Area	Moment of Inertia	Elastic Modulus	Radius of Gyration	Yield Stress	Ultimate Tensile Strength
						I	*Z*	*r*	min	min
mm	mm	kg/m		cm^2	m^2/m	cm^4	cm^3	cm	MPa	MPa
16.0	1.0	0.370	16.0 O/D x 1.0 Welded P.E.	0.471	0.051	0.133	0.166	0.532	150	275
	1.2	0.438	16.0 O/D x 1.2 Welded P.E.	0.558	0.051	0.154	0.193	0.525	150	275
	1.4	0.504	16.0 O/D x 1.4 Welded P.E.	0.643	0.051	0.173	0.216	0.519	150	275
	1.6	0.568	16.0 O/D x 1.6 Welded P.E.	0.724	0.051	0.190	0.238	0.512	150	275
	2.0	0.691	16.0 O/D x 2.0 Welded P.E.	0.880	0.051	0.220	0.275	0.500	150	275
✦	2.0	0.691	16.0 O/D x 2.0 TS 27 Hydraulic	0.880	0.051	0.220	0.275	0.500	180	290
✦ 17.2	2.3	0.852	10 NB Med. S&S BS 1387	1.11	0.055	0.325	0.372	0.541	195	320
✦	2.9	1.020	10 NB Heavy S&S BS 1387	1.34	0.055	0.368	0.422	0.524	195	320
19.0	1.0	0.444	19.0 O/D x 1.0 Welded P.E.	0.565	0.060	0.230	0.242	0.637	150	275
	1.2	0.527	19.0 O/D x 1.2 Welded P.E.	0.671	0.060	0.267	0.281	0.631	150	275
	1.4	0.608	19.0 O/D x 1.4 Welded P.E.	0.774	0.060	0.302	0.317	0.624	150	275
	1.6	0.687	19.0 O/D x 1.6 Welded P.E.	0.875	0.060	0.334	0.351	0.618	150	275
	2.0	0.839	19.0 O/D x 2.0 Welded P.E.	1.070	0.060	0.391	0.412	0.605	150	275
✦	2.0	0.839	19.0 O/D x 2.0 TS 27 Hydraulic	1.070	0.060	0.391	0.412	0.605	180	290
✦ 21.3	2.0	0.952	15 NB Light P.E. BS 1387	1.21	0.067	0.571	0.536	0.686	195	320
✦	2.0	0.952	15 NB DuraGal Ex-Light P.E.							
	2.6	1.22	15 NB Med P.E./ S&S BS 1387	1.56	0.067	0.702	0.655	0.671	195	320
	2.77	1.26	15 NB ASTM A106 Grade B Sch 40	1.61	0.067	0.708	0.664	0.662	240	415
✦	3.2	1.45	15 NB Heavy P.E./ S&S BS 1387	1.86	0.067	0.792	0.739	0.653	195	320
✦	3.2	1.45	15 NB X 3.2 Ammonia BS 3602	2.00	0.067	0.792	0.739	0.653	245	410
✦	3.6	1.6	15 NB X 3.2 Ammonia BS 3602	1.86	0.067	0.816	0.767	0.638	245	410
	3.73	1.62	15 NB ASTM A106 Grade B Sch 80	2.06	0.067	0.83	0.78	0.634	240	415
	4.78	1.95	15 NB ASTM A106 Grade B Sch 160	2.48	0.067	0.917	0.861	0.607	240	415
	7.47	2.56	15 NB ASTM A106 Grade B XXS	3.2	0.067	1.00	0.941	0.555	240	415

✦ These items are not commonly stocked, they are available on request. Minimum order quantities may apply. Please contact your local Steel & Tube branch.

Outside Diameter	Thickness	Mass per Metre	Usual Sales Description	Area of Section	Surface Area	Moment of Inertia	Elastic Modulus	Radius of Gyration	Yield Stress	Ultimate Tensile Strength
						I	*Z*	*r*	min	min
mm	mm	kg/m		cm^2	m^2/m	cm^4	cm^3	cm	MPa	MPa
✦ 22.2	1.0	0.523	22.2 O/D x 1.0 Welded P.E.	0.66	0.07	0.375	0.338	0.75	150	275
	1.2	0.622	22.2 O/D x 1.2 Welded P.E.	0.792	0.07	0.438	0.394	0.744	150	275
✦	1.4	0.718	22.2 O/D x 1.4 Welded P.E.	0.915	0.07	0.497	0.478	0.737	150	275
	1.6	0.813	22.2 O/D x 1.6 Welded P.E.	1.04	0.07	0.553	0.498	0.73	150	275
	2.0	0.997	22.2 O/D x 2.0 Welded P.E.	1.27	0.07	0.654	0.589	0.718	150	275
✦ 25.4	1.0	0.602	25.4 O/D x 1.0 Welded P.E.	0.77	0.08	0.571	0.45	0.863	150	275
	1.2	0.716	25.4 O/D x 1.2 Welded P.E.	0.91	0.08	0.67	0.527	0.857	150	275
	1.4	0.829	25.4 O/D x 1.4 Welded P.E.	1.06	0.08	0.763	0.6	0.85	150	275
	1.6	0.939	25.4 O/D x 1.6 Welded P.E.	1.2	0.08	0.851	0.67	0.843	150	275
	2.0	1.154	25.4 O/D x 2.0 Welded P.E.	1.47	0.08	1.01	0.798	0.83	150	275
✦	2.6	1.462	25.4 O/D x 2.6 TS 27 Hydraulic	1.86	0.08	1.23	0.965	0.811	180	290
	2.9	1.61	25.4 O/D x 2.9 Boiler BS 3059	2.05	0.08	1.32	1.04	0.802	195	320
✦	3.2	1.75	25.4 O/D x 3.2 TS 27 Hydraulic	2.23	0.08	1.4	1.11	0.793	180	290
	6.3	2.97	25.4 O/D x 6.3 Boiler BS 3059	3.79	0.08	1.91	1.51	0.711	195	320
✦ 26.7	2.87	1.68	20 NB API Line Pipe Sch 40	2.15	0.084	1.55	1.16	0.849	241	414
	2.87	1.68	20 NB ASTM A106 Grade B Sch 40	2.15	0.084	1.55	1.16	0.849	240	415
	3.91	2.19	20 NB ASTM A106 Grade B Sch 80	2.8	0.084	1.87	1.4	0.817	240	415
	5.56	2.89	20 NB ASTM A106 Grade B Sch 160							
	7.82	3.63	20 NB ASTM A106 Grade B Sch XXS							
✦ 26.9	2.0	1.23	20 NB DuraGal Ex-Light P.E.							
	2.0	1.23	20 NB Galtube Plus P.E.	Please refer to Galtube Plus tables on page 90						
✦	2.3	1.40	20 NB DuraGal Light P.E.							
	2.3	1.40	20 NB Light P.E. BS 1387	1.81	0.085	1.39	1.03	0.875	195	320
✦	2.6	1.56	20 NB DuraGal Med P.E.							
	2.6	1.58	20 NB Med P.E./ S&S BS 1387	2.02	0.085	1.51	1.12	0.866	195	320
	3.2	1.9	20 NB Heavy P.E./ S&S BS 1387	2.42	0.085	1.74	1.29	0.847	195	320
✦	3.6	2.07	20 NB x 3.6 Ammonia BS 3602	2.63	0.085	1.83	1.36	0.833	245	410

✦ These items are not commonly stocked, they are available on request. Minimum order quantities may apply. Please contact your local Steel & Tube branch.

Outside Diameter	Thickness	Mass per Metre	Usual Sales Description	Area of Section	Surface Area	Moment of Inertia	Elastic Modulus	Radius of Gyration	Yield Stress	Ultimate Tensile Strength
						I	*Z*	*r*	min	min
mm	mm	kg/m		cm^2	m^2/m	cm^4	cm^3	cm	MPa	MPa
✦ 28.6	1.0	0.681	28.6 O/D x 1.0 Welded P.E.	0.864	0.09	0.827	0.578	0.978	150	275
	1.2	0.811	28.6 O/D x 1.2 Welded P.E.	1.03	0.09	0.971	0.679	0.97	150	275
✦	1.4	0.939	28.6 O/D x 1.4 Welded P.E.	1.19	0.09	1.11	0.776	0.963	150	275
	1.6	1.066	28.6 O/D x 1.6 Welded P.E.	1.36	0.09	1.24	0.868	0.956	150	275
	2.0	1.312	28.6 O/D x 2.0 Welded P.E.	1.67	0.09	1.49	1.04	0.943	150	275
✦ 31.8	1.0	0.76	31.8 O/D x 1.0 Welded P.E.	0.966	0.1	1.15	0.722	1.09	150	275
	1.2	0.906	31.8 O/D x 1.2 Welded P.E.	1.15	0.1	1.35	0.851	1.08	150	275
✦	1.4	1.05	31.8 O/D x 1.4 Welded P.E.	1.34	0.1	1.56	0.973	1.08	150	275
	1.6	1.192	31.8 O/D x 1.6 Welded P.E.	1.52	0.1	1.74	1.09	1.07	150	275
	2.0	1.47	31.8 O/D x 2.0 Welded P.E.	1.87	0.1	2.09	1.31	1.06	150	275
	2.9	2.07	31.8 O/D x 2.9 Boiler BS 3059	2.63	0.1	2.78	1.75	1.03	195	320
✦	4.0	2.74	31.8 O/D x 4.0 Boiler BS 3059	3.5	0.1	3.44	2.17	0.993	195	320
	6.3	3.9	31.8 O/D x 6.3 Boiler BS 3059	5.05	0.1	4.35	2.74	0.928	195	320
32.0	6.0	3.84	32 x 20 (Nom) TIM6V Hollow Bar	Please refer to Hollow Bar tables on page 65						
	8.0	4.73	32 x 16 (Nom) TIM6V Hollow Bar							
✦ 33.4	3.38	2.5	25 NB API Line pipe Sch 40	3.19	0.105	3.64	2.18	1.07	241	414
	3.38	2.5	25 NB ASTM A106 Grade B Sch 40	3.19	0.105	3.64	2.18	1.07	240	415
	4.55	3.23	25 NB ASTM A106 Grade B Sch 80	4.13	0.105	4.4	2.63	1.03	240	415
	6.35	4.23	25 NB ASTM A106 Grade B Sch 160	5.4	0.105	5.21	3.12	9.82	240	415
	9.09	5.45	25 NB ASTM A106 Grade B Sch XXS							

✦ These items are not commonly stocked, they are available on request. Minimum order quantities may apply. Please contact your local Steel & Tube branch.

Outside Diameter	Thickness	Mass per Metre	Usual Sales Description	Area of Section	Surface Area	Moment of Inertia	Elastic Modulus	Radius of Gyration	Yield Stress	Ultimate Tensile Strength
						I	*Z*	*r*	min	min
mm	mm	kg/m		cm^2	m^2/m	cm^4	cm^3	cm	MPa	MPa
✦ 33.7	2.0	1.56	25 NB DuraGal Ex-Light P.E.							
	2.0	1.56	25 NB Galtube Plus P.E.	Please refer to Galtube CHS Table on page 90						
	2.0	1.56	25 NB I.L.G FirePlus P.E.							
	2.0	1.64	25 NB H.D.G. FirePlus G.B.E.							
✦	2.6	1.99	25 NB DuraGal Light P.E.							
	2.6	2.01	25 NB Light P.E. BS 1387	2.61	0.106	3.26	1.91	1.12	195	320
✦	3.2	2.41	25 NB DuraGal Med P.E.							
	3.2	2.41	25 NB I.L.G Med FirePlus							
	3.2	2.44	25 NB Med P.E./ S&S BS 1387	3.15	0.106	3.8	2.23	1.1	195	320
	4.0	2.97	25 NB Heavy P.E./ S&S BS 1387	3.84	0.106	4.42	2.59	1.07	195	320
✦	4.0	2.97	25 NB x 4.0 Ammonia BS 3602	3.84	0.106	4.42	2.59	1.07	245	410
✦ 35.0	1.0	0.839	35.0 O/D x 1.0 Welded P.E.	1.07	0.11	1.54	0.88	1.2	150	275
	1.2	1.0	35.0 O/D x 1.2 Welded P.E.	1.27	0.11	1.82	1.04	1.2	150	275
✦	1.4	1.16	35.0 O/D x 1.4 Welded P.E.	1.48	0.11	2.09	1.19	1.19	150	275
	1.6	1.318	35.0 O/D x 1.6 Welded P.E.	1.68	0.11	2.35	1.34	1.18	150	275
	2.0	1.628	35.0 O/D x 2.0 Welded P.E.	2.07	0.11	2.83	1.62	1.17	150	275
36.0	5.5	1.14	36 x 25 (Nom) TIM6V Hollow Bar	Please refer to Hollow Bar table on page 65						
	8.0	5.52	36 x 20 (Nom) TIM6V Hollow Bar							
	10.0	6.4	36 x 16 (Nom) TIM6V Hollow Bar							
✦ 38.0	1.0	0.913	38.0 O/D x 1.0 Welded P.E.	1.16	0.119	1.99	1.05	1.31	150	275
	1.2	1.089	38.0 O/D x 1.2 Welded P.E.	1.39	0.119	2.35	1.24	1.3	150	275
✦	1.4	1.264	38.0 O/D x 1.4 Welded P.E.	1.61	0.119	2.7	1.42	1.29	150	275
	1.6	1.436	38.0 O/D x 1.6 Welded P.E.	1.83	0.119	3.04	1.6	1.29	150	275
	2.0	1.776	38.0 O/D x 2.0 Welded P.E.	2.26	0.119	3.68	1.93	1.27	150	275
	2.9	2.51	38.0 O/D x 2.9 Boiler BS 3059	3.2	0.119	4.96	2.61	1.24	195	320
	6.3	4.93	38.0 O/D x 2.9 Boiler BS 3059	6.28	0.119	8.19	4.31	1.14	195	320

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Outside Diameter	Thickness	Mass per Metre	Usual Sales Description	Area of Section	Surface Area	Moment of Inertia	Elastic Modulus	Radius of Gyration	Yield Stress	Ultimate Tensile Strength
						I	*Z*	*r*	min	min
mm	mm	kg/m		cm^2	m^2/m	cm^4	cm^3	cm	MPa	MPa
40.0	6.0	5.03	40 x 28 (Nom) TIM6V Hollow Bar	Please refer to Hollow tables on page 65						
	7.5	6.01	40 x 25 (Nom) TIM6V Hollow Bar							
	10.0	7.4	40 x 20 (Nom) TIM6V Hollow Bar							
✦ 41.3	1.2	1.187	41.3 O/D x 1.2 Welded P.E.	1.51	0.13	3.04	1.47	1.42	150	275
✦	1.4	1.378	41.3 O/D x 1.4 Welded P.E.	1.75	0.13	3.5	1.69	1.41	150	275
	1.6	1.567	41.3 O/D x 1.6 Welded P.E.	1.99	0.13	3.93	1.91	1.4	150	275
	2.0	1.939	41.3 O/D x 2.0 Welded P.E.	2.47	0.13	4.78	2.31	1.39	150	275
42.2	3.56	3.38	32 NB API Line pipe Sch 40	4.32	0.133	8.13	3.85	1.37	241	414
	3.56	3.38	32 NB ASTM A106 Grade B Sch 40	4.32	0.133	8.13	3.85	1.37	240	415
✦	4.85	4.47	32 NB API Line pipe Sch 80	5.69	0.133	10.09	4.78	1.33	241	414
	4.85	4.47	32 NB ASTM A106 Grade B Sch 80	5.69	0.133	10.09	4.78	1.33	240	415
42.4	1.2	1.282	44.5 O/D x 1.2 Welded P.E.	1.63	0.14	3.83	1.72	1.53	150	275
✦	1.4	1.488	44.5 O/D x 1.4 Welded P.E.	1.89	0.14	4.4	1.98	1.52	150	275
	1.6	1.693	44.5 O/D x 1.6 Welded P.E.	2.16	0.14	4.97	2.23	1.52	150	275
✦	2.0	1.99	32 NB DuraGal Ex-Light P.E.							
	2.0	1.99	32 NB Galtube Plus P.E.	Please refer to Galtube CHS tables on page 90						
	2.0	1.99	32 NB I.L.G FirePlus P.E.							
	2.0	2.096	44.5 O/D x 2.0 Welded P.E.	2.67	0.14	6.04	2.72	1.5	150	275
	2.0	2.10	32 NB H.D.G. FirePlus G.B.E.							
✦	2.6	2.55	32 NB DuraGal Light P.E.							
	2.6	2.58	32 NB Light P.E. BS 1387	3.34	0.133	6.78	3.16	1.43	195	320
✦	3.2	3.09	32 NB DuraGal Med P.E.							
	3.2	3.09	32 NB I.L.G Med FirePlus P.E.							
	3.2	3.14	32 NB Med P.E./ S&S BS 1387	4.05	0.133	7.99	3.73	1.41	195	320
	3.2	3.26	44.5 O/D x 3.2 Boiler BS 3059	4.15	0.14	8.91	4.0	1.46	195	320
	4.0	3.84	32 NB Heavy P.E./ S&S BS 1387	4.95	0.133	9.42	4.4	1.38	195	320
✦	4.5	4.21	32 NB x 4.5 Ammonia BS 3602	5.36	0.133	9.76	4.6	1.35	245	410
	6.3	5.94	44.5 O/D x 6.3 Boiler BS 3059	7.56	0.14	14.17	6.37	1.37	195	320

