



HOLLOW SECTIONS

4.1 Square Hollow Sections

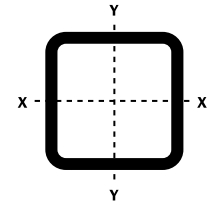
Tolerances - ASTM A-500

Tolerances	Square & Rectangular Hollow Sections		
	ASTM A-500		
	Largest Outside Dia. Across Flat	Tolerance, Plus & Minus	
	in (mm)	in (mm)	
Outside Dimension	2 1⁄₂ (63.5) and under	0.020 (0.50)	
	Over 2 1⁄₂ to 3 1⁄₂ (63.5 to 88.9), incl	0.025 (0.64)	
	Over 3 1⁄₂ to 5 1⁄₂ (88.9 to 139.7), incl	0.030 (0.76)	
	Over 5 1⁄₂ (139.7)	1%	
Thickness	Plus and minus 10% of nominal thickness, exclusive of weld area		
Tolerances of Length	Plus 2 in (50.8mm) and minus zero on ordered lengths. (Please specify if any lighter tolerances is required)		
Out of Roundness	-		
Concavity / Convexity	Shall not exceed the outside dimension tolerance		
Squareness of Size	Adjacent side may deviate from 90 degrees by plus and minus 2 degree max.		
External Corner Profile	3T (max.)		
	Specified Dia. Of Longest Side, in (mm)	Max. Twist in 3ft, in	Max. Twist in 1m, mm
Twist	1 1⁄₂ (38.1) and under	0.050	1.390
	Over 1 1⁄₂ to 2 1⁄₂ (38.1 to 63.5), incl	0.062	1.720
	Over 2 1⁄₂ to 4 (63.5 to 101.6), incl	0.075	2.090
	Over 4 to 6 (101.6 to 152.4), incl	0.087	2.420
	Over 6 to 8 (152.4 to 203.2), incl	0.100	2.780
	Over 8 (203.2)	0.112	3.110
Straightness	1⁄8 in x $\frac{\text{Total Length in ft}}{5}$		
Mass	-		



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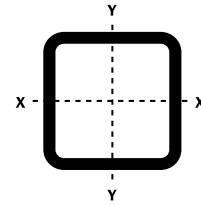
ASTM A-500

Nominal Size		Wall Thickness	Calculated Weight		Sectional Area	Moment of Inertia		Sectional Modulus		Radius of Gyration		Plastic Modulus	
mm	in	mm	kg/m	kg/6m	cm ²	I _x cm ⁴	I _y cm ⁴	Z _x cm ³	Z _y cm ³	i _x cm	i _y cm	S _x cm ³	S _y cm ³
20 x 20	-	1.6	0.873	5.238	1,112	0.608	0.608	0.608	0.608	0.739	0.739	0.751	0.751
25 x 25	1 x 1	1.6	1.160	6.960	1.48	1.34	1.34	1.07	1.07	0.95	0.95	1.29	1.29
		2.3	1.600	9.600	2.04	1.75	1.75	1.40	1.40	0.93	0.93	1.73	1.73
		3.0	2.010	12.060	2.56	2.06	2.06	1.65	1.65	0.90	0.90	2.10	2.10
30 x 30	-	1.6	1.410	8.460	1.80	2.40	2.40	1.60	1.60	1.16	1.16	1.91	1.91
		2.3	1.970	11.820	2.50	3.19	3.19	2.12	2.12	1.13	1.13	2.59	2.59
		3.0	2.480	14.880	3.16	3.83	3.83	2.55	2.55	1.10	1.10	3.18	3.18
32 x 32	1 1/4 x 1 1/4	1.6	1.510	9.060	1.92	2.95	2.95	1.84	1.84	1.24	1.24	2.19	2.19
		1.8	1.690	10.140	2.15	3.25	3.25	2.03	2.03	1.23	1.23	2.42	2.42
		2.0	1.860	11.160	2.37	3.53	3.53	2.21	2.21	1.22	1.22	2.65	2.65
		2.3	2.110	12.660	2.69	3.93	3.93	2.46	2.46	1.21	1.21	2.98	2.98
		3.0	2.670	16.020	3.40	4.75	4.75	2.97	2.97	1.18	1.18	3.68	3.68
		3.2	2.830	16.980	3.60	4.95	4.95	3.10	3.10	1.17	1.17	3.86	3.86
35 x 35	-	1.6	1.626	9.756	2.07	3.79	3.79	2.17	2.17	1.35	1.35	2.57	2.57
		2.0	1.992	11.952	2.54	4.51	4.51	2.58	2.58	1.33	1.33	3.09	3.09
		2.3	2.255	13.530	2.87	4.99	4.99	2.85	2.85	1.32	1.32	3.46	3.46
		3.0	2.833	16.998	3.61	5.95	5.95	3.40	3.40	1.28	1.28	4.23	4.23
38 x 38	1 1/2 x 1 1/2	1.6	1.810	10.860	2.31	5.08	5.08	2.67	2.67	1.48	1.48	3.14	3.14
		2.0	2.230	13.380	2.85	6.12	6.12	3.22	3.22	1.47	1.47	3.83	3.83
		2.3	2.540	15.240	3.24	6.85	6.85	3.61	3.61	1.45	1.45	4.32	4.32
		3.0	3.240	19.440	4.12	8.38	8.38	4.41	4.41	1.43	1.43	5.38	5.38
40 x 40	-	1.6	1.880	11.280	2.39	5.79	5.79	2.90	2.90	1.56	1.56	3.41	3.41
		1.9	2.200	13.200	2.80	6.67	6.67	3.33	3.33	1.55	1.55	4.05	4.05
		2.0	2.310	13.860	2.94	6.94	6.94	3.47	3.47	1.54	1.54	4.13	4.13
		2.3	2.620	15.720	3.33	7.73	7.73	3.86	3.86	1.52	1.52	4.96	4.96
		3.0	3.300	19.800	4.21	9.39	9.39	4.70	4.70	1.51	1.51	6.27	6.27
50 x 50	2 x 2	1.6	2.410	14.460	3.08	12.00	12.00	4.79	4.79	1.97	1.97	5.57	5.57
		1.9	2.800	16.800	3.62	13.92	13.92	5.57	5.57	1.96	1.96	6.52	6.52
		2.3	3.410	20.460	4.34	16.40	16.40	6.56	6.56	1.94	1.94	7.74	7.74
		3.0	4.250	25.500	5.41	19.50	19.50	7.79	7.79	1.90	1.90	9.39	9.39
		4.0	5.450	32.700	6.95	23.70	23.70	9.49	9.49	1.85	1.85	11.70	11.70
		4.5	6.020	36.120	7.67	25.50	25.50	10.20	10.20	1.82	1.82	12.80	12.80
		5.0	6.560	39.360	8.36	27.00	27.00	10.80	10.80	1.80	1.80	13.70	13.70
		6.0	7.560	45.360	9.63	29.50	29.50	11.80	11.80	1.75	1.75	15.30	15.30
60 x 60	-	1.6	2.880	17.280	3.67	20.70	20.70	6.89	6.89	2.37	2.37	8.66	8.66
		2.3	4.060	24.360	5.17	28.30	28.30	9.44	9.44	2.34	2.34	11.00	11.00
		3.0	5.180	31.080	6.60	35.04	35.04	11.70	11.70	2.30	2.30	14.00	14.00
		4.0	6.710	40.260	8.55	42.30	42.30	14.10	14.10	2.24	2.24	17.80	17.80
		4.5	7.430	44.580	9.46	46.88	46.88	15.60	15.60	2.22	2.22	19.50	19.50
65 x 65	2 1/2 x 2 1/2	1.6	3.133	18.798	3.99	26.50	26.50	8.20	8.20	2.58	2.58	9.40	9.40
		2.3	4.420	26.520	5.63	36.40	36.40	11.20	11.20	2.54	2.54	13.10	13.10
		3.0	5.660	33.960	7.21	45.40	45.40	14.00	14.00	2.51	2.51	16.60	16.60
		4.0	7.340	44.040	9.35	56.60	56.60	17.40	17.40	2.46	2.46	21.00	21.00
		4.5	8.140	48.840	10.37	61.60	61.60	18.90	18.90	2.44	2.44	23.10	23.10
		5.0	8.920	53.520	11.36	66.10	66.10	20.30	20.30	2.41	2.41	25.00	25.00
		6.0	10.400	62.400	13.23	73.90	73.90	22.70	22.70	2.36	2.36	28.50	28.50
75 x 75	3 x 3	1.6	3.636	21.816	4.63	41.30	41.30	11.00	11.00	2.99	2.99	12.70	12.70
		2.3	5.140	30.840	6.55	57.10	57.10	15.20	15.20	2.95	2.95	17.70	17.70
		3.0	6.600	39.600	8.41	71.60	71.60	19.10	19.10	2.92	2.92	22.50	22.50
		4.0	8.600	51.600	10.95	90.20	90.20	24.00	24.00	2.87	2.87	28.80	28.80
		4.5	9.550	57.300	12.17	98.60	98.60	26.30	26.30	2.58	2.58	31.70	31.70
		5.0	10.500	63.000	13.36	106.00	106.00	28.40	28.40	2.82	2.82	34.50	34.50
		6.0	12.300	73.800	15.63	120.00	120.00	32.00	32.00	2.77	2.77	39.60	39.60
80 x 80	-	2.3	5.505	33.028	7.01	69.90	69.90	17.50	17.50	3.16	3.16	20.30	20.30
		3.0	7.072	42.430	9.01	87.80	87.80	22.00	22.00	3.12	3.12	25.80	25.80
		4.0	9.223	55.336	11.75	111.00	111.00	27.80	27.80	3.07	3.07	33.10	33.10
		4.5	10.259	61.556	13.07	121.60	121.60	30.40	30.40	3.05	3.05	36.50	36.50
		5.0	11.270	67.622	14.36	131.50	131.50	32.90	32.90	3.03	3.03	39.70	39.70
		6.0	13.215	79.289	16.83	149.20	149.20	37.30	37.30	2.98	2.98	45.80	45.80



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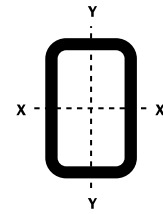
ASTM A-500

Nominal Size		Wall Thickness	Calculated Weight		Sectional Area	Moment of Inertia		Sectional Modulus		Radius of Gyration		Plastic Modulus	
						I _x	I _y	Z _x	Z _y	i _x	i _y	S _x	S _y
mm	in	mm	kg/m	kg/6m	cm ²	cm ⁴	cm ⁴	cm ³	cm ³	cm	cm	cm ³	cm ³
90 x 90	3 1/2 x 3 1/2	2.3	6.230	37.380	7.93	101.0	101.0	22.4	22.4	3.56	3.56	25.9	25.9
		3.0	8.010	48.060	10.21	127.0	127.0	28.3	28.3	3.53	3.53	33.0	33.0
		4.0	10.500	63.000	13.35	162.0	162.0	36.0	36.0	3.48	3.48	42.6	42.6
		4.5	11.700	70.200	14.87	178.0	178.0	39.5	39.5	3.46	3.46	47.1	47.1
		5.0	12.800	76.800	16.36	193.0	193.0	42.9	42.9	3.43	3.43	51.4	51.4
		6.0	15.100	90.600	19.23	220.0	220.0	49.0	49.0	3.39	3.39	59.5	59.5
100 x 100	4 x 4	2.3	6.950	41.700	8.85	140.0	140.0	27.9	27.9	3.97	3.97	32.3	32.3
		3.0	8.960	53.760	11.41	177.0	177.0	35.4	35.4	3.94	3.94	41.2	41.2
		4.0	11.700	70.200	14.95	226.0	226.0	45.3	45.3	3.89	3.89	53.3	53.3
		4.5	13.100	78.600	16.67	249.0	249.0	49.9	49.9	3.87	3.87	59.0	59.0
		5.0	14.400	86.400	18.36	271.0	271.0	54.2	54.2	3.84	3.84	64.6	64.6
		6.0	17.000	102.000	21.63	311.0	311.0	62.3	62.3	3.79	3.79	75.1	75.1
120 x 120	-	9.0	24.100	144.600	30.00	391.0	391.0	78.1	78.1	3.61	3.61	98.6	98.6
		2.3	8.394	50.364	10.69	245.3	245.3	40.9	40.9	4.79	4.79	47.0	47.0
		3.0	10.840	65.040	13.81	312.4	312.4	52.1	52.1	4.76	4.76	60.2	60.2
		4.0	14.247	85.482	18.15	402.3	402.3	67.0	67.0	4.71	4.71	78.3	78.3
		4.5	15.911	95.466	20.27	444.7	444.7	74.1	74.1	4.68	4.68	87.0	87.0
		5.0	17.550	105.300	22.36	485.5	485.5	80.9	80.9	4.66	4.66	95.5	95.5
125 x 125	5 x 5	6.0	20.751	124.506	26.43	562.2	562.2	93.7	93.7	4.61	4.61	111.6	111.6
		9.0	29.732	178.392	37.88	755.3	755.0	125.9	125.9	4.47	4.47	154.5	154.5
		3.0	11.300	67.800	14.41	354.0	354.0	56.7	56.7	4.96	4.96	65.6	65.6
		4.0	14.900	89.400	18.95	457.0	457.0	73.2	73.2	4.91	4.91	85.3	85.3
		4.5	16.600	99.600	21.17	506.0	506.0	80.9	80.9	4.89	4.89	94.8	94.8
		5.0	18.300	109.800	23.36	553.0	553.0	88.4	88.4	4.86	4.86	104.0	104.0
150 x 150	6 x 6	6.0	21.700	130.200	27.63	641.0	641.0	103.0	103.0	4.82	4.82	122.0	122.0
		9.0	31.100	186.600	39.00	838.0	838.0	134.0	134.0	4.64	4.64	165.0	165.0
		3.0	13.700	82.200	17.41	623.0	623.0	83.0	83.0	5.98	5.98	95.5	95.5
		4.0	18.000	108.000	22.95	808.0	808.0	108.0	108.0	5.93	5.93	125.0	125.0
		4.5	20.200	121.200	25.67	896.0	896.0	120.0	120.0	5.91	5.91	139.0	139.0
		5.0	22.300	133.000	28.36	982.0	982.0	131.0	131.0	5.89	5.89	153.0	153.0
180 x 180	-	6.0	26.400	158.400	33.63	1146.0	1146.0	153.0	153.0	5.84	5.84	180.0	180.0
		9.0	38.200	229.200	48.00	1540.0	1540.0	205.0	205.0	5.66	5.66	248.0	248.0
		4.0	21.783	130.698	27.75	1421.8	1421.8	158.0	158.0	7.16	7.16	182.2	182.2
		4.5	24.389	146.334	31.07	1581.3	1581.3	175.0	175.0	7.13	7.13	203.3	203.3
		5.0	26.970	161.820	34.36	1736.9	1736.9	193.0	193.0	7.11	7.11	224.0	224.0
		6.0	32.055	192.330	40.83	2036.6	2036.6	226.0	226.0	7.06	7.06	264.4	264.4
200 x 200	8 x 8	9.0	46.690	280.140	59.48	2846.1	2846.1	316.2	316.2	6.92	6.92	376.7	376.7
		4.0	24.295	145.770	30.95	1968.2	1968.2	196.8	196.8	7.97	7.97	226.4	226.4
		4.5	27.215	163.290	34.67	2191.6	2191.6	219.2	219.2	7.95	7.95	252.9	252.9
		5.0	30.110	180.660	38.36	2410.2	2410.2	241.0	241.0	7.93	7.93	278.9	278.9
		6.0	35.823	214.938	45.63	2832.9	2832.9	283.3	283.3	7.88	7.88	329.7	329.7
		9.0	52.342	314.052	66.68	3988.8	3988.8	398.9	398.9	7.73	7.73	472.4	472.4
250 x 250	10 x 10	10.0	57.641	345.846	73.43	4337.9	4337.9	433.8	433.8	7.69	7.69	516.8	516.8
		12.0	67.932	407.592	86.54	4983.9	4983.9	498.4	498.4	7.59	7.59	600.9	600.9
		16.0	87.274	523.644	111.18	6076.9	6076.9	607.7	607.7	7.39	7.39	750.7	750.7
		5.0	37.960	227.760	48.36	4805.1	4805.1	384.4	384.4	9.97	9.97	442.3	442.3
		6.0	45.243	271.458	57.63	5672.2	5672.2	453.8	453.8	9.92	9.92	524.5	524.5
		9.0	66.472	398.832	84.68	8093.6	8093.6	647.5	647.5	9.78	9.78	758.8	758.8
300 x 300	12 x 12	10.0	73.341	440.046	93.43	8842.3	8842.3	707.4	707.4	9.73	9.73	832.8	832.8
		12.0	86.772	520.632	110.54	10254.8	10254.8	820.4	820.4	9.63	9.63	975.0	975.0
		16.0	112.394	674.364	143.18	12752.3	12752.3	1020.2	1020.2	9.44	9.44	1235.9	1235.9
		6.0	54.663	327.978	69.63	9963.9	9963.9	664.3	664.3	11.96	11.96	764.2	764.2
		9.0	80.602	483.612	102.68	14341.3	14341.3	956.1	956.1	11.82	11.82	1112.7	1112.7
		10.0	89.041	534.246	113.43	15714.5	15714.5	1047.6	1047.6	11.77	11.77	1223.9	1223.9
350 x 350	14 x 14	12.0	105.612	633.672	134.54	18335.4	18335.4	1222.4	1222.4	11.67	11.67	1439.1	1439.1
		16.0	137.514	825.084	175.18	23089.4	23089.4	1539.3	1539.3	11.48	11.48	1841.0	1841.0
		6.0	64.083	384.498	81.63	16008.1	16008.1	914.7	914.7	14.00	14.00	1049.0	1049.0
		9.0	94.732	568.392	120.68	23182.0	23182.0	1324.7	1324.7	13.86	13.86	1534.1	1534.1
		10.0	104.741	628.446	133.43	25454.7	25454.7	1454.6	1454.6	13.81	13.81	1690.0	1690.0
		12.0	124.452	746.712	158.54	29825.7	29825.7	1704.3	1704.3	13.72	13.72	1993.3	1993.3
350 x 350	14 x 14	16.0	162.634	975.804	207.18	37888.2	37888.2	2165.0	2165.0	13.52	13.52	2566.1	2566.1



