

ESP

ENGTEX STEEL PIPE SDN BHD
Manufacturer of ERW Pipes

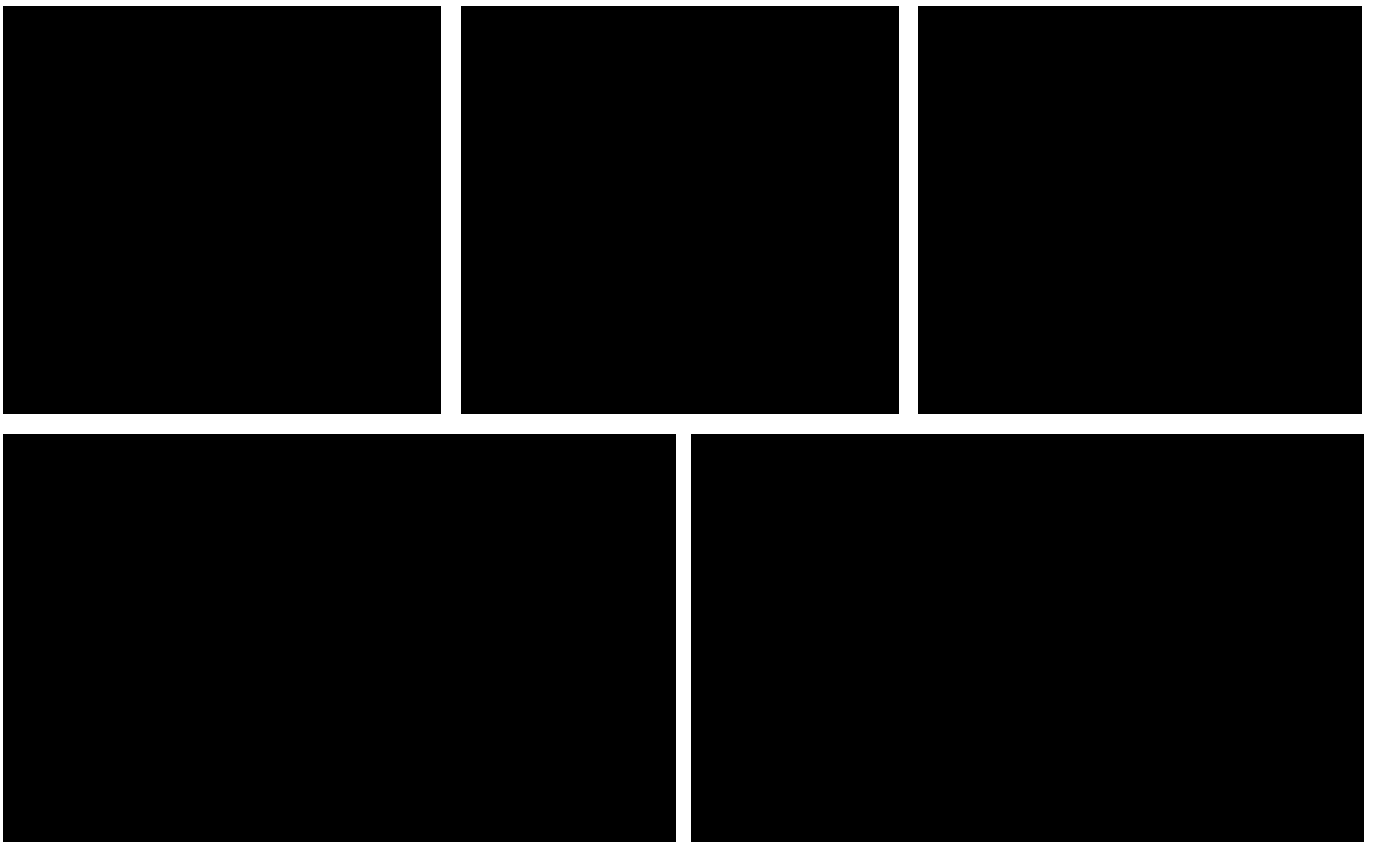


PRODUCT CATALOGUE

Engtex

ESP

ENGTEX STEEL PIPE SDN BHD
Manufacturer of ERW Pipes





COMPANY PROFILE

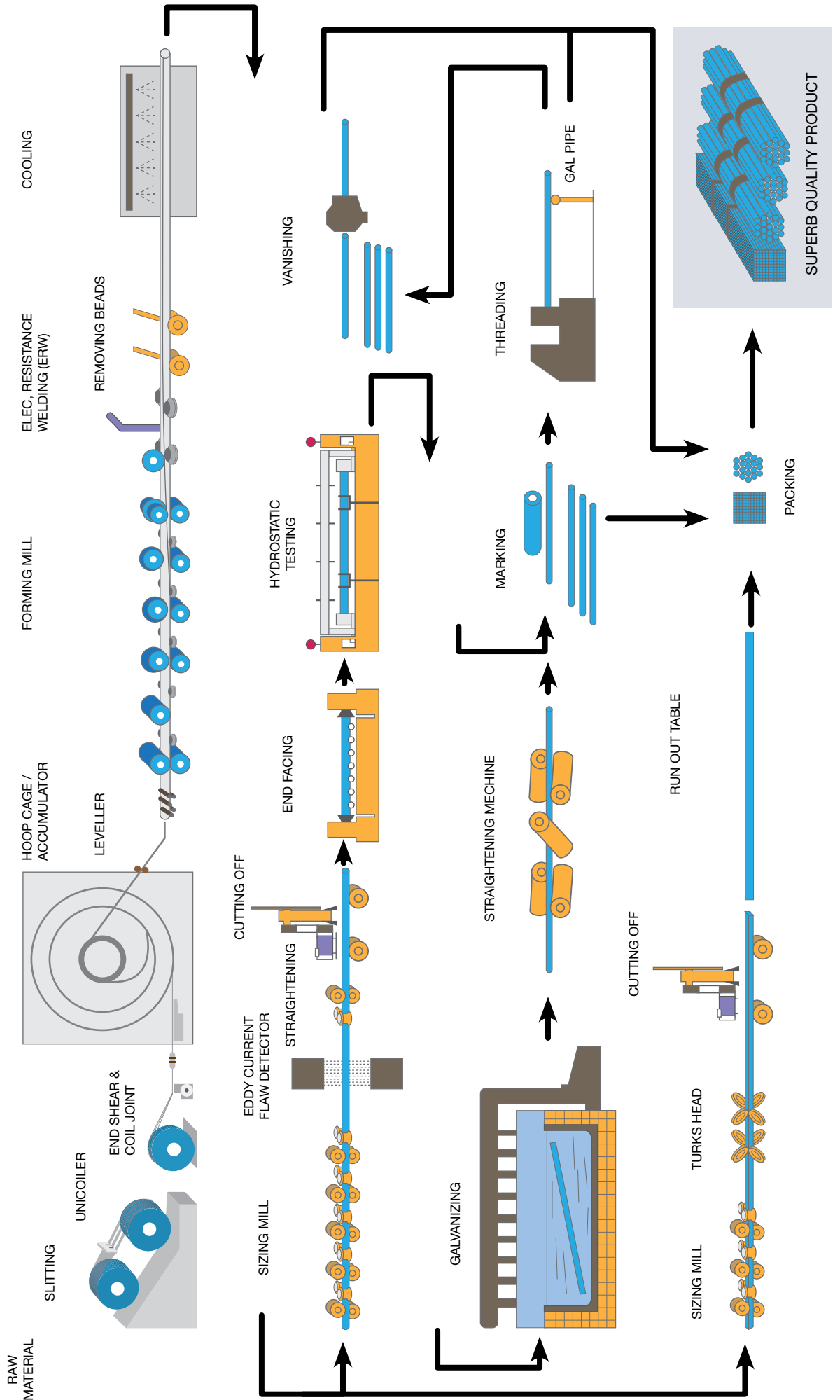
Engtex Steel Pipe Sdn Bhd ("ESP") is a subsidiary of Engtex Group Bhd, a company listed in the Bursa Malaysia Securities Bhd. ESP factory was set up and commercialize its products in 2018 on the manufacturing of ERW steel pipes and hollow sections. It produce a wide range of quality industrial products which cover its applications in water, oil and gas industries, building construction, infra-structural, and general engineering industries. We have pipe mill facilities and its supporting equipments to manufacture ERW steel pipes ranging

from 1/2"Ø (21.4mm O.D) to 10"Ø (275.7mm O.D) and steel hollow sections ranging from 25mm square to 150mm square with thickness from 1.60mm to 6mm. Our products also conform to IKRAM QA Certification and are recognized by our relevant product certification body such as CIDB.

For business sustainability, we are driven very much in providing competitive price, consistent quality, enhanced relationship and excellent service for all our value customers and trading partners.



MANUFACTURING PROCESS FLOW



MAIN PRODUCTS

Our Company manufactures a wide range of quality industrial steel products which are widely accepted by the building and secondary manufacturing industries.



WATER & GENERAL APPLICATION

For carrying water, gas, steam, etc.
For agricultural application, civil engineering,
steel towers, furniture, mining industry, etc.

SPECIFICATION

BS EN 10255/BS 1387
MS 863 : 2010
JIS G 3452

Welded Steel Pipe for Ordinary Uses, Water Piping and Structural Purposes



WATER & GENERAL APPLICATION

Industrial water, irrigation & agriculture water,
sewage & drainage piping, etc.

SPECIFICATION

BS EN 10224/BS 3601
SPAN TS-21827

ERW Steel Tubes for Cement Lined Pipes



OTHER GENERAL APPLICATION

Ordinary uses, light structure support, etc.

SPECIFICATION

ESP S1
Manufacturer's
Standard

Carbon Steel Tubes for General Purposes (A, AA Pipes)



STRUCTURAL APPLICATION

Buildings, bicycles, vehicles, machineries, lamp
post, hand rails, furniture pipes, structures and all
other supports, etc.

SPECIFICATION

BS EN 10219
ASTM A 500
JIS G 3444

Square, Rectangular and Circular Hollow Sections for Building Construction, Infrastructure
and General Engineering Industry.

ERW PIPES



Technical Specification References

Classification	Specification	Designation of Grade	Mechanical Properties			Chemical Composition %					Bend Test (N2)		Flattening Test H
			Tensile Strength Min.	Yield Strength Min.	Elongation Min.	C	Si	Mn	P	S	Bending Angle	Bending Radius	
			N/mm ²	N/mm ²	%	Max	Max	Max	Max	Max			
Welded Steel Tubes - Light, Medium & Heavy	BS EN 10255/ BS 1387 MS 863 : 2010	-	320 to 520	195	20 (N3)	0.20	-	1.20	0.045	0.045	180 °	6D	3/5 D
Carbon Steel Pipes For Ordinary Piping	JIS G 3452	SGP	290min.	-	(N1) Test Piece No. 11 & 12 - 30 min. (N1) Test Piece No. 5 - 25min.	-	-	-	0.040	0.040	90 °	6D	2/3 D
ERW Steel Tubes for Cement Lined Pipes	BS EN 10224/ BS 3601 SPAN TS-21827: PART 2	ERW 320	320 - 460	195 min.	25 (N3)	0.16	-	0.30-0.70	0.040	0.040	-	-	As specified in BS 3601
		ERW 430	430 - 570	275 min.	22 (N3)	0.21	0.35	0.40 - 1.20	0.040	0.040			Specification
ESP Manufacturer Standard Welded Steel Pipes	ESP S1	(A) (AA)	270 min.	170 min.	20 (N3)	0.20	-	1.20	0.045	0.045	90 °	6D	1/3 D

NOTES :

- (N1) - When the tensile test is carried out on No. 12 or No. 15 test piece for the pipe under 8mm in wall thickness the minimum value of elongation shall be obtained by subtracting 1.5% from the thickness values of elongation given in Table above for each 1 mm decrease in wall thickness, and rounding off to an integer in accordance with JIS Z 8401
- (N1) - The values elongation given in Table above shall not applied to the pipe whose nominal size is 32mm or smaller.
- (N2) - Bend Test in table above only applied to pipes of nominal size 2" (50mm) or smaller.
- (N3) - Gauge length $L_0 = 5.65 \sqrt{S_0}$ (%)
- H - Distance between the plates
- D - Outside diameter of the pipe
- ESP S1 - Manufacturer's Standard