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Outside Diameter	Thickness	Mass per Metre	Usual Sales Description	Area of Section	Surface Area	Moment of Inertia	Elastic Modulus	Radius of Gyration	Yield Stress	Ultimate Tensile Strength
						I	Z	r	min	min
mm	mm	kg/m		cm^2	m^2/m	cm^4	cm^3	cm	MPa	MPa
45.0	6.5	6.8	45 x 32 (Nom) TIM6V Hollow Bar	Please refer to Hollow Bar tables on page 65						
	8.5	7.93	45 x 28 (Nom) TIM6V Hollow Bar							
	12.5	10.01	45 x 20 (Nom) TIM6V Hollow Bar							
47.6	1.2	1.373	47.6 O/D x 1.2 Welded P.E.	1.75	0.15	4.71	1.98	1.64	150	275
✦	1.4	1.595	47.6 O/D x 1.4 Welded P.E.	2.03	0.15	5.43	2.28	1.63	150	275
	1.6	1.815	47.6 O/D x 1.6 Welded P.E.	2.31	0.15	6.12	2.57	1.63	150	275
✦	2.0	2.249	47.6 O/D x 2.0 Welded P.E.	2.87	0.15	7.46	3.14	1.61	150	275
✦ 48.3	2.3	2.61	40 NB DuraGal Ex-Light P.E.							
	2.3	2.61	40 NB Galtube Plus P.E.	Please refer to Galtube CHS tables on page 90						
	2.3	2.61	40 NB I.L.G FirePlus P.E.							
	2.3	2.73	40 NB H.D.G. FirePlus G.B.E.							
✦	2.9	2.61	40 NB DuraGal Light P.E.							
	2.9	3.25	40 NB Light P.E. BS 1387	4.21	0.152	10.09	4.51	1.61	195	320
✦	3.2	3.56	40 NB DuraGal Med P.E.							
	3.2	3.56	40 NB I.L.G Med FirePlus P.E.							
	3.2	3.61	40 NB Med P.E./ S&S BS 1387	4.61	0.152	11.8	4.88	1.6	195	320
✦	3.68	4.05	40 NB API Line pipe Sch 40	5.16	0.152	12.93	5.35	1.58	241	414
	3.68	4.05	40 NB ASTM A106 Grade B Sch 40	5.16	0.152	12.93	5.35	1.58	240	415
	4.00	4.43	40 NB Heavy P.E./ S&S BS 1387	5.66	0.152	14	5.8	1.57	195	320
✦	4.00	4.43	48.3 O/D x 4.0 Scaffold NZS1413	5.66	0.152	14	5.8	1.57	195	320
✦	4.50	4.86	40 NB x 4.5 Ammonia BS 3602	6.19	0.152	15.01	6.21	1.56	245	410
✦	5.08	5.41	40 NB API Line pipe Sch 80	6.9	0.152	16.33	6.76	1.54	241	414
	5.08	5.41	40 NB ASTM A106 Grade B Sch 80	6.9	0.152	16.33	6.76	1.54	240	415
	7.14	7.24	40 NB ASTM A106 Grade B Sch 160							
	10.15	9.56	40 NB ASTM A106 Grade B Sch XXS							
50.0	7	7.73	50 x 36 (Nom) TIM6V Hollow Bar	Please refer to Hollow Bar tables on page 65						
	9	9.41	50 x 32 (Nom) TIM6V Hollow Bar							
	12.5	11.55	50 x 25 (Nom) TIM6V Hollow Bar							

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	Outside Diameter	Thickness	Mass per Metre	Usual Sales Description	Area of Section	Surface Area	Moment of Inertia	Elastic Modulus	Radius of Gyration	Yield Stress	Ultimate Tensile Strength
							I	*Z*	*r*	min	min
	mm	mm	kg/m		cm^2	m^2/m	cm^4	cm^3	cm	MPa	MPa
	51.0	1.2	1.471	51.0 O/D x 1.2 Welded P.E.	1.88	0.16	5.82	2.28	1.76	150	275
✦		1.4	1.713	51.0 O/D x 1.4 Welded P.E.	2.18	0.16	6.71	2.63	1.75	150	275
		1.6	1.949	51.0 O/D x 1.6 Welded P.E.	2.48	0.16	7.58	2.97	1.75	150	275
		2.0	2.417	51.0 O/D x 2.0 Welded P.E.	3.08	0.16	9.26	3.63	1.73	150	275
✦		2.6	3.104	51.0 O/D x 2.6 Welded P.E.	3.96	0.16	11.61	4.55	1.71	150	275
		3.2	3.77	51.0 O/D x 3.2 Boiler BS 3059	4.8	0.16	13.79	5.41	1.69	195	320
✦		3.25	3.827	51.0 O/D x 44.5 I/D Drawn Finish	0.16					–	–
		6.3	6.94	51.0 O/D x 6.3 Boiler BS 3059	0.16					–	–
		12.5	11.9	51.0 O/D x 12.5 HFS BS 3601	15.11	0.16	30.97	12.14	1.43	235	410
✦	54.0	1.2	1.563	54.0 O/D x 1.2 Welded P.E.	1.99	0.17	6.94	2.57	1.87	150	275
✦		1.4	1.816	54.0 O/D x 1.4 Welded P.E.	2.31	0.17	8.01	2.97	1.86	150	275
		1.6	2.068	54.0 O/D x 1.6 Welded P.E.	2.63	0.17	9.05	3.35	1.85	150	275
✦		2.0	2.565	54.0 O/D x 2.0 Welded P.E.	3.27	0.17	11.06	4.1	1.84	150	275
✦		2.6	3.296	54.0 O/D x 2.6 Welded P.E.	4.2	0.17	13.9	5.15	1.82	150	275
	56.0	8.0	9.82	56 x 40 (Nom) TIM6V Hollow Bar	Please refer to Hollow Bar tables on page 65						
		10.0	11.71	56 x 36 (Nom) TIM6V Hollow Bar							
		14.0	14.49	56 x 28 (Nom) TIM6V Hollow Bar							
✦	57.0	1.2	1.652	57.0 O/D x 1.2 Welded P.E.	2.1	0.179	8.19	2.87	1.97	150	275
✦		1.4	1.920	57.0 O/D x 1.4 Welded P.E.	2.44	0.179	9.46	3.32	1.97	150	275
		1.6	2.186	57.0 O/D x 1.6 Welded P.E.	2.78	0.179	10.69	3.75	1.96	150	275
		2.0	2.713	57.0 O/D x 2.0 Welded P.E.	3.46	0.179	13.08	4.59	1.95	150	275
✦		2.6	3.488	57.0 O/D x 2.6 Welded P.E.	4.44	0.179	16.47	5.78	1.93	150	275
		2.9	3.869	57.0 O/D x 2.9 Boiler BS 3059	4.93	0.179	18.08	6.35	1.92	195	320
✦		3.2	4.247	57.0 O/D x 3.2 Boiler BS 3059	5.41	0.179	19.64	6.89	1.91	195	320
		6.3	7.880	57.0 O/D x 6.3 Boiler BS 3059	14.11	0.179	32.74	11.49	1.81	195	320

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Outside Diameter	Thickness	Mass per Metre	Usual Sales Description	Area of Section	Surface Area	Moment of Inertia	Elastic Modulus	Radius of Gyration	Yield Stress	Ultimate Tensile Strength
						I	*Z*	*r*	min	min
mm	mm	kg/m		cm^2	m^2/m	cm^4	cm^3	cm	MPa	MPa
✦ 60.3	1.4	2.034	60.3 O/D x 1.4 Welded P.E.	2.59	0.189	11.24	3.73	2.08	150	275
	1.6	2.316	60.3 O/D x 1.6 Welded P.E.	2.95	0.189	12.72	4.22	2.08	150	275
✦	2.0	2.876	60.3 O/D x 2.0 Welded P.E.	3.66	0.189	15.58	5.17	2.06	150	275
✦	2.0	2.876	50 NB Victaulite pipe	3.66	0.189	15.58	5.17	2.06	350	430
✦	2.3	3.29	50 NB DuraGal Ex-Light P.E.							
	2.3	3.29	50 NB Galtube Plus P.E.	Please refer to Galtube CHS tables on page 90						
	2.3	3.29	50 NB I.L.G FirePlus P.E.							
	2.3	3.44	50 NB H.D.G. FirePlus G.B.E.							
✦	2.9	4.11	50 NB DuraGal Light P.E.							
	2.9	4.11	50 NB Light P.E. BS 1387	5.31	0.189	21.90	7.27	2.03	195	320
	3.6	5.10	50 NB Med P.E./ S&S BS 1387	6.51	0.189	26.20	8.70	2.01	195	320
✦	3.6	5.03	50 NB DuraGal Med P.E.							
	3.6	5.03	50 NB I.L.G Med FirePlus P.E.							
✦	3.91	5.44	50 NB API Line pipe Sch 40	6.93	0.189	27.66	9.18	2.00	241	414
	3.91	5.44	50 NB ASTM A106 Grade B Sch 40	6.93	0.189	27.66	9.18	2.00	240	415
	4.50	6.17	50 NB Heavy P.E./ S&S BS 1387	7.84	0.189	30.80	10.20	1.98	195	320
✦	4.90	6.69	50 NB x 4.9 Ammonia BS 3602	8.53	0.189	32.97	10.94	1.97	245	410
✦	5.54	7.48	50 NB API Line pipe Sch 80	9.53	0.189	36.09	11.97	1.95	241	414
	5.54	7.48	50 NB ASTM A106 Grade B Sch 80	9.53	0.189	36.09	11.97	1.95	240	415
	8.74	11.11	50 NB ASTM A106 Grade B Sch 160							
	11.07	13.44	50 NB ASTM A106 Grade B Sch XXS							
63.0	6.5	9.44	63 x 50 (Nom) TIM6V Hollow Bar	Please refer to Hollow Bar tables on page 65						
	9.0	12.37	63 x 45 (Nom) TIM6V Hollow Bar							
	11.5	15.05	63 x 40 (Nom) TIM6V Hollow Bar							
	13.5	16.97	63 x 36 (Nom) TIM6V Hollow Bar							
	15.5	18.68	63 x 32 (Nom) TIM6V Hollow Bar							

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Outside Diameter	Thickness	Mass per Metre	Usual Sales Description	Area of Section	Surface Area	Moment of Inertia	Elastic Modulus	Radius of Gyration	Yield Stress	Ultimate Tensile Strength
						I	*Z*	*r*	min	min
mm	mm	kg/m		cm^2	m^2/m	cm^4	cm^3	cm	MPa	MPa
✦ 63.5	1.2	1.844	63.5 O/D x 1.2 Welded P.E.	2.35	0.199	11.40	3.59	2.20	150	275
✦	1.4	2.144	63.5 O/D x 1.4 Welded P.E.	2.73	0.199	13.17	4.15	2.20	150	275
	1.6	2.443	63.5 O/D x 1.6 Welded P.E.	3.11	0.199	14.91	4.70	2.19	150	275
	2.0	3.034	63.5 O/D x 2.0 Welded P.E.	3.86	0.199	18.29	5.76	2.18	150	275
	3.2	4.760	63.5 O/D x 3.2 Boiler BS 3059	6.06	0.199	27.63	8.50	2.13	195	320
	6.3	8.890	63.5 O/D x 6.3 Boiler BS 3059	11.33	0.199	46.86	14.75	2.03	195	320
✦	12.5	15.700	63.5 O/D x 12.5 HFS BS 3601	20.02	0.199	69.03	21.74	1.86	235	410
✦ 63.6	6.4	9.03	50.8 I/D x 6.4 Int. Cylinder Finish		0.200				–	–
70.0	1.6	2.699	70.0 O/D x 1.6 Welded P.E.	3.44	0.220	20.12	5.75	2.41	150	275
✦	2.0	3.354	70.0 O/D x 2.0 Welded P.E.	4.27	0.220	24.72	7.06	2.41	150	275
✦	2.6	4.32	70.0 O/D x 2.6 Welded P.E.	5.50	0.220	31.31	8.95	2.38	150	275
✦	8.0	12.200	70.0 O/D x 8.0 HFS BS 3601	15.58	0.220	76.12	21.75	2.21	235	410
71.0	7.5	12.18	71 x 56 (Nom) TIM6V Hollow Bar	Please refer to Hollow Bar tables on page 65						
	10.5	16.15	71 x 50 (Nom) TIM6V Hollow Bar							
	13.0	19.14	71 x 45 (Nom) TIM6V Hollow Bar							
	15.5	21.82	71 x 40 (Nom) TIM6V Hollow Bar							
	17.5	23.72	71 x 36 (Nom) TIM6V Hollow Bar							
✦ 73.0	5.16	8.62	65 NB API Line pipe Sch 40	11.00	0.229	63.63	17.43	2.41	241	414
	5.16	8.62	65 NB ASTM A106 Grade B Sch 40	11.00	0.229	63.63	17.43	2.41	240	415
	7.01	11.41	65 NB ASTM A106 Grade B Sch 80	14.53	0.229	80.00	21.92	2.35	240	415
75.0	7.5	13.34	75 x 60 (Nom) TIM6V Hollow Bar	Please refer to Hollow tables on page 65						
	9.5	15.90	75 x 56 (Nom) TIM6V Hollow Bar							
	12.5	19.87	75 x 50 (Nom) TIM6V Hollow Bar							
	15.0	22.87	75 x 45 (Nom) TIM6V Hollow Bar							
	17.5	25.54	75 x 40 (Nom) TIM6V Hollow Bar							

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Outside Diameter	Thickness	Mass per Metre	Usual Sales Description	Area of Section	Surface Area	Moment of Inertia	Elastic Modulus	Radius of Gyration	Yield Stress	Ultimate Tensile Strength
						I	*Z*	*r*	min	min
mm	mm	kg/m		cm^2	m^2/m	cm^4	cm^3	cm	MPa	MPa
✦ 76.1	2.3	4.19	65 NB DuraGal Ex-Light P.E.							
	2.3	4.19	65 NB I.L.G FirePlus P.E.							
	2.3	4.37	65 NB H.D.G. FirePlus G.B.E.							
	2.6	4.71	65 NB Galtube Plus P.E.	Please refer to Hollow tables on page 65						
✦	3.2	5.75	65 NB DuraGal Light P.E.							
✦	3.2	5.80	76.1 O/D x 3.2 Boiler BS 3059	7.45	0.239	49.70	13.00	2.58	195	320
✦	3.6	6.44	65 NB DuraGal Med P.E.							
	3.6	6.44	65 NB I.L.G Med FirePlus P.E.							
	3.6	6.51	65 NB Med P.E./ S&S BS 1387	8.34	0.239	55.00	14.40	2.57	195	320
	4.5	7.90	65 NB Heavy P.E./ S&S BS 1387	10.10	0.239	65.00	17.10	2.54	195	320
✦	4.9	8.60	65 NB x 4.9 Ammonia BS 3602	10.96	0.239	69.78	18.34	2.53	245	410
	6.3	10.80	76.1 O/D x 6.3 Boiler BS 3059	13.82	0.239	84.82	22.29	2.48	195	320
✦	8.0	13.44	76.1 O/D x 8.0 Boiler BS 3059	17.11	0.239	101	26.43	2.42	195	320
✦	9.5	15.60	76.1 O/D x 9.5 HFS BS 3601	19.88	0.239	112	29.55	2.39	235	410
✦	12.5	19.60	76.1 O/D x 12.5 HFS BS 3601	24.98	0.239	131	34.47	2.29	235	410
✦ 76.3	6.4	11.03	63.5 I/D x 6.4 Int. Cylinder Finish							
80.0	8.5	15.58	80 x 63 (Nom) TIM6V Hollow Bar	Please refer to Hollow tables on page 65						
	12.0	20.75	80 x 56 (Nom) TIM6V Hollow Bar							
	15.0	24.77	80 x 50 (Nom) TIM6V Hollow Bar							
	17.5	27.76	80 x 45 (Nom) TIM6V Hollow Bar							
	20.0	30.42	80 x 40 (Nom) TIM6V Hollow Bar							
85.0	9.0	17.50	85 x 67 (Nom) TIM6V Hollow Bar							
	12.0	22.27	85 x 61 (Nom) TIM6V Hollow Bar							
	15.0	26.67	85 x 55 (Nom) TIM6V Hollow Bar							
	17.5	29.98	85 x 50 (Nom) TIM6V Hollow Bar							
	20.0	32.96	85 x 45 (Nom) TIM6V Hollow Bar							