HOLLOW SECTIONS

4.2 Rectangular Hollow Sections

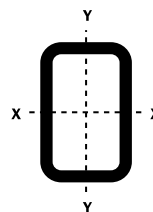


ASTM A-500

Nominal Size		Wall Thickness	Calculated Weight		Sectional Area	Moment of Inertia		Sectional Modulus		Radius of Gyration		Plastic Modulus	
						I _x	I _y	Z _x	Z _y	r _x	r _y	S _x	S _y
mm	in	mm	kg/m	kg/6m	cm ²	cm ⁴	cm ⁴	cm ³	cm ³	cm	cm	cm ³	cm ³
38 x 19	1 1/2 x 3/4	1.6	1.330	7.980	1.70	3.06	1.01	1.61	1.06	1.34	0.771	2.08	1.26
38 x 25	1 1/2 x 1	1.6	1.490	8.940	1.89	3.70	1.91	1.95	1.53	1.40	1.01	2.42	1.80
50 x 25	2 x 1	1.6	1.790	10.740	2.28	7.29	2.44	2.91	1.95	1.79	1.03	3.69	2.25
		2.3	2.510	15.060	3.19	9.86	3.23	3.94	2.59	1.76	1.01	5.11	3.09
		3.0	3.190	19.140	4.06	12.10	3.89	4.84	3.11	1.73	0.98	6.43	3.84
65 x 35	2 1/2 x 1 3/8	1.6	2.380	14.280	3.03	16.87	6.47	5.19	3.70	2.36	1.46	6.39	4.17
		1.9	2.797	16.782	3.56	19.54	7.46	6.01	4.26	2.34	1.45	7.46	4.85
		2.3	3.338	20.028	4.25	22.88	8.69	7.04	4.96	2.32	1.43	8.81	5.72
		3.0	4.246	25.476	5.41	28.11	10.57	8.65	6.04	2.28	1.40	10.99	7.11
65 x 38	2 1/2 x 1 1/2	4.0	5.455	32.730	6.95	34.29	12.73	10.55	7.27	2.22	1.35	13.73	8.83
		1.6	2.490	14.940	3.17	18.30	7.94	5.63	4.18	2.40	1.58	6.91	4.75
		1.9	2.880	17.280	3.67	21.02	9.12	6.46	4.80	2.35	1.56	8.14	5.58
		2.3	3.520	21.120	4.48	25.20	10.80	7.74	5.69	2.37	1.55	9.68	6.62
		3.0	4.390	26.340	5.29	29.80	12.80	9.18	6.75	2.31	1.51	12.30	8.36
75 x 25	3 x 1	3.2	4.650	27.900	5.92	31.30	13.40	9.63	7.06	2.30	1.51	13.00	8.34
		4.0	5.640	33.840	7.19	36.50	15.50	11.20	8.17	2.25	1.47	15.80	10.60
		1.6	2.380	14.280	3.03	20.10	3.51	5.35	2.81	2.55	1.07	7.12	3.21
		1.9	2.800	16.800	3.56	23.30	4.03	6.22	3.22	2.53	1.05	8.37	3.75
		2.3	3.340	20.040	4.25	27.40	4.67	7.31	3.74	2.51	1.04	10.01	4.44
		3.0	4.250	25.500	5.40	33.90	5.66	9.04	4.52	2.47	1.01	12.62	5.52
75 x 38	3 x 1 1/2	4.0	5.450	32.700	6.95	41.94	6.77	11.18	5.42	2.42	0.97	16.23	6.94
		4.5	6.020	36.120	7.67	45.43	7.22	12.11	5.77	2.40	0.96	17.93	7.57
		1.6	2.710	16.260	3.45	25.30	8.85	6.76	4.66	2.71	1.60	8.59	5.34
		1.9	3.180	19.080	4.06	29.40	10.20	7.85	5.39	2.69	1.59	10.10	6.26
		2.3	3.810	22.860	4.85	34.60	12.00	9.23	6.30	2.67	1.57	12.10	7.44
		3.0	4.860	29.160	6.19	42.80	14.70	11.40	7.72	2.63	1.54	15.30	9.41
75 x 50	3 x 2	3.2	5.150	30.900	6.56	45.00	15.40	12.00	8.09	2.62	1.53	16.30	9.95
		4.0	6.270	37.620	7.99	52.80	17.90	14.10	9.40	2.57	1.50	19.80	12.00
		4.5	6.940	41.640	8.84	57.10	19.20	15.20	10.10	2.54	1.47	21.90	13.20
		1.6	3.008	18.048	3.83	30.51	16.39	8.14	6.56	2.82	2.07	9.75	7.40
		1.9	3.540	21.240	4.51	35.50	19.10	9.48	7.62	2.81	2.05	11.80	8.88
		2.3	4.240	25.440	5.40	41.90	22.40	11.20	8.96	2.79	2.04	14.10	10.60
100 x 50	4 x 2	3.0	5.420	32.520	6.91	52.20	27.80	13.90	11.10	2.75	2.00	17.90	13.50
		4.0	7.020	42.120	8.95	65.00	34.30	17.30	13.70	2.69	1.96	23.20	17.30
		4.5	7.790	46.740	9.92	70.60	37.20	18.80	14.90	2.67	1.94	25.70	19.10
		5.0	8.530	51.180	10.86	75.60	39.70	20.20	15.90	2.64	1.91	28.10	20.90
		6.0	9.920	59.520	12.63	84.40	44.10	22.50	17.60	2.58	1.87	32.60	24.10
		1.6	3.636	21.816	4.63	61.30	21.08	12.26	8.43	3.64	2.13	15.04	9.33
		1.9	4.290	25.740	5.46	71.60	24.50	14.30	9.80	3.62	2.12	18.10	11.20
		2.3	5.140	30.840	6.55	84.80	29.00	17.00	11.60	3.60	2.10	21.70	13.30
100 x 75	4 x 3	3.0	6.600	39.600	8.41	106.00	36.10	21.30	14.40	3.56	2.07	27.80	17.00
		4.0	8.600	51.600	10.95	134.00	44.90	26.80	18.00	3.50	2.03	36.10	21.90
		4.5	9.550	57.300	12.17	147.00	48.90	29.30	19.50	3.47	2.00	40.10	24.30
		5.0	10.500	63.000	13.36	158.00	52.50	31.60	21.00	3.44	1.98	44.00	26.50
		6.0	12.300	73.800	15.63	179.00	58.70	35.70	23.50	3.38	1.94	51.40	30.70
		2.3	6.046	36.276	7.70	112.30	72.30	22.50	19.30	3.82	3.06	26.60	21.90
		3.0	7.780	46.680	9.91	142.00	91.10	28.40	24.30	3.78	3.03	35.10	28.70
		4.0	10.200	61.200	12.95	180.00	115.00	36.00	30.80	3.73	2.99	45.70	37.40
120 x 60	-	4.5	11.300	67.800	14.42	198.00	127.00	39.60	33.70	3.71	2.96	50.90	41.50
		5.0	12.500	75.000	15.86	215.00	137.00	42.90	36.50	3.68	2.94	55.90	45.60
		6.0	14.600	87.600	18.63	245.00	156.00	49.00	41.60	3.63	2.89	65.50	53.30
		3.0	8.013	48.078	10.21	189.10	64.40	31.50	21.50	4.30	2.51	39.20	24.20
		4.0	10.479	62.874	13.35	240.80	81.30	40.10	27.10	4.25	2.47	50.50	31.10
120 x 80	-	4.5	11.672	70.032	14.87	264.50	88.90	44.10	29.60	4.22	2.44	55.80	34.30
		5.0	12.840	77.040	16.36	287.00	96.00	47.80	32.00	4.19	2.42	61.00	37.40
		6.0	15.099	90.594	19.23	328.00	108.80	54.70	36.30	4.13	2.38	70.60	43.10
		3.0	8.956	53.736	11.41	230.20	123.40	38.40	30.90	4.49	3.29	46.20	35.00
		4.0	11.735	70.410	14.95	294.60	157.30	49.10	39.30	4.44	3.24	59.80	45.20
120 x 80	-	4.5	13.085	78.510	16.67	324.60	173.00	54.10	43.20	4.41	3.22	66.20	50.10
		5.0	14.410	86.460	18.36	353.20	187.80	58.90	46.90	4.39	3.20	72.50	54.70
		6.0	16.983	101.898	21.63	406.10	215.00	67.70	53.80	4.33	3.15	84.30	63.60

4 HOLLOW SECTIONS

4.2 Rectangular Hollow Sections



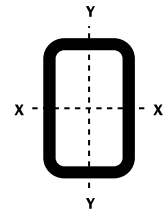
ASTM A-500

Nominal Size		Wall Thickness	Calculated Weight		Sectional Area	Moment of Inertia		Sectional Modulus		Radius of Gyration		Plastic Modulus		
mm	in	mm	kg/m	kg/6m	cm²	I _x cm⁴	I _y cm⁴	Z _x cm³	Z _y cm³	i _x cm	i _y cm	S _x cm³	S _y cm³	
125 x 50	5 x 2	2.3	6.046	36.276	7.70	148.2	35.5	23.7	14.2	4.39	2.15	29.9	15.7	
		3.0	7.780	46.680	9.91	187.0	44.4	29.9	17.7	4.34	2.12	39.5	20.5	
		4.0	10.200	61.200	12.95	238.0	55.6	38.0	22.2	4.28	2.07	51.6	26.5	
		4.5	11.300	67.800	14.42	261.0	60.6	41.7	24.2	4.25	2.05	57.4	29.4	
		5.0	12.500	75.000	15.86	282.0	65.2	45.2	26.1	4.22	2.03	63.1	32.1	
		6.0	14.600	87.600	18.63	322.0	73.3	51.5	29.3	4.16	1.98	74.0	37.3	
125 x 75	5 x 3	2.3	6.949	41.694	8.85	191.5	87.5	30.6	23.3	4.65	3.14	37.0	26.1	
		3.0	8.960	53.760	11.41	243.0	111.0	38.9	29.5	4.61	3.12	48.7	34.1	
		4.0	11.700	70.200	14.95	311.0	141.0	49.7	37.5	4.56	3.07	63.7	44.5	
		4.5	13.100	78.600	16.67	342.0	155.0	54.8	41.2	4.53	3.04	70.9	49.5	
		5.0	14.400	86.400	18.36	373.0	168.0	59.6	44.7	4.50	3.02	78.1	54.3	
		6.0	17.000	102.000	21.63	428.0	192.0	68.5	51.1	4.45	2.98	91.9	63.7	
150 x 50	6 x 2	9.0	24.100	144.600	31.23	626.0	269.0	98.5	70.6	4.47	2.94	126.3	86.5	
		2.3	6.949	41.694	8.85	235.7	42.0	31.4	16.8	5.16	2.18	40.3	18.5	
		3.0	8.960	53.760	11.41	299.0	52.6	39.8	21.1	5.12	2.15	53.2	24.1	
		4.0	11.700	70.200	14.95	381.0	66.2	50.9	26.5	5.05	2.10	69.5	31.1	
		4.5	13.100	78.600	16.67	420.0	72.2	56.0	28.9	5.02	2.08	77.5	34.5	
		5.0	14.400	86.400	18.36	456.0	77.9	60.8	31.1	4.99	2.06	85.3	37.8	
150 x 75	6 x 3	6.0	17.000	102.000	21.63	523.0	87.9	69.8	35.2	4.92	2.02	100.0	43.9	
		2.3	7.852	47.112	10.00	298.4	102.7	39.8	27.4	5.46	3.20	48.8	30.3	
		3.0	10.100	60.600	12.91	380.0	130.0	50.6	34.7	5.42	3.17	64.2	39.5	
		4.0	13.300	79.800	16.95	488.0	166.0	65.1	44.2	5.37	3.13	84.1	51.6	
		4.5	14.900	89.400	18.92	539.0	183.0	71.9	48.7	5.34	3.11	93.8	57.4	
		5.0	16.400	98.400	20.86	588.0	198.0	78.4	52.9	5.31	3.08	103.0	63.1	
150 x 100	6 x 4	6.0	19.300	115.800	24.63	679.0	228.0	90.5	60.7	5.25	3.04	122.0	74.0	
		9.0	27.600	165.600	35.17	905.0	297.0	121.0	79.2	5.07	2.91	172.0	105.0	
		3.0	11.311	67.866	14.41	460.7	247.6	61.4	49.5	5.65	4.15	73.5	55.8	
		4.0	14.900	89.400	18.95	595.0	319.0	79.3	63.7	5.60	4.10	98.7	74.5	
		4.5	16.600	99.600	21.17	658.0	352.0	87.7	70.4	5.58	4.08	110.0	83.1	
		5.0	18.300	109.800	23.36	719.0	384.0	95.9	76.8	5.55	4.05	122.0	91.5	
160 x 80	-	6.0	21.700	130.200	27.63	835.0	444.0	111.1	88.8	5.50	4.01	144.0	108.0	
		9.0	31.100	186.600	39.67	1129.0	595.0	150.5	119.0	5.33	3.87	190.9	143.0	
		3.0	10.840	65.040	13.81	463.8	159.0	58.0	39.8	5.80	3.39	71.4	44.3	
		3.2	11.529	69.174	14.69	491.4	168.3	61.4	42.1	5.78	3.38	75.8	47.0	
		4.0	14.247	85.482	18.15	597.7	203.6	74.7	50.9	5.74	3.35	92.9	57.4	
		4.5	15.911	95.466	20.27	661.0	224.3	82.6	56.1	5.71	3.33	103.2	63.7	
		5.0	17.550	105.300	22.36	721.7	244.1	90.2	61.0	5.68	3.30	113.2	69.7	
		6.0	20.751	124.505	26.43	836.1	280.9	104.5	70.2	5.62	3.26	132.2	81.3	
		9.0	29.734	178.404	37.88	1123.7	370.2	140.5	92.6	5.45	3.13	183.1	111.6	
				12.0	39.672	238.032	50.54	1350.0	705.1	180.0	141.0	5.17	3.74	233.9



HOLLOW SECTIONS

4.2 Rectangular Hollow Sections

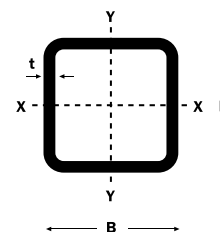


ASTM A-500

Nominal Size		Wall Thickness	Calculated Weight		Sectional Area	Moment of Inertia		Sectional Modulus		Radius of Gyration		Plastic Modulus	
						I _x	I _y	Z _x	Z _y	i _x	i _y	S _x	S _y
mm	in	mm	kg/m	kg/6m	cm ²	cm ⁴	cm ⁴	cm ³	cm ³	cm	cm	cm ³	cm ³
200 x 100	8 x 4	4.0	18.000	108.000	22.95	1200.0	411.0	120.0	82.2	7.23	4.23	152.0	93.7
		4.5	20.200	121.200	25.67	1331.0	455.0	133.0	90.9	7.20	4.21	170.0	105.0
		5.0	22.300	133.800	28.36	1459.0	497.0	146.0	99.4	7.17	4.19	188.0	115.0
		6.0	26.400	158.400	33.63	1703.0	577.0	170.0	115.0	7.12	4.14	222.0	136.0
		9.0	38.200	229.200	48.00	2280.0	764.0	228.0	153.0	6.89	3.99	293.0	180.0
200 x 150	8 x 6	12.0	49.092	294.552	62.54	2860.0	938.8	286.0	187.8	6.76	3.87	375.3	228.2
		4.0	21.155	126.930	26.95	1584.0	1021.1	158.4	136.1	7.67	6.16	187.2	154.1
		4.5	23.683	142.098	30.17	1761.6	1134.6	176.2	151.3	7.64	6.13	208.9	171.8
		5.0	26.185	157.110	33.36	1934.7	1245.1	193.5	166.0	7.62	6.11	230.1	189.2
		6.0	31.113	186.678	39.63	2268.1	1457.2	226.8	194.3	7.56	6.06	271.5	223.1
250 x 150	10 x 6	9.0	45.277	271.662	57.68	3167.3	2024.9	316.7	270.0	7.41	5.93	386.4	316.9
		12.0	58.512	351.072	74.54	3921.83	2495.37	392.18	332.72	7.25	5.79	488.01	412.17
		4.0	24.295	145.770	30.95	2697.0	1234.3	215.8	146.6	9.34	6.32	259.6	183.3
		4.5	27.215	163.290	34.67	3003.9	1372.8	240.3	183.0	9.31	6.29	289.9	204.6
		5.0	30.110	180.660	38.36	3304.3	1508.0	264.3	201.1	9.28	6.27	319.8	225.5
250 x 150	10 x 6	6.0	35.823	214.938	45.63	1768.4	3885.7	310.9	235.8	9.23	6.23	378.1	266.3
		9.0	52.342	314.052	66.68	2472.8	5478.7	438.3	329.7	9.06	6.09	541.9	380.4
		10.0	57.641	345.846	73.43	2683.0	5960.6	476.8	357.7	9.01	6.04	592.8	415.7
		12.0	67.932	407.592	86.54	3068.0	6853.3	548.3	409.1	8.90	5.95	689.4	482.3
		16.0	87.274	523.644	111.18	3706.5	8365.0	669.2	494.2	8.67	5.77	861.5	600.0
300 x 200	12 x 8	4.5	34.280	205.680	43.67	5662.0	3051.7	377.5	305.2	11.39	8.36	448.7	340.8
		5.0	37.960	227.760	48.36	6241.2	3361.0	416.1	336.1	11.36	8.34	495.7	376.4
		6.0	45.243	271.458	57.63	7370.5	3962.3	491.4	396.2	11.31	8.29	587.8	446.1
		9.0	66.472	398.832	84.68	10529.5	5631.6	702.0	563.2	11.15	8.16	850.8	644.3
		10.0	73.341	440.046	93.43	11507.9	6144.5	767.2	614.5	11.10	8.11	933.9	706.8
300 x 200	12 x 8	12.0	86.772	520.632	110.54	13355.8	7107.4	890.4	710.7	10.99	8.02	1093.5	826.5
		16.0	112.394	674.364	143.18	16630.1	8792.2	1108.7	879.2	10.78	7.84	1386.6	1045.1
400 x 200	16 x 8	4.5	41.345	248.070	52.67	11315.9	3911.8	565.8	391.2	14.66	8.62	689.6	428.8
		5.0	45.810	274.860	58.36	12490.2	4311.8	624.5	431.2	14.63	8.60	762.5	473.9
		6.0	54.663	327.978	69.63	14789.8	5091.7	739.5	509.2	14.57	8.55	906.0	562.5
		9.0	80.602	483.612	102.68	21304.0	7274.5	1065.2	727.4	14.40	8.42	1319.1	816.2
		10.0	89.041	534.246	113.43	23349.3	7951.2	1167.5	795.1	14.35	8.37	1451.0	896.8
400 x 200	16 x 8	12.0	105.612	633.672	134.54	27254.6	9231.0	1362.7	923.1	14.23	8.28	1706.2	1052.1
		16.0	137.514	825.084	175.18	34342.2	11507.5	1717.1	1150.7	14.00	8.10	2182.5	1339.5
400 x 300	16 x 12	9.0	94.732	568.392	120.68	28148.9	18153.2	1409.2	1210.2	15.28	12.26	1671.0	1374.6
		10.0	104.741	628.446	133.43	30956.0	19921.2	1547.8	1328.1	15.23	12.22	1841.0	1513.9
		12.0	124.452	746.712	158.54	36290.2	13314.9	1814.5	1554.3	15.13	12.13	2171.8	1784.7
		16.0	162.634	975.804	207.18	46145.5	29548.7	2307.3	1969.9	14.92	11.94	2796.9	2295.4