BS 1387 : 1985 / MS 863 : 2010 Light, Medium, Heavy

GENERAL INFORMATION OF BS 1387 / MS 863 : WELDED STEEL PIPE

DESCRIPTION	BS 1387 : 1985 welded steel tube is produced in three thickness classes* - Light, Medium and Heavy - available in black finished or hot dipped galvanized finished in 6 meter uniform mill lengths.			
APPLICATIONS	For ordinary conveyance of steam, gas, air, water, etc.			
END FINISH AND END PROTECTION	Plain-end square-cut (PE) or threaded and fixed with coupling (T/C). (PE) tubes are shipped without any protection on both ends. T/C tubes are supplied screwed with taper threads to BS 21 and fitted with one taper-threaded malleable iron socket, as required under this specifications.			
IDENTIFICATION MARKING	Tubes are marked by colour bands about 50mm wide, painted about 300mm from each end, as follow : Light tubes - Brown Medium tubes - Blue Heavy tubes - Red			
PERTINENT EXCERPTS FROM BS 1387 : 1985 SPECIFICATION				
CHEMICAL COMPOSITION	The chemical composition of the steel, by ladle analysis, shall comply with the table below			
	C max.	Mn max.	P max.	S max.
	0.20%	1.20%	0.045%	0.045%
MECHANICAL PROPERTIES	The mechanical properties at room temperature shall be given as table below :			
	Tensile strength (N/ mm ²)	: 320 to 460		
	Yield strength (N/ mm ²)	: 195 min.		
	Elongation on gauge length $L_0 = 5.65 \sqrt{S_0}$ (%)	: 20 min.		
TOLERANCES ON DIMENSION AND MASS	Outside Diameter : As shown in table on following page.			
	Wall Thickness :	Light tubes	- 8%	
		Medium and heavy tubes	-10%	
	Mass :	The mean consignment mass for quantities of 150 mm and over of one size shall not deviate more than $\pm 4\%$ from the mass of consignment calculated from the mass given in table appropriate. No single tube shall deviate by more than = 10%, -8% from the mass given in table as appropriate.		
BEND TEST	Black tubes up to and including DN 50 shall be bent cold without any signs of fracture or failure, through 180 degrees round a former having a radius at the bottom of the groove equal to six times the outside diameter of the tube as given in table. Hot-dip-zinc coated tubes shall be bent cold without cracking the steel, through 90° round a former having a radius at the bottom of the groove equal to eight times the outside diameter of the tube.			
FLATTENING TEST	The flattening test applies to tubes greater than DN 50. A ring not less than 40mm in length taken from one end of each selectes tube shall be flattened cold between parallel flat platens without showing either crack or flaw until the distance between the platens, measured under load, is not greater than 75% of original outside diameter of the tube, and no cracks or flaws in the metal elsewhere than in the weld shall occur until the distance between the platens is less than 60% of original diameter. The weld shall be placed at 90 degrees to the direction of flattening.			
LEAK TIGHTNESS TEST	The test shall be either a hydraulic test at a pressure of 50 bar (50 x 10 N/ M ²), or, alternatively, an eddy current test.			
HOT-DIP ZINC COATING TEST (IF REQUIRED)	After the four successive one-minute immersions in the copper-sulphate solution, the test sample shall not show any adherent red deposits of metallic copper.			
BORE TEST FOR HOT-DIP COATED TUBES	Hot-dip zinc coated tubes up to and including DN 25mm shall have a rod 230 mm in length, of the appropriate diameter specified below, passed through them and shall have a free bore.			
	Rod Diameters			
	Nominal size (DN)	Diameter of Rod (mm)		
	15mm	9.5		
	20mm	14.3		
	25mm	20.6		

BLACK & GALVANIZED Welded Steel Pipes

MS 863 : 2010 / MANUFACTURER'S STANDARD

CLASS	Nominal		Outside Diameter		Wall	Calculated Weight						Number of Threads	Socket		Test Pressure	
	Size		Maximum	Minimum	Thickness	Plain Ends			Threads And Coupling				Outer Diameter	Min Length		
	mm	in	mm	mm	mm	kg/m	kg/ft	lb/ft	kg/m	kg/ft	lb/ft	per inch	mm	mm	Bar	Psi
LIGHT (L2)	15	1/2	21.4	21.0	2.0	0.947	0.289	0.636	0.956	0.291	0.642	14	27.8	38.1	50	725
	20	3/4	26.9	26.4	2.3	1.38	0.421	0.928	1.39	0.424	0.935	14	34.1	41.3	50	725
	25	1	33.8	33.2	2.6	1.98	0.604	1.33	2	0.61	1.34	11	42.1	47.6	50	725
	32	1 1/4	42.5	41.9	2.6	2.54	0.774	1.71	2.57	0.78	1.73	11	51.6	54.0	50	725
	40	1 1/2	48.4	47.8	2.9	3.23	0.985	2.17	3.27	1	2.2	11	57.9	57.2	50	725
	50	2	60.2	59.6	2.9	4.08	1.24	2.73	4.15	1.26	2.78	11	70.6	63.5	50	725
	65	2 1/2	76.0	75.2	3.2	5.71	1.74	3.83	5.83	1.78	3.92	11	87.3	69.9	50	725
	80	3	88.7	87.9	3.2	6.72	2.05	4.52	6.89	2.1	4.63	11	101.6	76.2	50	725
	100	4	113.9	113.0	3.6	9.75	2.97	6.55	10	3.05	6.72	11	128.6	88.9	50	725
MEDIUM (M)	15	1/2	21.8	21.1	2.6	1.21	0.369	0.814	1.22	0.372	0.82	14	27.8	38.1	50	725
	20	3/4	27.3	26.5	2.6	1.56	0.475	1.05	1.57	0.479	1.06	14	34.1	41.3	50	725
	25	1	34.2	33.3	3.2	2.41	0.735	1.62	2.43	0.741	1.63	11	42.1	47.6	50	725
	32	1 1/4	42.9	42.1	3.2	3.1	0.945	2.08	3.13	0.954	2.1	11	51.6	54.0	50	725
	40	1 1/2	48.8	47.9	3.2	3.56	1.09	2.4	3.6	1.1	2.42	11	57.9	57.2	50	725
	50	2	60.8	59.7	3.6	5.03	1.53	3.37	5.1	1.55	3.42	11	70.6	63.5	50	725
	65	2 1/2	76.6	75.3	3.6	6.42	1.96	4.32	6.54	1.99	4.39	11	87.3	69.9	50	725
	80	3	89.5	88.0	4.0	8.36	2.55	5.62	8.53	2.6	5.73	11	101.6	76.2	50	725
	100	4	115.0	113.1	4.5	12.2	3.72	8.2	12.5	3.81	8.4	11	128.6	88.9	50	725
HEAVY (H)	15	1/2	21.8	21.0	3.2	1.44	0.439	0.968	1.45	0.442	0.974	14	27.8	38.1	50	725
	20	3/4	27.3	26.5	3.2	1.87	0.57	1.257	1.88	0.573	1.263	14	34.1	41.3	50	725
	25	1	34.2	33.3	4.0	2.93	0.896	1.98	2.95	0.899	1.98	11	42.1	47.6	50	725
	32	1 1/4	42.9	42.0	4.0	3.79	1.16	2.56	3.82	1.16	2.57	11	51.6	54.0	50	725
	40	1 1/2	48.8	47.9	4.0	4.37	1.33	2.95	4.41	1.34	2.96	11	57.9	57.2	50	725
	50	2	60.8	59.7	4.5	6.19	1.89	4.17	6.26	1.91	4.21	11	70.6	63.5	50	725
	65	2 1/2	76.6	75.3	4.5	7.93	2.42	5.34	8.05	2.45	5.41	11	87.3	69.9	50	725
	80	3	89.5	88.0	5.0	10.3	3.14	6.92	10.5	3.2	7.06	11	101.6	76.2	50	725
	100	4	115.0	113.1	5.4	14.5	4.42	9.71	14.8	4.51	9.95	11	128.6	88.9	50	725
125	5	140.8	138.5	5.4	17.9	5.46	12	18.4	5.61	12.4	11	155.6	95.3	50	725	
150	6	166.5	163.9	5.4	21.3	6.49	14.3	21.9	6.68	14.7	11	184.2	95.3	50	725	

Tolerance :	Wall thickness	: Light (L2)	- 8%
		Medium (M) and Heavy (H)	- 10%
	Length	: Plus 50mm or minus 0mm (Manufacturer Standard)	
	Mass	: Plus 10% or minus 8% on individual tubes for type L2	

BLACK Welded Steel Pipes (For General Structure Purposes)

ESP S1 MANUFACTURER'S STANDARD

CLASS	Nominal Size		Outside Diameter				Wall Thickness		Calculated Weight Plain Ends		
			Maximum		Minimum						
	mm	in	mm	in	mm	in	mm	in	kg/m	kg/ft	lb/ft
LIGHT (A)	90	3 1/2	102.0	3.98	101.1	3.95	3.2	0.126	7.761	2.366	5.220
EXTRA LIGHT (AA)	15	1/2	21.4	0.84	21.0	0.83	1.6	0.063	0.773	0.236	0.520
	20	3/4	26.9	1.06	26.4	1.04	1.6	0.063	0.990	0.302	0.666
	25	1	33.8	1.33	33.2	1.31	1.9	0.075	1.480	0.451	0.994
	32	1 1/4	42.5	1.67	41.9	1.65	1.9	0.075	1.890	0.576	1.270
	40	1 1/2	48.4	1.90	47.8	1.88	1.9	0.075	2.160	0.658	1.450
	50	2	60.2	2.30	59.6	2.35	1.9	0.075	2.720	0.829	1.830
	65	2 1/2	76.0	2.99	75.2	2.96	1.9	0.075	3.450	1.050	2.310
	80	3	88.7	3.49	87.9	3.46	2.1	0.083	4.460	1.360	3.000
	90	3 1/2	102.0	3.98	101.1	3.95	2.1	0.083	5.150	1.570	3.460
	100	4	113.9	4.48	113.0	4.45	2.3	0.091	6.310	1.920	4.230
	125	5	140.6	5.53	138.7	5.46	4.0	0.157	13.400	4.080	8.990
150	6	166.1	6.54	164.1	6.46	4.0	0.157	15.900	4.850	10.700	
(AAA)	25	1	33.8	1.33	33.2	1.31	1.6	0.063	1.259	0.384	0.847
	32	1 1/4	42.5	1.67	41.9	1.65	1.6	0.063	1.602	0.488	1.076
	40	1 1/2	48.4	1.90	47.8	1.88	1.6	0.063	1.835	0.559	1.233
	50	2	60.2	2.30	59.6	2.35	1.6	0.063	2.300	0.701	1.546
	65	2 1/2	76.0	2.99	75.2	2.96	1.6	0.063	2.920	0.890	1.962
	80	3	88.7	3.49	87.9	3.46	1.6	0.063	3.421	1.043	2.300
	100	4	113.9	4.48	113.0	4.45	1.9	0.075	5.226	1.593	3.513
	125	5	140.6	5.53	138.7	5.46	3.0	0.118	10.110	3.082	6.796
	150	6	166.1	6.54	164.1	6.46	3.0	0.118	11.990	3.655	8.059

Thickness Tolerances : $\pm 10\%$

CARBON Steel Pipes (For Ordinary Piping)

JIS G 3452 / MANUFACTURER'S STANDARD

Nominal Size		Outside Diameter			Wall Thickness	Calculated Weight		Test Pressure	
in	mm	mm	Max. (mm)	Min. (mm)	mm	kg/m	lb/ft	kg/cm ²	PSI
1/2	15	21.7	22.2	21.2	2.8	1.31	0.88	25	360
3/4	20	27.2	27.7	26.7	2.8	1.68	1.13	25	360
1	25	34.0	34.5	33.5	3.2	2.43	1.63	25	360
1 1/4	32	42.7	43.2	42.2	3.5	3.38	2.27	25	360
1 1/2	40	48.6	49.1	48.1	3.5	3.89	2.61	25	360
2	50	60.5	61.1	59.9	3.8	5.31	3.57	25	360
2 1/2	65	76.3	77.1	75.5	4.2	7.47	5.02	25	360
3	80	89.1	90.0	88.2	4.2	8.79	5.91	25	360
3 1/2	90	101.6	102.6	100.6	4.2	10.1	6.79	25	360
4	100	114.3	115.4	113.2	4.5	12.2	8.20	25	360
5	125	139.8	141.2	138.4	4.5	15.0	10.1	25	360
6	150	165.2	166.8	163.6	5.0	19.8	13.3	25	360
7	175	190.7	192.3	189.1	5.3	24.2	16.3	25	360
8	200	216.3	218.0	214.6	4.5	23.5	15.8	25	360
8	200	216.3	218.0	214.6	5.8	30.1	20.2	25	360
10	250	267.4	269.5	265.3	6.0	35.9	24.2	25	360
10	250	267.4	269.5	265.3	6.6	42.4	28.5	25	360

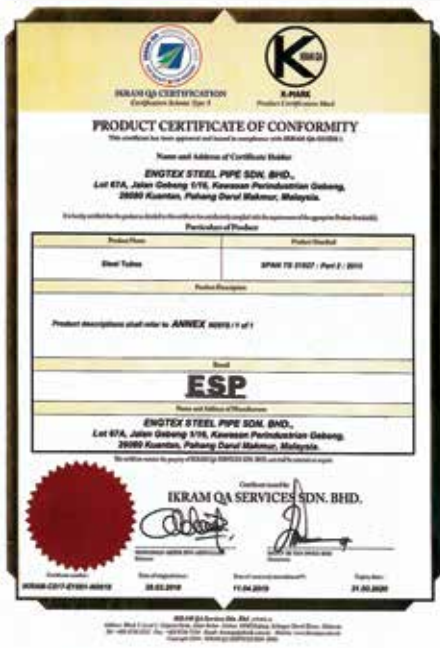
Thickness Tolerances : -12.5%

ERW Steel Tubes (For Cement Lined Pipes)