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Outside Diameter	Thickness	Mass per Metre	Usual Sales Description	Area of Section	Surface Area	Moment of Inertia	Elastic Modulus	Radius of Gyration	Yield Stress	Ultimate Tensile Strength
						I	Z	r	min	min
mm	mm	kg/m		cm^2	m^2/m	cm^4	cm^3	cm	MPa	MPa
88.9	1.6	3.445	88.9 O/D x 1.6 Welded P.E.	4.39	0.279	41.82	9.41	3.09	150	275
✦	2.0	4.286	88.9 O/D x 2.0 Welded P.E.	5.46	0.279	51.57	11.60	3.07	150	275
✦	2.0	4.286	80 NB Victaulite pipe	5.46	0.279	51.57	11.60	3.07	350	430
✦	2.6	5.53	80 NB Ex-Light DuraGal P.E.							
	2.6	5.53	80 NB I.L.G FirePlus P.E.							
	2.6	5.75	80 NB H.D.G. FirePlus G.B.E.							
✦	3.2	6.76	80 NB DuraGal Light P.E.							
✦	3.6	7.57	88.9 O/D x 3.6 Boiler BS 3059	9.65	0.279	88.00	19.77	3.02	195	320
	4.0	8.47	80 NB Med P.E. S&S BS 1387	10.80	0.279	97.70	22.00	3.00	195	320
✦	4.0	8.38	80 NB DuraGal Med P.E.							
	4.0	8.38	80 NB I.L.G Med FirePlus P.E.							414
	4.8	9.96	80 NB UltraPipe C350LO AS 1163	Please refer to UltraPipe tables on page 91						
✦	4.9	10.10	80 NB Heavy P.E./ S&S BS 1387	12.90	0.279	114	25.60	2.98	195	320
✦	5.4	11.10	80 NB x 5.4 Ammonia BS 3602	14.10	0.279	124	27.90	2.95	245	410
	5.49	11.29	80 NB API Line pipe Sch 40	14.38	0.279	126	28.27	2.96	241	414
	5.49	11.29	80 NB ASTM A106 Grade B Sch 40	14.38	0.279	126	28.27	2.96	240	415
	5.5	11.30	80 NB UltraPipe C350LO AS 1163	Please refer to UltraPipe tables on page 91						
	7.62	15.27	80 NB ASTM A106 Grade B Sch 80	19.45	0.279	162	36.47	2.89	240	415
	8.00	15.96	88.9 O/D x 8.0 Boiler BS 3059	20.33	0.279	168	37.79	2.87	195	320
✦	9.5	18.60	88.9 O/D x 9.5 HFS BS 3601	23.70	0.279	189	42.61	2.82	235	410
	11.13	21.33	80 NB ASTM A106 Grade B Sch 160							
✦	12.5	23.60	88.9 O/D x 12.5 HFS							
	15.24	27.67	80 NB ASTM A106 Grade B Sch XXS							
✦ 89.0	6.4	13.04	76.2 I/D x 6.4 Int. Cylinder Finish							
90.0	9.5	19.53	90 x 71 (Nom) TIM6V Hollow Bar	Please refer to Hollow Bar tables on page 65						
	11.5	22.95	90 x 67 (Nom) TIM6V Hollow Bar							
	13.5	26.23	90 x 63 (Nom) TIM6V Hollow Bar							
	17.0	31.49	90 x 56 (Nom) TIM6V Hollow Bar							
	20.0	35.49	90 x 50 (Nom) TIM6V Hollow Bar							

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	Outside Diameter	Thickness	Mass per Metre	Usual Sales Description	Area of Section	Surface Area	Moment of Inertia	Elastic Modulus	Radius of Gyration	Yield Stress	Ultimate Tensile Strength
							I	*Z*	*r*	min	min
	mm	mm	kg/m		cm^2	m^2/m	cm^4	cm^3	cm	MPa	MPa
	95.0	10.0	21.67	95 x 75 (Nom) TIM6V Hollow Bar							
		13.0	27.08	95 x 69 (Nom) TIM6V Hollow Bar							
		14.0	28.80	95 x 67 (Nom) TIM6V Hollow Bar							
		16.0	32.08	95 x 63 (Nom) TIM6V Hollow Bar							
		19.5	37.33	95 x 56 (Nom) TIM6V Hollow Bar							
		22.5	41.31	95 x 50 (Nom) TIM6V Hollow Bar							
	100.0	10.0	23.06	100 x 80 (Nom) TIM6V Hollow Bar							
		12.5	27.84	100 x 75 (Nom) TIM6V Hollow Bar							
		14.5	31.51	100 x 71 (Nom) TIM6V Hollow Bar							
		18.5	38.28	100 x 63 (Nom) TIM6V Hollow Bar							
		22.0	43.52	100 x 56 (Nom) TIM6V Hollow Bar							
	101.6	1.6	3.946	101.6 O/D x 1.6 Welded P.E.	5.02	0.319	63.00	12.37	3.53	150	275
		2.0	4.913	101.6 O/D x 2.0 Welded P.E.	6.26	0.319	77.63	15.28	3.52	150	275
✦		2.6	6.348	101.6 O/D x 2.6 Welded P.E.	8.09	0.319	99.14	19.52	3.50	150	275
✦		3.6	8.70	101.6 O/D x 3.6 Boiler BS 3059	11.08	0.319	133.00	26.23	3.47	195	320
✦		6.3	14.80	101.6 O/D x 6.3 HFS BS 3601	18.86	0.319	215.00	42.33	3.38	235	410
		8.0	18.50	101.6 O/D x 8.0 Boiler BS 3059	23.52	0.319	260.00	51.08	3.32	195	320
✦		9.5	21.58	101.6 O/D x 9.5 HFS BS 3601	27.49	0.319	295.00	57.98	3.27	235	410
✦		12.5	27.48	101.6 O/D x 12.5 HFS BS 3601	34.99	0.319	350.00	69.69	3.18	235	410
	106.0	10.5	26.18	106 x 85 (Nom) TIM6V Hollow Bar	Please refer to Hollow Bar tables on page 65						
		13.0	30.78	106 x 80 (Nom) TIM6V Hollow Bar							
		17.5	39.34	106 x 71 (Nom) TIM6V Hollow Bar							
		21.5	46.10	106 x 63 (Nom) TIM6V Hollow Bar							
		25.0	51.34	106 x 56 (Nom) TIM6V Hollow Bar							
	112.0	11.0	29.06	112 x 90 (Nom) TIM6V Hollow Bar	Please refer to Hollow Bar tables on page 65						
		13.5	33.88	112 x 85 (Nom) TIM6V Hollow Bar							
		16.0	39.04	112 x 80 (Nom) TIM6V Hollow Bar							
		20.5	47.63	112 x 71 (Nom) TIM6V Hollow Bar							
		24.5	54.37	112 x 63 (Nom) TIM6V Hollow Bar							

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Outside Diameter	Thickness	Mass per Metre	Usual Sales Description	Area of Section	Surface Area	Moment of Inertia	Elastic Modulus	Radius of Gyration	Yield Stress	Ultimate Tensile Strength
						I	*Z*	*r*	min	min
mm	mm	kg/m		cm^2	m^2/m	cm^4	cm^3	cm	MPa	MPa
114.3	3.05	8.37	100 NB I.L.G FirePlus P.E.							
	3.05	8.65	100 NB H.D.G. FirePlus G.B.E.							
✦	3.18	8.70	100 NB x 3.18 API Line Pipe	11.10	0.359	171	30.01	3.93	241	414
✦	3.20	8.77	100 NB DuraGal Ex-Light P.E.							
	3.60	9.83	100 NB DuraGal Light P.E.							
	4.50	12.10	100 NB Med P.E./ S&S BS 1387	15.40	0.359	233	40.80	3.89	195	320
✦	4.50	12.20	100 NB DuraGal Med P.E.							
	4.50	12.20	100 NB I.L.G Med FirePlus P.E.							
✦	4.78	12.89	100 NB x 4.78 ASTM A106 Grade B	16.44	0.359	247	43.23	3.88	240	415
	4.8	13.00	100 NB UltraPipe C350LO AS 1163	Please refer to UltraPipe tables on page 91						
	5.40	14.50	100 NB Heavy P.E./ S&S BS 1387	18.40	0.359	274	47.90	3.86	195	320
✦	5.40	14.50	100 NB x 5.4 Ammonia BS 3602	18.40	0.359	274	47.90	3.86	245	410
	6.00	16.00	100 NB UltraPipe C350LO AS 1163	Please refer to UltraPipe tables on page 91						
	6.02	16.07	100 NB API Line pipe Sch 40	20.48	0.359	301	52.68	3.83	241	414
	6.02	16.07	100 NB ASTM A106 Gr B Sch 40	20.48	0.359	301	52.68	3.83	240	415
✦	6.30	16.80	114.3 O/D x 6.3 HFS BS 3601	21.38	0.359	313	54.72	3.82	235	410
	8.56	22.31	100 NB ASTM A106 Gr B Sch 80	28.43	0.359	400	70.00	3.75	240	415
✦	9.50	24.60	114.3 O/D x 9.5 HFS BS 3601	31.27	0.359	433	75.75	3.72	235	410
✦	12.50	31.45	114.3 O/D x 12.5 HFS BS 3601	39.98	0.359	526	91.98	3.63	235	410
	13.49	33.54	100 NB ASTM A106 Grade B Sch 160							
	17.12	41.01	100 NB ASTM A106 Grade B Sch XXS							
✦ 114.4	6.40	17.05	101.6 I/D x 6.4 Int. Cylinder Finish						–	–
118.0	11.5	32.08	118 x 95 (Nom) TIM6V Hollow Bar	Please refer to Hollow Bar tables on page 65						
	14.0	37.12	118 x 90 (Nom) TIM6V Hollow Bar							
	19.0	47.79	118 x 80 (Nom) TIM6V Hollow Bar							
	23.5	56.36	118 x 71 (Nom) TIM6V Hollow Bar							
	27.5	63.09	118 x 63 (Nom) TIM6V Hollow Bar							

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Outside Diameter	Thickness	Mass per Metre	Usual Sales Description	Area of Section	Surface Area	Moment of Inertia	Elastic Modulus	Radius of Gyration	Yield Stress	Ultimate Tensile Strength
						I	*Z*	*r*	min	min
mm	mm	kg/m		cm^2	m^2/m	cm^4	cm^3	cm	MPa	MPa
125.0	12.5	36.68	125 x 100 (Nom) TIM6V Hollow Bar							
	15.0	42.05	125 x 95 (Nom) TIM6V Hollow Bar							
	17.5	47.82	125 x 90 (Nom) TIM6V Hollow Bar							
	22.5	58.57	125 x 80 (Nom) TIM6V Hollow Bar							
	27.0	67.12	125 x 71 (Nom) TIM6V Hollow Bar							
✦ 127.0	6.30	18.8	127.0 O/D x 6.3 HFS BS 3601	23.89	0.399	436	68.70	4.27	235	410
✦	9.50	27.5	127.0 O/D x 9.5 HFS BS 3601	35.07	0.399	609	95.93	4.17	235	410
✦	12.50	35.3	127.0 O/D x 12.5 HFS BS 3601	44.96	0.399	746	117.00	4.07	235	410
132.0	13.0	39.65	132 x 106 (Nom) TIM6V Hollow Bar	Please refer to Hollow Bar tables on page 65						
	17.0	49.72	132 x 98 (Nom) TIM6V Hollow Bar							
	21.0	59.23	132 x 90 (Nom) TIM6V Hollow Bar							
	26.0	69.95	132 x 80 (Nom) TIM6V Hollow Bar							
	30.5	78.48	132 x 71 (Nom) TIM6V Hollow Bar							
139.7	4.88	16.2	125 NB Med P.E./ S&S AS 1074	20.70	0.439	470	67.30	4.77	–	325
	5.40	17.0	125 NB Heavy P.E./ S&S AS 1074	22.70	0.439	513	73.50	4.75	–	325
✦	5.40	17.0	125 NB x 5.4 Ammonia BS 3602	22.70	0.439	513	73.50	4.75	245	410
✦	6.30	19.7	139.7 O/D x 6.3 HFS BS 3601	26.40	0.439	588	84.27	4.72	235	410
✦	12.50	39.2	139.7 O/D x 12.5 HFS BS 3601	49.95	0.439	1020	146	4.52	235	410
✦	19.00	56.56	139.7 O/D x 19.0 HFS BS 3601	72.05	0.439	1345	192	4.32	235	410
140.0	14.0	45.20	140 x 112 (Nom) TIM6V Hollow Bar	Please refer to Hollow Bar tables on page 65						
	17.0	53.27	140 x 106 (Nom) TIM6V Hollow Bar							
	20.0	61.01	140 x 100 (Nom) TIM6V Hollow Bar							
	25.0	73.01	140 x 90 (Nom) TIM6V Hollow Bar							
	30.0	83.71	140 x 80 (Nom) TIM6V Hollow Bar							
141.3	3.18	10.80	125 NB x 3.18 API Line Pipe	13.80	0.444	329	46.60	4.88	241	414
✦	6.55	21.78	125 NB API Line pipe Sch 40	27.73	0.444	630	89.29	4.77	241	414
	6.55	21.78	125 NB ASTM A106 Grade B Sch 40	27.73	0.444	630	89.29	4.77	240	415
	9.53	30.94	125 NB ASTM A106 Grade B Sch 80							

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Outside Diameter	Thickness	Mass per Metre	Usual Sales Description	Area of Section	Surface Area	Moment of Inertia	Elastic Modulus	Radius of Gyration	Yield Stress	Ultimate Tensile Strength
						I	*Z*	*r*	min	min
mm	mm	kg/m		cm^2	m^2/m	cm^4	cm^3	cm	MPa	MPa
✦ 142.8	7.9	26.28	142.8 O/D x 7.9 Int. Cylinder Finish							
150.0	12.5	49.73	150 x 125 (Nom) TIM6V Hollow Bar	Please refer to Hollow Bar tables on page 65						
	14.0	54.36	150 x 122 (Nom) TIM6V Hollow Bar							
	16.0	54.82	150 x 118 (Nom) TIM6V Hollow Bar							
	22.0	71.57	150 x 106 (Nom) TIM6V Hollow Bar							
	27.5	85.54	150 x 95 (Nom) TIM6V Hollow Bar							
	33.0	100.77	150 x 84 (Nom) TIM6V Hollow Bar							
	35.0	102.05	150 x 80 (Nom) TIM6V Hollow Bar							
✦ 152.4	6.3	22.70	152.4 O/D x 6.3 HFS BS 3601	28.91	0.479	773	101	5.17	235	410
✦	9.5	33.50	152.4 O/D x 9.5 HFS BS 3601	42.65	0.479	1093	143	5.06	235	410
✦	12.5	43.10	152.4 O/D x 12.5 HFS BS 3601	54.93	0.479	1355	178	4.96	235	410
✦	19.0	62.50	152.4 O/D x 19.0 HFS BS 3601	80.00	0.479	1807	237	4.76	235	410
✦	25.0	78.50	152.4 O/D x 25.0 HFS BS 3601	100.00	0.479	2108	276	4.59	235	410
160.0	14.0	56.46	160 x 132 (Nom) TIM6V Hollow Bar	Please refer to Hollow Bar tables on page 65						
	19.0	68.29	160 x 122 (Nom) TIM6V Hollow Bar							
	24.0	82.96	160 x 112 (Nom) TIM6V Hollow Bar							
	30.0	99.02	160 x 100 (Nom) TIM6V Hollow Bar							
	32.5	109.46	160 x 95 (Nom) TIM6V Hollow Bar							
	35.0	110.97	160 x 90 (Nom) TIM6V Hollow Bar							
✦ 165.1	2.5	10.00	150 NB Victaulite pipe	12.80	0.519	422	51.10	5.75	350	430
	3.4	14.00	150 NB Primed FirePlus P.E.							
	3.4	14.00	150 NB H.D.G. FirePlus G.B.E.							
	4.88	19.20	150 NB Med P.E./ S&S AS 1074	24.50	0.519	788	95.50	5.67	–	325
	5.40	21.30	150 NB Heavy P.E./ S&S AS 1074	27.00	0.519	863	104	5.65	–	325
✦	5.40	21.30	150 NB x 5.4 Ammonia BS 3602	27.00	0.519	863	104	5.65	245	410
✦	12.50	47.00	165.1 O/D x 12.5 HFS BS 3601	59.93	0.519	1756	213	5.41	235	410
✦ 165.2	6.4	25.06	152 I/D x 6.4 Int. Cylinder Finish						–	–
168.2	7.9	31.23	152 I/D x 7.9 Int. Cylinder Finish						–	–