4 HOLLOW SECTIONS

4.3 Cold Rolled Square Hollow Sections



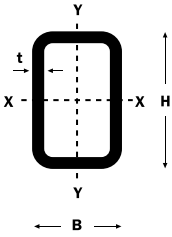
APM S001

Nominal Size		Wall Thickness	Calculated Weight		Sectional Area	Moment of Inertia		Sectional Modulus		Radius of Gyration		Plastic Modulus	
mm	in	mm	kg/m	kg/6m	cm ²	I _x cm ⁴	I _y cm ⁴	Z _x cm ³	Z _y cm ³	I _x cm	I _y cm	S _x cm ³	S _y cm ³
12 x 12	1/2 x 1/2	0.8	0.277	1.662	0.353	0.073	0.073	0.122	0.1220	0.456	0.456	0.147	0.147
		1.0	0.339	2.034	0.431	0.087	0.087	0.144	0.144	0.448	0.448	0.177	0.177
		1.2	0.397	2.382	0.506	0.098	0.098	0.163	0.163	0.440	0.440	0.204	0.204
		1.6	0.505	3.030	0.644	0.116	0.116	0.193	0.193	0.424	0.424	0.249	0.249
16 x 16	5/8 x 5/8	0.8	0.378	2.265	0.481	0.184	0.184	0.231	0.2310	0.619	0.619	0.273	0.273
		1.0	0.464	2.784	0.591	0.221	0.221	0.276	0.276	0.611	0.611	0.331	0.331
		1.2	0.548	3.288	0.698	0.254	0.254	0.317	0.317	0.603	0.603	0.386	0.386
		1.6	0.706	4.236	0.900	0.310	0.310	0.387	0.387	0.587	0.587	0.483	0.483
19 x 19	3/4 x 3/4	0.8	0.453	2.718	0.577	0.317	0.317	0.334	0.334	0.742	0.742	0.393	0.393
		1.0	0.559	3.354	0.711	0.383	0.383	0.403	0.403	0.733	0.733	0.479	0.479
		1.2	0.661	3.966	0.842	0.443	0.443	0.466	0.466	0.725	0.725	0.560	0.560
		1.6	0.857	5.142	1.092	0.548	0.548	0.577	0.577	0.709	0.709	0.709	0.709
20 x 20	-	1.2	0.679	4.074	0.865	0.498	0.498	0.498	0.498	0.759	0.759	0.601	0.601
		1.6	0.873	5.238	1.112	0.608	0.608	0.608	0.608	0.739	0.739	0.751	0.751
25 x 25	1 x 1	0.8	0.604	3.624	0.769	0.748	0.748	0.599	0.599	0.987	0.987	0.696	0.696
		1.0	0.747	4.482	0.951	0.910	0.910	0.728	0.728	0.978	0.978	0.854	0.854
		1.2	0.887	5.322	1.13	1.06	1.06	0.85	0.85	0.97	0.97	1.01	1.01
		1.6	1.160	6.960	1.48	1.34	1.34	1.07	1.07	0.95	0.95	1.29	1.29
30 x 30	-	1.0	0.904	5.423	1.15	1.61	1.61	1.07	1.07	1.18	1.18	1.25	1.25
		1.2	1.080	6.480	1.37	1.89	1.89	1.26	1.26	1.17	1.17	1.48	1.48
		1.6	1.410	8.460	1.80	2.40	2.40	1.60	1.60	1.16	1.16	1.91	1.91
32 x 32	1 1/4 x 1 1/4	1.0	0.967	5.800	1.23	1.97	1.97	1.23	1.23	1.26	1.26	1.43	1.43
		1.2	1.150	6.900	1.47	2.31	2.31	1.44	1.44	1.26	1.26	1.69	1.69
		1.6	1.510	9.060	1.92	2.95	2.95	1.84	1.84	1.24	1.24	2.19	2.19
35 x 35	-	1.0	1.047	6.282	1.33	2.55	2.55	1.45	1.45	1.38	1.38	1.69	1.69
		1.2	1.245	7.470	1.59	2.98	2.98	1.70	1.70	1.37	1.37	1.99	1.99
		1.6	1.626	9.756	2.07	3.79	3.79	2.17	2.17	1.35	1.35	2.57	2.57
38 x 38	1 1/2 x 1 1/2	1.0	1.155	6.930	1.47	3.35	3.35	1.76	1.76	1.51	1.51	2.04	2.04
		1.2	1.380	8.280	1.75	3.95	3.95	2.08	2.08	1.50	1.50	2.42	2.42
		1.6	1.810	10.860	2.31	5.08	5.08	2.67	2.67	1.48	1.48	3.14	3.14
40 x 40	-	1.2	1.430	8.580	1.83	4.54	4.54	2.27	2.27	1.54	1.54	2.72	2.72
		1.6	1.880	11.280	2.39	5.79	5.79	2.90	2.90	1.56	1.56	3.41	3.41
50 x 50	2 x 2	1.2	1.810	10.860	2.31	9.08	9.08	3.63	3.63	1.98	1.98	4.20	4.20
		1.6	2.410	14.460	3.08	12.00	12.00	4.79	4.79	1.97	1.97	5.57	5.57



HOLLOW SECTIONS

4.4 Cold Rolled Rectangular Hollow Sections



APM S001

Nominal Size		Wall Thickness	Calculated Weight		Sectional Area	Moment of Inertia		Sectional Modulus		Radius of Gyration		Plastic Modulus	
						I _x	I _y	Z _x	Z _y	i _x	i _y	S _x	S _y
mm	in	mm	kg/m	kg/6m	cm ²	cm ⁴	cm ⁴	cm ³	cm ³	cm	cm	cm ³	cm ³
25 x 12	1 x 1/2	0.8	0.440	2.409	0.561	0.444	0.139	0.355	0.231	0.889	0.497	0.445	0.264
		1.0	0.543	3.257	0.691	0.536	0.165	0.429	0.276	0.880	0.489	0.553	0.325
		1.2	0.642	3.853	0.818	0.621	0.189	0.496	0.316	0.871	0.481	0.649	0.379
		1.6	0.832	4.991	1.060	0.770	0.229	0.616	0.382	0.853	0.465	0.829	0.478
38 x 19	1 1/2 x 3/4	1.0	0.857	5.141	1.091	2.050	0.691	1.080	0.727	1.370	0.796	1.350	0.829
		1.2	1.020	6.114	1.298	2.400	0.804	1.260	0.847	1.360	0.787	1.600	0.977
		1.6	1.330	8.005	1.700	3.060	1.010	1.610	1.060	1.340	0.771	2.080	1.260
38 x 25	1 1/2 x 1	1.0	0.951	5.706	1.210	2.460	1.280	1.290	1.030	1.420	1.030	1.570	1.180
		1.2	1.130	6.792	1.440	2.890	1.500	1.520	1.200	1.420	1.020	1.860	1.390
		1.6	1.490	8.910	1.890	3.700	1.910	1.950	1.530	1.400	1.010	2.420	1.800
50 x 25	2 x 1	0.8	0.918	4.293	1.170	3.900	1.330	1.560	1.070	1.830	1.070	1.910	1.180
		1.0	1.140	6.836	1.450	4.790	1.630	1.920	1.300	1.820	1.060	2.380	1.460
		1.2	1.360	8.148	1.730	5.650	1.910	2.260	1.530	1.810	1.050	2.820	1.730
		1.6	1.790	10.718	2.280	7.290	2.440	2.910	1.950	1.790	1.030	3.690	2.250
65 x 35	2 1/2 x 1 3/8	1.2	1.810	8.148	2.310	13.070	5.040	4.020	2.880	2.380	1.480	4.910	3.210
		1.6	2.380	14.280	3.030	16.870	6.470	5.190	3.700	2.360	1.460	6.390	4.170
65 x 38	2 1/2 x 1 1/2	1.2	1.866	11.196	2.380	13.800	6.060	4.250	3.190	2.410	1.600	5.140	3.560
		1.6	2.490	14.938	3.170	18.300	7.940	5.630	4.180	2.400	1.580	6.910	4.750
75 x 25	3 x 1	1.2	1.810	6.836	2.310	15.310	2.730	4.080	2.180	2.580	1.090	5.240	2.400
		1.6	2.380	14.279	3.030	20.100	3.510	5.350	2.810	2.550	1.070	7.120	3.210
75 x 38	3 x 1 1/2	1.2	2.055	6.836	2.620	19.560	6.870	5.220	3.610	2.730	1.620	6.390	4.000
		1.6	2.710	16.239	3.450	25.300	8.850	6.760	4.660	2.710	1.600	8.590	5.340

4 HOLLOW SECTIONS

4.5 Cold Formed Square Hollow Sections

Technical Specification References

BS EN 10219

Classification	Specification	Designation of Grade	Mechanical Properties				Chemical Composition %								Impact Properties		
			Tensile Strength		Yield Strength Min.	Elongation Min.		C	Si	Mn	P	S	Mo	Al	CEV	Test Temperature	Min Average Absorbed Energy for Standard Test Piece
						CHS	RHS / SHS										
			N/mm ²			%											
Cold Formed Welded Structural Hollow Sections of Non-alloy and Fine Grain Steels	BS EN 10219	S235JRH	360-510	340-470	235	24		0.17	-	1.40	0.045	0.045	-	-	0.35	20	27
		S275JRH	430-580	410-560	275	20		0.20	-	1.50	0.040	0.040	-	-	0.40	20	27
		S275J0H	430-580	410-560	275	20		0.20	-	1.50	0.040	0.040	-	-	0.40	0	27
		S275J2H	430-580	410-560	275	20		0.20	-	1.50	0.035	0.035	-	-	0.40	-20	27
		S355JRH	510-680	490-630	355	20		0.22	0.55	1.60	0.040	0.040	-	-	0.45	20	27
		S355J0H	510-680	490-630	355	20		0.22	0.55	1.60	0.040	0.040	-	-	0.45	0	27
		S355J2H	510-680	490-630	355	20		0.22	0.55	1.60	0.035	0.035	-	-	0.45	-20	27
Structural Steel Hollow Sections for Australian Standard	AS 1163	C 250	320		250	22	18	0.12	0.05	0.50	0.040	0.030	0.10	0.10	0.25	-	-
		C 250 Lo	320		250	22	18	0.12	0.05	0.50	0.040	0.030	0.10	0.10	0.25	0	27
		C 350	430		350	20	16	0.20	0.25	1.60	0.040	0.030	0.10	0.10	0.39	-	-
		C 350 Lo	430		350	20	16	0.20	0.25	1.60	0.040	0.030	0.10	0.10	0.39	0	27
		C 450	500		450	16	14	0.20	0.45	1.60	0.040	0.030	0.35	0.10	0.39	-	-
		C 450 Lo	500		450	16	14	0.20	0.45	1.60	0.040	0.030	0.35	0.10	0.39	0	27
Carbon Steel Square Pipes for General Structural Purposes	JIS G 3466	STKR 400	400		245	-	23 (N1)	0.25	-	-	0.04	0.04	-	-	-	-	-
		STKR 490	490		325	-	23 (N1)	0.18	0.55	1.50	0.04	0.04	-	-	-	-	-
Carbon Steel Tubes for General	JIS G 3444	STK 290	290		-	30 (N1)	-	-	-	-	0.050	0.050	-	-	-	-	-
						20 (N2)	-	-	-	-	-	-	-	-	-		
		STK 400	400		235	23 (N1)	-	0.250	-	-	0.040	0.040	-	-	-	-	-
						18 (N2)	-	0.250	-	-	0.040	0.040	-	-	-	-	-
		STK 500	500		355	15 (N1)	-	0.300 to 1.00	0.300	0.350	0.040	0.040	-	-	-	-	-
						10 (N2)	-	0.300 to 1.00	0.300	0.350	0.040	0.040	-	-	-	-	-
STK 540	540		390	20 (N1)	-	0.230	1.500	0.550	0.040	0.040	-	-	-	-	-	-	
				16 (N2)	-	0.230	1.500	0.550	0.040	0.040	-	-	-	-	-	-	
Square & Rectangular Hollow Sections	ASTM A-500	Grade A	310		269	As specified in A-500 Specification		0.30	-	-	0.045	0.045	-	-	-	-	-
		Grade B	400		317			0.30	-	-	0.045	0.045	-	-	-	-	-
		Grade C	427		345			0.27	-	1.35	0.035	0.035	-	-	-	-	-
		Grade D	400		250			0.30	-	-	0.045	0.045	-	-	-	-	-
Lipped Channles & Plain Channels	JIS G 3350	SSC 400	400-540		245	21 (N2)		0.25	-	-	0.05	0.05	-	-	-	-	-
	SS 104	400-550	250		21	0.25		-	-	0.25	0.25		-	-	-	-	-
High Tensile C Purlin	Equivalent to ASTM A446 Gr. B	-	450		345	12.00		0.40	-	-	0.20	0.04	-	-	-	-	-

Notes:

- SS 104 specification can be produced upon request.
- The impact properties of steel qualities JR and J0 are verified by laboratory testing only when specified at the time of the inquiry and order.
- The steel qualities J0 and J2 can be produced upon request with extra cost.
- (N1) Test piece No. 11 and 12.
- (N2) Test piece No. 5
 - When the tensile test is carried out on No. 5 and 12 test piece for the tube under 8mm in wall thickness, the minimum elongation value shall be determined by reducing 1.5% per 1mm of decrease in wall thickness from the values given in the Table above and rounding off the value obtained to integer in accordance with JIS Z 8401.
- t - Thickness
 CHS - Circular Hollow Sections
 RHS - Rectangular Hollow Sections
 SHS - Square Hollow Sections

4 HOLLOW SECTIONS

4.5 Cold Formed Square Hollow Sections

Tolerances

BS EN 10219

	Type	Cold Formed Welded Structural Hollow Sections of Non-alloy and Fine Grain Steels	
		BS EN 10219	
Outside Dimension (OD)	CHS	$\pm 1\%$ with a min. of $\pm 0.5\text{mm}$ and a max. of $\pm 10\text{mm}$	
	SHS & RHS	Size (mm)	Tolerance
		$H, B < 100\text{mm}$	$\pm 1\%$ with a min. of $\pm 0.5\text{mm}$
		$100\text{mm} \leq H, B \leq 200\text{mm}$	$\pm 0.8\%$
Thickness (t)	CHS	$H, B > 200\text{mm}$	$\pm 0.6\%$
		For $OD \leq 406.4\text{mm}$	$\pm 10\%$
		$t \leq 5\text{mm}$	$\pm 0.50\text{mm}$
		$t > 5\text{mm}$	$\pm 10\%$
	SHS & RHS	For $OD > 406.4\text{mm}$	$\pm 10\%$ with a max. of 2mm
		$t \leq 5\text{mm}$	$\pm 10\%$
Tolerances of Length	CHS SHS & RHS	$t > 5\text{mm}$	$\pm 0.50\text{mm}$
Out of Roundness	CHS	2% for hollow sections having a diameter to thickness ratio not exceeding 100	
Concavity / Convexity	SHS & RHS	max. 0.8% with a min. of 0.5mm	
Squareness of Size	SHS & RHS	$90^\circ \pm 1^\circ$	
External Corner Profile	SHS & RHS	$t \leq 6\text{mm}$	1.6T to 2.4T
		$6\text{mm} < t \leq 10\text{mm}$	2.0T to 3.0T
		$10\text{mm} < t$	2.4T to 3.6T
Twist	SHS & RHS	2mm plus 0.50mm/m length	
Straightness	CHS	0.2% of total length	
	SHS & RHS	0.15% of total length	
Mass	CHS	$\pm 6\%$ on individual length	
	SHS & RHS	$\pm 6\%$ on individual length	

Notes:

CHS - Circular Hollow Sections

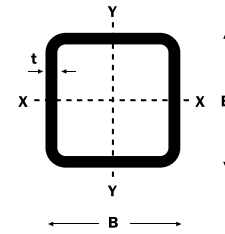
RHS - Rectangular Hollow Sections

SHA - Square Hollow Sections



HOLLOW SECTIONS

4.5 Cold Formed Square Hollow Sections



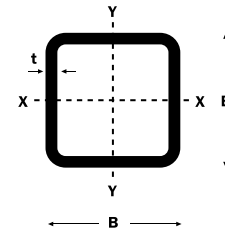
BS EN 10219

Designation		Weight			Cross Sectional Area	Ratio for Local Buckling	Second Moment of Area	Radius of Gyration	Elastic Modulus	Plastic Modulus	Torsional Constant		Superficial Area per Metre Length	Normal Length per Tonne
Size	Thickness	M			A	B/t	I	r	Z	S	J	C	As	L
B x B	t	kg/m	kg/ft	lb/ft	cm ²		cm ⁴	cm	cm ³	cm ³	cm ⁴	cm ³	m ² /m	m
mm	mm													
20 x 20	1.60	0.873	0.266	0.586	1.11	7.5	0.608	0.74	0.61	0.75	1.03	0.924	0.075	1145.9
25 x 25	1.60	1.12	0.343	0.755	1.43	10.6	1.28	0.94	1.02	1.24	2.12	1.54	0.095	889.8
	2.00	1.36	0.416	0.916	1.74	7.5	1.48	0.92	0.19	1.47	2.53	1.80	0.093	733.4
	2.30	1.53	0.467	1.03	1.95	5.9	1.61	0.91	1.29	1.62	2.80	1.97	0.092	652.5
	2.50	1.64	0.500	1.10	2.09	5.0	1.69	0.90	1.35	1.71	2.97	2.07	0.091	609.8
	3.00	1.89	0.576	1.27	2.41	3.3	1.84	0.87	1.47	1.91	3.33	2.27	0.090	529.0
30 x 30	1.60	1.38	0.419	0.92	1.75	13.8	2.31	1.15	1.54	1.84	3.77	2.32	0.115	727.2
	2.00	1.68	0.511	1.13	2.14	10.0	2.72	1.31	1.81	2.21	4.54	2.75	0.113	596.1
	2.30	1.89	0.577	1.27	2.41	8.0	2.99	1.11	2.00	2.45	5.07	3.03	0.112	528.1
	2.50	2.03	0.619	1.37	2.59	7.0	3.16	1.10	2.10	2.61	5.40	3.20	0.111	492.0
32 x 32	3.00	2.36	0.720	1.59	3.01	5.0	3.50	1.08	2.34	2.96	6.15	3.58	0.110	423.5
35 x 35	1.60	1.48	0.450	0.992	1.88	15.0	2.84	1.23	1.78	2.12	4.62	2.68	0.123	677.7
	2.00	1.80	0.550	1.21	2.30	11.0	3.36	1.21	2.10	2.54	5.58	3.18	0.121	554.6
	2.30	2.04	0.621	1.37	2.60	8.9	3.71	1.20	2.32	2.84	6.24	3.52	0.120	490.7
	2.50	2.19	0.667	1.47	2.79	7.8	3.92	1.19	2.45	3.02	6.66	3.72	0.119	456.7
	3.00	2.55	0.777	1.71	3.25	5.7	4.38	1.16	2.74	3.44	7.62	4.18	0.118	392.2
38 x 38	1.60	1.63	0.496	1.093	2.07	16.9	3.79	1.35	2.16	2.57	6.11	3.26	0.135	614.9
	2.00	1.99	0.607	1.34	2.54	12.5	4.51	1.33	2.58	3.09	7.41	3.89	0.133	502.1
	2.30	2.25	0.687	1.52	2.87	10.2	4.99	1.32	2.85	3.46	8.31	4.32	0.132	443.5
	2.50	2.42	0.739	1.63	3.09	9.0	5.29	1.31	3.02	3.69	8.89	4.58	0.131	412.4
	3.00	2.83	0.863	1.90	3.61	6.7	5.95	1.28	3.40	4.23	10.22	5.18	0.130	353.0
40 x 40	1.60	1.78	0.542	1.19	2.26	18.8	4.92	1.47	2.59	3.06	7.9	3.90	0.147	562.8
	2.00	2.18	0.664	1.46	2.78	14.0	5.88	1.46	3.10	3.70	9.6	4.67	0.145	458.7
	2.30	2.47	0.753	1.66	3.15	11.5	6.54	1.44	3.44	4.15	10.8	5.20	0.144	404.6
	2.50	2.66	0.811	1.79	3.39	10.2	6.94	1.43	3.65	4.44	11.6	5.53	0.143	375.9
	3.00	3.12	0.949	2.09	3.97	7.7	7.85	1.41	4.13	5.10	13.3	6.28	0.142	321.0
50 x 50	1.60	1.88	0.572	1.262	2.39	20.0	5.79	1.56	2.90	3.41	9.27	4.36	0.155	532.6
	1.90	2.20	0.671	1.48	2.80	16.1	6.66	1.54	3.33	3.96	10.8	5.02	0.153	454.5
	2.00	2.31	0.703	1.55	2.94	15.0	6.94	1.54	3.47	4.13	11.3	5.23	0.153	433.7
	2.30	2.62	0.797	1.76	3.33	12.4	7.73	1.52	3.86	4.64	12.7	5.83	0.152	382.3
	2.50	2.82	0.859	1.89	3.59	11.0	8.22	1.51	4.11	4.97	13.6	6.21	0.151	354.9
60 x 60	3.00	3.30	1.010	2.22	4.21	8.3	9.32	1.49	4.66	5.72	15.8	7.07	0.150	302.7
	1.60	2.38	0.725	1.60	3.03	26.3	11.7	1.96	4.68	5.46	18.5	7.03	0.195	420.2
	1.90	2.80	0.852	1.88	3.56	21.3	13.6	1.95	5.42	6.37	21.6	8.15	0.193	357.6
	2.00	2.93	0.894	1.97	3.74	20.0	14.1	1.95	5.66	6.66	22.6	8.51	0.193	340.9
	2.30	3.34	1.02	2.24	4.25	16.7	15.9	1.93	6.34	7.52	25.6	9.55	0.192	299.6
	2.50	3.60	1.10	2.42	4.59	15.0	16.9	1.92	6.78	8.07	27.5	10.22	0.191	277.6
	3.00	4.25	1.29	2.85	5.41	11.7	19.5	1.90	7.79	9.39	32.1	11.8	0.190	235.5
	4.00	5.45	1.66	3.67	6.95	7.5	23.7	1.85	9.49	11.70	40.4	14.4	0.186	183.3
	4.50	6.02	1.83	4.05	7.67	6.1	25.5	1.82	10.20	12.80	44.1	15.6	0.185	166.1
	5.00	6.56	2.00	4.41	8.36	5.0	27.0	1.80	10.80	13.70	47.5	16.6	0.183	152.4
65 x 65	6.00	7.56	2.30	5.08	9.63	3.3	29.5	1.75	11.80	15.30	53.2	18.2	0.179	132.2
	1.60	2.88	0.879	1.94	3.67	32.5	20.7	2.37	6.89	7.99	32.4	10.4	0.235	346.9
	2.30	4.06	1.24	2.73	5.17	21.1	28.3	2.34	9.44	11.1	45.2	14.2	0.232	246.3
	2.50	4.39	1.34	2.95	5.59	19.0	30.3	2.33	10.11	11.9	48.7	15.2	0.231	227.9
	3.00	5.19	1.58	3.49	6.61	15.0	35.1	2.31	11.7	14.0	57.1	17.7	0.230	192.8
	4.00	6.71	2.05	4.51	8.55	10.0	43.6	2.26	14.5	17.6	72.6	22.0	0.226	149.0
	4.50	7.43	2.27	4.99	9.47	8.3	47.2	2.23	15.7	19.3	79.8	23.9	0.225	134.5
	2.00	3.88	1.18	2.60	4.94	27.5	32.3	2.56	9.9	11.6	50.9	14.9	0.253	258.0
	2.30	4.42	1.35	2.97	5.63	23.3	36.4	2.54	11.2	13.1	57.9	16.9	0.252	226.2
	2.50	4.78	1.46	3.21	6.09	21.0	39.1	2.53	12.0	14.1	62.4	18.1	0.251	209.2
70 x 70	3.00	5.66	1.72	3.80	7.21	16.7	45.4	2.51	14.0	16.6	73.3	21.0	0.250	176.7
	4.00	7.34	2.24	4.93	9.35	11.3	56.6	2.46	17.4	21.0	93.7	26.3	0.246	136.3
	4.50	8.14	2.48	5.47	10.37	9.4	61.6	2.44	18.9	23.1	103.1	28.7	0.245	122.9
	5.00	8.91	2.72	5.99	11.36	8.0	66.1	2.41	20.3	25.0	112.0	30.9	0.243	112.2
	6.00	10.39	3.17	6.98	13.23	5.8	73.9	2.36	22.7	28.5	128.2	34.7	0.239	96.3
	2.50	5.17	1.58	3.48	6.59	23.0	49.4	2.74	14.1	16.5	78.5	21.2	0.271	193.3
	3.00	6.13	1.87	4.12	7.81	18.3	57.5	2.71	16.4	19.4	92.4	24.7	0.270	163.1
	4.00	7.97	2.43	5.35	10.15	12.5	72.1	2.67	20.6	24.8	118.5	31.1	0.266	125.5
	5.00	9.70	2.96	6.52	12.36	9.0	84.6	2.62	24.2	29.6	142.2	36.7	0.263	103.1
	6.00	11.33	3.45	7.61	14.43	6.7	95.2	2.57	27.2	33.8	163.5	41.4	0.259	88.3
75 x 75	6.30	11.53	3.51	7.75	14.69	6.1	93.8	2.53	26.8	33.8	168.2	42.1	0.253	86.7
	2.30	5.14	1.57	3.46	6.55	27.6	57.1	2.95	15.2	17.7	90.0	22.9	0.292	194.4
	2.50	5.56	1.70	3.74	7.09	25.0	61.4	2.94	16.4	19.1	97.1	24.6	0.291	179.7
	3.00	6.60	2.01	4.44	8.41	20.0	71.6	2.92	19.1	22.5	114.5	28.7	0.290	151.5
	4.00	8.59	2.62	5.77	10.95	13.8	90.2	2.87	24.1	28.8	147.3	36.3	0.286	116.4
	4.50	9.55	2.91	6.42	12.17	11.7	98.6	2.85	26.3	31.7	162.7	39.7	0.285	104.7
	5.00	10.48	3.20	7.05	13.36	10.0	106.3	2.82	28.4	34.5	177.4	42.9	0.283	95.4
	6.00	12.27	3.74	8.25	15.63	7.5	120.2	2.77	32.0	39.6	204.6	48.7	0.279	81.5



HOLLOW SECTIONS

4.5 Cold Formed Square Hollow Sections



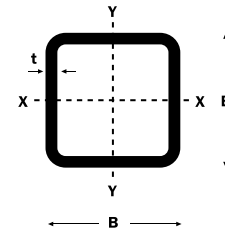
BS EN 10219

Designation		Weight			Cross Sectional Area	Ratio for Local Buckling	Second Moment of Area	Radius of Gyration	Elastic Modulus	Plastic Modulus	Torsional Constant		Superficial Area per Metre Length	Normal Length per Tonne
Size	Thickness													
B x B	t	M			A	B/t	I	r	Z	S	J	C	As	L
mm	mm	kg/m	kg/ft	lb/ft	cm ²		cm ⁴	cm	cm ³	cm ³	cm ⁴	cm ³	m ² /m	m
80 x 80	2.30	5.50	1.68	3.70	7.01	29.8	69.9	3.16	17.5	20.3	109.7	26.2	0.312	181.7
	3.00	7.07	2.16	4.75	9.01	21.7	87.8	3.12	22.0	25.8	139.9	33.0	0.310	141.4
	4.00	9.22	2.81	6.20	11.75	15.0	111.0	3.07	27.8	33.1	180.4	41.8	0.306	108.4
	4.50	10.26	3.13	6.89	13.07	12.8	121.6	3.05	30.4	36.5	199.5	45.9	0.305	97.5
	5.00	11.27	3.43	7.57	14.36	11.0	131.4	3.03	32.9	39.7	217.8	49.7	0.303	88.7
	6.00	13.21	4.03	8.88	16.83	8.3	149.2	2.98	37.3	45.8	252.1	56.6	0.299	75.7
89 x 89	3.00	7.92	2.41	5.32	10.09	24.7	122.9	3.49	27.6	32.3	194.6	41.5	0.346	126.3
	4.00	10.35	3.16	6.69	13.19	17.3	156.2	3.44	35.1	41.6	251.9	52.9	0.342	96.6
	4.50	11.53	3.51	7.75	14.69	14.8	171.6	3.42	38.6	46.0	279.1	58.1	0.341	86.7
	5.00	12.68	3.87	8.52	16.16	12.8	186.1	3.39	41.8	50.2	305.3	63.1	0.339	78.8
	6.00	14.91	4.54	10.02	18.99	9.8	212.5	3.34	47.8	58.1	354.9	72.3	0.335	67.1
90 x 90	2.30	6.23	1.90	4.18	7.93	34.1	100.8	3.56	22.4	25.9	157.5	33.6	0.352	160.6
	3.00	8.01	2.44	5.38	10.21	25.0	127.3	3.53	28.3	33.0	201.4	42.5	0.350	124.8
	4.00	10.48	3.19	7.04	13.35	17.5	161.9	3.48	36.0	42.6	260.8	54.2	0.346	95.4
	4.50	11.67	3.56	7.84	14.87	15.0	177.9	3.46	39.5	47.1	289.0	59.6	0.345	85.7
	5.00	12.84	3.91	8.63	16.36	13.0	192.9	3.43	42.9	51.4	316.3	64.7	0.343	77.9
	6.00	15.10	4.60	10.15	19.23	10.0	220.5	3.39	49.0	59.5	367.8	74.2	0.339	66.2
	6.30	15.49	4.72	10.41	19.73	9.3	221.1	3.35	49.1	60.3	382.4	76.2	0.333	64.6
	8.00	18.87	5.75	12.68	24.04	6.3	254.6	3.25	56.6	71.3	455.6	88.8	0.326	53.0
100 x 100	2.30	6.95	2.12	4.67	8.85	38.5	139.7	3.97	27.9	32.3	217.5	41.9	0.392	143.9
	3.00	8.96	2.73	6.02	11.41	28.3	177.0	3.94	35.4	41.2	278.7	53.2	0.390	111.7
	4.00	11.73	3.58	7.88	14.95	20.0	226.4	3.89	45.3	53.3	362.0	68.1	0.386	85.2
	4.50	13.08	3.99	8.79	16.67	17.2	249.3	3.87	49.9	59.0	401.9	75.1	0.385	76.4
	5.00	14.41	4.39	9.68	18.36	15.0	271.1	3.84	54.2	64.6	440.5	81.7	0.383	69.4
	6.00	16.98	5.18	11.41	21.63	11.7	311.5	3.79	62.3	75.1	514.2	94.1	0.379	58.9
	6.30	17.47	5.32	11.74	22.25	10.9	314.2	3.76	62.8	76.4	536.0	97.0	0.373	57.3
	8.00	21.39	6.52	14.37	27.24	7.5	365.9	3.67	73.2	91.1	644.6	114.2	0.366	46.8
120 x 120	9.00	23.53	7.17	15.81	29.98	6.1	390.6	3.61	78.1	98.6	700.4	122.8	0.361	42.5
	2.30	8.39	2.56	5.64	10.69	47.2	245.3	4.79	40.9	47.0	379.4	61.3	0.472	119.1
	3.00	10.84	3.30	7.28	13.81	35.0	312.3	4.76	52.1	60.2	487.7	78.2	0.470	92.3
	4.00	14.25	4.34	9.57	18.15	25.0	402.3	4.71	67.0	78.3	636.6	100.8	0.466	70.2
	4.50	15.91	4.85	10.69	20.27	21.7	444.7	4.68	74.1	87.0	708.4	111.5	0.465	62.9
	5.00	17.55	5.35	11.79	22.36	19.0	485.5	4.66	80.9	95.4	778.5	121.8	0.463	57.0
	6.00	20.75	6.32	13.94	26.43	15.0	562.2	4.61	93.7	111.6	913.5	141.2	0.459	48.2
	6.30	21.42	6.53	14.40	27.29	14.0	571.6	4.58	95.3	114.2	955.5	146.2	0.453	46.7
	8.00	26.41	8.05	17.75	33.64	10.0	676.9	4.49	112.8	137.8	1163.0	174.6	0.446	37.9
125 x 125	9.00	29.19	8.90	19.61	37.18	8.3	730.0	4.43	121.7	150.3	1274.0	189.3	0.441	34.3
	3.00	11.31	3.45	7.06	14.41	36.7	354.5	4.96	56.7	65.6	552.7	85.1	0.490	88.4
	4.00	14.87	4.53	9.99	18.95	26.3	457.2	4.91	73.2	85.3	722.0	109.9	0.486	67.2
	4.50	16.62	5.06	11.17	21.17	22.8	505.8	4.89	80.9	94.8	803.9	121.7	0.485	60.2
	5.00	18.33	5.59	12.32	23.36	20.0	552.6	4.86	88.4	104.1	883.8	133.0	0.483	54.5
	6.00	21.69	6.61	14.58	27.63	15.8	640.9	4.82	102.5	121.9	1038.1	154.5	0.479	46.1
	6.30	22.41	6.83	15.06	28.55	14.8	652.6	4.78	104.4	124.9	1086.5	160.1	0.473	44.6
	8.00	27.67	8.43	18.59	35.24	10.6	775.3	4.69	124.1	151.0	1325.4	191.7	0.466	36.1
140 x 140	9.00	30.60	9.33	20.56	38.98	8.9	837.8	4.64	134.1	164.9	1454.1	208.2	0.461	32.7
	4.00	16.76	5.11	11.26	21.35	30.0	651.6	5.52	93.1	108.2	1023.3	139.8	0.546	59.7
	5.00	20.69	6.31	13.90	26.36	23.0	790.6	5.48	112.9	132.3	1255.8	169.8	0.543	48.3
	6.00	24.52	7.47	16.48	31.23	18.3	920.4	5.43	131.5	155.3	1478.8	197.9	0.539	40.8
	6.30	25.38	7.74	17.05	32.33	17.2	940.8	5.39	134.4	159.6	1549.6	205.4	0.533	39.4
	8.00	31.43	9.58	21.12	40.04	12.5	1126.8	5.30	161.0	194.2	1900.9	247.7	0.526	31.8
	10.00	38.12	11.62	25.62	48.57	9.0	1311.7	5.20	187.4	230.4	2274.0	290.9	0.517	26.2
	12.00	43.38	13.22	29.15	55.26	6.7	1398.3	5.03	199.8	252.9	2567.3	321.7	0.498	23.1
150 x 150	12.50	44.78	13.65	30.09	57.04	6.2	1425.2	5.00	203.6	259.2	2634.6	329.0	0.496	22.3
	3.00	13.67	4.17	9.18	17.41	45.0	622.7	5.98	83.0	95.5	964.6	124.6	0.590	73.2
	4.00	18.01	5.49	12.10	22.95	32.5	807.8	5.93	107.7	124.9	1264.8	161.7	0.586	55.5
	4.50	20.15	6.14	13.54	25.67	28.3	896.3	5.91	119.5	139.1	1410.8	179.5	0.585	49.6
	5.00	22.26	6.78	14.96	28.36	25.0	982.1	5.89	130.9	153.0	1554.1	196.8	0.583	44.9
	6.00	26.40	8.05	17.74	33.63	20.0	1145.9	5.84	152.8	179.9	1832.7	229.8	0.579	37.9
	6.30	27.36	8.34	18.38	34.85	18.8	1173.7	5.80	156.5	185.1	1921.6	238.8	0.573	36.6
	8.00	33.95	10.35	22.81	43.24	13.8	1411.8	5.71	188.2	226.0	2364.2	289.0	0.566	29.5
	9.00	37.66	11.48	25.31	47.98	11.7	1537.4	5.66	205.0	248.2	2608.1	316.0	0.561	26.6
160 x 160	12.50	48.70	14.85	32.73	62.04	7.0	1817.4	5.41	242.3	305.6	3321.3	389.3	0.536	20.5
	4.00	19.27	5.87	12.95	24.55	35.0	987.2	6.34	123.4	142.8	1541.5	185.3	0.626	51.9
	5.00	23.83	7.26	16.01	30.36	27.0	1202.4	6.29	150.3	175.2	1896.3	225.8	0.623	42.0
	6.00	28.29	8.62	19.01	36.03	21.7	1405.5	6.25	175.7	206.2	2238.9	264.2	0.619	35.4
	6.30	29.34	8.94	19.71	37.37	20.4	1442.1	6.21	180.3	212.6	2348.6	274.7	0.613	34.1
	8.00	36.46	11.11	24.50	46.44	15.0	1741.2	6.12	217.7	260.1	2896.7	333.6	0.606	27.4
	10.00	44.40	13.53	29.84	56.57	11.0	2047.7	6.02	256.0	310.9	3490.5	395.1	0.597	22.5
	12.00	50.91	15.52	34.21	64.86	8.3	2224.4	5.86	278.0	346.1	3997.1	443.2	0.578	19.6
	12.50	52.63	16.04	35.37	67.04	7.8	2275.0	5.83	284.4	355.7	4114.5	454.6	0.576	19.0
160 x 160	16.00	63.72	19.42	42.82	81.17	5.0	2546.4	5.60	318.3	412.7	4799.8	519.8	0.558	15.7