SPAN TS 21827 : PART 2 : 2013/BS 3601

Outside Diameter	Minimum Wall Thickness	Outside Diameter		Calculated Weight Plain
		Maximum	Minimum	
mm	mm	mm	mm	kg/m
114.3	3.6	115.4	113.2	10.35
139.7	3.6	141.1	138.3	12.73
168.3	3.6	170.0	166.6	15.41
193.7	4.0	195.2	192.2	19.63
219.1	4.0	221.3	216.9	22.26
244.5	4.0	246.9	242.1	24.89
273.0	4.0	275.7	270.3	27.84

CERTIFICATIONS



STRUCTURAL & GENERAL APPLICATION

ERW STRUCTURAL HOLLOW SECTIONS



Technical Specification References

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	Cu	Test Temperature °C	Min average absorbed energy for standard test piece J	
			N/mm ²															CHS
			T < 3mm	3mm ≤ T ≤ 40 mm	N/mm ²	%	Max	Max	Max	Max	Max	Max	Max	Max	Max			
Cold formed welded structural hollow sections of non-alloy and fine grain steels	BS EN 10219	S235JRH	360 - 510	360 - 510	235	24	0.17	-	1.40	0.045	0.045	-	-	0.35	-	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	
		S355J0H	510 - 680	470 - 630	355	20	0.22	0.55	1.60	0.040	0.040	-	-	0.45	-	0	27	
		S355J2H	510 - 680	470 - 630	355	20	0.22	0.55	1.60	0.035	0.035	-	-	0.45	-	-20	27	
Carbon Steel Tubes For General	JIS G 3444	STK 290	290	-	30 (N1) 20 (N2)	-	-	-	0.050	0.050	-	-	-	-	-	-	-	
		STK 400	400	235	23 (N1) 18 (N2)	-	0.250	-	0.040	0.040	-	-	-	-	-	-	-	
		STK 500	500	355	15 (N1) 10 (N2)	-	0.300 to 1.00	0.300	0.350	0.040	0.040	-	-	-	-	-	-	
		STK 540	540	390	20 (N1) 16 (N2)	-	0.230	1.500	0.550	0.040	0.040	-	-	-	-	-	-	
Cold-Formed Welded Carbon Steel Structural	ASTM A-500	Grade A	310	270	As specified in ASTM A500 Specification	0.30	-	1.40	0.045	0.045	-	-	-	0.18 min	-	-		
		Grade B	400	315		0.30	-	1.40	0.045	0.045	-	-	-	0.18 min	-	-		
		Grade C	425	345		0.27	-	1.35	0.045	0.045	-	-	-	0.18 min	-	-		
		Grade D	400	250		0.30	-	1.40	0.045	0.045	-	-	-	0.18 min	-	-		
		Grade A	310	230		0.30	-	1.40	0.045	0.045	-	-	-	0.18 min	-	-		
		Grade B	400	290		0.30	-	1.40	0.045	0.045	-	-	-	0.18 min	-	-		
		Grade C	425	315		0.27	-	1.35	0.045	0.045	-	-	-	0.18 min	-	-		
Grade D	400	250	0.30	-	1.40	0.045	0.045	-	-	-	0.18 min	-	-					

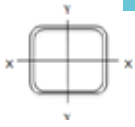
- NOTES :
- The impact properties of steel qualities JR and J0 are verified by laboratory testing only when specified at the time of the inquiry and order
 - The steel qualities J0 and J2 can be produced upon request with extra cost.
 - (N1) Test piece No. 11 and 12
 - (N2) Test piece No. 5
 - When the 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

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	± 1% with a min. of ± 0.5mm and a max. of ± 10mm.	
	SHS & RHS	Size (mm)	Tolerance
		H, B < 100mm 100mm ≤ H, B ≤ 200mm H, B > 200mm	± 1% with a min. of ± 0.5mm ± 0.8% ± 0.6%
Thickness (T)	CHS	For OD ≤ 406.4mm T ≤ 5mm T > 5mm	± 10% ± 0.50mm
		For OD > 406.4mm	± 10% with a max. of 2mm
	SHS & RHS	T ≤ 5mm T > 5mm	± 10% ± 0.50mm
Tolerances of Length	CHS SHS & RHS	-0mm, + 50mm	
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° ± 1°	
External Corner Profile	SHS & RHS	T ≤ 6mm 6mm < T ≤ 10mm 10mm < T	1.6T to 2.4T 2.0T to 3.0T 2.4T to 3.6T
Twist		2mm plus 0.50mm/m length	
Straightness	CHS	0.2% of total length	
	SHS & RHS	0.15% of total length	
Mass	CHS	± 6% on individual length	
	SHS & RHS	± 6% on individual length	

NOTES : CHS - Circular Hollow Sections
RHS - Rectangular Hollow Sections
SHS - Square Hollow Sections

SQUARE Hollow Sections

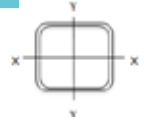


BS EN 10219/MANUFACTURER'S STANDARD

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	Nominal Length per tonne
Size	Thickness										J	C		
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
25 x 25	1.60	1.12	0.343	0.76	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	0.92	1.74	7.5	1.48	0.92	1.19	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	0.098	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
38 x 38	1.60	1.78	0.542	1.19	2.26	18.8	4.92	1.47	2.59	3.06	7.90	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	9.60	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	10.80	5.20	0.144	404.6
	2.50	2.66	0.811	1.79	3.39	10.2	6.95	1.43	3.66	4.44	11.60	5.53	0.143	375.9
	3.00	3.12	0.949	2.09	3.97	7.7	7.86	1.41	4.14	5.10	13.30	6.28	0.142	321.0
	4.00	3.95	1.203	2.65	5.03	4.5	9.28	1.36	4.88	6.22	16.40	7.48	0.138	253.4
50 x 50	1.60	2.38	0.725	1.60	3.03	26.3	11.70	1.96	4.68	5.46	18.50	7.03	0.195	420.2
	1.90	2.80	0.852	1.88	3.56	21.3	13.60	1.95	5.42	6.37	21.60	8.15	0.193	357.6
	2.00	2.93	0.894	1.97	3.74	20.0	14.10	1.95	5.66	6.66	22.60	8.51	0.193	340.9
	2.30	3.34	1.020	2.24	4.25	16.7	15.90	1.93	6.34	7.52	25.60	9.55	0.192	299.6
	2.50	3.60	1.100	2.42	4.59	15.0	16.90	1.92	6.78	8.07	27.50	10.22	0.191	277.6
	3.00	4.25	1.290	2.85	5.41	11.7	19.50	1.90	7.79	9.39	32.10	11.80	0.190	235.5
	4.00	5.45	1.660	3.67	6.95	7.5	23.70	1.85	9.49	11.70	40.40	14.40	0.186	183.3
	4.50	6.02	1.830	4.05	7.67	6.1	25.50	1.82	10.20	12.80	44.10	15.60	0.185	166.1
	5.00	6.56	2.000	4.41	8.36	5.0	27.00	1.80	10.80	13.70	47.50	16.60	0.183	152.4
	6.00	7.56	2.300	5.08	9.63	3.3	29.50	1.75	11.80	15.30	53.20	18.20	0.179	132.2
65 x 65	2.00	3.88	1.180	2.60	4.94	27.5	32.30	2.56	9.90	11.60	50.90	14.90	0.253	258.0
	2.30	4.42	1.350	2.97	5.63	23.3	36.40	2.54	11.20	13.10	57.90	16.90	0.252	226.2
	2.50	4.78	1.460	3.21	6.09	21.0	39.10	2.53	12.00	14.10	62.40	18.10	0.251	209.2
	3.00	5.66	1.720	3.80	7.21	16.7	45.40	2.51	14.00	16.60	73.30	21.00	0.250	176.7
	4.00	7.34	2.240	4.93	9.35	11.3	56.60	2.46	17.40	21.00	93.70	26.30	0.246	136.3
	4.50	8.14	2.480	5.47	10.37	9.4	61.60	2.44	18.90	23.10	103.10	28.70	0.245	122.9
	5.00	8.91	2.720	5.99	11.36	8.0	66.10	2.41	20.30	25.00	112.00	30.90	0.243	112.2
	6.00	10.39	3.170	6.98	13.23	5.8	73.90	2.36	22.70	28.50	128.20	34.70	0.239	96.3

SQUARE Hollow Sections

BS EN 10219/MANUFACTURER'S STANDARD



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	Nominal Length per tonne
Size	Thickness										J	C		
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
75 x 75	2.30	5.14	1.570	3.46	6.55	27.6	57.10	2.95	15.20	17.70	90.00	22.90	0.292	194.4
	2.50	5.56	1.700	3.74	7.09	25.0	61.40	2.94	16.40	19.10	97.10	24.60	0.291	179.7
	3.00	6.60	2.010	4.44	8.41	20.0	71.60	2.92	19.10	22.50	114.50	28.70	0.290	151.5
	4.00	8.59	2.620	5.77	10.95	13.8	90.20	2.87	24.10	28.80	147.30	36.30	0.286	116.4
	4.50	9.55	2.910	6.42	12.17	11.7	98.60	2.85	26.30	31.70	162.70	39.70	0.285	104.7
	5.00	10.48	3.200	7.05	13.36	10.0	106.30	2.82	28.40	34.50	177.40	42.90	0.283	95.4
100 x 100	2.30	6.95	2.120	4.67	8.85	38.5	139.70	3.97	27.90	32.30	217.50	41.90	0.392	143.9
	3.00	8.96	2.730	6.02	11.41	28.3	177.00	3.94	35.40	41.20	278.70	53.20	0.390	111.7
	4.00	11.73	3.580	7.88	14.95	20.0	226.40	3.89	45.30	53.30	362.00	68.10	0.386	85.2
	4.50	13.08	3.990	8.79	16.67	17.2	249.30	3.87	49.90	59.00	401.90	75.10	0.385	76.4
	5.00	14.41	4.390	9.68	18.36	15.0	271.10	3.84	54.20	64.60	440.50	81.70	0.383	69.4
	6.00	16.98	5.180	11.41	21.63	11.7	311.50	3.79	62.30	75.10	514.20	94.10	0.379	58.9
	6.30	17.47	5.320	11.74	22.25	10.9	314.20	3.76	62.80	76.40	536.00	97.00	0.373	57.3
	8.00	21.39	6.520	14.37	27.24	7.5	365.90	3.67	73.20	91.10	644.60	114.20	0.366	46.8
	9.00	23.53	7.170	15.81	29.98	6.1	390.60	3.61	78.10	98.60	700.40	122.80	0.361	42.5
125 x 125	3.00	11.31	3.450	7.60	14.41	36.7	354.50	4.96	56.70	65.60	552.70	85.10	0.490	88.4
	4.00	14.87	4.530	9.99	18.95	26.3	457.20	4.91	73.20	85.30	722.00	109.90	0.486	67.2
	4.50	16.62	5.060	11.17	21.17	22.8	505.80	4.89	80.90	94.80	803.90	121.70	0.485	60.2
	5.00	18.33	5.590	12.32	23.36	20.0	552.60	4.86	88.40	104.10	883.80	133.00	0.483	54.5
	6.00	21.69	6.610	14.58	27.63	15.8	640.90	4.82	102.50	121.90	1038.10	154.50	0.479	46.1
	6.30	22.41	6.830	15.06	28.55	14.8	652.60	4.78	104.40	124.90	1086.50	160.10	0.473	44.6
	8.00	27.67	8.430	18.59	35.24	10.6	775.30	4.69	124.10	151.00	1325.40	191.70	0.466	36.1
	9.00	30.60	9.330	20.56	38.98	8.9	837.80	4.64	134.10	164.90	1454.10	208.20	0.461	32.7
150 x 150	3.00	13.67	4.170	9.18	17.41	45.0	622.70	5.98	83.00	95.50	964.60	124.60	0.590	73.2
	4.00	18.01	5.490	12.10	22.95	32.5	807.80	5.93	107.70	124.90	1264.80	161.70	0.586	55.5
	4.50	20.15	6.140	13.54	25.67	28.3	896.30	5.91	119.50	139.10	1410.80	179.50	0.585	49.5
	5.00	22.26	6.780	14.96	28.36	25.0	982.10	5.89	130.90	153.00	1554.10	196.80	0.583	44.9
	6.00	26.40	8.050	17.74	33.63	20.0	1145.90	5.84	152.80	179.90	1832.70	229.80	0.579	37.9
	6.30	27.36	8.340	18.38	34.85	18.8	1173.70	5.80	156.50	185.10	1921.60	238.80	0.573	36.6
	8.00	33.95	10.350	22.81	43.24	13.8	1411.80	5.71	188.20	226.00	2364.20	289.00	0.566	29.5
	9.00	37.66	11.480	25.31	47.98	11.7	1537.40	5.66	205.00	248.20	2608.10	316.00	0.561	26.6
	12.50	48.70	14.850	32.73	62.04	7.0	1817.40	5.41	242.30	305.60	3321.30	389.30	0.536	20.5