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Outside Diameter	Thickness	Mass per Metre	Usual Sales Description	Area of Section	Surface Area	Moment of Inertia	Elastic Modulus	Radius of Gyration	Yield Stress	Ultimate Tensile Strength
						I	*Z*	*r*	min	min
mm	mm	kg/m		cm^2	m^2/m	cm^4	cm^3	cm	MPa	MPa
168.3	3.18	12.94	150 NB x 3.18 API Line Pipe	16.49	0.529	562	66.8	5.83	241	414
✦	4.78	19.23	150 NB x 4.78 API Line Pipe	24.55	0.529	821	97.6	5.78	241	414
✦	4.78	19.23	150 NB x 4.78 ASTM A106 Grade B	24.55	0.529	821	97.6	5.78	240	415
	4.8	25.4	150 NB UltraPipe C350LO AS 1163	Please refer to UltraPipe tables on page 91						
✦	5.00	20.13	150 NB x 5.0 API Line Pipe	25.65	0.529	856	102	5.77	240	415
✦	6.35	25.6	150 NB x 6.35 API Line Pipe	32.60	0.529	1070	127	5.73	240	415
	6.4	33.6	150 NB UltraPipe C350LO AS 1163	Please refer to UltraPipe tables on page 91						
	7.1	28.2	150 NB UltraPipe C350LO AS 1163							
	7.11	28.23	150 NB API Line pipe Sch 40	36.00	0.529	1170	139	5.70	241	414
	7.11	28.23	150 NB ASTM A106 Grade B Sch 40	36.00	0.529	1170	139	5.70	240	415
	10.97	42.56	150 NB ASTM A106 Grade B Sch 80	54.20	0.529	1690	201	5.59	240	415
	14.27	54.20	150 NB ASTM A106 Grade B Sch 120							
	18.26	67.55	150 NB ASTM A106 Grade B Sch 160							
	21.95	79.18	150 NB ASTM A106 Grade B Sch XXS							
170.0	15.0	61.92	170 x 140 (Nom) TIM6V Hollow Bar	Please refer to Hollow Bar tables on page 65						
	20.0	76.49	170 x 130 (Nom) TIM6V Hollow Bar							
	26.0	95.14	170 x 118 (Nom) TIM6V Hollow Bar							
	30.0	106.67	170 x 110 (Nom) TIM6V Hollow Bar							
	35.0	119.90	170 x 100 (Nom) TIM6V Hollow Bar							
180.0	15.0	69.77	180 x 150 (Nom) TIM6V Hollow Bar							
	17.0	77.99	180 x 146 (Nom) TIM6V Hollow Bar							
	20.0	81.72	180 x 140 (Nom) TIM6V Hollow Bar							
	27.5	106.57	180 x 125 (Nom) TIM6V Hollow Bar							
	34.0	126.03	180 x 112 (Nom) TIM6V Hollow Bar							
	40.0	142.02	180 x 100 (Nom) TIM6V Hollow Bar							
190.0	15.0	76.56	190 x 160 (Nom) TIM6V Hollow Bar							
	17.5	85.24	190 x 155 (Nom) TIM6V Hollow Bar							
	20.0	86.98	190 x 150 (Nom) TIM6V Hollow Bar							
	29.0	118.65	190 x 132 (Nom) TIM6V Hollow Bar							
	36.0	140.74	190 x 118 (Nom) TIM6V Hollow Bar							

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Outside Diameter	Thickness	Mass per Metre	Usual Sales Description	Area of Section	Surface Area	Moment of Inertia	Elastic Modulus	Radius of Gyration	Yield Stress	Ultimate Tensile Strength
						I	*Z*	*r*	min	min
mm	mm	kg/m		cm^2	m^2/m	cm^4	cm^3	cm	MPa	MPa
✦ 193.7	7.1	32.7	193.7 O/D x 7.1 HFS BS 3601	41.60	0.608	1814	187	6.60	235	410
✦	12.5	55.9	193.7 O/D x 12.5 HFS BS 3601	71.16	0.608	2934	303	6.42	235	410
200.0	20.0	92.25	200 x 160 (Nom) TIM6V Hollow Bar	Please refer to Hollow Bar tables on page 65						
	30.0	129.62	200 x 140 (Nom) TIM6V Hollow Bar							
✦ 219.1	3.0	16.00	200 NB Victaulite pipe	20.40	0.688	1190	109	7.64	350	430
	4.0	21.1	200 NB UltraPipe C350LO AS 1163	Please refer to UltraPipe tables on page 91						
	4.78	25.21	200 NB x 4.78 API Line pipe	32.30	0.688	1860	169	7.58	241	414
	4.8	25.4	200 NB UltraPipe C350LO AS 1163	Please refer to UltraPipe tables on page 91						
	6.35	33.31	200 NB API Line pipe Sch 20	42.44	0.688	2403	219	7.53	241	414
	6.35	33.31	200 NB ASTM A106 Grade B Sch 20	42.44	0.688	2403	219	7.53	240	415
	6.4	33.6	200 NB UltraPipe C350LO AS 1163	Please refer to UltraPipe tables on page 91						
	8.18	42.53	200 NB API Line pipe Sch 40	54.20	0.688	3018	275	7.47	241	414
	8.18	42.53	200 NB ASTM A106 Grade B Sch 40	54.20	0.688	3018	275	7.47	240	415
	8.2	42.6	200 NB UltraPipe C350LO AS 1163	Please refer to UltraPipe tables on page 91						
✦	12.70	64.30	200 NB API Line pipe Sch 80	82.60	0.688	4412	401	7.32	241	414
	12.70	64.30	200 NB ASTM A106 Grade B Sch 80	82.60	0.688	4412	401	7.32	240	415
	18.26	90.42	200 NB ASTM A106 Grade B Sch 120							
273.0	4.78	31.56	250 NB x 4.78 API Line pipe	40.28	0.858	3623	265	9.48	241	414
	6.35	41.77	250 NB API Line pipe Sch 20	53.20	0.858	4745	347	9.42	241	414
	6.35	41.77	250 NB ASTM A106 Grade B Sch 20	53.20	0.858	4745	347	9.42	240	415
	9.27	60.29	250 NB API Line pipe Sch 40	76.70	0.858	6626	485	9.32	241	414
	9.27	60.29	250 NB ASTM A106 Grade B Sch 40	76.70	0.858	6626	485	9.32	240	415
	12.70	81.54	250 NB ASTM A106 Grade B XS	104.0	0.858	8824	646	9.22	240	415
	15.09	95.97	250 NB ASTM A106 Grade B Sch 80	122.0	0.858	10200	747	9.13	240	415
273.1	4.8	31.8	250 NB UltraPipe C350LO AS 1163	Please refer to UltraPipe tables on page 91						
	6.4	42.1	250 NB UltraPipe C350LO AS 1163							
	9.3	60.5	250 NB UltraPipe C350LO AS 1163							
	12.7	81.6	250 NB UltraPipe C350LO AS 1163							

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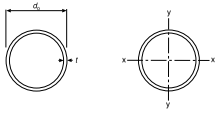
Outside Diameter	Thickness	Mass per Metre	Usual Sales Description	Area of Section	Surface Area	Moment of Inertia	Elastic Modulus	Radius of Gyration	Yield Stress	Ultimate Tensile Strength
						I	*Z*	*r*	min	min
mm	mm	kg/m		cm^2	m^2/m	cm^4	cm^3	cm	MPa	MPa
✦ 323.8	4.78	37.53	300 NB x 4.78 API Line pipe	47.9	1.02	6096	377	11.3	241	414
	6.35	49.40	300 NB API Line pipe Sch 20	63.4	1.02	7989	494	11.3	241	414
	6.35	49.40	300 NB ASTM A106 Grade B Sch 20	63.4	1.02	7989	494	11.3	240	415
	7.92	61.69	300 NB x 7.92 ASTM A106 Grade B	78.6	1.02	9809	606	11.2	240	415
	9.52	73.70	300 NB API Line pipe STD	93.8	1.02	11600	717	11.1	241	414
	9.52	73.70	300 NB ASTM A106 Grade B STD	93.8	1.02	11600	717	11.1	240	415
	10.31	79.65	300 NB ASTM A106 Grade B Sch 40	102	1.02	12490	771	11.0	240	415
	12.7		300 NB ASTM A106 Grade B XS							
	17.48	131.90	300 NB ASTM A106 Grade B Sch 80	168	1.02	19790	1220	10.8	240	415
323.9	6.4	50.1	300 NB UltraPipe C350L0 AS 1163	Please refer to UltraPipe tables on page 91						
	9.5	73.7	300 NB UltraPipe C350L0 AS 1163							
	12.7	97.5	300 NB UltraPipe C350L0 AS 1163							
355.6	6.4	63.1	350 NB UltraPipe C350L0 AS 1163	Please refer to UltraPipe tables on page 91						
	9.5	93.0	350 NB UltraPipe C350L0 AS 1163							
	9.53	81.1	350 NB ASTM A106 Grade B Sch 30	103	1.12	15500	871	12.2	240	415
	9.53	81.18	350 NB API Line pipe Sch STD							
	12.7	107	350 NB UltraPipe C350L0 AS 1163	Please refer to UltraPipe tables on page 91						
	12.7	107.38	350 NB ASTM A106 Grade B Sch XS							
406.4	6.35	93.21	400 NB API Line pipe Sch 10							
	6.4	63.1	400 NB UltraPipe C350L0 AS 1163	Please refer to UltraPipe tables on page 91						
	9.5	93.0	400 NB UltraPipe C350L0 AS 1163							
	9.53	93.0	400 NB ASTM A106 Grade B Sch 30	118	1.28	23300	1150	14.0	240	415
	9.53	62.62	400 NB API Line pipe Sch STD							
	12.7	123	400 NB UltraPipe C350L0 AS 1163	Please refer to UltraPipe tables on page 91						
457.0	6.4	71.1	400 NB UltraPipe C350L0 AS 1163	Please refer to UltraPipe tables on page 91						
	9.5	105	400 NB UltraPipe C350L0 AS 1163							
	12.7	139	400 NB UltraPipe C350L0 AS 1163							
508.0	6.35	79.17	500 NB API Line pipe Sch 10							
	9.35	117.06	500 NB API Line pipe Sch STD							

✦ These items are not commonly stocked, they are available on request. Minimum order quantities may apply. Please contact your local Steel & Tube branch.

Circular Hollow Sections

Dimensions and Properties

Grade C250L0 (AS 1163)



Designation		Mass per metre	External Surface Area		Dimension and Ratios d_o/t	Gross Section Area	Properties About any axis				Torsion Constant	Torsion Modulus	Form Factor	Properties for Design to AS 4100 About any axis		
d_o	t		per m	per t		A_g	I	Z	S	r	J	C	k_f	λ_s	Compactness[3]	Z_e
mm	mm	kg/m	m^2/m	m^2/t		mm^2	$10^6 mm^4$	$10^3 mm^3$	$10^3 mm^3$	mm	$10^6 mm^4$	$10^3 mm^3$			(C,N,S)	$10^3 mm^3$
165.1 x	5.4 CHS	21.3	0.519	24.4	30.6	2710	8.65	105	138	56.5	17.3	209	1.00	30.6	C	138
	5.0 CHS	19.7	0.519	26.3	33.0	2510	8.07	97.7	128	56.6	16.1	195	1.00	33.0	C	128
139.7 x	5.4 CHS	17.9	0.439	24.5	25.9	2280	5.14	73.7	97.4	47.5	10.3	147	1.00	25.9	C	97.4
	5.0 CHS	16.6	0.439	26.4	27.9	2120	4.81	68.8	90.8	47.7	9.61	138	1.00	27.9	C	90.8
114.3 x	5.4 CHS	14.5	0.359	24.8	21.2	1850	2.75	48.0	64.1	38.5	5.49	96.1	1.00	21.2	C	64.1
	4.5 CHS	12.2	0.359	29.5	25.4	1550	2.34	41.0	54.3	38.9	4.69	82.0	1.00	25.4	C	54.3
88.9 x	5.0 CHS	10.3	0.279	27.0	17.8	1320	1.16	26.2	35.2	29.7	2.33	52.4	1.00	17.8	C	35.2
	4.0 CHS	8.38	0.279	33.3	22.2	1070	0.963	21.7	28.9	30.0	1.93	43.3	1.00	22.2	C	28.9
76.1 x	4.5 CHS	7.95	0.239	30.1	16.9	1010	0.651	17.1	23.1	25.4	1.30	34.2	1.00	16.9	C	23.1
	3.6 CHS	6.44	0.239	37.1	21.1	820	0.540	14.2	18.9	25.7	1.08	28.4	1.00	21.1	C	18.9
60.3 x	4.5 CHS	6.19	0.189	30.6	13.4	789	0.309	10.2	14.0	19.8	0.618	20.5	1.00	13.4	C	14.0
	3.6 CHS	5.03	0.189	37.6	16.8	641	0.259	8.58	11.6	20.1	0.517	17.2	1.00	16.8	C	11.6
48.3 x	4.0 CHS	4.37	0.152	34.7	12.1	557	0.138	5.70	7.87	15.7	0.275	11.4	1.00	12.1	C	7.87
	3.2 CHS	3.56	0.152	42.6	15.1	453	0.116	4.80	6.52	16.0	0.232	9.59	1.00	15.1	C	6.52
42.4 x	4.0 CHS	3.79	0.133	35.2	10.6	483	0.0899	4.24	5.92	13.6	0.180	8.48	1.00	10.6	C	5.92
	3.2 CHS	3.09	0.133	43.1	13.3	394	0.0762	3.59	4.93	13.9	0.152	7.19	1.00	13.3	C	4.93
33.7 x	4.0 CHS	2.93	0.106	36.1	8.43	373	0.0419	2.49	3.55	10.6	0.0838	4.97	1.00	8.43	C	3.55
	3.2 CHS	2.41	0.106	44.0	10.5	307	0.0360	2.14	2.99	10.8	0.0721	4.28	1.00	10.5	C	2.99
26.9 x	3.2 CHS	1.87	0.0845	45.2	8.41	238	0.0170	1.27	1.81	8.46	0.0341	2.53	1.00	8.41	C	1.81
	2.6 CHS	1.56	0.0845	54.2	10.3	198	0.0148	1.10	1.54	8.64	0.0296	2.20	1.00	10.3	C	1.54

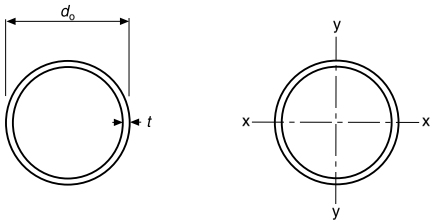
Notes:

1. This table is calculated in accordance with AS 4100 using design yield stress f_y = 250 MPa and design tensile strength f_u = 320 MPa as per AS 4100 table 2.1 for AS 1163 grade C250L0.
2. Grade C250L0 is cold formed and therefore is allocated the CF residual stresses classification in AS 4100.
3. C = Compact Section; N = Non-compact Section; S = Slender Section; as defined in AS 4100.

Galtube Plus Circular Hollow Sections

Dimensions and Properties

Grade C350L0 (Tubeline 350L0 – Type 1)



Dimension and Ratios						Full Section Properties							Effective Section Properties	
Designation		Mass per metre	External Surface Area		$\frac{d_o}{t}$	Full Section Area	About any axis				Torsion Constant	Torsion Modulus	Effective Section Area	About any axis
d_o	t		per m	per t		A_f	I	Z	S	r	J	C	A_e	I_e	Z_e
mm	mm	kg/m	m^2/m	m^2/t		mm^2	10^6mm^4	10^3mm^3	10^3mm^3	mm	10^6mm^4	10^3mm^3	mm	10^6mm^4	10^3mm^3
76.1 x 2.6 CHS[1]		4.71	0.239	50.7	30.4	578	0.392	10.3	13.5	26.0	0.784	20.6	578	0.392	12.9
60.3 x 2.3 CHS[1]		3.29	0.189	57.6	27.4	402	0.170	5.63	7.43	20.6	0.339	11.3	402	0.170	7.03
48.3 x 2.3 CHS[1]		2.61	0.152	58.2	22.0	319	0.0848	3.51	4.68	16.3	0.170	7.03	319	0.0848	4.39
42.4 x 2.0 CHS[1]		1.99	0.133	66.8	22.3	242	0.0497	2.34	3.12	14.3	0.0993	4.69	242	0.0497	2.93
33.7 x 2.0 CHS[1]		1.56	0.106	67.7	17.7	190	0.0241	1.43	1.92	11.3	0.0482	2.86	190	0.0241	1.79
26.9 x 2.0 CHS[1]		1.23	0.0845	68.8	14.2	149	0.0117	0.872	1.19	8.86	0.0235	1.74	149	0.0117	1.09

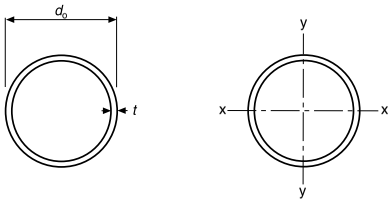
Notes:

1. In this table, the properties of these products are calculated in accordance with AS/NZS 4600 using design yield stress f_y = 350 MPa and design tensile strength f_u = 380 MPa.
2. Effective section properties are calculated in accordance with AS/NZS 4600.
3. All columns of the table (except for "Mass per metre" and "External Surface Area per t") are calculated using design thicknesses of 1.1mm, 1.9mm, 2.2mm and 2.5mm rather than the respective thicknesses *t* of 1.2mm, 2.0mm, 2.3mm and 2.6mm. This is to comply with clause 1.5.1.6 of AS/NZS 4600.