HOLLOW SECTIONS

4.5 Cold Formed Square Hollow Sections



BS EN 10219

Designation		Weight			Cross Sectional Area	Ratio for Local Buckling	Second Moment of Area	Radius of Gyration	Elastic Modulus	Plastic Modulus	Torsional Constant		Superficial Area per Metre Length	Normal Length per Tonne
Size	Thickness													
B x B	t	M			A	B/t	I	r	Z	S	J	C	As	L
mm	mm	kg/m	kg/ft	lb/ft	cm ²		cm ⁴	cm	cm ³	cm ³	cm ⁴	cm ³	m ² /m	m
180 x 180	4.00	21.78	6.64	14.64	27.75	40.0	1421.7	7.16	158.0	182.2	2210.2	237.1	0.706	45.9
	4.50	24.39	7.43	16.39	31.07	35.0	1581.3	7.13	175.7	203.3	2469.1	263.8	0.705	41.0
	5.00	26.97	8.22	18.12	34.36	31.0	1736.9	7.11	193.0	224.0	2724.2	289.8	0.703	37.1
	6.00	32.05	9.77	21.54	40.83	25.0	2036.5	7.06	226.3	264.4	3222.7	340.0	0.699	31.2
	6.30	33.29	10.15	22.37	42.41	23.6	2095.6	7.03	232.8	273.1	3382.8	354.1	0.693	30.0
	8.00	41.48	12.64	27.87	52.84	17.5	2545.9	6.94	282.9	335.7	4188.7	432.2	0.686	24.1
	9.00	46.14	14.06	31.01	58.78	15.0	2789.1	6.89	309.9	370.4	4639.9	474.9	0.681	21.7
200 x 200	4.00	24.29	7.40	16.32	30.95	45.0	1968.1	7.97	196.8	226.4	3048.7	295.3	0.786	41.2
	4.50	27.21	8.30	18.29	34.67	39.4	2191.5	7.95	219.2	252.9	3408.4	328.9	0.785	36.7
	5.00	30.11	9.18	20.23	38.36	35.0	2410.1	7.93	241.0	278.9	3763.3	361.8	0.783	33.2
	6.00	35.82	10.92	24.07	45.63	28.3	2832.7	7.88	283.3	329.7	4458.8	425.5	0.779	27.9
	6.30	37.25	11.35	25.03	47.45	26.7	2921.5	7.85	292.2	341.2	4682.2	443.5	0.773	26.8
	8.00	46.51	14.17	31.25	59.24	20.0	3566.3	7.76	356.6	420.9	5815.3	543.6	0.766	21.5
	9.00	51.79	15.79	34.80	65.98	17.2	3918.5	7.71	391.8	465.3	6454.1	598.9	0.761	19.3
	10.00	56.96	17.36	38.28	72.57	15.0	4251.1	7.65	425.1	508.1	7071.9	651.5	0.757	17.6
	12.00	65.99	20.11	44.34	84.06	11.7	4730.2	7.50	473.0	575.6	8230.6	743.4	0.738	15.2
	12.50	68.33	20.83	45.92	87.04	11.0	4859.4	7.47	485.9	593.5	8502.3	765.5	0.736	14.6
	16.00	83.82	25.55	56.32	106.77	7.5	5625.0	7.26	562.5	705.6	10211.5	900.8	0.718	11.9
220 x 220	5.00	33.25	10.33	22.34	42.36	39.0	3238.0	8.74	294.4	339.7	5037.7	441.8	0.863	30.1
	6.00	39.59	12.07	26.60	50.43	31.7	3813.4	8.70	346.7	402.2	5976.2	520.6	0.859	25.3
	6.30	41.20	12.56	27.69	52.49	29.9	3939.9	8.66	358.2	416.8	6277.3	543.0	0.853	24.3
	8.00	51.53	15.71	34.63	65.64	22.5	4828.0	8.58	438.9	515.6	7815.0	667.9	0.846	19.4
	10.00	63.24	19.28	42.50	80.57	17.0	5782.5	8.47	525.7	624.6	9533.0	803.6	0.837	15.8
	12.00	73.52	22.41	49.40	93.66	13.3	6486.8	8.32	589.7	712.0	11149.4	922.3	0.818	13.6
	12.50	76.18	23.22	51.19	97.04	12.6	6674.0	8.29	606.7	734.9	11530.3	950.8	0.816	13.1
	16.00	93.86	28.61	63.07	119.57	8.8	7812.2	8.08	710.2	880.8	13972.3	1129.5	0.798	10.7
250 x 250	5.00	37.96	11.57	25.51	48.36	45.0	4805.0	9.97	384.4	442.3	7443.0	576.8	0.983	26.3
	6.00	45.24	13.79	30.40	57.63	36.7	5672.0	9.92	453.8	524.4	8842.5	681.2	0.979	22.1
	6.30	47.14	14.37	31.68	60.05	34.7	5872.6	9.89	469.8	544.4	9290.4	711.2	0.973	21.2
	8.00	59.07	18.00	39.69	75.24	26.3	7229.2	9.80	578.3	675.8	11597.9	878.2	0.966	16.9
	9.00	65.92	20.09	44.30	83.98	22.8	7983.8	9.75	638.7	750.0	12913.5	971.7	0.961	15.2
	10.00	72.66	22.15	48.83	92.57	20.0	8706.7	9.70	696.5	822.0	14197.5	1061.8	0.957	13.8
	12.00	84.83	25.86	57.00	108.06	15.8	9859.4	9.55	788.8	943.6	16692.0	1226.5	0.938	11.8
	12.50	87.95	26.81	59.10	112.04	15.0	10161.3	9.52	812.9	975.2	17283.4	1266.3	0.936	11.4
	16.00	108.94	33.20	73.20	138.77	10.6	12047.1	9.32	963.8	1179.7	21147.9	1520.3	0.918	9.2
260 x 260	6.00	47.13	14.36	31.67	60.03	38.3	6404.5	10.33	492.7	568.8	9969.8	739.5	1.019	21.2
	6.30	49.12	14.97	33.01	62.57	36.3	6635.0	10.30	510.4	590.7	10475.3	772.3	1.013	20.4
	8.00	61.58	18.77	41.38	78.44	27.5	8178.0	10.21	629.1	733.9	13087.0	954.7	1.006	16.2
	10.00	75.80	23.11	50.94	96.57	21.0	9864.6	10.11	758.8	893.8	16035.7	1155.9	0.997	13.2
	12.00	88.59	27.00	59.53	112.86	16.7	11199.5	9.96	861.5	1028.0	18878.9	1337.5	0.978	11.3
	12.50	91.88	28.00	61.74	117.04	15.8	11547.9	9.93	888.3	1062.0	19554.1	1381.4	0.976	10.9
	16.00	113.96	34.74	76.58	145.17	11.3	13738.8	9.73	1056.8	1288.9	23987.3	1663.4	0.958	8.8
300 x 300	6.00	54.66	16.66	36.73	69.63	45.0	9963.7	11.96	664.2	764.2	15433.9	996.8	1.179	18.3
	6.30	57.03	17.38	38.32	72.65	42.6	10342.0	11.93	689.5	794.9	16218.5	1041.9	1.173	17.5
	9.00	80.05	24.40	53.79	101.98	28.3	14183.3	11.79	945.6	1102.1	22661.2	1434.4	1.161	12.5
	10.00	88.36	26.93	59.38	112.57	25.0	15519.4	11.74	1034.6	1210.9	24966.0	1572.0	1.157	11.3
	12.00	103.67	31.60	69.66	132.06	20.0	17767.4	11.60	1184.5	1401.5	29514.8	1829.4	1.138	9.6
	12.50	107.58	32.79	72.29	137.04	19.0	18348.1	11.57	1223.2	1450.6	30601.7	1891.8	1.136	9.3
	16.00	134.06	40.86	90.08	170.77	13.8	22076.0	11.37	1471.7	1773.8	37838.6	2299.3	1.118	7.5
350 x 350	6.00	64.08	19.53	43.06	81.63	53.3	16007.7	14.00	914.7	1049.0	24682.8	1372.4	1.379	15.6
	6.30	66.92	20.40	44.97	85.25	50.6	16644.6	13.97	951.1	1092.7	25939.1	1435.5	1.373	14.9
	8.00	84.19	25.66	56.57	107.24	38.8	20680.7	13.89	1181.8	1365.6	32557.6	1787.1	1.366	11.9
	9.00	94.18	28.71	63.29	119.98	33.9	22967.0	13.84	1312.4	1521.8	36372.1	1987.2	1.361	10.6
	10.00	104.06	31.72	69.93	132.57	30.0	25189.1	13.78	1439.4	1674.8	40127.4	2182.2	1.357	9.6
	12.00	122.51	37.34	82.32	156.06	24.2	29054.0	13.64	1660.2	1949.5	47599.0	2552.1	1.338	8.2
	12.50	127.20	38.77	85.48	162.04	23.0	30044.9	13.62	1716.9	2019.8	49394.6	2642.2	1.336	7.9
	16.00	159.18	48.517	106.961	202.77	16.9	36511.5	13.42	2086.4	2488.0	61483.2	3237.9	1.318	6.3

Note:

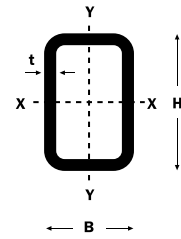
The calculation of sectional properties is based on BS EN 10219 with the following corner geometry :

Size Range	Inside Corner Radii	Outside Corner Radii
	mm	mm
Thickness ≤ 6mm	1T	2T
6mm > Thickness ≤ 10mm	1.5T	2.5T
Thickness > 10mm	2T	3.0T



HOLLOW SECTIONS

4.6 Cold Formed Rectangular Hollow Sections



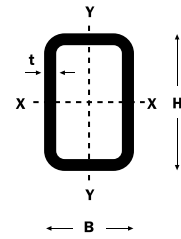
BS EN 10219

Designation		Weight			Area of Section	Ratio for Local Buckling		Second Moment of Area		Radius of Gyration		Elastic Modulus		Plastic Modulus		Torsional Constant		Superficial Area per Metre Length	Normal Length per Tonne
Size	Thickness					Flange	Web												
H x B	t	M			A	Flange	Web	Axis x-x	Axis y-y	Axis x-x	Axis y-y	Axis x-x	Axis y-y	Axis x-x	Axis y-y	J	C	As	L
mm	mm	kg/m	kg/ft	lb/ft	cm ²	B/t	H/t	cm ⁴	cm ⁴	cm	cm	cm ³	cm ³	cm ³	cm ³	cm ⁴	cm ³	m ² /m	m
38 x 19	1.60	1.30	0.396	0.873	1.66	6.9	18.8	2.91	0.973	1.33	0.766	1.53	1.02	1.95	1.20	2.46	1.79	0.109	769.4
38 x 25	1.60	1.45	0.442	0.975	1.85	10.6	18.8	3.55	1.85	1.39	1.00	1.87	1.48	2.30	1.72	3.99	2.45	0.121	689.5
40 x 20	2.00	1.68	0.511	1.13	2.14	15.0	5.0	1.30	4.00	0.79	1.38	1.34	2.02	1.60	2.61	3.45	2.36	0.113	596.1
	2.50	2.03	0.619	1.37	2.59	11.0	3.0	1.50	4.70	0.77	1.35	1.54	2.35	1.88	3.09	4.06	2.72	0.111	492.0
	3.00	2.36	0.720	1.59	3.01	8.3	1.7	1.70	5.20	0.75	1.32	1.68	2.60	2.12	3.50	4.57	3.00	0.110	423.5
50 x 25	1.60	1.75	0.534	1.18	2.23	10.6	26.3	7.02	2.37	1.77	1.03	2.81	1.90	3.53	2.17	5.85	3.29	0.145	570.8
	2.00	2.15	0.655	1.44	2.74	7.5	20.0	8.38	2.81	1.75	1.01	3.35	2.25	4.26	2.62	7.06	3.92	0.143	465.4
	2.30	2.44	0.742	1.64	3.10	5.9	16.7	9.31	3.10	1.73	1.00	3.72	2.48	4.78	2.92	7.90	4.34	0.142	410.6
	2.50	2.62	0.799	1.76	3.34	5.0	15.0	9.89	3.28	1.72	0.99	3.95	2.62	5.11	3.12	8.43	4.60	0.141	381.5
	3.00	3.07	0.935	2.06	3.91	3.3	11.7	11.2	3.67	1.69	0.97	4.47	2.93	5.86	3.56	9.64	5.18	0.140	325.9
50 x 30	2.00	2.31	0.703	1.55	2.94	20.0	10.0	4.29	9.54	1.21	1.80	2.86	3.81	3.33	4.74	9.77	4.84	0.153	433.7
	2.50	2.82	0.859	1.89	3.59	15.0	7.0	5.05	11.3	1.19	1.77	3.37	4.52	3.98	5.70	11.7	5.72	0.151	354.9
	3.00	3.30	1.007	2.22	4.21	11.7	5.0	5.70	12.8	1.16	1.75	3.80	5.13	4.58	6.57	13.5	6.49	0.150	302.7
60 x 40	4.00	4.20	1.280	2.82	5.35	7.5	2.5	6.69	15.3	1.12	1.69	4.46	6.10	5.58	8.05	16.5	7.71	0.146	238.2
	2.00	2.93	0.894	1.97	3.74	25.0	15.0	9.8	18.4	1.62	2.22	4.92	6.14	5.65	7.47	20.7	8.12	0.193	340.9
	2.50	3.60	1.098	2.42	4.59	19.0	11.0	11.7	22.1	1.60	2.19	5.87	7.36	6.84	9.06	25.1	9.72	0.191	277.6
	3.00	4.25	1.294	2.85	5.41	15.0	8.3	13.4	25.4	1.58	2.17	6.72	8.46	7.94	10.5	29.3	11.2	0.190	235.5
	4.00	5.45	1.662	3.67	6.95	10.0	5.0	16.3	31.0	1.53	2.11	8.14	10.3	8.89	13.2	36.7	13.7	0.186	183.3
65 x 35	5.00	6.56	1.999	4.41	8.36	7.0	3.0	18.4	35.3	1.48	2.06	9.21	11.8	11.5	15.4	42.8	15.6	0.183	152.4
	1.60	2.30	0.725	1.60	3.03	16.9	35.6	16.9	6.5	2.36	1.46	5.19	3.70	6.39	4.17	15.1	6.32	0.195	420.2
	1.90	2.80	0.852	1.88	3.56	13.4	29.2	19.5	7.5	2.34	1.45	6.01	4.26	7.46	4.85	17.6	7.30	0.193	357.6
	2.00	2.93	0.89	1.97	3.74	12.5	27.5	20.4	7.8	2.34	1.44	6.28	4.44	7.80	5.07	18.4	7.62	0.193	340.9
	2.30	3.34	1.02	2.24	4.25	10.2	23.3	22.9	8.7	2.32	1.43	7.04	4.96	8.81	5.72	20.8	8.53	0.192	299.6
65 x 38	2.50	3.60	1.10	2.42	4.59	9.0	21.0	24.4	9.3	2.31	1.42	7.52	5.29	9.45	6.13	22.3	9.1	0.191	277.6
	3.00	4.25	1.29	2.85	5.41	6.7	16.7	28.1	10.6	2.28	1.40	8.65	6.04	11.0	7.11	25.9	10.4	0.190	235.5
	4.00	5.45	1.66	3.67	6.95	3.8	11.3	34.3	12.7	2.22	1.35	10.55	7.27	13.7	8.83	32.2	12.7	0.186	183.3
	1.60	2.46	0.748	1.65	3.13	18.8	35.6	17.8	7.8	2.39	1.58	5.49	4.10	6.70	4.63	17.4	6.91	0.201	407.3
	1.90	2.89	0.880	1.94	3.68	15.0	29.2	20.7	9.0	2.37	1.56	6.36	4.74	7.82	5.40	20.3	8.00	0.199	346.5
70 x 50	2.00	3.03	0.923	2.03	3.86	14.0	27.5	21.6	9.4	2.37	1.56	6.64	4.94	8.18	5.64	21.2	8.35	0.199	330.3
	2.30	3.45	1.05	2.32	4.39	11.5	23.3	24.2	10.5	2.35	1.55	7.46	5.53	9.24	6.37	24.0	9.36	0.198	290.2
	2.50	3.72	1.13	2.50	4.74	10.2	21.0	25.9	11.2	2.34	1.54	7.97	5.90	9.92	6.83	25.8	10.0	0.197	268.8
	3.00	4.39	1.34	2.95	5.59	7.7	16.7	29.8	12.8	2.31	1.51	9.18	6.75	11.5	7.93	30.0	11.5	0.196	228.0
	4.00	5.64	1.72	3.79	7.19	4.5	11.3	36.5	15.5	2.25	1.47	11.24	8.17	14.5	9.89	37.5	14.0	0.192	177.2
75 x 25	2.00	3.56	1.09	2.39	4.54	30.0	20.0	18.8	31.5	2.03	2.63	7.50	8.99	8.58	10.8	37.5	12.20	0.233	280.8
	2.50	4.39	1.34	2.95	5.59	23.0	15.0	22.6	38.0	2.01	2.61	9.04	10.9	10.4	13.2	45.8	14.70	0.231	227.9
	3.00	5.19	1.58	3.49	6.61	18.3	11.7	26.1	44.1	1.99	2.58	10.4	12.6	12.2	15.4	53.6	17.1	0.230	192.8
	4.00	6.71	2.05	4.51	8.55	12.5	7.5	32.2	54.7	1.94	2.53	12.9	15.6	15.4	19.5	68.1	21.2	0.226	149.0
	5.00	8.13	2.48	5.46	10.36	9.0	5.0	37.2	63.5	1.90	2.48	14.9	18.1	18.2	23.1	80.8	24.6	0.223	123.0
75 x 35	1.60	2.38	0.725	1.60	3.03	10.6	41.9	19.7	3.5	2.55	1.07	5.26	2.78	6.81	3.11	9.9	5.05	0.195	420.2
	1.90	2.80	0.852	1.88	3.56	8.2	34.5	22.8	4.0	2.53	1.06	6.09	3.18	7.94	3.61	11.5	5.80	0.193	357.6
	2.00	2.93	0.894	1.97	3.74	7.5	32.5	23.8	4.1	2.53	1.05	6.36	3.31	8.31	3.77	12.0	6.04	0.193	340.9
	2.30	3.34	1.02	2.24	4.25	5.9	27.6	26.7	4.6	2.51	1.04	7.12	3.67	9.37	4.23	13.5	6.72	0.192	299.6
	2.50	3.60	1.10	2.42	4.59	5.0	25.0	28.5	4.9	2.49	1.03	7.60	3.89	10.06	4.53	14.4	7.1	0.191	277.6
75 x 38	3.00	4.25	1.29	2.85	5.41	3.3	20.0	32.7	5.5	2.46	1.01	8.72	4.39	11.7	5.21	16.5	8.1	0.190	235.5
	4.00	5.45	1.66	3.67	6.95	1.3	13.8	39.7	6.5	2.39	0.96	10.59	5.17	14.6	6.39	20.0	9.6	0.186	183.3
	4.50	6.02	1.83	4.05	7.67	0.6	11.7	42.6	6.8	2.36	0.94	11.30	5.45	15.8	6.89	21.4	10.2	0.185	166.1
	1.60	2.71	0.825	1.82	3.45	18.8	41.9	25.3	8.8	2.71	1.60	6.76	4.66	8.34	5.21	21.2	8.03	0.221	369.5
	1.90	3.18	0.971	2.14	4.06	15.0	34.5	29.4	10.2	2.69	1.59	7.85	5.39	9.75	6.08	24.7	9.30	0.219	314.0
80 x 60	2.00	3.34	1.019	2.25	4.26	14.0	32.5	30.8	10.7	2.69	1.58	8.20	5.62	10.21	6.36	25.9	9.71	0.219	299.2
	2.30	3.81	1.16	2.56	4.85	11.5	27.6	34.6	12.0	2.67	1.57	9.23	6.30	11.5	7.19	29.2	10.9	0.218	262.6
	2.50	4.11	1.25	2.76	5.24	10.2	25.0	37.1	12.8	2.66	1.56	9.88	6.73	12.4	7.72	31.4	11.7	0.217	243.2
	3.00	4.86	1.48	3.26	6.19	7.7	20.0	42.8	14.7	2.63	1.54	11.40	7.72	14.5	8.98	36.6	13.4	0.216	205.9
	4.00	6.27	1.91	4.21	7.99	4.5	13.8	52.8	17.9	2.57	1.50	14.10	9.40	18.3	11.2	45.9	16.5	0.212	159.5
80 x 80	4.50	6.94	2.11	4.66	8.84	3.4	11.7	57.1	19.2	2.54	1.47	15.20	10.1	19.9	12.3	50.0	17.8	0.211	144.1
	1.90	3.54	1.08	2.38	4.51	21.3	34.5	35.5	19.1	2.81	2.05	9.48	7.62	11.4	8.7	39.5	12.5	0.243	282.3
	2.00	3.72	1.13	2.50	4.74	20.0	32.5	37.2	19.9	2.80	2.05	9.91	7.96	12.0					