RECTANGULAR Hollow Sections

BS EN 10219/MANUFACTURER'S STANDARD

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	Nominal Length per tonne
Size	Thickness					Flange	Web	Axis	Axis	Axis	Axis	Axis	Axis	Axis	Axis	J	C		
H x B	T	M			A	B/t	H/t	x-x	y-y	x-x	y-y	x-x	y-y			As	L		
mm	mm	Kg/m	Kg/ft	lb/ft	cm ²			cm ⁴	cm ⁴	cm	cm	cm ³	cm ³	cm ³	cm ³	cm ⁴	cm ⁴	m ² /m	m
50 x 25	1.60	1.75	0.534	1.18	2.23	10.6	26.3	7.0	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	8.4	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	9.3	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	9.9	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
65 x 38	1.60	2.46	0.748	1.65	3.13	18.8	35.6	17.8	7.79	2.39	1.58	5.49	4.10	6.70	4.63	17.40	6.91	0.201	407.3
	1.90	2.89	0.880	1.94	3.68	15.0	29.2	20.7	9.00	2.37	1.56	6.36	4.74	7.82	5.40	20.30	8.00	0.199	346.5
	2.00	3.03	0.923	2.03	3.86	14.0	27.5	21.6	9.39	2.37	1.56	6.64	4.94	8.18	5.64	21.20	8.35	0.199	330.3
	2.30	3.45	1.050	2.32	4.39	11.5	23.3	24.2	10.50	2.35	1.55	7.46	5.53	9.24	6.37	24.00	9.36	0.198	290.2
	2.50	3.72	1.130	2.50	4.74	10.2	21.0	25.9	11.20	2.34	1.54	7.97	5.90	9.92	6.83	25.80	10.00	0.197	268.8
	3.00	4.39	1.340	2.95	5.59	7.7	16.7	29.8	12.80	2.31	1.51	9.18	6.75	11.50	7.93	30.00	11.50	0.196	228.0
	4.00	5.64	1.720	3.79	7.19	4.5	11.3	36.5	15.50	2.25	1.47	11.24	8.17	14.50	9.89	37.50	14.00	0.192	177.2
75 x 50	1.90	3.54	1.080	2.38	4.51	21.3	34.5	35.5	19.10	2.81	2.05	9.48	7.62	11.40	8.70	39.50	12.50	0.243	282.3
	2.00	3.72	1.130	2.50	4.74	20.0	32.5	37.2	19.90	2.80	2.05	9.91	7.96	12.00	9.10	41.40	13.10	0.243	268.9
	2.30	4.24	1.290	2.85	5.40	16.7	27.6	41.9	22.40	2.79	2.04	11.17	8.96	13.60	10.30	46.90	14.80	0.242	235.8
	2.50	4.58	1.400	3.08	5.84	15.0	25.0	45.0	24.00	2.77	2.03	11.99	9.60	14.60	11.00	50.50	15.90	0.241	218.2
	3.00	5.42	1.650	3.64	6.91	11.7	20.0	52.2	27.80	2.75	2.00	13.91	11.10	17.10	12.90	59.30	18.40	0.240	184.4
	4.00	7.02	2.140	4.72	8.95	7.5	13.8	65.0	34.30	2.69	1.96	17.32	13.70	21.70	16.30	75.30	22.90	0.236	142.4
	4.50	7.79	2.370	5.23	9.92	6.1	11.7	70.6	37.20	2.67	1.94	18.82	14.90	23.80	17.90	82.70	24.90	0.235	128.4
	5.00	8.52	2.600	5.73	10.86	5.0	10.0	75.6	39.70	2.64	1.91	20.17	15.90	25.70	19.30	89.50	26.70	0.233	117.3
	6.00	9.92	3.020	6.66	12.63	3.3	7.5	84.4	44.10	2.58	1.87	22.50	17.60	29.20	21.90	101.80	29.80	0.229	100.8
100 x 50	1.90	4.29	1.310	2.88	5.45	21.3	47.6	71.6	24.50	3.62	2.12	14.30	9.80	17.60	10.90	58.70	16.90	0.293	233.2
	2.00	4.50	1.370	3.03	5.74	20.0	45.0	75.0	25.70	3.62	2.12	15.00	10.30	18.50	11.50	61.60	17.70	0.293	222.0
	2.30	5.14	1.570	3.46	6.55	16.7	38.5	84.8	29.00	3.60	2.10	17.00	11.60	21.00	13.00	69.90	20.00	0.292	194.4
	2.50	5.56	1.700	3.74	7.09	15.0	35.0	91.2	31.10	3.59	2.09	18.20	12.40	22.70	14.00	75.40	21.50	0.291	179.7
	3.00	6.60	2.010	4.44	8.41	11.7	28.3	106.5	36.10	3.56	2.07	21.30	14.40	26.70	16.40	88.60	25.00	0.290	151.5
	4.00	8.59	2.620	5.77	10.95	7.5	20.0	134.1	44.90	3.50	2.03	26.80	18.00	34.10	20.90	113.00	31.30	0.286	116.4
	4.50	9.55	2.910	6.42	12.17	6.1	17.2	146.6	48.90	3.47	2.00	29.30	19.50	37.60	23.00	124.30	34.20	0.285	104.7
	5.00	10.48	3.200	7.05	13.36	5.0	15.0	158.2	52.50	3.44	1.98	31.60	21.00	40.80	25.00	134.90	36.80	0.283	95.4
	6.00	12.27	3.740	8.25	15.63	3.3	11.7	178.8	58.70	3.38	1.94	35.80	23.50	46.90	28.50	154.20	41.40	0.279	81.5
	6.30	12.52	3.820	8.41	15.95	2.9	10.9	175.7	58.20	3.32	1.91	35.10	23.30	46.90	28.60	158.10	42.10	0.273	79.9

RECTANGULAR Hollow Sections

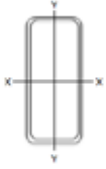


BS EN 10219/MANUFACTURER'S STANDARD

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	Nominal Length per tonne
Size	Thickness					Flange	Web	Axis	Axis	Axis	Axis	Axis	Axis	Axis	Axis	J	C		
H x B	T	M			A	B/t	H/t	x-x	y-y	x-x	y-y	x-x	y-y			As	L		
mm	mm	Kg/m	Kg/ft	lb/ft	cm ²			cm ⁴	cm ⁴	cm	cm	cm ³	cm ³	cm ³	cm ³	cm ⁴	cm ⁴	m ² /m	m
100 x 75	3.00	7.78	2.370	5.23	9.91	20.0	28.3	141.8	91.10	3.78	3.03	28.40	24.30	33.90	27.90	176.60	39.10	0.340	128.6
	3.20	8.26	2.520	5.55	10.53	18.4	26.3	149.8	96.20	3.77	3.02	30.00	25.60	35.90	29.50	187.30	41.30	0.339	121.0
	4.00	10.16	3.100	6.83	12.95	13.8	20.0	180.2	115.40	3.73	2.99	36.00	30.80	43.70	35.90	228.20	49.70	0.336	98.4
	4.50	11.32	3.450	7.61	14.42	11.7	17.2	197.9	126.50	3.71	2.96	39.60	33.70	48.30	39.60	252.70	54.60	0.335	88.4
	5.00	12.45	3.790	8.36	15.86	10.0	15.0	214.6	137.00	3.68	2.94	42.90	36.50	52.70	43.20	276.20	59.20	0.333	80.3
	6.00	14.63	4.460	9.83	18.63	7.5	11.7	245.1	156.00	3.63	2.89	49.00	41.60	61.00	49.90	320.40	67.70	0.329	68.4
	6.30	14.99	4.570	10.07	19.10	6.9	10.9	244.9	156.30	3.58	2.86	49.00	41.70	61.60	50.50	332.50	69.50	0.323	66.7
125 x 50	2.50	6.55	2.000	4.40	8.34	15.0	45.0	159.6	38.10	4.37	2.14	25.50	15.20	32.30	17.00	101.30	27.10	0.341	152.8
	3.00	7.78	2.370	5.23	9.91	11.7	36.7	187.0	44.40	4.34	2.12	29.90	17.70	38.10	20.00	119.00	31.60	0.340	128.6
	4.00	10.16	3.100	6.83	12.95	7.5	26.3	237.5	55.60	4.28	2.07	38.00	22.20	49.00	25.50	152.10	39.80	0.336	98.4
	4.50	11.32	3.450	7.61	14.42	6.1	22.8	260.7	60.60	4.25	2.05	41.70	24.20	54.20	28.10	167.40	43.50	0.335	88.4
	5.00	12.45	3.790	8.36	15.86	5.0	20.0	282.5	65.20	4.22	2.03	45.20	26.10	59.10	30.60	182.00	47.00	0.333	80.3
	6.00	14.63	4.460	9.83	18.63	3.3	15.8	322.0	73.30	4.16	1.98	51.50	29.30	68.30	35.10	208.50	53.10	0.329	68.4
	6.30	14.99	4.570	10.07	19.10	2.9	14.8	319.4	73.30	4.09	1.96	51.10	29.30	68.30	35.50	214.60	54.20	0.323	66.7
125 x 75	3.00	8.96	2.730	6.02	11.41	20.0	36.7	242.8	110.50	4.61	3.11	38.90	29.50	47.30	33.30	242.90	49.50	0.390	111.7
	4.00	11.73	3.580	7.88	14.95	13.8	26.3	310.8	140.70	4.56	3.07	49.70	37.50	61.10	43.00	314.50	63.10	0.386	85.2
	4.50	13.08	3.990	8.79	16.67	11.7	22.8	342.4	154.50	4.53	3.04	54.80	41.20	67.70	47.50	348.60	69.50	0.385	76.4
	5.00	14.41	4.390	9.68	18.36	10.0	20.0	372.5	167.70	4.50	3.02	59.60	44.70	74.10	52.00	381.50	75.60	0.383	69.4
	6.00	16.98	5.180	11.41	21.63	7.5	15.8	428.3	191.80	4.45	2.98	68.50	51.10	86.20	60.30	443.80	86.70	0.379	58.9
	9.00	23.53	7.170	15.81	29.98	3.3	8.9	534.5	238.00	4.22	2.82	85.50	63.50	112.70	78.70	596.40	111.90	0.361	42.5
150 x 50	3.00	8.96	2.730	6.02	11.41	11.7	45.0	298.5	52.60	5.12	2.15	39.80	21.10	51.40	23.50	150.20	38.30	0.390	111.7
	4.00	11.73	3.580	7.88	14.95	7.5	32.5	381.4	66.20	5.05	2.10	50.90	26.50	66.50	30.10	192.10	48.30	0.386	815.2
	4.50	13.08	3.990	8.79	16.67	6.1	28.3	419.8	72.20	5.02	2.08	56.00	28.90	73.60	33.20	211.60	52.90	0.385	76.4
	5.00	14.41	4.390	9.68	18.36	5.0	25.0	456.3	77.90	4.99	2.06	60.80	31.10	80.50	36.20	230.10	57.10	0.383	69.4
	6.00	16.98	5.180	11.41	21.63	3.3	20.0	523.5	87.90	4.92	2.02	69.80	35.20	93.50	41.70	264.00	64.80	0.379	58.9
	6.30	17.47	5.320	11.74	22.25	2.9	18.8	522.8	88.50	4.85	1.99	69.70	35.40	94.60	42.40	272.20	66.30	0.373	57.3