UltraPipe Circular Hollow Sections

Dimensions and Properties

Grade C350L0 (AS 1163)



Designation		Mass per metre	External Surface Area		$\frac{d_o}{t}$	Gross Section Area	Properties							Properties for Design To AS 4100		
							About any axis							About any axis		
d_o	t		per m	per t		A_g	I	Z	S	r	J	C	k_f	λ_s	Compactness[3]	Z_e
mm	mm	kg/m	m^2/m	m^2/t		mm^2	$10^6 mm^4$	$10^3 mm^3$	$10^3 mm^3$	mm	$10^6 mm^4$	$10^3 mm^3$			(C,N,S)	$10^3 mm^3$
457.0 x 12.7 CHS		139	1.44	10.3	36.0	17700	438	1920	2510	157	876	3830	1.00	50.4	N	2500
	9.5 CHS	105	1.44	13.7	48.1	13400	334	1460	1900	158	669	2930	1.00	67.3	N	1790
	6.4 CHS	71.1	1.44	20.2	71.4	9060	230	1010	1300	159	460	2010	0.904	100	N	1090
406.4 x 12.7 CHS		123	1.28	10.4	32.0	15700	305	1500	1970	139	609	3000	1.00	44.8	C	1970
	9.5 CHS	93.0	1.28	13.7	42.8	11800	233	1150	1500	140	467	2300	1.00	59.9	N	1450
	6.4 CHS	63.1	1.28	20.2	63.5	8040	161	792	1020	141	322	1580	0.960	88.9	N	895
355.6 x 12.7 CHS		107	1.12	10.4	28.0	13700	201	1130	1490	121	403	2260	1.00	39.2	C	1490
	9.5 CHS	81.1	1.12	13.8	37.4	10300	155	871	1140	122	310	1740	1.00	52.4	N	1130
	6.4 CHS	55.1	1.12	20.3	55.6	7020	107	602	781	123	214	1200	1.00	77.8	N	710
323.9 x 12.7 CHS		97.5	1.02	10.4	25.5	12400	151	930	1230	110	301	1860	1.00	35.7	C	1230
	9.5 CHS	73.7	1.02	13.8	34.1	9380	116	717	939	111	232	1430	1.00	47.7	C	939
	6.4 CHS	50.1	1.02	20.3	50.6	6380	80.5	497	645	112	161	994	1.00	70.9	N	601
273.1 x 12.7 CHS		81.6	0.858	10.5	21.5	10400	88.3	646	862	92.2	177	1290	1.00	30.1	C	862
	9.3 CHS	60.5	0.858	14.2	29.4	7710	67.1	492	647	93.3	134	983	1.00	41.1	C	647
	6.4 CHS	42.1	0.858	20.4	42.7	5360	47.7	349	455	94.3	95.4	699	1.00	59.7	N	441
	4.8 CHS	31.8	0.858	27.0	56.9	4050	36.4	267	346	94.9	72.8	533	1.00	79.7	N	312

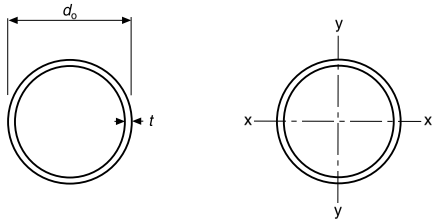
Notes:

1. This table is calculated in accordance with AS 4100 using design yield stress f_y = 350 MPa and design tensile strength f_u = 430 MPa as per AS 4100 table 2.1 for AS 1163 grade C350L0.
2. Grade C350L0 is cold formed and therefore is allocated the CF residual stresses classification in AS 4100.
3. C = Compact Section; N = Non-compact Section; S = Slender Section; as defined in AS 4100.

UltraPipe Circular Hollow Sections

Dimensions and Properties

Grade C350L0 (AS 1163)



Designation		Dimension and Ratios: Mass per metre	External Surface Area			Gross Section Area	Properties: About any axis				Torsion Constant	Torsion Modulus	Form Factor	Properties for Design to AS 4100: About any axis		
d_o	t		per m	per t	$\frac{d_o}{t}$	A_g	I	Z	S	r	J	C	k_f	λ_s	Compactness[3]	Z_e
mm	mm	kg/m	m^2/m	m^2/t		mm^2	$10^6 mm^4$	$10^3 mm^3$	$10^3 mm^3$	mm	$10^6 mm^4$	$10^3 mm^3$			(C,N,S)	$10^3 mm^3$
219.1 x	8.2 CHS	42.6	0.688	16.1	26.7	5430	30.3	276	365	74.6	60.5	552	1.00	37.4	C	365
	6.4 CHS	33.6	0.688	20.5	34.2	4280	24.2	221	290	75.2	48.4	442	1.00	47.9	C	290
	4.8 CHS	25.4	0.688	27.1	45.6	3230	18.6	169	220	75.8	37.1	339	1.00	63.9	N	210
	4.0 CHS	21.2	0.688	32.4	54.8	2700	15.6	143	185	76.1	31.3	286	1.00	76.7	N	169
168.3 x	7.1 CHS	28.2	0.529	18.7	23.7	3600	11.7	139	185	57.0	23.4	278	1.00	33.2	C	185
	6.4 CHS	25.6	0.529	20.7	26.3	3260	10.7	127	168	57.3	21.4	254	1.00	36.8	C	168
	4.8 CHS	19.4	0.529	27.3	35.1	2470	8.25	98.0	128	57.8	16.5	196	1.00	49.1	C	128
114.3 x	6.0 CHS	16.0	0.359	22.4	19.1	2040	3.00	52.5	70.4	38.3	6.00	105	1.00	26.7	C	70.4
	4.8 CHS	13.0	0.359	27.7	23.8	1650	2.48	43.4	57.6	38.8	4.96	86.8	1.00	33.3	C	57.6
88.9 x	5.5 CHS	11.3	0.279	24.7	16.2	1440	1.26	28.3	38.3	29.6	2.52	56.6	1.00	22.6	C	38.3
	4.8 CHS	9.96	0.279	28.1	18.5	1270	1.12	25.3	34.0	29.8	2.25	50.6	1.00	25.9	C	34.0

Notes:

1. This table is calculated in accordance with AS 4100 using design yield stress f_y = 350 MPa and design tensile strength f_u = 430 MPa as per AS 4100 table 2.1 for AS 1163 grade C350L0.
2. Grade C350L0 is cold formed and therefore is allocated the CF residual stresses classification in AS 4100.
3. C = Compact Section; N = Non-compact Section; S = Slender Section; as defined in AS 4100.

UltraPipe Pressure Ratings

Available in sizes from 88.9mm O.D. to 457.0mm O.D., UltraPipe is created using continuous cast steel strip of low carbon equivalent, which is joined using the high-frequency electric resistance welding (HFERW) process.
This process produces a flawless, continuous longitudinal seam of unparalleled symmetry and strength.

UltraPipe is a straighter, rounder pipe of more consistent wall thickness, and it has a tighter bevel tolerance than required by most standards.

These features mean it can be used in a wide variety of applications, including:

- Pressure piping for flammable, toxic, high pressure or lethal fluids and gases.
- Pipelines for gas and liquid petroleum.
- Structural and architectural uses in buildings and bridges.
- Water bore casing. (Imported grade B and grade X42 line pipe does not comply with AS1396 due to the higher mechanical properties specified in this bore casing standard.)

Fluid Type Examples

Fluid	Type	Example
1	Lethal fluids	Carbonyl chloride, cyanogen, hydrocyanic acid, xylyl bromide.
2	Flammable, toxic HHT*	Steam, petroleum, methane, aviation fuel, chlorine, CO2, cryogenic fluids
3	Gas and combustible liquids not covered above	Argon, neon, nitrogen, air, fuel oil, crude oil, machine oil
4	Any other liquids not covered above	Water and other safe fluids.

HHT* Harmful to Human Tissues

AS 4041 Table 1.4 Classes for Fluids

Liquid	Fluid	Gas	Class 1	Class 2A	Class 2P	Class 3
Lethal	1	Lethal	Yes	No	No	No
Flammable Toxic HHT* (includes steam and cryogenic)	2	Flammable Toxic HHT*	Yes	Yes 10MPa	No	Yes 2MPa max DN150
Combustible liquids	3	Any other gases not above	Yes	10MPa (gas) Yes (liquid)	No	Yes
Any other liquids not above	4	--	Yes	Yes	Yes	Yes

HHT* Harmful to Human Tissues

Class 1 – AS 4041 Maximum operating pressures in MPa for UltraPipe

			Fluid 1		Fluid 2		Fluid 3		Fluid 4	
Design Strength MPa		f	176	156	176	156	176	156	176	156
Thickness tolerance factor			0.925	0.925	0.925	0.925	0.925	0.925	0.925	0.925
Piping class factor		M	1	1	1	1	1	1	1	1
Weld joint factor		e	1	1	1	1	1	1	1	1
			Maximum Operating Temperature							
OD	WT	MDMT°C	Ambient	100°C	Ambient	100°C	Ambient	100°C	Ambient	100°C
457.0	12.7	-20	9.3	8.3	9.3	8.3	9.3	8.3	9.3	8.3
457.0	9.5	-25	6.9	6.2	6.9	6.2	6.9	6.2	6.9	6.2
457.0	6.4	-40	4.6	4.1	4.6	4.1	4.6	4.1	4.6	4.1
406.4	12.7	-20	10.5	9.3	10.5	9.3	10.5	9.3	10.5	9.3
406.4	9.5	-25	7.8	6.9	7.8	6.9	7.8	6.9	7.8	6.9
406.4	6.4	-40	5.2	4.6	5.2	4.6	5.2	4.6	5.2	4.6
355.6	12.7	-20	12.1	10.7	12.1	10.7	12.1	10.7	12.1	10.7
355.6	9.5	-25	9.0	8.0	9.0	8.0	9.0	8.0	9.0	8.0
355.6	6.4	-40	6.0	5.3	6.0	5.3	6.0	5.3	6.0	5.3
323.9	12.7	-20	13.3	11.8	13.3	11.8	13.3	11.8	13.3	11.8
323.9	9.5	-25	9.9	8.8	9.9	8.8	9.9	8.8	9.9	8.8
323.9	6.4	-40	6.6	5.8	6.6	5.8	6.6	5.8	6.6	5.8
273.1	12.7	-20	15.9	14.1	15.9	14.1	15.9	14.1	15.9	14.1
273.1	9.3	-25	11.5	10.2	11.5	10.2	11.5	10.2	11.5	10.2
273.1	6.4	-40	7.8	7.0	7.8	7.0	7.8	7.0	7.8	7.0
273.1	4.8	-50	5.9	5.2	5.9	5.2	5.9	5.2	5.9	5.2
219.1	8.2	-30	12.7	11.3	12.7	11.3	12.7	11.3	12.7	11.3
219.1	6.4	-40	9.8	8.7	9.8	8.7	9.8	8.7	9.8	8.7
219.1	4.8	-50	7.3	6.5	7.3	6.5	7.3	6.5	7.3	6.5
219.1	4.0	-50	6.1	5.4	6.1	5.4	6.1	5.4	6.1	5.4
168.3	7.1	-35	14.4	12.7	14.4	12.7	14.4	12.7	14.4	12.7
168.3	6.4	-40	12.9	11.4	12.9	11.4	12.9	11.4	12.9	11.4
168.3	4.8	-50	9.6	8.5	9.6	8.5	9.6	8.5	9.6	8.5
114.3	6.0	-45	18.1	16.0	18.1	16.0	18.1	16.0	18.1	16.0
114.3	4.8	-50	14.3	12.7	14.3	12.7	14.3	12.7	14.3	12.7
88.9	5.5	-45	21.5	19.1	21.5	19.1	21.5	19.1	21.5	19.1
88.9	4.8	-50	18.6	16.5	18.6	16.5	18.6	16.5	18.6	16.5

Note 1: For other temperatures consult AS4041 for appropriate pressure ratings.
Note 2: MDMT = Material Design Minimum Temperature.

Class 2A – AS 4041 Maximum operating pressures in MPa for UltraPipe

			Fluid 1		Fluid 2		Fluid 3		Fluid 3		Fluid 4	
							Gas	*Gas*	*Liquid*	*Liquid*		
Design Strength MPa		f	176	156	176	156	176	156	176	156	176	156
Thickness tolerance factor			0.925	0.925	0.925	0.925	0.925	0.925	0.925	0.925	0.925	0.925
Piping class factor		M	1	1	1	1	1	1	1	1	1	1
Weld joint factor		e	1	1	1	1	1	1	1	1	1	1
			Maximum Operating Temperature									
OD	WT	MDMT°C	Ambient	100°C	Ambient	100°C	Ambient	100°C	Ambient	100°C	Ambient	100°C
457.0	12.7	-20			9.3	8.3	9.3	8.3	9.3	8.3	9.3	8.3
457.0	9.5	-25			6.9	6.2	6.9	6.2	6.9	6.2	6.9	6.2
457.0	6.4	-40			4.6	4.1	4.6	4.1	4.6	4.1	4.6	4.1
406.4	12.7	-20	This class is		10.0	10.0	10.0	9.3	10.5	9.3	10.5	9.3
406.4	9.5	-25	not suitable for		7.8	6.9	7.8	6.9	7.8	6.9	7.8	6.9
406.4	6.4	-40	fluid 1		5.2	4.6	5.2	4.6	5.2	4.6	5.2	4.6
355.6	12.7	-20			10.0	10.0	10.0	10.0	12.1	10.7	12.1	10.7
355.6	9.5	-25			9.0	8.0	9.0	8.0	9.0	8.0	9.0	8.0
355.6	6.4	-40			6.0	5.3	6.0	5.3	6.0	5.3	6.0	5.3
323.9	12.7	-20			10.0	10.0	10.0	10.0	13.3	11.8	13.3	11.8
323.9	9.5	-25			9.9	8.8	9.9	8.8	9.9	8.8	9.9	8.8
323.9	6.4	-40			6.6	5.8	6.6	5.8	6.6	5.8	6.6	5.8
273.1	12.7	-20			10.0	10.0	10.0	10.0	15.9	14.1	15.9	14.1
273.1	9.3	-25			10.0	10.0	10.0	10.0	11.5	10.2	11.5	10.2
273.1	6.4	-40			7.8	7.0	7.8	7.0	7.8	7.0	7.8	7.0
273.1	4.8	-50			5.9	5.2	5.9	5.2	5.9	5.2	5.9	5.2
219.1	8.2	-30			10.0	10.0	10.0	10.0	12.7	11.3	12.7	11.3
219.1	6.4	-40	This class is		9.8	8.7	9.8	8.7	9.8	8.7	9.8	8.7
219.1	4.8	-50	not suitable for		7.3	6.5	7.3	6.5	7.3	6.5	7.3	6.5
219.1	4.0	-50	fluid 1		6.1	5.4	6.1	5.4	6.1	5.4	6.1	5.4
168.3	7.1	-35			10.0	10.0	10.0	10.0	14.4	12.7	14.4	12.7
168.3	6.4	-40			10.0	10.0	10.0	10.0	12.9	11.4	12.9	11.4
168.3	4.8	-50			9.6	8.5	9.6	8.5	9.6	8.5	9.6	8.5
114.3	6.0	-45			10.0	10.0	10.0	10.0	18.1	16.0	18.1	16.0
114.3	4.8	-50			10.0	10.0	10.0	10.0	14.3	12.7	14.3	12.7
88.9	5.5	-45	This class is		10.0	10.0	10.0	10.0	21.5	19.1	21.5	19.1
88.9	4.8	-50	not suitable for		10.0	10.0	10.0	10.0	18.6	16.5	18.6	16.5
			fluid 1									

Note 1: For other temperatures consult AS4041 for appropriate pressure ratings.
Note 2: MDMT = Material Design Minimum Temperature.