HOLLOW SECTIONS

4.6 Cold Formed Rectangular Hollow Sections



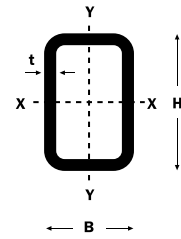
BS EN 10219

Designation		Weight			Area of Section	Ratio for		Second Moment of Area		Radius of Gyration		Elastic Modulus		Plastic Modulus		Torsional Constant		Superficial Area per Metre Length	Normal Length per Tonne
Size	Thickness					Local Buckling	Axis x-x			Axis y-y	Axis x-x	Axis y-y	Axis x-x	Axis y-y	J	C			
H x B	t	M			A	Flange	Web	Axis x-x	Axis y-y	Axis x-x	Axis y-y	Axis x-x	Axis y-y	Axis x-x	Axis y-y	cm ⁴	cm ³	As	L
mm	mm	kg/m	kg/ft	lb/ft	cm ²	B/t	H/t	cm ⁴	cm ⁴	cm	cm	cm ³	cm ³	cm ³	cm ³	cm ⁴	cm ³	m ² /m	m
100 x 40	2.50	5.17	1.58	3.48	6.59	35.0	11.0	18.8	79.3	1.69	3.47	9.39	15.9	10.6	20.2	50.5	16.8	0.271	193.3
	3.00	6.13	1.87	4.12	7.81	28.3	8.3	21.7	92.3	1.67	3.44	10.84	18.5	12.4	23.7	59.0	19.4	0.270	163.1
	4.00	7.97	2.43	5.35	10.15	20.0	5.0	26.7	115.7	1.62	3.38	13.35	23.1	15.7	30.3	74.5	24.0	0.266	125.5
	5.00	9.70	2.96	6.52	12.36	15.0	3.0	30.8	135.6	1.58	3.31	15.38	27.1	18.5	36.1	87.9	27.9	0.263	103.1
	1.90	4.29	1.31	2.88	5.46	21.3	47.6	71.6	24.5	3.62	2.12	14.3	9.8	17.6	10.9	58.7	16.9	0.293	233.2
	2.00	4.50	1.37	3.03	5.74	20.0	45.0	75.0	25.7	3.62	2.12	15.0	10.3	18.5	11.5	61.6	17.7	0.293	222.0
100 x 50	2.30	5.14	1.57	3.46	6.55	16.7	38.5	84.8	29.0	3.60	2.10	17.0	11.6	21.0	13.0	69.9	20.0	0.292	194.4
	2.50	5.56	1.70	3.74	7.09	15.0	35.0	91.2	31.1	3.59	2.09	18.2	12.4	22.7	14.0	75.4	21.5	0.291	179.7
	3.00	6.60	2.01	4.44	8.41	11.7	28.3	106.5	36.1	3.56	2.07	21.3	14.4	26.7	16.4	88.6	25.0	0.290	151.5
	4.00	8.59	2.62	5.77	10.95	7.5	20.0	134.1	44.9	3.50	2.03	26.8	18.0	34.1	20.9	113.0	31.3	0.286	116.4
	4.50	9.55	2.91	6.42	12.17	6.1	17.2	146.6	48.9	3.47	2.00	29.3	19.5	37.6	23.0	124.3	34.2	0.285	104.7
	5.00	10.48	3.20	7.05	13.36	5.0	15.0	158.2	52.5	3.44	1.98	31.6	21.0	40.8	25.0	134.9	36.8	0.283	95.4
100 x 60	6.00	12.27	3.74	8.25	15.63	3.3	11.7	178.8	58.7	3.38	1.94	35.8	23.5	46.9	28.5	154.2	41.4	0.279	81.5
	6.30	12.52	3.82	8.41	15.95	2.9	10.9	175.7	58.2	3.32	1.91	35.1	23.3	46.9	28.6	158.1	42.1	0.273	79.9
	2.50	5.96	1.82	4.00	7.59	35.0	19.0	46.9	103.1	2.49	3.69	15.6	20.6	17.7	25.1	103.3	26.2	0.311	167.9
	3.00	7.07	2.16	4.75	9.01	28.3	15.0	54.6	120.6	2.46	3.66	18.2	24.1	20.8	29.6	121.7	30.6	0.310	141.4
	4.00	9.22	2.81	6.20	11.75	20.0	10.0	68.7	152.6	2.42	3.60	22.9	30.5	26.6	37.9	156.3	38.7	0.306	108.4
	5.00	11.27	3.43	7.57	14.36	15.0	7.0	80.8	180.8	2.37	3.55	26.9	36.2	31.9	45.6	187.9	45.8	0.303	88.7
100 x 75	6.00	13.21	4.03	8.88	16.83	11.7	5.0	91.2	205.3	2.33	3.49	30.4	41.1	36.6	52.5	216.4	51.9	0.299	75.7
	6.30	13.51	4.12	9.08	17.21	10.9	4.5	90.9	203.4	2.30	3.44	30.3	40.7	36.6	52.8	223.4	53.0	0.293	74.0
	3.00	7.78	2.37	5.23	9.91	20.0	28.3	141.8	91.1	3.78	3.03	28.4	24.3	33.9	27.9	176.6	39.1	0.340	128.6
	3.20	8.26	2.52	5.55	10.53	18.4	26.3	149.8	96.2	3.77	3.02	30.0	25.6	35.9	29.5	187.3	41.3	0.339	121.0
	4.00	10.16	3.10	6.83	12.95	13.8	20.0	180.2	115.4	3.73	2.99	36.0	30.8	43.7	35.9	228.2	49.7	0.336	98.4
	4.50	11.32	3.45	7.61	14.42	11.7	17.2	197.9	126.5	3.71	2.96	39.6	33.7	48.3	39.6	252.7	54.6	0.335	88.4
100 x 80	5.00	12.45	3.79	8.36	15.86	10.0	15.0	214.6	137.0	3.68	2.94	42.9	36.5	52.7	43.2	276.2	59.2	0.333	80.3
	6.00	14.63	4.46	9.83	18.63	7.5	11.7	245.1	156.0	3.63	2.89	49.0	41.6	61.0	49.9	320.4	67.7	0.329	68.4
	6.30	14.99	4.57	10.07	19.10	6.9	10.9	244.9	156.3	3.58	2.86	49.0	41.7	61.6	50.5	332.5	69.5	0.323	66.7
	2.50	6.74	2.06	4.53	8.59	35.0	27.0	90.2	126.9	3.24	3.84	22.5	25.4	25.8	30.0	165.8	35.7	0.351	148.3
	3.00	8.01	2.44	5.38	10.21	28.3	21.7	105.6	148.8	3.22	3.82	26.4	29.8	30.4	35.4	196.1	41.9	0.350	124.8
	4.00	10.48	3.19	7.04	13.35	20.0	15.0	134.2	189.5	3.17	3.77	33.5	37.9	39.2	45.6	253.8	53.4	0.346	95.4
120 x 60	5.00	12.84	3.91	8.63	16.36	15.0	11.0	159.6	225.9	3.12	3.72	39.9	45.2	47.2	55.1	307.5	63.7	0.343	77.9
	6.00	15.10	4.60	10.15	19.23	11.7	8.3	182.1	258.4	3.08	3.67	45.5	51.7	54.7	63.8	357.4	73.0	0.339	66.2
	6.30	15.49	4.72	10.41	19.73	10.9	7.7	182.8	258.8	3.04	3.62	45.7	51.8	55.4	64.6	371.4	75.0	0.333	64.6
	2.50	6.74	2.06	4.53	8.59	19.0	43.0	161.2	55.2	4.33	2.53	26.9	18.4	33.2	20.6	132.6	31.7	0.351	148.3
	3.00	8.01	2.44	5.38	10.21	15.0	35.0	189.1	64.4	4.30	2.51	31.5	21.5	39.2	24.2	156.3	37.1	0.350	124.8
	4.00	10.48	3.19	7.04	13.35	10.0	25.0	240.7	81.2	4.25	2.47	40.1	27.1	50.5	31.1	201.1	47.0	0.346	95.4
120 x 80	4.50	11.67	3.56	7.84	14.87	8.3	21.7	264.5	88.9	4.22	2.44	44.1	29.6	55.8	34.3	222.1	51.6	0.345	85.7
	5.00	12.84	3.91	8.63	16.36	7.0	19.0	287.0	96.0	4.19	2.42	47.8	32.0	60.9	37.4	242.2	55.8	0.343	77.9
	6.00	15.10	4.60	10.15	19.23	5.0	15.0	328.0	108.8	4.13	2.38	54.7	36.3	70.6	43.1	279.7	63.6	0.339	66.2
	6.30	15.49	4.72	10.41	19.73	4.5	14.0	327.0	109.2	4.07	2.35	54.5	36.4	71.2	43.7	289.3	65.1	0.333	64.6
	2.50	7.53	2.29	5.06	9.59	27.0	43.0	195.8	105.2	4.52	3.31	32.6	26.3	39.1	29.6	215.8	43.2	0.391	132.8
	3.00	8.96	2.73	6.02	11.41	21.7	35.0	230.2	123.4	4.49	3.29	38.4	30.9	46.2	35.0	255.5	50.8	0.390	111.7
125 x 50	4.00	11.73	3.58	7.88	14.95	15.0	25.0	294.6	157.3	4.44	3.24	49.1	39.3	59.8	45.2	331.2	64.9	0.386	85.2
	4.50	13.08	3.99	8.79	16.67	12.8	21.7	324.6	172.9	4.41	3.22	54.1	43.2	66.2	50.1	367.3	71.5	0.385	76.4
	5.00	14.41	4.39	9.68	18.36	11.0	19.0	353.1	187.8	4.39	3.20	58.9	46.9	72.4	54.7	402.3	77.8	0.383	69.4
	6.00	16.98	5.18	11.41	21.63	8.3	15.0	406.1	215.0	4.33	3.15	67.7	53.8	84.3	63.5	468.5	89.4	0.379	58.9
	6.30	17.47	5.32	11.74	22.25	7.7	14.0	408.5	217.1	4.28	3.12	68.1	54.3	85.6	64.7	487.8	92.1	0.373	57.3
	2.50	6.55	2.00	4.40	8.34	15.0	45.0	159.6	38.1	4.37	2.14	25.5	15.2	32.3	17.0	101.3	27.1	0.341	152.8
125 x 75	3.00	7.78	2.37	5.23	9.91	11.7	36.7	187.0	44.4	4.34	2.12	29.9	17.7	38.1	20.0	119.0	31.6	0.340	128.6
	4.00	10.16	3.10	6.83	12.95	7.5	26.3	237.5	55.6	4.28	2.07	38.0	22.2	49.0	25.5	152.1	39.8	0.336	98.4
	4.50	11.32	3.45	7.61	14.42	6.1	22.8	260.7	60.6	4.25	2.05	41.7	24.2	54.2	28.1	167.4	43.5	0.335	88.4
	5.00	12.45	3.79	8.36	15.86	5.0	20.0	282.5	65.2	4.22	2.03	45.2	26.1	59.1	30.6	182.0	47.0	0.333	80.3
	6.00	14.63	4.46	9.83	18.63	3.3	15.8	322.0	73.3	4.16	1.98	51.5	29.3	68.3	35.1	208.5	53.1	0.329	68.4
	6.30	14.99	4.57	10.07	19.10	2.9	14.8	319.4	73.3	4.09	1.96	51.1	29.3	68.8	35.5	214.6	54.2	0.323	66.7
140 x 80	3.00	8.96	2.73	6.02	11.41	20.0	36.7	242.8	110.5	4.61	3.11	38.9	29.5	47.3	33.3	242.9	49.5	0.390	111.7
	4.00	11.73	3.58	7.88	14.95	13.8	26.3	310.8	140.7	4.56	3.07	49.7	37.5						



HOLLOW SECTIONS

4.6 Cold Formed Rectangular Hollow Sections



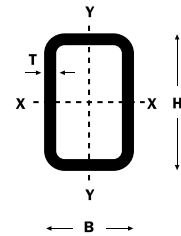
BS EN 10219

Designation		Weight			Area of Section	Ratio for Local Buckling		Second Moment of Area		Radius of Gyration		Elastic Modulus		Plastic Modulus		Torsional Constant		Superficial Area per Metre Length	Normal Length per Tonne
Size	Thickness																		
H x B	t	M			A	Flange	Web	Axis x-x	Axis y-y	Axis x-x	Axis y-y	Axis x-x	Axis y-y	Axis x-x	Axis y-y	J	C	As	L
mm	mm	kg/m	kg/ft	lb/ft	cm²	B/t	H/t	cm⁴	cm⁴	cm	cm	cm³	cm³	cm³	cm³	cm⁴	cm³	m²/m	m
150 x 75	3.00	10.13	3.09	6.81	12.91	20.0	45.0	379.6	130.0	5.42	3.17	50.6	34.7	62.5	38.7	311.8	59.8	0.440	98.7
	4.00	13.30	4.06	8.94	16.95	13.8	32.5	488.0	165.9	5.37	3.13	65.1	44.2	81.1	50.1	404.3	76.6	0.436	75.2
	4.50	14.85	4.53	9.98	18.92	11.7	28.3	538.9	182.5	5.34	3.11	71.9	48.7	90.0	55.5	448.4	84.4	0.435	67.3
	5.00	16.37	4.99	11.00	20.86	10.0	25.0	587.7	198.4	5.31	3.08	78.4	52.9	98.6	60.7	491.0	91.9	0.433	61.1
	6.00	19.34	5.89	12.99	24.63	7.5	20.0	679.1	227.6	5.25	3.04	90.5	60.7	115.1	70.6	572.0	105.8	0.429	51.7
	6.30	19.94	6.08	13.40	25.40	6.9	18.8	685.6	230.9	5.20	3.01	91.4	61.6	117.2	72.2	595.8	109.1	0.423	50.2
	8.00	24.53	7.48	16.48	31.24	4.4	13.8	806.3	269.0	5.08	2.93	107.5	71.7	140.8	86.3	714.5	128.5	0.416	40.8
	9.00	27.07	8.25	18.19	34.48	3.3	11.7	865.5	287.3	5.01	2.89	115.4	76.6	153.0	93.6	775.2	138.1	0.411	36.9
150 x 100	4.00	14.87	4.53	9.99	18.95	20.0	32.5	594.6	318.6	5.60	4.10	79.3	63.7	95.7	72.5	661.6	104.9	0.486	67.2
	4.50	16.62	5.06	11.17	21.17	17.2	28.3	658.1	352.0	5.58	4.08	87.7	70.4	106.3	80.5	736.1	116.1	0.485	60.2
	5.00	18.33	5.59	12.32	23.36	15.0	25.0	719.2	384.0	5.55	4.05	95.9	76.8	116.7	88.3	808.7	126.8	0.483	54.5
	6.00	21.69	6.61	14.58	27.63	11.7	20.0	834.7	444.2	5.50	4.01	111.3	88.8	136.7	103.3	948.3	147.1	0.479	46.1
	6.30	22.41	6.83	15.06	28.55	10.9	18.8	848.3	452.7	5.45	3.98	113.1	90.5	139.9	105.9	991.6	152.3	0.473	44.6
	8.00	27.67	8.43	18.59	35.24	7.5	13.8	1008.1	535.7	5.35	3.90	134.4	107.1	169.2	127.9	1205.9	181.8	0.466	36.1
	9.00	30.60	9.33	20.56	38.98	6.1	11.7	1089.5	577.5	5.29	3.85	145.3	115.5	184.8	139.5	1320.3	197.2	0.461	32.7
	3.00	10.84	3.30	7.28	13.81	21.7	48.3	463.8	159.0	5.80	3.39	58.0	39.8	71.4	44.3	380.3	68.6	0.470	92.3
160 x 80	4.00	14.25	4.34	9.57	18.15	15.0	35.0	597.7	203.5	5.74	3.35	74.7	50.9	92.9	57.4	494.1	88.0	0.466	70.2
	4.50	15.91	4.85	10.69	20.27	12.8	30.6	660.9	224.3	5.71	3.33	82.6	56.1	103.2	63.7	548.5	97.2	0.465	62.9
	5.00	17.55	5.35	11.79	22.36	11.0	27.0	721.7	244.1	5.68	3.30	90.2	61.0	113.2	69.7	601.3	105.9	0.463	57.0
	6.00	20.75	6.32	13.94	26.43	8.3	21.7	836.0	280.9	5.62	3.26	104.5	70.2	132.3	81.3	702.1	122.3	0.459	48.2
	6.30	21.42	6.53	14.40	27.29	7.7	20.4	846.5	285.7	5.57	3.24	105.8	71.4	135.1	83.3	732.3	126.3	0.453	46.7
	8.00	26.41	8.05	17.75	33.64	5.0	15.0	1001.2	334.9	5.46	3.16	125.2	83.7	162.9	100.0	882.3	149.5	0.446	37.9
	9.00	29.19	8.90	19.61	37.18	3.9	12.8	1078.7	359.1	5.39	3.11	134.8	89.8	177.5	108.7	960.4	161.3	0.441	34.3
	4.00	16.76	5.11	11.26	21.35	20.0	40.0	926.0	373.9	6.59	4.18	102.9	74.8	125.9	84.0	853.8	127.1	0.546	59.7
180 x 100	5.00	20.69	6.31	13.90	26.36	15.0	31.0	1124.2	451.8	6.53	4.14	124.9	90.4	154.0	102.6	1044.8	153.9	0.543	48.3
	6.00	24.52	7.47	16.48	31.23	11.7	25.0	1309.6	523.8	6.48	4.10	145.5	104.8	180.8	120.2	1226.7	178.9	0.539	40.8
	6.30	25.38	7.74	17.05	32.33	10.9	23.6	1335.0	535.8	6.43	4.07	148.3	107.2	185.5	123.6	1283.4	185.5	0.533	39.4
	8.00	31.43	9.58	21.12	40.04	7.5	17.5	1598.5	637.5	6.32	3.99	177.6	127.5	225.6	149.9	1565.2	222.5	0.526	31.8
	10.00	38.12	11.62	25.62	48.57	5.0	13.0	1859.5	736.4	6.19	3.89	206.6	147.3	267.5	177.2	1858.6	259.6	0.517	26.2
	12.00	43.38	13.22	29.15	55.26	3.3	10.0	1965.1	782.1	5.96	3.76	218.3	156.4	292.4	194.2	2072.9	284.5	0.498	23.1
	12.50	44.78	13.65	30.09	57.04	3.0	9.4	2001.0	795.8	5.92	3.74	222.3	159.2	299.6	198.9	2121.7	290.4	0.496	22.3
	4.00	18.01	5.49	12.10	22.95	20.0	45.0	1199.7	410.8	7.23	4.23	120.0	82.2	148.0	91.7	985.4	141.8	0.586	55.5
200 x 100	4.50	20.15	6.14	13.54	25.67	17.2	39.4	1331.4	454.6	7.20	4.21	133.1	90.9	164.9	102.0	1097.1	157.1	0.585	49.6
	5.00	22.26	6.78	14.96	28.36	15.0	35.0	1459.3	496.9	7.17	4.19	145.9	99.4	181.4	112.1	1206.3	171.9	0.583	44.9
	6.00	26.40	8.05	17.74	33.63	11.7	28.3	1703.3	576.9	7.12	4.14	170.3	115.4	213.3	131.5	1417.0	200.1	0.579	37.9
	6.30	27.36	8.34	18.38	34.85	10.9	26.7	1739.2	591.1	7.06	4.12	173.9	118.2	219.1	135.4	1482.8	207.6	0.573	36.6
	8.00	33.95	10.35	22.81	43.24	7.5	20.0	2090.8	705.4	6.95	4.04	209.1	141.1	267.3	164.7	1810.7	249.6	0.566	29.5
	9.00	37.66	11.48	25.31	47.98	6.1	17.2	2275.6	764.4	6.89	3.99	227.6	152.9	293.4	180.5	1988.3	271.8	0.561	26.6
	10.00	41.26	12.58	27.73	52.57	5.0	15.0	2444.4	817.7	6.82	3.94	244.4	163.5	318.1	195.2	2154.1	292.1	0.557	24.2
	12.00	47.15	14.37	31.68	60.06	3.3	11.7	2606.7	875.6	6.59	3.82	260.7	175.1	350.0	215.3	2414.4	321.8	0.538	21.2
200 x 120	12.50	48.70	14.85	32.73	62.04	3.0	11.0	2658.9	892.2	6.55	3.79	265.9	178.4	359.1	220.8	2473.8	328.8	0.536	20.5
	4.00	19.27	5.87	12.95	24.55	25.0	45.0	1353.4	617.7	7.43	5.02	135.3	102.9	163.7	115.4	1345.3	172.5	0.626	51.9
	5.00	23.83	7.26	16.01	30.36	19.0	35.0	1649.4	750.1	7.37	4.97	164.9	125.0	200.9	141.4	1652.0	209.9	0.623	42.0
	6.00	28.29	8.62	19.01	36.03	15.0	28.3	1929.2	874.3	7.32	4.93	192.9	145.7	236.5	166.3	1946.7	245.1	0.619	35.4
	6.30	29.34	8.94	19.71	37.37	14.0	26.7	1975.7	897.7	7.27	4.90	197.6	149.6	243.5	171.5	2040.2	254.7	0.613	34.1
	8.00	36.46	11.11	24.50	46.44	10.0	20.0	2385.9	1079.0	7.17	4.82	238.6	179.8	298.0	209.5	2507.0	308.3	0.606	27.4
	10.00	44.40	13.53	29.84	56.57	7.0	15.0	2805.7	1262.1	7.04	4.72	280.6	210.4	356.1	249.8	3007.0	363.7	0.597	22.5
	12.00	50.91	15.52	34.21	64.86	5.0	11.7	3031.4	1367.9	6.84	4.59	303.1	228.0	395.1	277.8	3418.9	405.7	0.578	19.6
200 x 150	12.50	52.63	16.04	35.37	67.04	4.6	11.0	3099.0	1397.4	6.80	4.57	309.9	232.9	406.0	285.3	3513.8	415.7	0.576	19.0
	4.00	21.15	6.45	14.21	26.95	32.5	45.0	1583.9	1021.0	7.67	6.16	158.4	136.1	187.2	154.1	1942.0	218.5	0.686	47.3
	4.50	23.68	7.22	15.91	30.17	28.3	39.4	1761.5	1134.5	7.64	6.13	176.1	151.3	208.9	171.8	2168.5	243.0	0.685	42.2
	5.00	26.18	7.98	17.60	33.36	25.0	35.0	1934.7	1245.0	7.62	6.11	193.5	166.0	230.1	189.2	2391.4	266.8	0.683	38.2
	6.00	31.11	9.48	20.91	39.63	20.0	28.3	2268.0	1457.1	7.56	6.06	226.8	194.3	271.5	223.1	2826.2	312.7	0.679	32.1
	6.30	32.30	9.85	21															