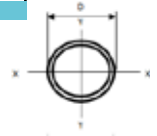
RECTANGULAR Hollow Sections

BS EN 10219/MANUFACTURER'S STANDARD



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	Nominal Length per tonne
Size	Thickness					Flange	Web	Axis	Axis	Axis	Axis	Axis	Axis	Axis	Axis	J	C		
H x B	T	M			A	B/t	H/t	x-x	y-y	x-x	y-y	x-x	y-y	x-x	y-y	J	C	As	L
mm	mm	Kg/m	Kg/ft	lb/ft	cm ²			cm ⁴	cm ⁴	cm	cm	cm ³	cm ³	cm ³	cm ³	cm ⁴	cm ⁴	m ² /m	m
150 x 75	3.00	10.13	3.090	6.81	12.91	20.0	45.0	379.6	130.00	5.42	3.17	50.60	34.70	62.50	38.70	311.80	59.80	0.440	98.7
	4.00	13.30	4.060	8.94	16.95	13.8	32.5	488.0	165.90	5.37	3.13	65.10	44.20	81.10	50.10	404.30	76.60	0.436	75.2
	4.50	14.85	4.530	9.98	18.92	11.7	28.3	538.9	182.50	5.34	3.11	71.90	48.70	90.00	55.50	448.40	84.40	0.435	67.3
	5.00	16.37	4.990	11.00	20.86	10.0	25.0	587.7	198.40	5.31	3.08	78.40	52.90	98.60	60.70	491.00	91.90	0.433	61.1
	6.00	19.34	5.890	12.99	24.63	7.5	20.0	679.1	227.60	5.25	3.04	90.50	60.70	115.10	70.60	572.00	105.80	0.429	51.7
	6.30	19.94	6.080	13.40	25.40	6.9	18.8	685.6	230.90	5.20	3.01	91.40	61.60	117.20	72.20	595.80	109.10	0.423	50.2
	8.00	24.53	7.480	16.48	31.24	4.4	13.8	806.3	269.00	5.08	2.93	107.50	71.70	140.80	86.30	714.50	128.50	0.416	40.8
	9.00	27.07	8.250	18.19	34.48	3.3	11.7	865.8	287.30	5.01	2.89	115.40	76.60	153.00	93.60	775.20	138.10	0.411	36.9
150 x 100	4.00	14.87	4.530	9.99	18.95	20.0	32.5	594.6	318.60	5.60	4.10	79.30	63.70	95.70	72.50	661.60	104.90	0.486	67.2
	4.50	16.62	5.060	11.17	21.17	17.2	28.3	658.1	352.00	5.58	4.08	87.70	70.40	106.30	80.50	736.10	116.10	0.485	60.2
	5.00	18.33	5.590	12.32	23.36	15.0	25.0	719.2	384.00	5.55	4.05	95.90	76.80	116.70	88.30	808.70	126.80	0.483	54.5
	6.00	21.69	6.610	14.58	27.63	11.7	20.0	834.7	444.20	5.50	4.01	111.30	88.80	136.70	103.30	948.30	147.10	0.479	46.1
	6.30	22.41	6.830	15.06	28.55	10.9	18.8	848.3	452.70	5.45	3.98	113.10	90.50	139.90	105.90	991.60	152.30	0.473	44.6
	8.00	27.67	8.430	18.59	35.24	7.5	13.8	1008.1	535.70	5.35	3.90	134.40	107.10	169.20	127.90	1205.90	181.80	0.466	36.1
	9.00	30.60	9.330	20.56	38.98	6.1	11.7	1089.5	577.50	5.29	3.85	145.30	115.50	184.80	139.50	1320.30	197.20	0.461	32.7
200 x 100	4.00	18.01	5.490	12.10	22.95	20.0	45.0	1199.7	410.80	7.23	4.23	120.00	83.20	148.00	91.70	985.40	141.80	0.586	55.5
	4.50	20.15	6.140	13.54	25.67	17.2	39.4	1331.4	454.60	7.20	4.21	133.10	90.90	164.90	102.00	1097.10	157.10	0.585	49.6
	5.00	22.26	6.780	14.96	28.36	15.0	35.0	1459.3	496.90	7.17	4.19	145.90	99.40	181.40	112.10	1206.30	171.90	0.583	44.9
	6.00	26.40	8.050	17.74	33.63	11.7	28.3	1703.3	576.90	7.12	4.14	170.30	115.40	213.30	131.50	1417.00	200.10	0.579	37.9
	6.30	27.36	8.340	18.38	34.85	10.9	26.7	1739.2	591.10	7.06	4.12	173.90	118.20	219.10	135.40	1482.80	207.60	0.573	36.6
	8.00	33.95	10.350	22.81	43.24	7.5	20.0	2090.8	705.40	6.95	4.04	209.10	141.10	267.30	164.70	1810.70	249.60	0.566	29.5
	9.00	37.66	11.480	25.31	47.98	6.1	17.2	2275.6	764.40	6.89	3.99	227.60	152.90	293.40	180.50	1988.30	271.80	0.561	26.6
	10.00	41.26	12.580	27.73	52.57	5.0	15.0	2444.4	817.70	6.82	3.94	244.40	163.50	318.10	195.20	2154.10	292.10	0.557	24.2
	12.00	47.15	14.370	31.68	60.06	3.3	11.7	2606.7	875.60	6.59	3.82	260.70	175.10	350.00	215.30	2414.40	321.80	0.538	21.2
	12.50	48.70	14.850	32.73	62.04	3.0	11.0	2658.9	892.20	6.55	3.79	265.90	178.40	359.10	220.80	2473.80	328.80	0.536	20.5

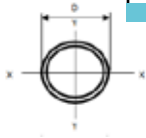
CIRCULAR Hollow Sections



BS EN 10219/MANUFACTURER'S STANDARD

Designation		Weight	Cross Sectional Area	Second Moment of Area	Radius of Gyration	Elastic Modulus	Plastic Modulus	Torsional inertia constant	Torsional modulus constant	Superficial Area per metre length	Nominal Length per tonne	Ratio for Local Buckling
Size	Thickness											
OD	T	M	A	I	i	Wel	Wpl	Lt	Ct	As	L	B/T
mm	mm	Kg/m	cm ²	cm ⁴	cm	cm ³	cm ³	cm ⁴	cm ³	m ² /m	m	
21.3	2.0	0.952	1.21	0.57	0.69	0.54	0.75	1.14	1.07	0.07	1050.49	10.65
21.3	2.5	1.159	1.48	0.66	0.67	0.62	0.89	1.33	1.25	0.07	862.75	8.52
21.3	3.0	1.354	1.72	0.74	0.66	0.70	1.01	1.48	1.39	0.07	738.60	7.10
26.9	2.0	1.228	1.56	1.22	0.88	0.91	1.24	2.44	1.81	0.08	814.24	13.45
26.9	2.5	1.504	1.92	1.44	0.87	1.07	1.49	2.88	2.14	0.08	664.74	10.76
26.9	3.0	1.768	2.25	1.63	0.85	1.21	1.72	3.27	2.43	0.08	565.54	8.97
33.7	2.0	1.564	1.99	2.51	1.12	1.49	2.01	5.02	2.98	0.11	639.57	16.85
33.7	2.5	1.924	2.45	3.00	1.11	1.78	2.44	6.00	3.56	0.11	519.86	13.48
33.7	3.0	2.271	2.89	3.44	1.09	2.04	2.84	6.88	4.08	0.11	440.27	11.23
42.4	2.0	1.993	2.54	5.19	1.43	2.45	3.27	10.38	4.90	0.13	501.84	21.20
42.4	2.5	2.460	3.13	6.26	1.41	2.95	3.99	12.52	5.91	0.13	406.51	16.96
42.4	3.0	2.915	3.71	7.25	1.40	3.42	4.67	14.49	6.84	0.13	343.05	14.13
42.4	4.0	3.788	4.83	8.99	1.36	4.24	5.92	17.98	8.48	0.13	263.99	10.60
48.3	2.0	2.284	2.91	7.81	1.64	3.23	4.29	15.62	6.47	0.15	437.89	24.15
48.3	2.5	2.824	3.60	9.46	1.62	3.92	5.25	18.92	7.83	0.15	354.14	19.32
48.3	3.0	3.351	4.27	11.00	1.61	4.55	6.17	22.00	9.11	0.15	298.37	16.10
48.3	4.0	4.370	5.57	13.77	1.57	5.70	7.87	27.54	11.40	0.15	228.83	12.08
48.3	5.0	5.339	6.80	16.15	1.54	6.69	9.42	32.31	13.38	0.15	187.29	9.66
60.3	2.0	2.876	3.66	15.58	2.06	5.17	6.80	31.16	10.34	0.19	347.76	30.15
60.3	2.5	3.564	4.54	18.99	2.05	6.30	8.36	37.99	12.60	0.19	280.62	24.12
60.3	3.0	4.239	5.40	22.22	2.03	7.37	9.86	44.45	14.74	0.19	235.89	20.10
60.3	4.0	5.554	7.07	28.17	2.00	9.34	12.70	56.35	18.69	0.19	180.06	15.08
60.3	5.0	6.819	8.69	33.48	1.96	11.10	15.33	66.95	22.21	0.19	146.65	12.06
76.1	2.0	3.655	4.66	31.98	2.62	8.40	10.98	63.96	16.81	0.24	273.61	38.05
76.1	2.5	4.538	5.78	39.19	2.60	10.30	13.55	78.37	20.60	0.24	220.38	30.44
76.1	3.0	5.408	6.89	46.10	2.59	12.11	16.04	92.19	24.23	0.24	184.90	25.37
76.1	4.0	7.112	9.06	59.06	2.55	15.52	20.81	118.11	31.04	0.24	140.60	19.03
76.1	5.0	8.767	11.17	70.92	2.52	18.64	25.32	141.84	37.28	0.24	114.06	15.22
76.1	6.0	10.373	13.21	81.76	2.49	21.49	29.56	163.52	42.97	0.24	96.41	12.68
76.1	6.3	10.845	13.81	84.82	2.48	22.29	30.78	169.64	44.58	0.24	92.21	12.08
88.9	2.0	4.286	5.46	51.57	3.07	11.60	15.11	103.14	23.20	0.28	233.31	44.45
88.9	2.5	5.327	6.79	63.37	3.06	14.26	18.67	126.75	28.51	0.28	187.73	35.56
88.9	3.0	6.355	8.10	74.76	3.04	16.82	22.15	149.53	33.64	0.28	157.35	29.63
88.9	4.0	8.375	10.67	96.34	3.00	21.67	28.85	192.68	43.35	0.28	119.40	22.23
88.9	5.0	10.346	13.18	116.37	2.97	26.18	35.24	232.75	52.36	0.28	96.66	17.78
88.9	6.0	12.267	15.63	134.94	2.94	30.36	41.31	269.88	60.72	0.28	81.52	14.82
88.9	6.3	12.833	16.35	140.24	2.93	31.55	43.07	280.47	63.10	0.28	77.92	14.11

CIRCULAR Hollow Sections

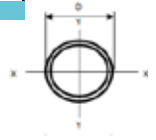


BS EN 10219/MANUFACTURER'S STANDARD

Designation		Weight	Cross Sectional Area	Second Moment of Area	Radius of Gyration	Elastic Modulus	Plastic Modulus	Torsional inertia constant	Torsional modulus constant	Superficial Area per metre length	Nominal Length per tonne	Ratio for Local Buckling
Size	Thickness											
OD	T	M	A	I	i	Wel	Wpl	Lt	Ct	As	L	B/T
mm	mm	Kg/m	cm ²	cm ⁴	cm	cm ³	cm ³	cm ⁴	cm ³	m ² /m	m	
101.6	2.0	4.913	6.26	77.63	3.52	15.28	19.84	155.26	30.56	0.32	203.56	50.80
101.6	2.5	6.110	7.78	95.61	3.50	18.82	24.56	191.22	37.64	0.32	163.67	40.64
101.6	3.0	7.295	9.29	113.04	3.49	22.25	29.17	226.07	44.50	0.32	137.08	33.87
101.6	4.0	9.628	12.26	146.28	3.45	28.80	38.12	292.57	57.59	0.32	103.87	25.40
101.6	5.0	11.912	15.17	177.47	3.42	34.93	46.70	354.94	69.87	0.32	83.95	20.32
101.6	6.0	14.146	18.02	206.68	3.39	40.68	54.91	413.35	81.37	0.32	70.69	16.93
101.6	6.3	14.807	18.86	215.07	3.38	42.34	57.30	430.13	84.67	0.32	67.54	16.13
114.3	2.5	6.893	8.78	137.26	3.95	24.02	31.25	274.52	48.03	0.36	145.08	45.72
114.3	3.0	8.234	10.49	162.55	3.94	28.44	37.17	325.10	56.88	0.36	121.44	38.10
114.3	4.0	10.881	13.86	211.07	3.90	36.93	48.69	422.13	73.86	0.36	91.91	28.58
114.3	5.0	13.478	17.17	256.92	3.87	44.96	59.77	513.84	89.91	0.36	74.20	22.86
114.3	6.0	16.025	20.41	300.21	3.83	52.53	70.45	600.42	105.06	0.36	62.40	19.05
114.3	6.3	16.780	21.38	312.71	3.82	54.72	73.57	625.43	109.44	0.36	59.60	18.14
114.3	8.0	20.972	26.72	379.49	3.77	66.40	90.57	758.98	132.81	0.36	47.68	14.29
139.7	3.0	10.114	12.88	301.09	4.83	43.11	56.07	602.18	86.21	0.44	98.88	46.57
139.7	4.0	13.386	17.05	392.86	4.80	56.24	73.68	785.72	112.49	0.44	74.70	34.93
139.7	5.0	16.610	21.16	480.54	4.77	68.80	90.76	961.08	137.59	0.44	60.21	27.94
139.7	6.0	19.783	25.20	564.26	4.73	80.78	107.33	1128.52	161.56	0.44	50.55	23.28
139.7	6.3	20.726	26.40	588.62	4.72	84.27	112.20	1177.24	168.54	0.44	48.25	22.17
139.7	8.0	25.983	33.10	720.29	4.66	103.12	138.93	1440.58	206.24	0.44	38.49	17.46
168.3	3.0	12.230	15.58	532.28	5.85	63.25	81.98	1064.57	126.51	0.53	81.77	56.10
168.3	4.0	16.208	20.65	697.09	5.81	82.84	108.00	1394.18	165.68	0.53	61.70	42.08
168.3	5.0	20.136	25.65	855.85	5.78	101.70	133.38	1711.69	203.41	0.53	49.66	33.66
168.3	6.0	24.015	30.59	1008.69	5.74	119.87	158.12	2017.39	239.74	0.53	41.64	28.05
168.3	6.3	25.170	32.06	1053.42	5.73	125.18	165.42	2106.84	250.37	0.53	39.73	26.71
168.3	8.0	31.626	40.29	1297.27	5.67	154.16	205.74	2594.54	308.32	0.53	31.62	21.04
168.3	10.0	39.039	49.73	1563.98	5.61	185.86	250.92	3127.97	371.71	0.53	25.62	16.83
177.8	4.0	17.145	21.84	825.09	6.15	92.81	120.85	1650.17	185.62	0.56	58.33	44.45
177.8	5.0	21.308	27.14	1013.97	6.11	114.06	149.34	2027.94	228.11	0.56	46.93	35.56
177.8	6.0	25.421	32.38	1196.22	6.08	134.56	177.16	2392.43	269.12	0.56	39.34	29.63
177.8	6.3	26.646	33.94	1249.62	6.07	140.56	185.38	2499.24	281.13	0.56	37.53	28.22
177.8	8.0	33.500	42.68	1541.44	6.01	173.39	230.83	3082.87	346.78	0.56	29.85	22.23
177.8	10.0	41.382	52.72	1861.98	5.94	209.45	281.90	3723.96	418.89	0.56	24.17	17.78
177.8	12.0	49.067	62.51	2159.06	5.88	242.86	330.45	4318.11	485.73	0.56	20.38	14.82
177.8	12.5	50.957	64.91	2229.79	5.86	250.82	342.20	4459.59	501.64	0.56	19.62	14.22