Class 2P – AS 4041 Maximum operating pressures in MPa for UltraPipe

			Fluid 1		Fluid 2		Fluid 3		Fluid 4	
Design Strength MPa		f	176	156	176	156	176	208	208	156
Thickness tolerance factor			0.925	0.925	0.925	0.925	0.925	0.925	0.925	0.925
Piping class factor		M	1	1	1	1	1	1	1	1
Weld joint factor		e	1	1	1	1	1	1	1	1
			Maximum Operating Temperature							
OD	WT	MDMT°C	Ambient	99°C	Ambient	99°C	Ambient	99°C	Ambient	99°C
457.0	12.7	-20							11.0	8.3
457.0	9.5	-25							8.2	6.2
457.0	6.4	-40							5.5	4.1
406.4	12.7	-20	This class is not suitable for fluid 1				This class is not suitable for fluid 3		12.5	9.3
406.4	9.5	-25							9.2	6.9
406.4	6.4	-40							6.2	4.6
355.6	12.7	-20							14.3	10.7
355.6	9.5	-25							10.6	8.0
355.6	6.4	-40							7.1	5.3
323.9	12.7	-20			This class is not suitable for fluid 2				15.7	11.8
323.9	9.5	-25							11.7	8.8
323.9	6.4	-40							7.8	5.8
273.1	12.7	-20							18.8	14.1
273.1	9.3	-25							13.6	10.2
273.1	6.4	-40							9.3	7.0
273.1	4.8	-50							6.9	5.2
219.1	8.2	-30							15.0	11.3
219.1	6.4	-40	This class is not suitable for fluid 1				This class is not suitable for fluid 3		11.6	8.7
219.1	4.8	-50							8.7	6.5
219.1	4.0	-50							7.2	5.4
168.3	7.1	-35							17.0	12.7
168.3	6.4	-40			This class is not suitable for fluid 2				15.3	11.4
168.3	4.8	-50							11.3	8.5
114.3	6.0	-45							21.4	16.0
114.3	4.8	-50							16.9	12.7
88.9	5.5	-45	This class is not suitable for fluid 1				This class is not suitable for fluid 3		25.4	19.1
88.9	4.8	-50							22.0	16.5

Note 1: For other temperatures consult AS4041 for appropriate pressure ratings.
Note 2: MDMT = Material Design Minimum Temperature.

Class 3 – AS 4041 Maximum operating pressures in MPa for UltraPipe

			Fluid 1		Fluid 2		Fluid 3		Fluid 4	
Design Strength MPa		f	176	156	176	156	176	156	176	156
Thickness tolerance factor			0.925	0.925	0.925	0.925	0.925	0.925	0.925	0.925
Piping class factor		M	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Weld joint factor		e	1	1	1	1	1	1	1	1
			Maximum Operating Temperature							
OD	WT	MDMT°C	Ambient	100°C	Ambient	100°C	Ambient	100°C	Ambient	100°C
457.0	12.7	-0					5.6	5.0	5.6	5.0
457.0	9.5	-5					4.2	3.7	4.2	3.7
457.0	6.4	-20					2.8	2.5	2.8	2.5
406.4	12.7	-0	This class is not suitable for fluid 1				6.3	5.6	6.3	5.6
406.4	9.5	-5					4.7	4.2	4.7	4.2
406.4	6.4	-20					3.1	2.8	3.1	2.8
355.6	12.7	-0					7.3	6.4	7.3	6.4
355.6	9.5	-5					5.4	4.8	5.4	4.8
355.6	6.4	-20					3.6	3.2	3.6	3.2
323.9	12.7	-0					8.0	7.1	8.0	7.1
323.9	9.5	-5					5.9	5.3	5.9	5.3
323.9	6.4	-20					4.0	3.5	4.0	3.5
273.1	12.7	-0					9.5	8.5	9.5	8.5
273.1	9.3	-5	This class is not suitable for fluid 1				6.9	6.1	6.9	6.1
273.1	6.4	-20					4.7	4.2	4.7	4.2
273.1	4.8	-30					3.5	3.1	3.5	3.1
219.1	8.2	-10			This class is only suitable for 168mm diameter maximum in fluid 2		7.6	6.8	7.6	6.8
219.1	6.4	-20					5.9	5.2	5.9	5.2
219.1	4.8	-30					4.4	3.9	4.4	3.9
219.1	4.0	-30					3.6	3.2	3.6	3.2
168.3	7.1	-15			2.0	2.0	8.6	7.6	8.6	7.6
168.3	6.4	-20			2.0	2.0	7.7	6.9	7.7	6.9
168.3	4.8	-30			2.0	2.0	5.8	5.1	5.8	5.1
114.3	6.0	-25			2.0	2.0	10.8	9.6	10.8	9.6
114.3	4.8	-30			2.0	2.0	8.6	7.6	8.6	7.6
88.9	5.5	-25	This class is not suitable for fluid 1		2.0	2.0	12.9	11.4	12.9	11.4
88.9	4.8	-30			2.0	2.0	11.2	9.9	11.2	9.9

Note 1: For other temperatures consult AS4041 for appropriate pressure ratings.
Note 2: MDMT = Material Design Minimum Temperature.

Useful Equivalents

One U.K. gallon	=	277.42 cubic in
	=	0.160544 cubic ft
	=	10 lb of water at 62°F
	=	4.54596 litre
	=	1.20094 U.S. gallon
One U.S. gallon	=	0.83268 U.K. gallon
	=	8.3268 lb of water
	=	3.78531 litre
One litre	=	0.219967 U.K. gallon
	=	0.264178 U.S. gallon
One cubic in. of water	=	0.036047 lb
	=	0.0036047 U.K. gallon
One cubic ft of water	=	6.22884 U.K. gallon
	=	7.48047 U.S. gallon
	=	28.3161 litre
	=	62.288 lb
	=	0.0278 ton
One lb of water	=	27.742 cubic in
	=	0.10 U.K. gallon
	=	0.120094 U.S. gallon
	=	0.45359237 kilogramme
One ton of water	=	35.962 cubic ft
	=	224 U.K. gallon
	=	269.01056 U.S. gallon
	=	1018.2950 litre
lbf	=	4.44822 N
	=	.45393 kgf
N	=	0.22481 lbf
	=	0.10197 kgf
kgf	=	2.20462 lbf
	=	9.80665 N
lbf/in²	=	2.30667 feet head
	=	6.89476 kN/m²
	=	0.0689476 bars
	=	0.07031 kgf/cm²
	=	0.06805 atm
	=	0.7031 metres head
feet head	=	0.43353 lbf/in²
	=	2.98907 kN/m²
	=	0.2965 bars
	=	0.03048 kgf/cm²
	=	0.02950 atm
	=	0.3048 metres head
kN/m²	=	0.14538 lbf/in²
	=	0.334558 feet head
	=	0.001 bars
	=	0.0101972 kgf/cm²
	=	0.0098694 atm
	=	0.101972 metres head
bar	=	14.5038 lbf/in²
	=	33.4558 feet head
	=	100 kN/m²
	=	1.01972 kgf/cm²
	=	0.98694 atm
	=	10.1972 metres head
kgf/cm²	=	14.2233 lbf/in²
	=	32.8084 feet head
	=	0.0098067 kN/m²
	=	0.98067 bars
	=	0.96784 atm
	=	10 metres head
atm	=	14.6959 lbf/in²
	=	33.8986 feet head
	=	101.325 kN/m²
	=	1.01325 bars
	=	1.03323 kgf/cm²
	=	10.3323 metres head
tonf/in²	=	15.4443 MN/m²
	=	1.54443 h bars
	=	1.57488 kgf/mm²
MN/m²	=	0.064749 tonf/in²
	=	0.1 h bars
	=	0.101972 kgf/mm²
h bar	=	0.64749 tonf/in²
	=	10 MN/m²
	=	1.01972 kgf/mm²

Conversion Factors

To calculate the mass of steel:

Round	dia. mm² x 0.006165	= kg per metre
Hexagon	size mm² x 0.006798	= kg per metre
Square	thickness mm² x 0.00785	= kg per metre
Flat	width in mm x thickness in mm x 0.00785	= kg per metre

Imperial to Metric Conversion Factors

Unit	Imperial	Metric	Imperial to Metric Conversion
Length	inch	millimetre	1 in = 25.40 mm
	foot	millimetre	1 ft = 304.8 mm
	foot	metre	1 ft = 0.3048 m
	yard	metre	1 yd = 0.9144 m
	mile	metre	1 mile = 1609 m
	mile	kilometre	1 mile = 1.609 km
Area	square inch	square millimetre	1 in^2 = 645.2 mm^2
	square foot	square millimetre	1 ft^2 = 92900 mm^2
	square foot	square metre	1 ft^2 = 0.09290 m^2
	square yard	square metre	1 yd^2 = 0.8361 m^2
Liquid	gallon (UK)	litre	1 gal = 4.546 litre
Volume	cubic inch	cubic millimetre	1 in^3 = 16387 mm^3
	cubic foot	cubic metre	1 ft^3 = 0.02832 m^3
	cubic yard	cubic metre	1 yd^3 = 0.7646 m^3
Mass	ounce	gram	1 oz = 28.35 g
	pound	kilogram	1 lb = 0.4536 kg
	hundredweight	kilogram	1 cwt = 50.80 kg
	ton	kilogram & tonne	1 ton = 1016 kg
	ton	tonne	1 ton = 1.016 tonne
	short ton US	tonne	1 short ton = 0.9072 tonne
Force	pound force	newton	1 lbf = 4.448 N
	ton force	kilonewton	1 tonf = 9.964 kN
	1000 pound force	kilonewton	1 kip = 4.448 kN

Imperial to Metric Conversion Factors - *continued*

Stress and Pressure	pound force per square inch pound force per square inch ton force per square inch 1000 pound force per square inch	megapascal (newton per square mm) kilopascal (newton per square mm x 10^{-3}) megapascal (newton per square mm) megapascal (newton per square mm)	1 lbf/in^2 = 0.006895 MPa (N/mm^2) 1 lbf/in^2 = 6.895 kPa (N/mm^2 x 10^{-3}) 1 tonf/in^2 = 15.44 MPa (N/mm^2) 1 kip/in^2 = 6.895 MPa (N/mm^2)
Mass per Unit Length	pound per foot pound per yard	kilogram per metre kilogram per metre	1 lb/ft = 1.488 kg/m 1 lb/yd = 0.4961 kg/m
Mass per Unit Area	pound per square inch pound per square foot	kilogram per square metre kilogram per square metre	1 lb/in^2 = 703.1 kg/m^2 1 lb/ft^2 = 4.882 kg/m^2
Mass per Unit Volume	pound per cubic inch pound per cubic foot pound per cubic yard	kilogram per cubic metre kilogram per cubic metre kilogram per cubic metre	1 lb/in^3 = 27680 kg/m^3 1 lb/ft^3 = 16.02 kg/m^3 1 lb/yd^3 = 0.5933 kg/m^3
Moment of Force (Torque)	pound force inch pound force foot 1000 pound force inch tons force foot	newton metre newton metre kilonewton metre kilonewton metre	1 lbf in = 0.113 N m 1 lbf ft = 1.356 N m 1 kip in = 0.113 kN m 1 ton ft = 3.037 kN m
Modulus of Section	inch^3	millimetre^3	1 inch^3 = 16 390 mm^3
Second Moment of Area (Moment of Inertia)	inch^4	millimetre^4	1 inch^4 = 416 200 mm^4
Power	foot pound per second horsepower British thermal units per hour	watt watt watt	1 ft lbf/s = 1.356 W 1 hp = 754.7 W 1 Btu/h = 0.2931 W
Energy	foot pounds-force	joules	1 ft lbf = 1.356 J
Velocity	foot per second mile per hour inch per second	metre per second kilometre per hour millimetre per second	1 fps = 0.3048 m/s 1 mph = 1.609 km/h 1 ips = 25.40 mm/s

Metric to Imperial Conversion Factors

Unit	Imperial	Metric	Imperial to Metric Conversion
Length	inch foot foot yard mile mile	millimetre millimetre metre metre metre kilometre	1 mm = 0.03937 in 1 mm = 0.003281 ft 1 m = 3.281 ft 1 m = 1.094 yd 1 m = 0.0006214 mile 1 km = 0.6214 mile
Area	square inch square foot square foot square yard	square millimetre square millimetre square metre square metre	1 mm2 = 0.001550 in^2 1 mm2 = 0.00001076 ft^2 1 m2 = 10.76 ft^2 1 m2 = 1.196 yd^2
Liquid	gallon (UK)	litre	1 litre = 0.2200 gal
Volume	cubic inch cubic foot cubic yard	cubic millimetre cubic metre cubic metre	1 mm3 = 0.00006102 in^3 1 m3 = 35.31 ft^3 1 m3 = 1.308 yd^3
Mass	ounce pound hundredweight ton ton short ton US	gram kilogram kilogram kilogram & tonne tonne tonne	1 g = 0.03527 oz 1 kg = 2.205 lb 1 kg = 0.01968 cwt 1 kg = 0.0009842 ton 1 tonne = 0.9842 ton 1 tonne = 1.102 short ton
Force	pound force ton force 1000 pound force	newton kilonewton kilonewton kilogram force-newton*	1 N = 0.2248 lbf 1 kN = 0.1004 tonf 1 kN = 0.2248 kip 1 kgf = 9.807 N* 1 N = 0.1020 kgf*

* Conversion between metric units

Metric to Imperial Conversion Factors- *continued*

Stress and Pressure	pound force per square inch pound force per square inch ton force per square inch 1000 pound force per square inch	megapascal (newton per square mm) kilopascal (newton per square mm x 10^{-3}) megapascal (newton per square mm) megapascal (newton per square mm) kilogram force per square mm – megapascal (newton per square mm)	1 MPa (N/mm2) = 145.0 lbf/in^2 1 kPa (N/mm2 x 10^{-3}) = 0.1450 lbf/in^2 1 MPa (N/mm2)= 0.06476 $tonf/in^2$ 1 MPa (N/mm2) = 0.1450 kip/in^2 1 kgf/mm^2 = 9.807 MPa (N/mm^2)
Mass per Unit Length	pound per foot pound per yard	kilogram per metre kilogram per metre	1 kg/m = 0.672 lb/ft 1 kg/m = 2.016 lb/yd
Mass per Unit Area	pound per square inch pound per square foot	kilogram per square metre kilogram per square metre	1 kg/m^2 = 0.001422 lb/in^2 1 kg/m^2 = 0.2048 lb/ft^2
Mass per Unit Volume	pound per cubic inch pound per cubic foot pound per cubic yard	kilogram per cubic metre kilogram per cubic metre kilogram per cubic metre	1 kg/m^3 = 0.00003605 lb/in^3 1 kg/m^3 = 0.0624 lb/ft^3 1 kg/m^3 = 1.686 lb/yd^3
Moment of Force (Torque)	pound force inch pound force foot 1000 pound force inch tons force foot	newton metre newton metre kilonewton metre kilonewton metre kilogram force per metre – newton metre*	1 N m = 8.851 lbf in 1 N m = 0.7376 lbf ft 1 kN m = 8.851 kip in 1 kN m = 0.3293 tonf ft 1 kgf m = 9.807 N m* 1 N m = 0.102 kgf m*
Modulus of Section	$inch^3$	$millimetre^3$	1 mm^3 = 0.00006102 in^3
Second Moment of Area (Moment of Inertia)	$inch^4$	$millimetre^4$	1mm^4 = 0.0002403 in^4
Power	foot pound per second horsepower British thermal units per hour	watt watt watt	1 W = 0.7376 ft lbf/s 1 W = 0.001341 hp 1 W = 3.412 Btu/h
Energy	foot pounds-force	joules (1 kW h = 3 600 000 J 1 kW h = 3.6 MJ)	1 J = 0.7376 ft lbf
Velocity	foot per second mile per hour inch per second	metre per second kilometre per hour millimetre per second	1 m/s = 3.281 fps 1 km/h = 0.6214 mph 1 mm/s = 0.03937 ips

* Conversion between metric units

Comparison Grades – International Table

This comparison chart has been compiled for customers who work to overseas drawings and specifications. It is a guide only as standards or brand names are seldom exactly identical.