HOLLOW SECTIONS

4.6 Cold Formed Rectangular Hollow Sections



BS EN 10219

Designation		Weight			Area of Section	Ratio for Local Buckling		Second Moment of Area		Radius of Gyration		Elastic Modulus		Plastic Modulus		Torsional Constant		Superficial Area per Metre Length	Normal Length per Tonne
Size	Thickness																		
H x B	t	M			A	Flange	Web	Axis x-x	Axis y-y	Axis x-x	Axis y-y	Axis x-x	Axis y-y	Axis x-x	Axis y-y	J	C	As	L
mm	mm	kg/m	kg/ft	lb/ft	cm²	B/t	H/t	cm⁴	cm⁴	cm	cm	cm³	cm³	cm³	cm³	cm⁴	cm³	m²/m	m
260 x 180	5.00	33.25	10.13	22.34	42.36	31.0	47.0	4121.4	2349.5	9.86	7.45	317.0	261.1	377.4	294.0	4694.9	425.9	0.863	30.1
	6.30	41.20	12.56	27.69	52.49	23.6	36.3	5012.7	2856.3	9.77	7.38	385.6	317.4	462.9	360.6	5844.3	523.0	0.853	24.3
	8.00	51.53	15.71	34.63	65.64	17.5	27.5	6145.2	3493.2	9.68	7.29	472.7	388.1	572.7	445.8	7266.7	642.4	0.846	19.4
	10.00	63.24	19.28	42.50	80.57	13.0	21.0	7363.3	4174.1	9.56	7.20	566.4	463.8	693.8	539.5	8850.3	771.9	0.837	15.8
	12.00	73.52	22.41	49.40	93.66	10.0	16.7	8245.0	4679.2	9.38	7.07	634.2	519.9	789.9	614.9	10328.3	884.4	0.818	13.6
	12.50	76.18	23.22	51.19	97.04	9.4	15.8	8482.5	4811.9	9.35	7.04	652.5	534.7	815.3	634.6	10676.0	911.4	0.816	13.1
	16.00	93.86	28.61	63.07	119.57	6.3	11.3	9923.0	5613.5	9.11	6.85	763.3	623.7	976.6	759.4	12890.0	1079.4	0.798	10.7
300 x 100	6.00	35.82	10.92	24.07	45.63	11.7	45.0	4776.8	842.4	10.23	4.30	318.5	168.5	411.4	187.9	2403.5	306.2	0.779	27.9
	6.30	37.25	11.35	25.03	47.45	10.9	42.6	4906.8	868.1	10.17	4.28	327.1	173.6	424.9	194.4	2515.2	318.3	0.773	26.8
	8.00	46.51	14.17	31.25	59.24	7.5	32.5	5977.9	1044.8	10.05	4.20	398.5	209.0	523.5	238.3	3080.3	385.2	0.766	21.5
	10.00	56.96	17.36	38.28	72.57	5.0	25.0	7106.0	1224.4	9.90	4.11	473.7	244.9	630.9	285.2	3681.0	454.5	0.757	17.6
	12.00	65.99	20.11	44.34	84.06	3.3	20.0	7808.3	1343.1	9.64	4.00	520.6	268.6	710.3	320.9	4177.5	508.5	0.738	15.2
	12.50	68.33	20.83	45.92	87.04	3.0	19.0	8009.6	1373.9	9.59	3.97	534.0	274.8	731.8	330.2	4291.5	521.2	0.736	14.6
300 x 150	6.00	35.82	10.92	24.07	45.63	11.7	45.0	4776.8	842.4	10.23	4.30	318.5	168.5	411.4	187.9	2403.5	306.2	0.779	27.9
	6.30	37.25	11.35	25.03	47.45	10.9	42.6	4906.8	868.1	10.17	4.28	327.1	173.6	424.9	194.4	2515.2	318.3	0.773	26.8
	8.00	46.51	14.17	31.25	59.24	7.5	32.5	5977.9	1044.8	10.05	4.20	398.5	209.0	523.5	238.3	3080.3	385.2	0.766	21.5
	10.00	56.96	17.36	38.28	72.57	5.0	25.0	7106.0	1224.4	9.90	4.11	473.7	244.9	630.9	285.2	3681.0	454.5	0.757	17.6
	12.00	65.99	20.11	44.34	84.06	3.3	20.0	7808.3	1343.1	9.64	4.00	520.6	268.6	710.3	320.9	4177.5	508.5	0.738	15.2
	12.50	68.33	20.83	45.92	87.04	3.0	19.0	8009.6	1373.9	9.59	3.97	534.0	274.8	731.8	330.2	4291.5	521.2	0.736	14.6
	16.00	93.86	28.61	63.07	119.57	6.3	11.3	9923.0	5613.5	9.11	6.85	763.3	623.7	976.6	759.4	12890.0	1079.4	0.798	10.7
300 x 200	6.00	40.53	12.35	27.24	51.63	20.0	45.0	6073.5	2079.6	10.85	6.35	404.9	277.3	499.6	309.5	4988.5	478.6	0.879	24.7
	6.30	42.19	12.86	28.35	53.75	18.8	42.6	6265.6	2150.0	10.80	6.32	417.7	286.7	517.4	320.9	5234.4	498.9	0.873	23.7
	8.00	52.79	16.09	35.47	67.24	13.8	32.5	7683.6	2623.0	10.69	6.25	512.2	349.7	640.3	396.4	6490.6	611.5	0.866	18.9
	10.00	64.81	19.76	43.55	82.57	10.0	25.0	9209.4	3125.0	10.56	6.15	614.0	416.7	775.9	479.2	7878.6	732.8	0.857	15.4
	12.00	75.41	22.98	50.67	96.06	7.5	20.0	10298.1	3498.0	10.35	6.03	686.5	466.4	883.1	546.1	9153.1	836.9	0.838	13.3
	12.50	78.14	23.82	52.51	99.54	7.0	19.0	10594.2	3594.8	10.32	6.01	706.3	479.3	911.5	563.4	9451.9	861.8	0.836	12.8
	16.00	96.38	29.38	64.76	122.77	4.4	13.8	12387.0	4174.4	10.04	5.83	825.8	556.6	1092.2	673.0	11328.0	1015.0	0.818	10.4
300 x 250	4.50	34.28	10.45	23.03	43.67	39.4	61.7	5661.9	3051.7	11.39	8.36	377.5	305.2	448.7	340.8	6185.1	500.9	0.985	29.2
	5.00	37.96	11.57	25.51	48.36	35.0	55.0	6241.1	3360.9	11.36	8.34	416.1	336.1	495.7	376.4	6835.8	551.9	0.983	26.3
	6.00	45.24	13.79	30.40	57.63	28.3	45.0	7370.2	3962.2	11.31	8.29	491.3	396.2	587.8	446.1	8115.2	651.2	0.979	22.1
	6.30	47.14	14.37	31.68	60.05	26.7	42.6	7624.4	4103.8	11.27	8.27	508.3	410.4	609.9	463.2	8523.5	679.8	0.973	21.2
	8.00	59.07	18.00	39.69	75.24	20.0	32.5	9389.3	5061.7	11.17	8.19	626.0	504.2	757.1	574.5	10626.5	838.4	0.966	16.9
	9.00	65.92	20.09	44.30	83.98	17.2	28.3	10371.4	5561.3	11.11	8.14	691.4	556.1	840.2	637.2	11822.4	927.0	0.961	15.2
	10.00	72.66	22.15	48.83	92.57	15.0	25.0	11312.7	6057.7	11.05	8.09	754.2	605.8	920.9	698.1	12987.1	1012.2	0.957	13.8
300 x 300	12.00	84.83	25.86	57.00	108.06	11.7	20.0	12787.8	6853.7	10.88	7.96	852.5	685.4	1055.9	801.2	15235.6	1167.1	0.938	11.8
	12.50	87.95	26.81	59.10	112.04	11.0	19.0	13178.9	7059.9	10.85	7.94	878.6	706.0	1091.2	827.9	15767.7	1204.5	0.936	11.4
	16.00	108.94	33.20	73.20	138.77	7.5	13.8	15616.7	8340.3	10.61	7.75	1041.1	834.0	1319.4	1000.0	19222.9	1441.7	0.918	9.2
	6.00	54.66	16.66	36.73	69.63	36.7	53.3	12457.3	7458.4	13.38	10.35	711.8	596.7	842.6	670.8	14553.7	966.8	1.179	18.3
	6.30	57.03	17.38	38.32	72.65	34.7	50.6	12923.1	7743.8	13.34	10.32	738.5	619.5	876.2	698.0	15291.0	1010.4	1.173	17.5
	8.00	71.63	21.83	48.13	91.24	26.3	38.8	16001.3	9572.6	13.24	10.24	914.4	765.8	1092.0	869.4	19136.3	1252.8	1.166	14.0
	10.00	88.36	26.93	59.38	112.57	20.0	30.0	19407.5	11588.3	13.13	10.15	1109.0	927.1	1334.8	1062.0	23499.7	1522.3	1.157	11.3
350 x 250	12.00	103.67	31.60	69.66	132.06	15.8	24.2	22196.5	13260.9	12.96	10.02	1268.4	1060.9	1543.9	1229.2	27749.3	1769.8	1.138	9.6
	12.50	107.58	32.79	72.29	137.04	15.0	23.0	22922.5	13690.0	12.93	9.99	1309.9	1095.2	1597.9	1272.0	28763.6	1829.8	1.136	9.3
	16.00	134.06	40.86	90.08	170.77	10.6	16.9	27580.2	16434.4	12.71	9.81	1576.0	1314.8	1953.6	1554.1	35497.2	2220.3	1.118	7.5
	4.50	41.34	12.60	27.78	52.67	39.4	83.9	11315.6	3911.8	14.66	8.62	565.8	391.2	689.5	428.8	9188.6	672.9	1.185	24.2
	5.00	45.81	13.96	30.78	58.36	35.0	75.0	12489.8	4311.8	14.63	8.60	624.5	431.2	762.4	473.9	10158.7	742.0	1.183	21.8
	6.00	54.66	16.66	36.73	69.63	28.3	61.7	14789.4	5091.6	14.57	8.55	739.5	509.2	906.0	562.5	12068.5	877.0	1.179	18.3
	6.30	57.03	17.38	38.32	72.65	26.7	58.5	15329.7	5286.1	14.53	8.53	766.5	528.6	641.7	585.2	12672.8	916.2	1.173	17.5
400 x 200	8.00	71.63	21.83	48.13	91.24	20.0	45.0	18974.4	6517.1	14.42	8.45	948.7	651.7	1173.3	728.1	15820.2	1133.3	1.166	14.0
	9.00	80.05	24.40	53.79	101.98	17.2	39.4	21023.3	7204.2	14.36	8.40	1051.2	720.4	1305.1	809.1	17615.5	1255.3	1.161	12.5
	10.00	88.36	26.93	59.38	112.57	15.0	35.0	23002.7	7864.4	14.30	8.36	1150.1	786.4	1433.7	888.1	19368.5	1373.2	1.157	11.3
	12.00	103.67	31.60	69.66	132.06	11.7	28.3	26248.4	8977.3	14.10	8.24	1312.4	897.7	1656.2	1026.8	22782.1	1591.4	1.138	9.6
	12.50	107.58	32.79	72.29	137.04	11.0	27.0	27100.5	9260.5	14.06	8.22	1355.0	926.0	1713.9	1062.3	23594.1	1644.0	1.136	9.3
	16.00	134.06	40.86	90.08	170.77	7.5	20.0	32547.0	11055.6	13.81	8.05	1627.3	1105.6	2093.3	1294.4	28928.3	1983.8	1.118	7.5
	6.30	66.92	20.40	44.97	85.25	42.6	58.5	20212.6	13059.6	15.40	12.38	1010.6	870.6	1189.7	980.0	24851.9	1404.1	1.373	14.9
400 x 300	8.00	84.19	25.66	56.57	107.24	32.5	45.0	25121.8	16212.1	15.31	12.30	1256.1	1080.8	1486.9	1224.3	31178.9	1747.2	1.366	11.9
	9.00	94.18	28.71	63.29	119.98	28.3	39.4	27904.2	17995.1	15.25	12.25	1395.2	1199.7	1657.0	1364.0	34822.4	1942.3	1.361	10.6
	10.00	104.06	31.72	69.93	132.57	25.0	35.0	30609.3	19726.0	15.20	12.20	1530.5	1315.1	1823.7	1500.9	38407.0	2132.4	1.357	9.6
	12.00	122.51	37.34	82.32	156.06	20.0	28.3	35283.9	22746.9	15.04	12.07	1764.2	1516.5	2121.8	1747.1	45527.1	2492.4	1.338	8.2
	12.50	127.20	38.77	85.48	162.04	19.0	27.0	36488.5	23517.4	15.01	12.05	1824.4	1567.8	2198.3	1810.0	47237.1	2580.1	1.336	7.9

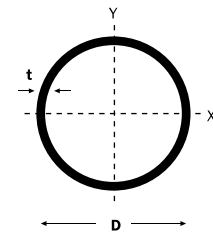
Note:
The calculation of sectional properties is based on BS EN 10219 with the following corner geometry :

Size Range	Inside Corner Radii	Outside Corner Radii
	mm	mm
Thickness ≤ 6mm	1T	2T
6mm < Thickness ≤ 10mm	1.5T	2.5T
Thickness > 10mm	2T	3.0T