CIRCULAR Hollow Sections

BS EN 10219/MANUFACTURER'S STANDARD



Designation		Weight	Cross Sectional Area	Second Moment of Area	Radius of Gyration	Elastic Modulus	Plastic Modulus	Torsional inertia constant	Torsional modulus constant	Superficial Area per metre length	Nominal Length per tonne	Ratio for Local Buckling
Size	Thickness											
OD	T	M	A	I	i	Wel	Wpl	Lt	Ct	As	L	B/T
mm	mm	Kg/m	cm ²	cm ⁴	cm	cm ³	cm ³	cm ⁴	cm ³	m ² /m	m	
193.7	4.0	18.713	23.84	1072.79	6.71	110.77	143.97	2145.58	221.54	0.61	53.44	48.43
193.7	5.0	23.268	29.64	1320.23	6.67	136.32	178.08	2640.46	272.63	0.61	24.98	38.74
193.7	6.0	27.774	35.38	1559.72	6.64	161.05	211.46	3119.45	322.09	0.61	36.01	32.28
193.7	6.3	29.116	37.09	1630.05	6.63	168.31	221.33	3260.09	336.61	0.61	34.35	30.75
193.7	8.0	36.637	46.67	2015.54	6.57	208.11	276.05	4031.07	416.22	0.61	27.29	24.21
193.7	10.0	45.303	57.71	2441.59	6.50	252.10	337.79	4883.18	504.20	0.61	22.07	19.37
193.7	12.0	53.772	68.50	2839.20	6.44	293.15	396.75	5678.40	586.31	0.61	18.60	16.14
193.7	12.5	55.858	71.16	2934.31	6.42	302.97	411.07	5868.62	605.95	0.61	17.90	15.50
219.1	4.0	21.219	27.03	1563.84	7.61	142.75	185.09	3127.67	285.50	0.69	47.13	54.78
219.1	5.0	26.400	33.63	1928.04	7.57	176.00	229.24	3856.09	351.99	0.69	37.88	43.82
219.1	6.0	31.532	40.17	2281.95	7.54	208.30	272.54	4563.89	416.60	0.69	31.71	36.52
219.1	6.3	33.062	42.12	2386.14	7.53	217.81	285.37	4772.28	435.63	0.69	30.25	34.78
219.1	8.0	41.648	53.06	2959.63	7.47	270.16	356.68	5919.27	540.33	0.69	24.01	27.39
219.1	10.0	51.567	65.69	3598.44	7.40	328.47	437.56	7196.88	656.95	0.69	19.39	21.91
219.1	12.0	61.289	78.07	4199.88	7.33	383.38	515.26	8399.76	766.75	0.69	16.32	18.26
219.1	12.5	63.688	81.13	4344.58	7.32	396.58	534.20	8659.16	793.17	0.69	15.70	17.53
244.5	5.0	29.532	37.62	2698.58	8.47	220.74	286.84	5397.16	441.49	0.77	33.86	48.90
244.5	6.0	35.291	44.96	3198.53	8.43	261.64	341.37	6397.07	523.28	0.77	28.34	40.75
244.5	6.3	37.009	47.14	3346.03	8.42	273.70	357.54	6692.05	547.41	0.77	27.02	38.81
244.5	8.0	46.660	59.44	4160.45	8.37	340.32	447.63	8320.89	680.65	0.77	21.43	30.56
244.5	10.0	57.831	73.67	5073.15	8.30	414.98	550.24	10146.29	829.96	0.77	17.29	24.45
244.5	12.0	68.806	87.65	5938.34	8.23	485.75	649.25	11876.69	971.51	0.77	14.53	20.38
244.5	12.5	71.518	91.11	6147.42	8.21	502.86	673.45	12294.84	1005.71	0.77	13.98	19.56
273	5.0	33.046	42.10	3780.81	9.48	276.98	359.16	7561.63	553.97	0.86	30.26	54.60
273	6.0	39.508	50.33	4487.08	9.44	328.72	427.81	8974.17	657.45	0.86	25.31	45.50
273	6.3	41.437	52.79	4695.82	9.43	344.02	448.20	9391.65	688.03	0.86	24.13	43.33
273	8.0	52.282	66.60	5851.71	9.37	428.70	561.97	11703.43	857.39	0.86	19.13	34.13
273	10.0	64.860	82.62	7154.09	9.31	524.11	692.02	14308.19	1048.22	0.86	15.42	27.30
273	12.0	77.240	98.39	8396.14	9.24	615.10	818.03	16792.28	1230.20	0.86	12.95	22.75
273	12.5	80.304	102.30	8697.45	9.22	637.18	848.90	17394.90	1274.35	0.86	12.45	21.84

CARBON Steel Tubes (For General Structural Purposes)

JIS G 3444 - 1988 - STK 290	JIS G 3444 - 1988 - STK 500
JIS G 3444 - 1988 - STK 400	JIS G 3444 - 1988 - STK 540

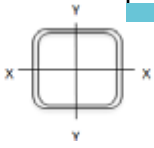
Outside Diameter	Wall Thickness	Calculated Weight	Cross-Sectional Area	Geometrical Moment of Inertia	Modulus of Section	Radius of Gyration of Area
mm	mm	kg/mm	cm ²	cm ⁴	cm ³	cm
21.7	2.0	0.972	1.238	0.607	0.560	0.700
27.2	2.0	1.24	1.583	1.26	0.930	0.890
	2.3	1.41	1.799	1.41	1.03	0.880
34.0	2.3	1.80	2.291	2.89	1.70	1.12
42.7	2.3	2.29	2.919	5.97	2.80	1.43
	2.5	2.49	3.157	6.40	3.00	1.42
	2.8	2.76	3.510	7.02	3.29	1.41
48.6	2.3	2.63	3.345	8.99	3.70	1.64
	2.5	2.84	3.621	9.65	3.97	1.63
	2.8	3.16	4.029	10.6	4.36	1.62
	3.2	3.58	4.564	11.8	4.86	1.61
60.5	2.3	3.30	4.205	17.8	5.90	2.06
	3.2	4.52	5.760	23.7	7.84	2.03
	4.0	5.57	7.100	28.5	9.41	2.00
76.3	2.8	5.08	6.465	43.7	11.5	2.60
	3.2	5.77	7.349	49.2	12.9	2.59
	4.0	7.13	9.085	59.5	15.6	2.56
89.1	2.8	5.96	7.591	70.7	15.9	3.05
	3.2	6.78	8.636	79.8	17.9	3.04
	4.0	8.39	10.69	97.0	21.8	3.01
101.6	3.2	7.76	9.892	120	23.6	3.48
	4.0	9.63	12.26	146	28.8	3.45
	5.0	11.9	15.17	177	34.9	3.42
114.3	3.2	8.77	11.17	172	30.2	3.93
	3.6	9.83	12.52	192	33.6	3.92
	4.5	12.2	15.52	234	41.0	3.89
	5.6	15.0	19.12	283	49.6	3.85
139.9	3.6	12.1	15.40	357	51.1	4.82
	4.0	13.4	17.07	394	56.3	4.80
	4.5	15.0	19.13	438	62.7	4.79
	6.0	19.8	25.22	566	80.9	4.74
165.2	4.5	17.8	22.72	734	88.90	5.68
	5.0	19.8	25.16	808	97.8	5.67
	6.0	23.6	30.01	952	115	5.63
	7.0	27.3	34.79	1090	132	5.60
190.7	4.5	20.7	26.32	1140	120	6.59
	5.0	22.9	29.17	1260	132	6.57
	6.0	27.3	34.82	1490	156	6.53
	7.0	31.7	40.40	1710	179	6.50
216.3	4.5	23.5	29.94	1680	155	7.49
	6.0	31.1	39.64	2190	203	7.44
	7.0	36.1	46.03	2520	233	7.40
267.4	6.0	38.7	49.27	421x10	315	9.24
	6.6	42.4	54.08	460x10	344	9.22
	7.0	45.0	57.26	486x10	363	9.21

Tolerances :	Description	Tolerance	
	Thickness (t)	t < 3mm	± 0.3mm
		3mm ≤ t < 12mm	± 10%
		12mm ≥ t	± 10% - 1.2mm
	Outside Diameter (OD)	OD < 50mm	± 0.25mm
		50mm ≥ OD	± 0.5%

Tolerances - ASTM A-500

Tolerances	Square & Rectangular Hollow Sections		
	ASTM A-500		
Outside Dimension	Largest Outside Dia. Across Flats in (mm)	Tolerances, plus & minus in (mm)	
	2 ½ (63.5) and under Over 2 ½ to 3 ½ (63.5 to 88.9), incl Over 3 ½ to 5 ½ (88.9 to 139.7), incl Over 5 ½ (139.7)	0.020 (0.50) 0.052 (0.64) 0.030 (0.76) 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 degree by plus and minus 2 degree max.		
External Corner Profile	3T (max.)		
Twist	Specified Dia of Longest Side, in (mm)	Max. Twist in 3ft, ibn	Max. Twist in 1m, mm
	1 ½ (38.1) and under Over 1 ½ to 2 ½ (38.1 to 63.5), incl Over 2 ½ to 4 (63.5 to 101.6), incl Over 4 to 6 (101.6 to 152.4), incl Over 6 to 8 (152.4 to 203.2), incl Over 8 (203.2)	0.050 0.062 0.075 0.087 0.100 0.112	1.390 1.720 2.090 2.420 2.780 3.110
Straightness	1/8 in x Total Length in ft 5		
Mass	-		

SQUARE Hollow Sections

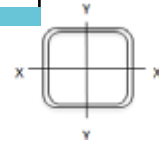


ASTM A-500/MANUFACTURER'S STANDARD

Designation		Weight	Cross Sectional Area	Second Moment of Area	Radius of Gyration	Elastic Modulus	Plastic Modulus	Torsional inertia constant	Torsional modulus constant	Superficial Area per metre length	Superficial Area per metre length	Nominal Length per tonne	Ratio for Local Buckling
Size	Thickness												
B x B	T	M	A	I	i	Wel	Wpl	Lt	Ct	As	As	L	Flange
mm	mm	Kg/m	cm ²	cm ⁴	cm	cm ³	cm ³	cm ⁴	cm ³	m ² /m	m ² /m	m	B/T
19 x 19	1.6	0.822	1.05	0.51	0.70	0.54	0.67	0.88	0.82	0.07	0.07	1215.92	6.88
25 x 25	1.6	1.160	1.43	1.28	0.94	1.02	1.24	2.12	1.54	0.09	0.10	889.79	10.63
25 x 25	2.0	1.364	1.74	1.48	0.92	1.19	1.47	2.53	1.80	0.09	0.09	733.39	7.50
25 x 25	2.3	1.600	1.95	1.61	0.91	1.29	1.62	2.80	1.97	0.09	0.09	652.55	5.87
25 x 25	2.5	1.640	2.09	1.69	0.90	1.35	1.71	2.97	2.07	0.09	0.09	609.79	5.00
25 x 25	3.0	2.010	2.41	1.84	0.87	1.47	1.91	3.33	2.27	0.09	0.09	528.97	3.33
32 x 32	1.6	1.510	1.88	2.84	1.23	1.78	2.12	4.62	2.68	0.12	0.12	677.72	15.00
32 x 32	1.8	1.690	2.09	3.11	1.22	1.95	2.33	5.11	2.94	0.12	0.12	609.23	12.78
32 x 32	2.0	1.860	2.30	3.36	1.21	2.10	2.54	5.58	3.18	0.12	0.12	554.59	11.00
32 x 32	2.3	2.110	2.60	3.71	1.20	2.32	2.84	6.24	3.52	0.12	0.12	490.68	8.91
32 x 32	2.5	2.189	2.79	3.92	1.19	2.45	3.02	6.66	3.72	0.12	0.12	456.75	7.80
32 x 32	3.0	2.670	3.25	4.38	1.16	2.74	3.44	7.62	4.18	0.12	0.12	392.18	5.67
32 x 32	3.2	2.830	3.42	4.54	1.15	2.84	3.59	7.96	4.34	0.12	0.12	372.19	5.00
38 x 38	1.6	1.810	2.26	4.92	1.47	2.59	3.06	7.90	3.90	0.15	0.15	562.75	18.75
38 x 38	2.0	2.230	2.78	5.88	1.46	3.10	3.70	9.60	4.67	0.15	0.15	458.73	14.00
38 x 38	2.3	2.540	3.15	6.54	1.44	3.44	4.15	10.80	5.20	0.14	0.14	404.64	11.52
38 x 38	2.5	2.660	3.39	6.94	1.43	3.65	4.44	11.56	5.53	0.14	0.14	375.88	10.20
38 x 38	3.0	3.240	3.97	7.85	1.41	4.13	5.10	13.35	6.28	0.14	0.14	321.02	7.67
38 x 38	4.0	3.947	5.03	9.26	1.36	4.87	6.22	16.38	7.48	0.14	0.14	253.36	4.50
50 x 50	1.6	2.410	3.03	11.71	1.96	4.68	5.46	18.48	7.03	0.19	0.20	420.19	26.25
50 x 50	1.9	2.797	3.56	13.55	1.95	5.42	6.37	21.61	8.15	0.19	0.19	357.57	21.32
50 x 50	2.0	2.934	3.74	14.15	1.95	5.66	6.66	22.63	8.51	0.19	0.19	340.89	20.00
50 x 50	2.3	3.410	4.25	15.86	1.93	6.34	7.52	25.61	9.55	0.19	0.19	299.58	16.74
50 x 50	2.5	3.602	4.59	16.94	1.92	6.78	8.07	27.53	10.22	0.19	0.19	277.59	15.00
50 x 50	3.0	4.245	5.41	19.47	1.90	7.79	9.39	32.13	11.76	0.19	0.19	235.55	11.67
50 x 50	4.0	5.454	6.95	23.74	1.85	9.49	11.73	40.42	14.43	0.19	0.19	183.35	7.50
50 x 50	4.5	6.020	7.67	25.50	1.82	10.20	12.76	44.09	15.56	0.18	0.19	166.12	6.11
50 x 50	5.0	6.560	8.36	27.04	1.80	10.82	13.70	47.46	16.56	0.18	0.18	152.45	5.00
50 x 50	6.0	7.562	9.63	29.45	1.75	11.78	15.32	53.23	18.20	0.18	0.18	132.24	3.33