Grade	German Mat. No	Saarstahl Grade	Rochling	AISI	BS 4659	BS 970 Part1	JIS	ASSAB	Thyssen	Bohler/ VEW
High	1.3243	1.3243	GIANT M5 CO	M35	BM35		SKH 55			S705
Speed	1.3247	1.3247	GIANT 101	M42	BM42		SKH 59			S500
Steels	1.3343	1.3343	GIANT M5	M2	BM2		SKH 51	HSP 41	THYRAPID 3343	S600
Hot	1.2343	1.2343	RDC 2	H11	BH11		SKD 6			W300
Work	1.2344	1.2344	RDC 2 V	H13	BH13		SKD 61	8407	THYROTHERM 2344	W302
Steels	1.2714	1.2714	RGS 4	L6			SKS 51			W500
Plastic	1.2083	1.2083		420		420S29	SUS420J1	STAVAX	THYROPLAST 2083	M310
Mould	1.2311	1.2311	MFR	P20	BP20				THYROPLAST 2311	M201
Steels	1.2312	1.2312	MOULREX-A	P20+S						
	1.2738	1.2738		P20+Ni				HOLDAX	THYROPLAST 2312	M200
	1.2316	1.2316	BP 42							
Cold	1.2080	1.2080	RCCO	D3	BD3		SKD 1	XW5	THYRODUR 2080	K100
Work	1.2379	1.2379	RCC SUPRA	D2	BD2		SKD 11	XW41	THYRODUR 2379	K110
Steels	1.2436	1.2436	RCC EXTRA	D6			SKD 2	XW5		K107
	1.2510	1.2510	RUS 3	01	B01		SKS 3	DF2	THYRODUR 2510	K460
	1.2767	1.2767	RABW		EN30B	835M30			THYRODUR 2767	K600
	1.2842	1.2842	RUS	02						K720
	1.2363	1.2363	RKCM	A2	BA2		SKD 12	XW10	THYRODUR 2343	K305
	1.2550	1.2550	RTWK	S1	BS1			M4	THYRODUR 2550	K455
Engi-	1.1191	1.1191	R4	1045	EN8D	060A45	S45C	760		V945
neering	1.1203	1.1203	R5	1055	EN9	070M55	S55C			
Steels				4130		708A30	SCM430			V340
	1.7225	1.7225	MO 40	4140	EN19A	708M40	SCM440	709		V320
				4145H		708H45	SCM445H			
	1.6582	1.6582	MONIX 15	4340	EN24	817M40	SNCM439	705		V155
	1.6580	1.6580			EN25	826M31			THYSSEN 6580	V145
Case	1.5752	1.5752	RAE 3	3415	EN36A	655M13	SNC815			E200
Harden-					EN39B	835M15	SNCM815			
ing	1.6523	1.6523	MONIX E	8620	EN362	805A22	SNCM220			E115
	1.7131	1.7131	EC 80							E410
	1.7147	1.7147	EC 100							E401

Hardness Testing

The hardness of a given material is generally defined as the resistance it shows to penetration by a test body of defined shape. It can be measured with testing equipment of different design, the most common types being Brinell, Rockwell and Vickers.

Brinell hardness and Vickers hardness are expressed by the quotient of load and surface area of indentation. The hardness numbers for Brinell and Vickers hardness are not affected by the introduction of Newton as unit of force. It has been internationally agreed to simply multiply the load with the factor 0.102.

Example:

Old	**New**
$HB = \frac{F}{A}$	$HB = 0.102 \frac{F}{A}$
Load F in kp	Load F in N
Surface area of permanent indentation A in mm^2	

The following comparison of hardness tables are based on DIN 50 150 of December 1976. Values in **bold** face correspond exactly to DIN values. The other values are interpolated. Values in parenthesis are values outside the defined range of standardised hardness testing procedures. Also, Brinell hardness numbers in parenthesis apply only when testing with carbide ball.

The tables cover only hot formed or heat treated, unalloyed or low alloy steels and steel castings.

Interconversion of hardness numbers or conversion of hardness numbers to tensile strength values is subject to error and should only be employed when prescribed testing procedure is not applicable.

(Tests carried by Verein Deutscher Eisenhüttenleute [VDEh] showed a scatter range for the conversion of Vickers hardness numbers to tensile strength values of ±25 HV 10 or ±85 N/mm^2.)

Comparison of Hardness

Tensile strength	Vickers hardness ($F \geq 98$ N)	Ball indentation diameter[1]	Brinell hardness[2]	Rockwell hardness	
N/mm^2	HV	mm	HB	HRB	HRC
200	63	7.32	60		
210	65	7.22	62		
220	69	7.04	66		
225	70	6.99	67		
230	72	6.95	68		
240	75	6.82	71		
250	79	6.67	75		
255	**80**	6.63	**76**		
260	82	6.56	78		
270	**85**	6.45	81	**41**	
280	88	6.35	84	45	
285	**90**	6.28	86	**48**	
290	91	6.25	87	49	
300	94	6.19	89	51	
305	**95**	6.16	90	**52**	
310	97	6.10	92	54	
320	**100**	6.01	**95**	56	
330	103	5.93	98	58	

[1] steel ball with 10mm diameter

[2] calculated from: HB = 0.95 HV

Tensile strength N/mm²	Vickers hardness (F ≥ 98 N) HV	Ball indentation diameter[1] mm	Brinell hardness[2] HB	Rockwell hardness HRB	HRC
335	**105**	5.87	100	59	
340	107	5.83	102	60	
350	**110**	5.75	**105**	62	
360	113	5.70	107	63.5	
370	**115**	5.66	**109**	64.5	
380	119	5.57	113	66	
385	**120**	5.54	**114**	67	
390	122	5.50	116	67.5	
400	**125**	5.44	**119**	69	
410	128	5.38	122	70	
415	**130**	5.33	**124**	71	
420	132	5.32	125	72	
430	**135**	5.26	**128**	73	
440	138	5.20	131	74	
450	**140**	5.17	**133**	**75**	
460	143	5.11	136	76.5	
465	**145**	5.08	**138**	77	
470	147	5.05	140	77.5	
480	**150**	5.00	**143**	78.5	
490	153	4.96	145	79.5	
495	**155**	4.93	**147**	80	
500	157	4.90	149	81	
510	**160**	4.86	**152**	81.5	
520	163	4.81	155	82.5	
530	**165**	4.78	**157**	83	
540	168	4.74	160	84.5	
545	**170**	4.71	**162**	**85**	
550	172	4.70	163	85.5	
560	**175**	4.66	**166**	86	
570	178	4.62	169	86.5	
575	**180**	4.59	**171**	87	
580	181	4.58	172		
590	184	4.54	175	88	
595	**185**	4.53	**176**		
600	187	4.51	178	89	
610	**190**	4.47	**181**	**89.5**	
620	193	4.44	184	90	
625	**195**	4.43	**185**		
630	197	4.40	187	91	
640	**200**	4.37	**190**	**91.5**	
650	203	4.34	193	92	
660	**205**	4.32	**195**	**92.5**	
670	208	4.29	198	93	
675	**210**	4.27	**199**	**93.5**	
680	212	4.25	201		

[1] steel ball with 10mm diameter

[2] calculated from: HB = 0.95 HV

Tensile strength N/mm²	Vickers hardness (F ≥ 98 N) HV	Ball indentation diameter[1] mm	Brinell hardness[2] HB	Rockwell hardness HRB	Rockwell hardness HRC
690	**215**	4.22	**204**	**94**	
700	219	4.19	208		
705	**220**	4.18	**209**	**95**	
710	222	4.16	211	95.5	
720	**225**	4.13	**214**	**96**	
730	228	4.11	216		
740	**230**	4.08	**219**	96.5	
750	233	4.07	221	97	
755	**235**	4.05	**223**		
760	237	4.03	225	97.5	
770	**240**	4.01	**228**	98	
780	243	3.98	231		21
785	**245**	3.97	**223**		
790	247	3.95	235	99	
800	**250**	3.93	**238**	**99.5**	22
810	253	3.91	240		
820	**255**	3.89	**242**		23
830	258	3.87	245		
835	**260**	3.85	**247**		**24**
840	262	3.84	249		
850	**265**	3.82	**252**		
860	268	3.80	255		25
865	**270**	3.78	**257**		
870	272	3.77	258		26
880	**275**	3.76	**261**		
890	278	3.74	264		
900	**280**	3.72	**266**		27
910	283	3.70	269		
915	**285**	3.69	**271**		
920	287	3.68	273		28
930	**290**	3.66	**276**		
940	293	3.64	278		29
950	**295**	3.63	**280**		
960	299	3.61	284		
965	**300**	3.60	**285**		
970	302	3.59	287		30
980	305	3.57	290		
990	308	3.55	293		
995	**310**	3.54	**295**		**31**
1000	311	3.53	296		
1010	314	3.52	299		
1020	317	3.50	301		32
1030	**320**	3.49	**304**		
1040	323	3.47	307		
1050	327	3.45	311		33

[1] steel ball with 10mm diameter

[2] calculated from: HB = 0.95 HV

Tensile strength N/mm²	Vickers hardness (F ≥ 98 N) HV	Ball indentation diameter[1] mm	Brinell hardness[2] HB	Rockwell hardness HRB	Rockwell hardness HRC
1060	**330**	3.44	**314**		
1070	333	3.43	316		
1080	336	3.41	319		34
1090	339	3.40	322		
1095	**340**	3.39	**323**		
1100	342	3.38	325		
1110	345	3.36	328		35
1120	349	3.35	332		
1125	**350**	3.34	**333**		
1130	352	3.33	334		
1140	355	3.32	337		36
1150	358	3.31	340		
1155	360	3.30	342		
1160	361	3.29	343		
1170	364	3.28	346		37
1180	367	3.26	349		
1190	370	3.25	352		
1200	373	3.24	354		38
1210	376	3.23	357		
1220	380	3.21	361		
1230	382	3.20	363		39
1240	385	3.19	366		
1250	388	3.18	369		
1255	390	3.17	371		
1260	392		372		40
1270	394	3.16	374		
1280	397	3.14	377		
1290	400	3.13	380		
1300	403	3.12	383		41
1310	407	3.10	387		
1320	410	3.09	390		
1330	413	3.08	393		42
1340	417	3.07	396		
1350	420	3.06	399		
1360	423	3.05	402		43
1370	426	3.04	405		
1380	429		408		
1385	430	3.02	409		
1390	431		410		
1400	434	3.01	413		44
1410	437	3.00	415		
1420	**440**	2.99	**418**		
1430	443	2.98	421		
1440	446	2.97	424		45
1450	449	2.96	427		

[1] steel ball with 10mm diameter

[2] calculated from: HB = 0.95 HV

Tensile strength N/mm²	Vickers hardness (F ≥ 98 N) HV	Ball indentation diameter[1] mm	Brinell hardness[2] HB	Rockwell hardness HRB	Rockwell hardness HRC
1455	**450**		**428**		
1460	452	2.95	429		
1470	455	2.94	432		
1480	458	2.93	435		46
1485	**460**		**437**		
1490	461	2.92	438		
1500	464	2.91	441		
1510	467	2.90	444		
1520	**470**	2.89	**447**		
1530	473		449		47
1540	476	2.88	452		
1550	479	2.87	455		
1555	**480**		**(456)**		
1560	481	2.86	(457)		
1570	484	2.85	(460)		48
1580	486		(462)		
1590	489	2.84	(465)		
1595	**490**	2.83	**(466)**		
1600	491		(467)		
1610	494	2.82	(470)		
1620	497		(472)		49
1630	**500**		**(475)**		
1640	503	2.80	(478)		
1650	506	2.79	(481)		
1660	509		(483)		
1665	**510**	2.78	**(485)**		
1670	511		(486)		
1680	514	2.77	(488)		50
1690	517	2.76	(491)		
1700	**520**	2.75	**(494)**		
1710	522		(496)		
1720	525	2.74	(499)		
1730	527		(501)		51
1740	**530**	2.73	**(504)**		
1750	533	2.71	(506)		
1760	536	2.71	(509)		
1770	539		(512)		
1775	**540**	2.70	**(513)**		
1780	541		(514)		
1790	544	2.69	(517)		52
1800	547		(520)		
1810	**550**	2.68	**(523)**		
1820	553	2.67	(525)		
1830	556		(528)		
1840	559	2.66	(531)		
1845	**560**		**(532)**		53
1850	561	2.65	(533)		
1860	564		(536)		

[1] steel ball with 10mm diameter

[2] calculated from: HB = 0.95 HV

Tensile strength N/mm²	Vickers hardness (F ≥ 98 N) HV	Ball indentation diameter[1] mm	Brinell hardness[2] HB	Rockwell hardness HRB	Rockwell hardness HRC
1870	567	2.64	(539)		
1880	**570**		**(542)**		
1890	572	2.63	(543)		
1900	575	2.62	(546)		
1910	578		(549)		54
1920	**580**	2.61	**(551)**		
1930	583	2.60	(554)		
1940	586		(557)		
1950	589	2.59	(560)		
1955	**590**		**(561)**		
1960	591		(562)		
1970	594	2.58	(564)		
1980	596		(567)		55
1990	599	2.57	(569)		
1995	**600**		**(570)**		
2000	602	2.56	(572)		
2010	605		(575)		
2020	607	2.55	(577)		
2030	**610**		**(580)**		
2040	613	2.54	(582)		
2050	615		(584)		56
2060	618	2.53	(587)		
2070	**620**		**(589)**		
2080	623	2.52	(592)		
2090	626		(595)		
2100	629	2.51	(598)		
2105	**630**		**(599)**		
2110	631		(600)		
2120	634	2.50	(602)		
2130	636		(604)		
2140	639	2.49	(607)		57
2145	**640**		**(608)**		
2150	641		(609)		
2160	644	2.48	(621)		
2170	647	2.47	(615)		
2180	**650**		**(618)**		
2190	653		(620)		
2200	655	2.46	(622)		58
	675				59
	698				60
	720				**61**
	745				62
	773				63
	800				**64**
	829				65
	864				66
	900				**67**
	940				**68**

[1] steel ball with 10mm diameter

[2] calculated from: HB = 0.95 HV

Tensile Testing

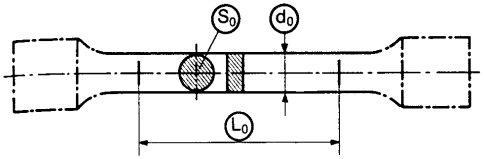
The following information on this basic testing procedure takes into account all changes resulting from internationally approved ISO recommendations which have been incorporated into a number of national standards.

ISO 6892
EU 2
DIN 50145
BS 18/Part 2
NFA 03-151
UNI 55612
JIS Z2201

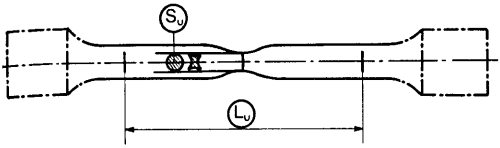
Symbols, designations, units

Symbol new	Symbol old	Designation	Unit
A	δ	Elongation after fracture	%
d_0	d_0	Original diameter of parallel length of test piece of circular cross section	mm
E	E	Modulus of elasticity	N/mm² (MPa)
F	P	Load	N
F_m	P_{max}	Maximum load	N
L_0	L_0	Original gauge length at ambient temperature	mm
L_u	L_B	Final gauge length after fracture	mm
R_p e.g. $R_{p0.2}$	σ $\sigma_{0.2}$	Proof stress (non-proportional elongation) e.g. 0.2 non-proportional elongation	N/mm² (MPa)
R_{eH}	σ_{So}	Upper yield stress	N/mm² (MPa)
R_{eL}	σ_{Su}	Lower yield stress	N/mm² (MPa)
R_m	σ_B	Tensile strength	N/mm² (MPa)
S_o	F_o	Original cross-sectional area	mm²
S_u	F_B	Minimum cross-sectional area after fracture	mm²
Z	Ψ	Reduction of area	%
ε	ε	Elongation	%
ε_e	ε_{el}	Elastic elongation	%
ε_p	–	Non-proportional elongation	%
ε_r	ε_{bl}	Permanent elongation	%
ε_t	ε_{ges}	Total elongation	%
σ	σ	Stress (nominal stress)	N/mm² (MPa)

Specimen prior to tensile testing



Specimen after fracture



Stress σ

Stress (nominal stress) is defined as load, at any moment during the test, divided by the original cross-sectional area.

$$\sigma = \frac{F}{S_o} \quad [N/mm^2]$$

Tensile strength R_m

Tensile strength is defined as stress corresponding to the maximum load divided by the original cross-sectional area of the specimen.

$$R_m = \frac{F_m}{S_o} \quad [N/mm^2]$$

Modulus of elasticity E (static modulus of elasticity)

Quotient of load F divided by the original cross-sectional area S_o and extension ΔL_e divided by extensometer gauge length L_{E0} in the rank of elastic deformation

$$E_m = \frac{F \cdot L_{E0}}{S_o \cdot \Delta L_e} = \frac{\sigma_m}{\varepsilon_e} \cdot 100$$