HOLLOW SECTIONS

4.7 Cold Formed Circular Hollow Sections



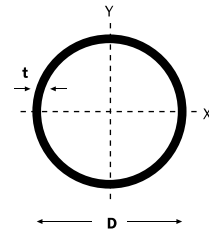
BS EN 10219

Designation		Weight			Cross Sectional Area	Ratio for Local Buckling	Second Moment of Area	Radius of Gyration	Elastic Modulus	Plastic Modulus	Torsional Constant		Superficial Area per Metre Length	Normal Length per Tonne
Outside Diameter	Thickness													
OD	t	M			A	D/t	I	r	Z	S	J	C	As	L
mm	mm	kg/m	kg/ft	lb/ft	cm ²		cm ⁴	cm	cm ³	cm ³	cm ⁴	cm ³	m ² /m	m
21.3	2.0	0.95	0.290	0.640	1.21	10.65	0.571	0.686	0.536	0.748	1.14	1.07	0.0669	1050.5
	2.5	1.16	0.353	0.779	1.48	8.52	0.664	0.671	0.623	0.889	1.33	1.25	0.0669	862.7
	3.0	1.35	0.413	0.910	1.72	7.10	0.741	0.656	0.696	1.01	1.48	1.39	0.0669	738.6
26.9	2.0	1.23	0.374	0.825	1.56	13.45	1.22	0.883	0.907	1.24	2.44	1.81	0.0845	814.2
	2.5	1.50	0.459	1.01	1.92	10.76	1.44	0.867	1.07	1.49	2.88	2.14	0.0845	664.7
	3.0	1.77	0.539	1.19	2.25	8.97	1.63	0.852	1.21	1.72	3.27	2.43	0.0845	565.5
33.7	2.0	1.56	0.477	1.05	1.99	16.85	2.51	1.21	1.49	2.01	5.02	2.98	0.106	639.6
	2.5	1.92	0.586	1.29	2.45	13.48	3.00	1.11	1.78	2.44	6.00	3.56	0.106	519.9
	3.0	2.27	0.692	1.53	2.89	11.23	3.44	1.09	2.04	2.84	6.88	4.08	0.106	440.3
42.4	2.0	1.99	0.607	1.34	2.54	21.20	5.19	1.43	2.45	3.27	10.38	4.90	0.133	501.8
	2.5	2.46	0.750	1.65	3.13	16.96	6.26	1.41	2.95	3.99	12.52	5.91	0.133	406.5
	3.0	2.91	0.888	1.96	3.71	14.13	7.25	1.40	3.42	4.67	14.49	6.84	0.133	343.1
	4.0	3.79	1.15	2.55	4.83	10.60	8.99	1.36	4.24	5.92	17.98	8.48	0.133	264.0
48.3	2.0	2.28	0.696	1.53	2.91	24.15	7.81	1.64	3.23	4.29	15.62	6.47	0.152	437.9
	2.5	2.82	0.861	1.90	3.60	19.32	9.46	1.62	3.92	5.25	18.92	7.83	0.152	354.1
	3.0	3.35	1.02	2.25	4.27	16.10	11.0	1.61	4.55	6.17	22.00	9.11	0.152	298.4
	4.0	4.37	1.33	2.94	5.57	12.08	13.8	1.57	5.70	7.87	27.54	11.40	0.152	228.8
	5.0	5.34	1.63	3.59	6.80	9.66	16.2	1.54	6.69	9.42	32.31	13.38	0.152	187.3
60.3	2.0	2.88	0.876	1.93	3.66	30.15	15.6	2.06	5.17	6.80	31.16	10.34	0.189	347.8
	2.5	3.56	1.09	2.39	4.54	24.12	19.0	2.05	6.30	8.36	37.99	12.60	0.189	280.6
	3.0	4.24	1.29	2.85	5.40	20.10	22.2	2.03	7.37	9.86	44.45	14.74	0.189	235.9
	4.0	5.55	1.69	3.73	7.07	15.08	28.2	2.00	9.34	12.70	56.35	18.69	0.189	180.1
	5.0	6.82	2.08	4.58	8.69	12.06	33.5	1.96	11.10	15.33	66.95	22.21	0.189	146.7
76.1	2.0	3.65	1.11	2.46	4.66	38.05	32.0	2.62	8.40	10.98	63.96	16.81	0.239	273.6
	2.5	4.54	1.38	3.05	5.78	30.44	39.2	2.60	10.30	13.55	78.37	20.60	0.239	220.4
	3.0	5.41	1.65	3.63	6.89	25.37	46.1	2.59	12.11	16.04	92.19	24.23	0.239	184.9
	4.0	7.11	2.17	4.78	9.06	19.03	59.1	2.55	15.52	20.81	118.11	31.04	0.239	140.6
	5.0	8.77	2.67	5.89	11.17	15.22	70.9	2.52	18.64	25.32	141.84	37.28	0.239	114.1
	6.0	10.37	3.16	6.97	13.21	12.68	81.8	2.49	21.49	29.56	163.52	42.97	0.239	96.4
	6.3	10.84	3.31	7.29	13.81	12.08	84.8	2.48	22.29	30.78	169.64	44.58	0.239	92.2
88.9	2.0	4.29	1.31	2.88	5.46	44.45	51.6	3.07	11.60	15.11	103.14	23.20	0.279	233.3
	2.5	5.33	1.62	3.58	6.79	35.56	63.4	3.06	14.26	18.67	126.75	28.51	0.279	187.7
	3.0	6.36	1.94	4.27	8.10	29.63	74.8	3.04	16.82	22.15	149.53	33.64	0.279	157.3
	4.0	8.38	2.55	5.63	10.67	22.23	96.3	3.00	21.67	28.85	192.68	43.35	0.279	119.4
	5.0	10.35	3.15	6.95	13.18	17.78	116.4	2.97	26.18	35.24	232.75	52.36	0.279	96.7
	6.0	12.27	3.74	8.24	15.63	14.82	134.9	2.94	30.36	41.31	269.88	60.72	0.279	81.5
	6.3	12.83	3.91	8.62	16.35	14.11	140.2	2.93	31.55	43.07	280.47	63.10	0.279	77.9
101.6	2.0	4.91	1.50	3.30	6.26	50.80	77.6	3.52	15.28	19.84	155.26	30.56	0.319	203.6
	2.5	6.11	1.86	4.11	7.78	40.64	95.6	3.50	18.82	24.56	191.22	37.64	0.319	163.7
	3.0	7.29	2.22	4.90	9.29	33.87	113.0	3.49	22.25	29.17	226.07	44.50	0.319	137.1
	4.0	9.63	2.93	6.47	12.26	25.40	146.3	3.45	28.80	38.12	292.57	57.59	0.319	103.9
	5.0	11.91	3.63	8.00	15.17	20.32	177.5	3.42	34.93	46.70	354.94	69.87	0.319	84.0
	6.0	14.15	4.31	9.51	18.02	16.93	206.7	3.39	40.68	54.91	413.35	81.37	0.319	70.7
	6.3	14.81	4.51	9.95	18.86	16.13	215.1	3.38	42.34	57.30	430.13	84.67	0.319	67.5
114.3	2.5	6.89	2.10	4.63	8.78	45.72	137.3	3.95	24.02	31.25	274.52	48.03	0.359	145.1
	3.0	8.23	2.51	5.53	10.49	38.10	162.5	3.94	28.44	37.17	325.10	56.88	0.359	121.4
	4.0	10.88	3.32	7.31	13.86	28.58	211.1	3.90	36.33	48.69	422.13	73.86	0.359	91.9
	5.0	13.48	4.11	9.06	17.17	22.86	256.9	3.87	44.96	59.77	513.84	89.91	0.359	74.2
	6.0	16.03	4.88	10.77	20.41	19.05	300.2	3.83	52.53	70.45	600.42	105.06	0.359	62.4
	6.3	16.78	5.11	11.28	21.38	18.14	312.7	3.82	54.72	73.57	625.43	109.44	0.359	59.6
	8.0	20.97	6.39	14.09	26.72	14.29	379.5	3.77	66.40	90.57	758.98	132.81	0.359	47.7
139.7	3.0	10.11	3.08	6.08	12.88	46.57	301.1	4.83	43.11	56.07	602.18	86.21	0.439	98.9
	4.0	13.39	4.08	9.00	17.05	34.93	392.9	4.80	56.24	73.68	758.72	112.49	0.439	74.7
	5.0	16.61	5.06	11.16	21.16	27.94	480.5	4.77	68.80	90.76	961.08	137.59	0.439	60.2
	6.0	19.78	6.03	13.29	25.20	23.28	564.3	4.73	80.78	107.33	1128.52	161.56	0.439	50.5
	6.3	20.73	6.32	13.93	26.40	22.17	588.6	4.72	84.27	112.20	1177.24	168.54	0.439	48.2
	8.0	25.98	7.92	17.46	33.10	17.46	720.3	4.66	103.12	138.93	1440.58	206.24	0.439	38.5
	10.0	39.04	11.90	26.23	49.73	16.83	1564.0	5.61	185.86	250.92	3127.97	371.71	0.529	25.6
168.3	3.0	12.23	3.73	8.22	15.58	56.10	532.3	5.85	63.25	81.98	1064.57	126.51	0.529	81.8
	4.0	16.21	4.94	10.89	20.65	42.08	697.1	5.81	82.84	108.00	1394.18	165.68	0.529	61.7
	5.0	20.14	6.14	13.53	25.65	33.66	855.8	5.78	101.70	133.38	1711.69	203.41	0.529	49.7
	6.0	24.02	7.32	16.14	30.59	28.05	1008.7	5.74	119.87	158.12	2017.39	239.74	0.529	41.6
	6.3	25.17	7.67	16.91	32.06	26.71	1053.4	5.73	125.18	165.42	2106.84	250.37	0.529	39.7
	8.0	31.63	9.64	21.25	40.29	21.04	1297.3	5.67	154.16	205.74	2594.54	308.32	0.529	31.6
	10.0	39.04	11.90	26.23	49.73	16.83	1564.0	5.61	185.86	250.92	3127.97	371.71	0.529	25.6



HOLLOW SECTIONS

4.7 Cold Formed Circular Hollow Sections



BS EN 10219

Designation		Weight			Cross Sectional Area	Ratio for Local Buckling	Second Moment of Area	Radius of Gyration	Elastic Modulus	Plastic Modulus	Torsional Constant		Superficial Area per Metre Length	Normal Length per Tonne
Outside Diameter	Thickness													
OD	t	M			A	D/t	I	r	Z	S	J	C	As	L
mm	mm	kg/m	kg/ft	lb/ft	cm ²		cm ⁴	cm	cm ³	cm ³	cm ⁴	cm ³	m ² /m	m
177.8	4.0	17.14	5.23	11.52	21.84	44.45	825.1	6.15	92.81	120.85	1650.17	185.62	0.559	58.3
	5.0	21.31	6.49	14.32	27.14	35.56	1014.0	6.11	114.06	149.34	2027.94	228.11	0.559	46.9
	6.0	25.42	7.75	17.08	32.38	29.63	1196.2	6.08	134.56	177.16	2392.43	269.12	0.559	39.3
	6.3	26.65	8.12	17.90	33.94	28.22	1249.6	6.07	140.56	185.38	2499.24	281.13	0.559	37.5
	8.0	33.50	10.21	22.51	42.68	22.23	1541.4	6.01	173.39	230.83	3082.87	346.78	0.559	29.9
	10.0	41.38	12.61	27.81	52.72	17.78	1862.0	5.94	209.45	281.90	3723.96	418.89	0.559	24.2
	12.0	49.07	14.96	32.97	62.51	14.82	2159.1	5.88	242.86	330.45	4318.11	485.73	0.559	20.4
193.7	12.5	50.96	15.53	34.24	64.91	14.22	2229.8	5.86	250.82	342.20	4459.59	501.64	0.559	19.6
	4.0	18.71	5.70	12.57	23.84	48.43	1072.8	6.71	110.77	143.97	2145.58	221.54	0.609	53.4
	5.0	23.27	7.09	15.64	29.64	38.74	1320.2	6.67	136.32	178.08	2604.46	272.63	0.609	43.0
	6.0	27.77	8.47	18.66	35.38	32.28	1559.7	6.64	161.05	211.46	3119.45	322.09	0.609	36.0
	6.3	29.12	8.87	19.56	37.09	30.75	1630.0	6.63	163.31	221.33	3260.09	336.61	0.609	34.3
	8.0	36.64	11.17	24.62	46.67	24.21	2015.5	6.57	208.11	276.05	4031.07	416.22	0.609	27.3
	10.0	45.30	13.81	30.44	57.71	19.37	2441.6	6.50	252.10	337.79	4883.18	504.20	0.609	22.1
219.1	12.0	53.77	16.39	36.13	68.50	16.14	2839.2	6.44	293.15	396.75	5678.40	586.31	0.609	18.6
	12.5	55.86	17.03	37.54	71.16	15.50	2934.3	6.42	302.97	411.07	5868.62	605.95	0.609	17.9
	4.0	21.22	6.47	14.26	27.03	54.78	1563.8	7.61	142.75	185.09	3127.67	285.50	0.688	47.1
	5.0	26.40	8.05	17.74	33.63	43.82	1928.0	7.57	176.00	229.24	3856.09	351.99	0.688	37.9
	6.0	31.53	9.61	21.19	40.17	36.52	2281.9	7.54	208.30	272.54	4563.89	416.60	0.688	31.7
	6.3	33.06	10.08	22.22	42.12	34.78	2386.1	7.53	217.81	285.37	4772.28	435.63	0.688	30.2
	8.0	41.65	12.69	27.99	53.06	27.39	2959.6	7.47	270.16	356.68	5919.27	540.33	0.688	24.0
244.5	10.0	51.57	15.72	34.65	65.69	21.91	3598.4	7.40	328.47	437.56	7196.88	656.95	0.688	19.4
	12.0	61.29	18.68	41.18	78.07	18.26	4199.9	7.33	383.38	515.26	8399.76	766.75	0.688	16.3
	12.5	63.69	19.41	42.80	81.13	17.53	4344.6	7.32	396.58	534.20	8689.16	793.17	0.688	15.7
	5.0	29.53	9.00	19.84	37.62	48.90	2698.6	8.47	220.74	286.84	5397.16	441.49	0.768	33.9
	6.0	35.29	10.76	23.71	44.96	40.75	3198.5	8.43	261.64	341.37	6397.07	523.28	0.768	28.3
	6.3	37.01	11.28	24.87	47.14	38.81	3346.0	8.42	273.70	357.54	6692.05	547.41	0.768	27.0
	8.0	46.66	14.22	31.35	59.44	30.56	4160.4	8.37	340.32	447.63	8320.89	680.65	0.768	21.4
273	10.0	57.83	17.63	38.86	73.67	24.45	5073.1	8.30	414.98	550.24	10146.29	829.96	0.768	17.3
	12.0	68.81	20.97	46.24	87.65	20.38	5938.3	8.23	485.75	649.25	11876.69	971.51	0.768	14.5
	12.5	71.52	21.8	48.06	91.11	19.56	6147.4	8.21	502.86	673.45	12294.84	1005.71	0.768	14.0
	5.0	33.05	10.07	22.21	42.10	54.60	3780.8	9.48	276.98	359.16	7561.63	553.97	0.858	30.3
	6.0	39.51	12.04	26.55	50.33	45.50	4487.1	9.44	328.72	427.81	8974.17	657.45	0.858	25.3
	6.3	41.44	12.63	27.84	52.79	43.33	4695.8	9.43	344.02	448.20	9391.65	688.03	0.858	24.1
	8.0	52.28	15.94	35.13	66.60	34.13	5851.7	9.37	428.70	561.97	11703.43	857.39	0.858	19.1
323.9	10.0	64.86	19.77	43.58	82.62	27.30	7154.1	9.31	524.11	692.02	14308.19	1048.22	0.858	15.4
	12.0	77.24	23.54	51.90	98.39	22.75	8396.1	9.24	615.10	818.03	16792.28	1230.20	0.858	12.9
	12.5	80.30	24.48	53.96	102.30	21.84	8697.4	9.22	637.18	848.90	17394.90	1274.35	0.858	12.5
	5.0	39.32	11.99	26.42	50.09	64.78	6369.4	11.28	393.30	508.53	12738.85	786.59	1.018	25.4
	6.0	47.04	14.34	31.61	59.92	53.98	7572.5	11.24	467.58	606.43	15144.93	935.16	1.018	21.3
	6.3	49.34	15.04	33.16	62.86	51.41	7928.9	11.23	489.59	635.56	15857.79	979.18	1.018	20.3
	8.0	62.32	19.00	41.88	79.39	40.49	9910.1	11.17	611.92	798.51	19820.16	1223.84	1.018	16.0
355.6	10.0	77.41	23.60	52.02	98.61	32.39	12158.3	11.10	750.75	985.67	24316.68	1501.49	1.018	12.9
	12.0	92.30	28.13	62.02	117.58	26.99	14319.6	11.04	884.20	1167.96	28639.12	1768.39	1.018	10.8
	12.5	95.99	29.26	64.51	122.29	25.91	14846.5	11.02	916.74	1212.78	29693.06	1833.47	1.018	10.4
	5.0	43.23	13.18	29.05	55.07	71.12	8463.6	12.40	476.02	614.64	16927.15	952.03	1.117	23.1
	6.0	51.73	15.77	34.76	65.90	59.27	10070.6	12.36	566.40	733.39	20141.11	1132.80	1.117	19.3
	6.3	54.27	16.54	36.47	69.13	56.44	10547.2	12.35	593.21	768.75	21094.41	1186.41	1.117	18.4
	8.0	68.58	20.90	46.08	87.36	44.45	13201.4	12.29	742.48	966.78	26402.75	1484.97	1.117	14.6
406.4	10.0	85.23	25.98	57.27	108.57	35.56	16223.5	12.22	912.46	1194.73	32447.00	1824.92	1.117	11.7
	12.0	101.68	30.99	68.33	129.53	29.63	19139.5	12.16	1076.46	1417.31	38278.95	2152.92	1.117	9.8
	12.5	105.77	32.24	71.07	134.74	28.45	19852.2	12.14	1116.55	1472.12	39704.35	2233.09	1.117	9.5
	16.0	134.00	40.84	90.04	170.70	22.23	24663.0	12.02	1387.12	1846.62	49326.00	2774.24	1.117	7.5
	6.0	59.25	18.06	39.81	75.47	67.73	15128.3	14.16	744.50	961.99	30256.65	1489.01	1.277	16.9
	6.3	62.16	18.85	41.77	79.19	64.51	15849.4	14.15	779.99	1008.59	31698.87	1559.98	1.277	16.1
	8.0	78.60	23.96	52.82	100.13	50.80	19873.9	14.09	978.05	1269.95	39747.79	1956.09	1.277	12.7
457	10.0	97.76	29.80	65.69	124.53	40.64	24475.8	14.02	1204.52	1571.66	48951.63	2409.04	1.277	10.2
	12.0	116.72	35.58	78.43	148.69	33.87	28937.0	13.95	1424.07	1867.19	57874.03	2848.13	1.277	8.6
	12.5	121.43	37.01	81.60	154.68	32.51	30030.7	13.93	1477.89	1940.12	60061.33	2955.77	1.277	8.2
	16.0	154.05	46.95	103.51	196.24	25.40	37448.8	13.81	1842.95	2439.96	74897.64	3685.91	1.277	6.5
	6.0	66.73	20.34	44.84	85.01	76.17	21618.1	15.95	946.09	1220.48	43236.21	1892.18	1.436	15.0
	6.3	70.02	21.34	47.05	89.20	72.54	22654.2	15.94	991.43	1279.81	45308.32	1982.86	1.436	14.3
	8.0	88.58	27.00	59.53	112.85	57.13	28446.4	15.88	1244.92	1612.98	56892.73	2489.83	1.436	11.3
457	10.0	110.24	33.60	74.08	140.43	45.70	35091.3	15.81	1535.73	1998.42	70182.65	3071.45	1.436	9.1
	12.0	131.69	40.14	88.49	167.76	38.08	41556.3	15.74	1818.66	2376.88	83112.60	3637.31	1.436	7.6
	12.5	137.03	41.77	92.08	174.55	36.56	43144.8	15.72	1888.18	2470.40	86289.61	3776.35	1.436	7.3
	16.0	174.01	53.04	116.93	221.67	28.56	53959.4	15.60	2361.46	3113.06	107918.8	4722.92	1.436	5.7