SQUARE Hollow Sections

ASTM A-500/MANUFACTURER'S STANDARD



Designation		Weight	Cross Sectional Area	Second Moment of Area	Radius of Gyration	Elastic Modulus	Plastic Modulus	Torsional inertia constant	Torsional modulus constant	Superficial Area per metre length	Superficial Area per metre length	Nominal Length per tonne	Ratio for Local Buckling
Size	Thickness												
B x B	T	M	A	I	i	Wel	Wpl	Lt	Ct	As	As	L	Flange
mm	mm	Kg/m	cm ²	cm ⁴	cm	cm ³	cm ³	cm ⁴	cm ³	m ² /m	m ² /m	m	B/T
65 x 65	1.6	3.133	3.99	26.52	2.58	8.16	9.44	41.38	12.25	0.25	0.25	319.13	35.63
65 x 65	2.0	3.876	4.94	32.31	2.56	9.94	11.58	50.92	14.93	0.25	0.25	258.03	27.50
65 x 65	2.3	4.421	5.63	36.45	2.54	11.21	13.13	57.86	16.86	0.25	0.25	226.18	23.26
65 x 65	2.5	4.780	6.09	39.10	2.53	12.03	14.14	62.39	18.10	0.25	0.25	209.21	21.00
65 x 65	3.0	5.659	7.21	45.42	2.51	13.97	16.57	73.35	21.05	0.25	0.25	176.72	16.67
65 x 65	4.0	7.338	9.35	56.64	2.46	17.43	21.05	93.72	26.34	0.25	0.25	136.27	11.25
65 x 65	4.5	8.139	10.37	61.59	2.44	18.95	23.10	103.14	28.70	0.24	0.24	122.86	9.44
65 x 65	5.0	8.915	11.36	66.10	2.41	20.34	25.03	112.03	30.88	0.24	0.24	112.17	8.00
65 x 65	6.0	10.388	13.23	73.91	2.36	22.74	28.53	128.23	34.72	0.24	0.24	96.26	5.83
75 x 75	1.6	3.636	4.63	41.29	2.99	11.01	12.69	64.09	16.52	0.29	0.29	275.04	41.88
75 x 75	2.3	5.144	6.55	57.10	2.95	15.23	17.74	89.98	22.88	0.29	0.29	194.42	27.61
75 x 75	2.5	5.565	7.09	61.38	2.94	16.37	19.12	97.13	24.60	0.29	0.29	179.70	25.00
75 x 75	3.0	6.601	8.41	71.62	2.92	19.10	22.49	114.54	28.73	0.29	0.29	151.50	20.00
75 x 75	4.0	8.594	10.95	90.19	2.87	24.05	28.76	147.32	36.28	0.29	0.29	116.36	13.75
75 x 75	4.5	9.552	12.17	98.55	2.85	26.28	31.68	162.68	39.71	0.28	0.28	104.68	11.67
75 x 75	5.0	10.485	13.36	106.33	2.82	28.35	34.46	177.35	42.92	0.28	0.28	95.98	10.00
75 x 75	6.0	12.272	15.63	120.16	2.77	32.04	39.58	204.62	48.70	0.28	0.28	81.49	7.50
100 x 100	2.3	6.494	8.85	139.73	3.97	27.95	32.26	217.48	41.95	0.39	0.39	143.91	38.48
100 x 100	3.0	8.956	11.41	177.05	3.94	35.41	41.21	278.68	53.19	0.39	0.39	111.66	28.33
100 x 100	4.0	11.734	14.95	226.35	3.89	45.27	53.30	362.01	68.10	0.39	0.39	85.22	20.00
100 x 100	4.5	13.085	16.67	249.29	3.87	49.86	59.04	401.87	75.07	0.38	0.38	76.42	17.22
100 x 100	5.0	14.410	18.36	271.10	3.84	54.22	64.59	440.52	81.72	0.38	0.38	69.40	15.00
100 x 100	6.0	16.982	21.63	311.47	3.79	62.29	75.10	514.16	94.12	0.38	0.38	58.89	11.67
125 x 125	3.0	11.311	14.41	354.50	4.96	56.72	65.56	552.66	85.14	0.49	0.49	88.41	36.67
125 x 125	4.0	14.874	18.95	457.23	4.91	73.16	85.33	721.99	109.92	0.49	0.49	67.23	26.25
125 x 125	4.5	16.617	21.17	505.83	4.89	80.93	94.84	803.85	121.67	0.48	0.48	60.18	22.78
125 x 125	5.0	18.335	23.36	552.62	4.86	88.42	104.10	883.82	133.01	0.48	0.48	54.54	20.00
125 x 125	6.0	21.692	27.63	640.89	4.82	102.54	121.87	1038.10	154.49	0.48	0.48	46.10	15.83
150 x 150	3.0	13.666	17.41	622.73	5.98	83.03	95.53	964.61	124.60	0.59	0.59	73.18	45.00
150 x 150	4.0	18.014	22.95	807.82	5.93	107.71	124.87	1264.76	161.73	0.59	0.59	55.51	32.50
150 x 150	4.5	20.150	25.67	896.30	5.91	119.51	139.08	1410.79	179.51	0.58	0.58	49.63	28.33
150 x 150	5.0	22.260	28.36	982.12	5.89	130.95	152.98	1554.13	196.79	0.58	0.58	44.92	25.00
150 x 150	6.0	26.402	33.63	1145.91	5.84	152.79	179.88	1832.69	229.84	0.58	0.58	37.88	20.00



RECTANGULAR Hollow Sections

ASTM A-500/MANUFACTURER'S STANDARD

Designation		Weight	Cross Sectional Area	Second Moment of Area	Second Moment of Area	Radius of Gyration	Radius of Gyration	Elastic Modulus	Elastic Modulus	Plastic Modulus	Plastic Modulus	Torsional inertia constant	Torsional modulus constant	Superficial Area per metre length	Nominal Length per tonne	Ratio for Local Buckling	Ratio for Local Buckling
Size	Thickness																
B x H	T	M	A	I _x	I _y	r _x	r _y	Z _x	Z _y	S _x	S _y	J	C	A _s	L	Flange	Web
mm	mm	Kg/m	cm ²	cm ⁴	cm ⁴	cm	cm	cm ³	cm ³	cm ³	cm ³	cm ⁴	cm ³	m ² /m	m	B/T	H/T
19 x 38	1.6	1.330	1.66	2.91	0.97	1.33	0.77	1.53	1.02	1.95	1.20	2.46	1.79	0.11	769.41	6.88	18.75
25 x 50	1.6	1.790	2.23	7.02	2.37	1.77	1.03	2.81	1.90	3.53	2.17	5.85	3.29	0.14	570.82	10.63	26.25
25 x 50	2.0	2.149	2.74	8.38	2.81	1.75	1.01	3.35	2.25	4.26	2.62	7.06	3.92	0.14	465.43	7.50	20.00
25 x 50	2.3	2.510	3.10	9.31	3.10	1.73	1.00	3.72	2.48	4.78	2.92	7.90	4.34	0.14	410.64	5.87	16.74
25 x 50	2.5	2.621	3.34	9.89	3.28	1.72	0.99	3.95	2.62	5.11	3.12	8.43	4.60	0.14	381.51	5.00	15.00
25 x 50	3.0	3.190	3.91	11.17	3.67	1.69	0.97	4.47	2.93	5.86	3.56	9.64	5.18	0.14	325.95	3.33	11.67
25 x 75	1.6	2.380	3.03	19.74	3.47	2.55	1.07	5.26	2.78	6.81	3.11	9.93	5.05	0.19	420.19	10.63	41.88
25 x 75	1.9	2.797	3.56	22.84	3.98	2.53	1.06	6.09	3.18	7.94	3.61	11.50	5.80	0.19	357.57	8.16	34.47
25 x 75	2.0	2.934	3.74	23.84	4.14	2.53	1.05	6.36	3.31	8.31	3.77	12.01	6.04	0.19	340.89	7.50	32.50
25 x 75	2.3	3.338	4.25	26.70	4.59	2.51	1.04	7.12	3.67	9.37	4.23	13.46	6.72	0.19	299.58	5.87	27.61
25 x 75	2.5	3.602	4.59	28.52	4.87	2.49	1.03	7.60	3.89	10.06	4.53	14.38	7.14	0.19	277.59	5.00	25.00
25 x 75	3.0	4.245	5.41	32.72	5.49	2.46	1.01	8.72	4.39	11.69	5.21	16.50	8.10	0.19	235.55	3.33	20.00
25 x 75	4.0	5.454	6.95	39.72	6.46	2.39	0.96	10.59	5.17	14.56	6.39	20.01	9.61	0.19	183.35	1.25	13.75
25 x 75	4.5	6.020	7.67	42.56	6.81	2.36	0.94	11.35	5.45	15.82	6.89	21.40	10.19	0.18	166.12	0.56	11.67
38 x 65	1.6	2.455	3.13	17.83	7.79	2.39	1.58	5.49	4.10	6.70	4.63	17.39	6.91	0.20	407.29	18.75	35.63
38 x 65	1.9	2.886	3.68	20.68	9.00	2.37	1.56	6.36	4.74	7.82	5.40	20.30	8.00	0.20	346.48	15.00	29.21
38 x 65	2.0	3.028	3.86	21.59	9.39	2.37	1.56	6.64	4.94	8.18	5.64	21.24	8.35	0.20	330.28	14.00	27.50
38 x 65	2.3	3.446	4.39	24.23	10.50	2.35	1.55	7.46	5.53	9.24	6.37	24.01	9.36	0.20	290.17	11.52	23.26
38 x 65	2.5	3.720	4.74	25.91	11.20	2.34	1.54	7.97	5.90	9.92	6.83	25.79	10.00	0.20	268.81	10.20	21.00
38 x 65	3.0	4.387	5.59	29.83	12.83	2.31	1.51	9.18	6.75	11.55	7.93	30.02	11.50	0.20	227.96	7.67	16.67
38 x 65	3.2	4.646	5.92	31.29	13.42	2.30	1.51	9.63	7.06	12.17	8.35	31.62	12.05	0.20	215.23	6.88	15.31
38 x 65	4.0	5.643	7.19	36.52	15.53	2.25	1.47	11.24	8.17	14.46	9.89	37.55	14.04	0.19	177.22	4.50	11.25
38 x 75	1.6	2.706	3.45	25.34	8.85	2.71	1.60	6.76	4.66	8.34	5.21	21.15	8.03	0.22	369.49	18.75	41.88
38 x 75	1.9	3.184	4.06	29.44	10.24	2.69	1.59	7.85	5.39	9.75	6.08	24.71	9.30	0.22	314.03	15.00	34.47
38 x 75	2.0	3.342	4.26	30.77	10.68	2.69	1.58	8.20	5.62	10.21	6.36	25.86	9.71	0.22	299.25	14.00	32.50
38 x 75	2.3	3.807	4.85	34.61	11.97	2.67	1.57	9.23	6.30	11.55	7.19	29.24	10.90	0.22	262.65	11.52	27.61
38 x 75	2.5	4.113	5.24	37.06	12.78	2.66	1.56	9.88	6.73	12.42	7.72	31.42	11.66	0.22	243.15	10.20	25.00
38 x 75	3.0	4.858	6.19	42.83	14.67	2.63	1.54	11.42	7.72	14.49	8.98	36.62	13.43	0.22	205.86	7.67	20.00
38 x 75	3.2	5.149	6.56	44.99	15.37	2.62	1.53	12.00	8.09	15.29	9.46	38.60	14.09	0.22	194.23	6.88	18.44
38 x 75	4.0	6.271	7.99	52.84	17.85	2.57	1.50	14.09	9.40	18.26	11.25	45.93	16.48	0.21	159.48	4.50	13.75
38 x 75	4.5	6.938	8.84	57.12	19.17	2.54	1.47	15.23	10.09	19.95	12.25	50.04	17.77	0.21	144.13	3.44	11.67