Tensile Strength – conversion

ksi to N/mm^2 (MPa) 1 lbf = 0.453 592 37 kp 1 kp = 9.806 65 N 1 in = 0.025 4 m 1 ksi = 1000 psi

ksi / N/mm2 (MPa)	0	1	2	3	4	5	6	7	8	9
0	–	6.90	13.79	20.68	27.58	34.47	41.37	48.26	55.16	62.05
10	68.95	75.84	82.74	89.63	96.53	103.42	110.32	117.21	124.11	131.00
20	137.90	144.79	151.69	158.58	165.47	172.37	176.26	186.16	193.0	199.95
30	206.84	213.74	220.60	227.53	234.42	241.32	248.21	255.11	262.00	268.90
40	275.79	282.69	289.58	296.48	303.37	310.26	317.16	324.05	330.95	337.84
50	344.74	351.63	358.53	365.42	372.32	379.21	386.11	393.00	399.90	406.79
60	413.69	420.58	427.48	434.47	441.26	448.16	455.05	461.95	468.84	475.74
70	482.63	489.53	496.48	503.32	510.21	517.11	524.00	530.90	537.79	544.69
80	551.58	558.48	565.37	572.27	579.16	586.05	592.95	599.84	606.74	613.63
90	620.53	627.42	634.32	641.21	648.11	655.00	661.90	668.79	675.69	682.58
100	689.48	696.37	703.27	710.16	717.06	723.95	730.84	737.74	744.63	751.53
110	758.43	765.32	772.21	779.11	786.00	792.90	799.79	806.69	813.58	820.48
120	827.37	834.27	841.16	848.06	854.95	861.85	868.74	875.63	882.53	889.42
130	896.32	903.21	910.11	917.00	923.90	930.79	937.69	944.85	951.48	958.37
140	965.27	972.16	979.06	985.95	992.85	999.74	1006.63	1013.53	1020.42	1027.32
150	1034.21	1041.11	1048.00	1054.90	1061.79	1068.69	1075.58	1082.48	1089.37	1096.27
160	1103.16	1110.06	1116.65	1123.85	1130.74	1137.63	1144.53	1151.42	1158.32	1165.21
170	1172.11	1179.00	1185.90	1192.79	1199.69	1206.58	1213.48	1220.37	1227.27	1234.16
180	1241.06	1247.95	1254.85	1261.74	1268.64	1275.53	1282.42	1289.32	1296.21	1303.11
190	1310.00	1316.90	1323.79	1330.69	1337.58	1344.48	1351.37	1358.27	1365.16	1372.06
200	1378.95	1385.85	1392.74	1399.64	1406.53	1413.43	1420.32	1427.21	1434.11	1441.00
210	1447.90	1454.74	1461.69	1648.58	1475.48	1482.37	1489.27	1496.16	1503.06	1509.95
220	1516.85	1523.74	1530.64	1537.53	1544.43	1551.32	1558.22	1565.11	1572.00	1578.90
230	1585.79	1592.69	1599.58	1606.48	1613.37	1620.27	1627.16	1634.06	1640.95	1647.85
240	1654.74	1661.64	1668.53	1675.43	1682.32	1689.22	1696.11	1703.01	1709.90	1716.79
250	1723.69	1730.58	1737.48	1744.37	1751.27	1758.16	1765.06	1771.95	1778.85	1785.74
260	1792.64	1799.53	1806.43	1813.32	1820.22	1827.11	1834.01	1840.90	1847.79	1854.69
270	1861.58	1868.48	1875.37	1882.27	1889.16	1896.06	1902.95	1909.85	1916.47	1923.64
280	1930.53	1937.43	1944.32	1951.22	1958.11	1965.01	1971.90	1978.80	1985.69	1992.58
290	1999.48	2006.37	2013.27	2020.16	2027.06	2033.95	2040.85	2047.74	2054.64	2061.53
300	2068.43	2075.32	2082.22	2089.11	2096.01	2102.90	2109.80	2116.69	2123.59	2130.48
310	2137.37	2144.27	2151.16	2158.06	2164.95	2171.85	2178.74	2185.64	2192.53	2199.43
320	2206.32	2213.22	2220.11	2227.01	2233.90	2240.80	2247.69	2254.59	2261.48	2268.38
330	2275.27	2282.16	2289.06	2295.95	2302.85	2309.74	2316.64	2323.53	2330.43	2337.32
340	2344.22	2351.11	2358.01	2364.90	2371.80	2378.69	2385.59	2392.48	2399.38	2406.37
350	2413.17	2420.06	2426.95	2433.85	2440.74	2447.64	2454.53	2461.43	2468.32	2475.22
360	2482.11	2489.01	2495.90	2502.80	2509.69	2516.59	2523.48	2530.38	2537.27	2544.17
370	2551.06	2557.95	2564.85	2571.74	2578.64	2585.53	2592.43	2599.32	2606.22	2613.11
380	2620.01	2626.90	2633.80	2640.69	2647.59	2654.48	2661.38	2668.27	2675.17	2682.06
390	2688.96	2695.85	2702.74	2709.64	2716.53	2723.43	2730.32	2737.22	2744.11	2751.01
400	2757.90	2764.80	2771.69	2778.59	2785.48	2792.38	2799.27	2806.17	2813.06	2819.96
410	2826.85	2833.75	2840.64	2847.53	2854.43	2861.32	2868.22	2875.11	2882.01	2888.90
420	2895.80	2902.69	2909.59	2916.48	2923.38	2930.27	2937.17	2944.06	2950.96	2957.85
430	2964.75	2971.64	2978.54	2985.43	2992.32	2999.22	3006.11	3013.01	3019.90	3026.80
440	3033.69	3940.59	3047.48	3054.38	3061.27	3068.17	3075.06	3081.96	3088.85	3095.75
450	3102.64	3109.54	3116.43	3123.33	3130.22	3137.11	3144.01	3150.90	3157.80	3164.69
460	3171.59	3148.78	3185.38	3192.27	3199.17	3206.06	3212.96	3219.85	3226.75	3233.64
470	3240.54	3247.43	3254.33	3261.22	3268.11	3275.01	3281.90	3288.50	3295.69	3302.59
480	3309.48	3316.38	3323.27	3330.17	3337.06	3343.96	3350.85	3357.75	3364.64	3371.54
490	3378.43	3385.33	3392.22	3399.12	3406.01	3412.90	3419.80	3426.69	3433.59	3440.48
500	3447.38	3454.27	3461.17	3468.06	3474.96	3481.85	3488.75	3495.64	3502.54	3509.43

Pressure, mechanical stress – conversion tonf/in² to MN/m² (MPa)

1 tonf (Brit.) = 2,240 lbf 1 lbf = 0.453 592 37 kp 1 kp = 9.806 65 N 1 in = 0.0254 m

tonf/in² MN/m² = N/mm² = (MPa)	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0	–	1.544	3.089	4.633	6.178	7.722	9.267	10.811	12.355	13.900
1	15.444	16.989	18.533	20.078	21.622	23.166	24.711	26.255	27.800	29.344
2	30.889	32.433	33.977	35.522	37.066	38.611	40.155	41.700	43.244	44.788
3	46.333	47.877	49.422	50.966	52.511	54.055	55.599	57.144	58.688	60.233
4	61.777	63.322	64.866	66.410	67.955	69.499	71.044	72.588	74.132	75.677
5	77.221	78.766	80.310	81.855	83.399	84.943	86.488	88.032	89.577	91.121
6	92.666	94.210	95.754	97.299	98.943	100.388	101.932	103.477	105.021	106.565
7	108.110	109.654	111.199	112.743	114.287	115.832	117.376	118.921	120.465	122.010
8	123.554	125.098	126.643	128.187	129.732	131.276	132.821	134.365	135.909	137.454
9	138.998	140.543	142.087	143.632	145.176	146.720	148.265	149.809	151.354	152.898
10	154.443	155.987	157.531	159.076	160.620	162.165	163.709	165.254	166.798	168.342
11	169.887	171.431	172.976	174.520	176.065	177.609	179.153	180.698	182.242	183.787
12	185.331	186.876	188.420	189.964	191.509	193.053	194.598	196.142	197.686	199.231
13	200.775	202.320	203.864	205.409	206.953	208.497	210.042	211.586	213.313	214.675
14	216.220	217.764	219.308	220.853	222.397	223.942	225.486	227.031	228.575	230.119
15	231.664	233.208	234.753	236.297	237.824	239.386	240.930	242.475	244.019	245.564
16	247.108	248.635	250.197	251.741	253.286	254.830	256.375	257.919	259.464	261.008
17	262.552	264.097	265.641	267.186	268.730	270.274	271.819	273.363	274.908	276.452
18	277.997	279.541	281.085	282.630	284.174	285.719	287.263	288.808	290.352	291.896
19	293.441	294.985	296.530	298.074	299.619	301.163	302.707	304.252	305.796	307.341
20	308.885	310.430	311.974	313.518	315.063	316.607	318.152	319.696	321.241	322.785
21	324.329	325.874	327.418	328.963	330.507	332.052	333.596	335.140	336.685	338.229
22	339.774	341.318	342.862	344.407	345.951	347.496	349.040	350.585	352.129	353.673
23	355.218	356.762	358.307	359.851	361.396	362.940	634.484	366.029	367.573	369.118
24	370.662	372.207	373.751	375.295	376.840	378.384	379.929	381.473	383.018	384.562
25	386.106	387.651	389.195	390.740	392.284	393.829	395.373	396.917	398.462	400.006
26	401.551	403.095	404.640	406.184	407.728	409.273	410.817	412.362	413.906	415.450
27	416.995	418.539	420.084	421.628	423.173	424.717	426.261	427.806	429.350	430.895
28	432.439	433.984	435.528	437.072	438.617	440.161	441.706	443.250	444.795	446.339
29	447.883	449.428	450.972	452.517	454.061	455.606	457.150	458.694	460.239	461.783
30	463.328	464.872	466.417	467.961	469.505	471.050	472.594	474.139	475.683	477.228
31	478.772	480.316	481.861	483.405	484.950	486.494	488.039	489.583	491.127	492.672
32	494.216	495.761	497.305	498.849	500.394	501.938	503.483	505.027	506.572	508.116
33	509.660	511.205	512.749	514.294	515.838	517.383	518.927	520.471	522.016	523.560
34	525.105	526.649	528.194	529.738	531.282	532.827	534.371	535.916	537.460	539.005
35	540.549	542.093	543.638	545.182	546.727	548.271	549.816	551.360	552.904	554.449
36	555.993	557.538	559.082	560.627	562.171	563.715	565.260	566.804	568.349	569.893
37	571.437	572.982	574.526	576.071	577.615	579.160	580.704	582.248	583.793	585.337
38	586.882	588.426	589.971	591.515	593.059	594.604	596.148	597.693	599.237	600.782
39	602.326	603.870	605.415	606.959	608.504	610.048	611.593	613.137	614.681	616.226
40	617.770	619.315	620.859	622.404	623.948	625.492	627.037	628.581	630.126	631.670
41	633.215	634.759	636.303	637.848	639.392	640.937	642.481	644.025	645.570	647.114
42	648.659	650.203	651.748	653.292	654.836	656.381	657.925	659.470	661.014	662.559
43	664.103	665.647	667.192	668.736	670.281	671.825	673.370	674.914	676.458	678.003
44	679.547	681.092	682.636	684.181	685.725	687.269	688.814	690.358	691.903	693.447
45	694.992	696.536	698.080	699.625	701.169	702.714	704.258	705.803	707.347	708.891
46	710.436	711.980	713.525	715.069	716.613	718.158	719.702	721.247	722.791	724.336
47	725.880	727.424	728.969	730.513	732.058	733.602	735.147	736.691	738.235	739.780
48	741.324	742.869	744.413	745.958	747.502	749.046	750.591	752.135	753.680	755.224
49	756.769	758.313	759.857	761.402	762.946	764.491	766.035	767.580	769.124	770.668

tonf/in² / MN/m² = N/mm² = (MPa)	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
50	772.21	773.76	775.30	776.85	778.39	779.94	781.48	783.02	784.57	786.11
51	787.66	789.20	790.75	792.29	793.84	795.38	796.48	798.47	800.01	801.56
52	803.10	804.65	806.19	807.74	801.28	810.82	812.37	813.91	815.46	817.00
53	818.55	820.09	821.63	823.18	824.72	826.27	827.81	829.36	830.90	823.45
54	833.99	835.35	837.08	838.62	840.17	841.71	843.26	844.80	846.35	847.89
55	849.43	850.98	852.52	854.07	855.61	857.16	858.70	860.25	861.79	863.33
56	864.88	866.42	867.97	869.51	871.06	872.60	874.15	875.69	877.23	878.78
57	880.32	881.87	883.41	884.96	886.50	888.05	889.59	891.13	892.68	894.22
58	895.77	897.31	898.86	900.40	901.95	903.49	905.03	906.58	908.12	909.67
59	911.21	912.76	914.30	915.84	917.38	918.93	920.48	922.02	923.57	925.11
60	926.66	928.20	929.74	931.29	932.83	934.38	935.92	937.47	930.01	940.56
61	942.10	943.64	945.19	946.73	948.28	949.82	951.37	952.91	954.46	956.00
62	957.54	959.09	960.63	962.18	963.72	965.27	966.81	968.36	969.90	971.44
63	972.99	974.53	976.08	977.62	979.17	980.71	982.26	983.80	985.34	986.89
64	988.43	989.98	991.52	993.07	994.61	996.16	997.70	999.24	1000.79	1002.33
65	1003.88	1005.72	1006.97	1008.51	1010.05	1011.60	1013.14	1014.69	1016.23	1017.78
66	1019.32	1020.87	1022.41	1023.95	1025.50	1027.04	1027.04	1030.13	1031.68	1033.22
67	1034.77	1036.31	1037.85	1039.40	1040.94	1042.49	1042.49	1045.58	1047.12	1048.67
68	1050.21	1051.75	1053.30	1054.84	1056.39	1057.93	1057.93	1061.02	1062.56	1064.11
69	1065.65	1067.20	1068.74	1070.29	1071.83	1073.38	1073.38	1076.76	1078.01	1079.55
70	1081.10	1082.64	1084.19	1085.73	1087.28	1088.82	1088.82	1091.91	1093.45	1095.00
71	1096.54	1098.09	1099.63	1101.18	1102.72	1104.26	1104.26	1107.35	1108.90	1110.44
72	1111.99	1113.53	1115.08	1116.62	1118.16	1119.71	1119.71	1122.80	1124.34	1125.89
73	1127.43	1128.98	1130.52	1132.06	1133.61	1135.15	1135.15	1138.24	1139.79	1141.33
74	1142.87	1144.42	1145.96	1147.51	1149.05	1150.60	1150.60	1153.69	1155.23	1156.77
75	1158.32	1159.86	1161.41	1162.95	1164.50	1166.04	1167.59	1169.13	1170.67	1172.22
76	1173.76	1175.32	1167.85	1178.40	1179.94	1181.49	1183.03	1184.57	1186.12	1187.66
77	1189.21	1190.75	1192.30	1193.84	1195.39	1196.93	1198.47	1200.02	1201.56	1203.11
78	1204.65	1206.20	1207.74	1209.29	1210.83	1212.37	1213.92	1215.46	1217.01	1218.55
79	1220.10	1221.64	1223.19	1224.73	1226.27	1227.82	1229.36	1230.91	1232.45	1234.00
80	1235.54	1237.08	1238.63	1240.17	1241.72	1234.26	1244.81	1246.35	1247.90	1249.44
81	1250.98	1252.53	1254.07	1255.62	1257.16	1258.71	1260.25	1261.80	1263.34	1264.88
82	1266.43	1267.97	1269.52	1271.06	1272.61	1274.15	1275.70	1277.24	1278.78	1280.33
83	1281.87	1283.42	1284.96	1286.51	1288.05	1289.60	1291.14	1292.68	1294.23	1295.77
84	1297.32	1298.86	1300.41	1301.95	1303.50	1305.04	1306.58	1308.13	1309.67	1311.22
85	1312.76	1314.31	1315.85	1317.40	1318.94	1320.48	1322.03	1323.57	1325.12	1326.66
86	1328.21	1329.75	1331.29	1332.84	1334.38	1335.93	1337.47	1339.02	1340.56	1342.11
87	1343.65	1345.19	1346.74	1348.28	1349.83	1351.37	1352.92	1354.46	1356.01	1357.55
88	1359.09	1360.64	1362.18	1363.73	1365.27	1366.82	1368.36	1369.91	1371.45	1372.99
89	1374.54	1376.08	1377.63	1379.17	1380.72	1382.26	1383.81	1385.35	1386.89	1388.44
90	1389.98	1391.53	1393.07	1394.62	1396.16	1397.71	1399.25	1400.79	1402.34	1403.88
91	1405.43	1406.97	1408.52	1410.06	1411.61	1413.15	1414.69	1416.24	1417.78	1419.33
92	1420.87	1422.42	1423.96	1425.50	1427.05	1428.59	1430.14	1431.68	1433.23	1434.77
93	1436.32	1437.86	1439.40	1440.95	1442.49	1444.04	1445.58	1447.13	1448.67	1450.22
94	1451.76	1453.30	1454.85	1456.39	1457.94	1459.48	1461.03	1462.57	1464.12	1465.66
95	1467.20	1468.75	1470.29	1471.84	1473.38	1474.93	1476.47	1478.02	1479.56	1481.10
96	1482.65	1484.19	1485.74	1487.28	1488.83	1490.37	1491.92	1493.46	1495.00	1496.55
97	1498.09	1499.64	1501.18	1502.73	1504.27	1505.81	1507.36	1508.90	1510.45	1511.99
98	1513.54	1515.08	1516.63	1518.17	1519.71	1521.26	1522.80	1524.35	1525.89	1527.44
99	1528.98	1530.53	1532.07	1533.61	1535.16	1536.70	1538.25	1539.79	1541.34	1542.88
100	1544.43	–	–	–	–	–	–	–	–	–

Notes:

Notes:

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