RECTANGULAR Hollow Sections



ASTM A-500/MANUFACTURER'S STANDARD

Designation		Weight	Cross Sectional Area	Second Moment of Area	Second Moment of Area	Radius of Gyration	Radius of Gyration	Elastic Modulus	Elastic Modulus	Plastic Modulus	Plastic Modulus	Torsional inertia constant	Torsional modulus constant	Superficial Area per metre length	Nominal Length per tonne	Ratio for Local Buckling	Ratio for Local Buckling
Size	Thickness																
B x H	T	M	A	I _x	I _y	i _x	i _y	Z _x	Z _y	S _x	S _y	J	C	A _s	L	Flange	Web
mm	mm	Kg/m	cm ²	cm ⁴	cm ⁴	cm	cm	cm ³	cm ³	cm ³	cm ³	cm ⁴	cm ³	m ² /m	m	B/T	H/T
50 x 75	1.6	3.008	3.83	30.51	16.39	2.82	2.07	8.14	6.56	9.75	7.40	33.67	10.78	0.24	332.46	26.25	41.88
50 x 75	1.9	3.542	4.51	35.54	19.05	2.81	2.05	9.48	7.62	11.42	8.65	39.46	12.55	0.24	282.29	21.32	34.47
50 x 75	2.0	3.719	4.74	37.16	19.91	2.80	2.05	9.91	7.96	11.96	9.06	41.35	13.12	0.24	268.92	20.00	32.50
50 x 75	2.3	4.241	5.40	41.90	22.41	2.79	2.04	11.17	8.96	13.56	10.26	46.92	14.78	0.24	235.81	16.74	27.61
50 x 75	2.5	4.584	5.84	44.95	24.00	2.77	2.03	11.99	9.60	14.59	11.04	50.54	15.85	0.24	218.17	15.00	25.00
50 x 75	3.0	5.423	6.91	52.17	27.76	2.75	2.00	13.91	11.10	17.09	12.91	59.27	18.38	0.24	184.40	11.67	20.00
50 x 75	4.0	7.024	8.95	64.96	34.34	2.69	1.96	17.32	13.74	21.66	16.33	75.33	22.88	0.24	142.37	7.50	13.75
50 x 75	4.5	7.786	9.92	70.56	37.19	2.67	1.94	18.82	14.87	23.75	17.88	82.66	24.86	0.23	128.44	6.11	11.67
50 x 75	5.0	8.522	10.86	75.65	39.75	2.64	1.91	20.17	15.90	25.71	19.33	89.52	26.67	0.23	117.34	5.00	10.00
50 x 75	6.0	9.917	12.63	84.37	44.06	2.58	1.87	22.50	17.63	29.23	21.92	101.82	29.79	0.23	100.84	3.33	7.50
50 x 100	1.6	3.636	4.63	61.29	21.08	3.64	2.13	12.26	8.43	15.04	9.33	50.08	14.53	0.29	275.04	26.25	57.50
50 x 100	1.9	4.288	5.46	71.62	24.55	3.62	2.12	14.32	9.82	17.65	10.94	58.75	16.94	0.29	233.20	21.32	47.63
50 x 100	2.0	4.504	5.74	74.98	25.67	3.62	2.12	15.00	10.27	18.50	11.46	61.59	17.73	0.29	222.05	20.00	45.00
50 x 100	2.3	5.143	6.55	84.83	28.95	3.60	2.10	16.97	11.58	21.03	13.01	69.95	20.02	0.29	194.42	16.74	38.48
50 x 100	2.5	5.565	7.09	91.20	31.06	3.59	2.09	18.24	12.42	22.67	14.01	75.39	21.49	0.29	179.70	15.00	35.00
50 x 100	3.0	6.600	8.41	106.46	36.06	3.56	2.07	21.29	14.42	26.66	16.44	88.56	25.01	0.29	151.50	11.67	28.33
50 x 100	4.0	8.594	10.95	134.14	44.95	3.50	2.03	26.83	17.98	34.10	20.93	112.99	31.35	0.29	116.36	7.50	20.00
50 x 100	4.5	9.552	12.17	146.61	48.87	3.47	2.00	29.32	19.55	37.56	23.00	124.25	34.18	0.28	104.69	6.11	17.22
50 x 100	5.0	10.485	13.36	158.19	52.45	3.44	1.98	31.64	20.98	40.84	24.95	134.87	36.80	0.28	95.38	5.00	15.00
50 x 100	6.0	12.272	15.63	178.75	58.67	3.38	1.94	35.75	23.47	46.90	28.52	154.20	41.43	0.28	81.49	3.33	11.67
50 x 125	2.3	6.046	7.70	148.24	35.50	4.39	2.15	23.72	14.20	29.94	15.75	93.92	25.25	0.34	165.39	16.74	49.35
50 x 125	2.5	6.546	8.34	159.61	38.12	4.37	2.14	25.54	15.25	32.31	16.98	101.26	27.13	0.34	152.76	15.00	45.00
50 x 125	3.0	7.778	9.91	187.02	44.35	4.34	2.12	29.92	17.74	38.11	19.96	119.03	31.64	0.34	128.57	11.67	36.67
50 x 125	4.0	10.164	12.95	237.53	55.56	4.28	2.07	38.01	22.22	49.03	25.53	152.13	39.82	0.34	98.38	7.50	26.25
50 x 125	4.5	11.319	14.42	260.68	60.55	4.25	2.05	41.71	24.22	54.17	28.12	167.45	43.52	0.33	88.35	6.11	22.78
50 x 125	5.0	12.447	15.86	282.46	65.16	4.22	2.03	45.19	26.07	59.10	30.58	181.95	46.95	0.33	80.34	5.00	20.00
50 x 125	6.0	14.627	18.63	322.00	73.28	4.16	1.98	51.52	29.31	68.32	35.12	208.52	53.10	0.33	68.37	3.33	15.83
50 x 150	2.3	6.949	8.85	235.71	42.04	5.16	2.18	31.43	16.82	40.28	18.49	118.46	30.49	0.39	143.91	16.74	60.22
50 x 150	3.0	8.956	11.41	298.55	52.65	5.12	2.15	39.81	21.06	51.43	23.49	150.22	38.28	0.39	111.66	11.67	45.00
50 x 150	4.0	11.734	14.95	381.39	66.16	5.05	2.10	50.85	26.47	66.47	30.13	192.14	48.30	0.39	85.22	7.50	32.50
50 x 150	4.5	13.085	16.67	419.82	72.23	5.02	2.08	55.98	28.89	73.60	33.24	211.60	52.85	0.38	76.42	6.11	28.33
50 x 150	5.0	14.410	18.36	456.29	77.87	4.99	2.06	60.84	31.15	80.48	36.20	230.05	57.11	0.38	69.40	5.00	25.00
50 x 150	6.0	16.982	21.63	523.47	87.89	4.92	2.02	69.80	35.16	93.48	41.72	263.99	64.77	0.38	58.89	3.33	20.00



RECTANGULAR Hollow Sections

ASTM A-500/MANUFACTURER'S STANDARD

Designation		Weight	Cross Sectional Area	Second Moment of Area	Second Moment of Area	Radius of Gyration	Radius of Gyration	Elastic Modulus	Elastic Modulus	Plastic Modulus	Plastic Modulus	Torsional inertia constant	Torsional modulus constant	Superficial Area per metre length	Nominal Length per tonne	Ratio for Local Buckling	Ratio for Local Buckling
Size	Thickness																
B x H	T	M	A	I _x	I _y	i _x	i _y	Z _x	Z _y	S _x	S _y	J	C	As	L	Flange	Web
mm	mm	Kg/m	cm ²	cm ⁴	cm ⁴	cm	cm	cm ³	cm ³	cm ³	cm ³	cm ⁴	cm ³	m ² /m	m	B/T	H/T
75 x 100	2.3	6.046	7.70	112.28	72.30	3.82	3.06	22.46	19.28	26.64	21.92	138.34	30.98	0.34	165.39	27.61	38.48
75 x 100	3.0	7.778	9.91	141.75	91.07	3.78	3.03	28.35	24.29	33.93	27.89	176.64	39.09	0.34	128.57	20.00	28.33
75 x 100	3.2	8.264	10.53	149.79	96.17	3.77	3.02	29.96	25.64	35.95	29.53	187.25	41.30	0.34	121.01	18.44	26.25
75 x 100	4.0	10.164	12.95	180.25	115.42	3.73	2.99	36.05	30.78	43.70	35.86	228.25	49.70	0.34	98.38	13.75	20.00
75 x 100	4.5	11.319	14.42	197.95	126.55	3.71	2.96	39.59	33.75	48.30	39.61	252.68	54.60	0.33	88.35	11.67	17.22
75 x 100	5.0	12.447	15.86	214.64	137.00	3.68	2.94	42.93	36.53	52.72	43.21	276.18	59.22	0.33	80.34	10.00	15.00
75 x 100	6.0	14.627	18.63	245.11	155.96	3.63	2.89	49.02	41.59	61.00	49.93	320.42	67.71	0.33	68.37	7.50	11.67
75 x 125	2.3	6.949	8.85	191.52	87.51	4.65	3.14	30.64	23.33	36.99	26.10	189.93	39.08	0.39	143.91	27.61	49.35
75 x 125	3.0	8.956	11.41	242.85	110.52	4.61	3.11	38.86	29.47	47.26	33.29	242.86	49.46	0.39	111.66	20.00	36.67
75 x 125	4.0	11.734	14.95	310.76	140.65	4.56	3.07	49.72	37.51	61.13	42.96	314.53	63.14	0.39	85.22	13.75	26.25
75 x 125	4.5	13.085	16.67	342.40	154.54	4.53	3.04	54.78	41.21	67.73	47.55	348.61	69.50	0.38	76.42	11.67	22.78
75 x 125	5.0	14.410	18.36	372.51	167.68	4.50	3.02	59.60	44.71	74.10	57.96	381.52	75.55	0.38	69.40	10.00	20.00
75 x 125	6.0	16.982	21.63	428.29	191.76	4.45	2.98	68.53	51.14	86.17	60.28	443.81	86.75	0.38	58.89	7.50	15.83
75 x 150	2.3	7.852	10.00	298.43	102.71	5.46	3.20	39.79	27.39	48.77	30.28	243.63	47.18	0.44	127.36	27.61	60.22
75 x 150	3.0	10.133	12.91	379.59	129.97	5.42	3.17	50.61	34.66	62.45	38.69	311.78	59.82	0.44	98.69	20.00	45.00
75 x 150	4.0	13.304	16.95	488.00	165.88	5.37	3.13	65.07	44.24	81.07	50.06	404.26	76.59	0.44	75.16	13.75	32.50
75 x 150	4.5	14.851	18.92	538.94	182.54	5.34	3.11	71.86	48.68	89.97	55.48	448.36	84.42	0.43	67.33	11.67	28.33
75 x 150	5.0	16.372	20.86	587.74	198.36	5.31	3.08	78.37	52.90	98.61	60.71	491.02	91.89	0.43	61.08	10.00	25.00
75 x 150	6.0	19.337	24.63	679.08	227.56	5.25	3.04	90.54	60.68	115.08	70.63	572.03	105.80	0.43	51.71	7.50	20.00
100 x 150	3.0	11.311	14.41	460.64	247.64	5.65	4.15	61.42	49.53	73.48	55.76	507.20	81.40	0.49	88.41	28.33	45.00
100 x 150	4.0	18.874	18.95	594.60	318.57	5.60	4.10	79.28	63.71	95.67	72.50	661.63	104.94	0.49	67.23	20.00	32.50
100 x 150	4.5	16.617	21.17	658.06	351.96	5.58	4.08	87.74	70.39	106.34	80.53	736.08	116.08	0.48	60.18	17.22	28.33
100 x 150	5.0	18.335	23.36	719.20	384.02	5.55	4.05	95.89	76.80	116.73	88.34	808.68	126.81	0.48	54.54	15.00	25.00
100 x 150	6.0	21.692	27.63	834.69	444.19	5.50	4.01	111.29	88.84	136.68	103.30	948.34	147.07	0.48	46.10	11.67	20.00
100 x 200	4.0	18.014	22.95	1199.71	410.78	7.23	4.23	119.97	82.16	148.04	91.70	985.38	141.81	0.59	55.51	20.00	45.00
100 x 200	4.5	20.150	25.67	1331.44	454.64	7.20	4.21	133.14	90.93	164.89	102.02	1097.11	157.12	0.58	49.63	17.22	39.44
100 x 200	5.0	22.260	28.36	1459.25	496.94	7.17	4.19	145.93	99.39	181.37	112.09	1206.29	171.94	0.58	44.92	15.00	35.00
100 x 200	6.0	26.402	33.63	1703.31	576.91	7.12	4.14	170.33	115.38	213.27	131.50	1417.03	200.10	0.58	37.88	11.67	28.33

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