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Group Activities

ANN YAK SIONG HARDWARE SDN BHD

ANN YAK SIONG HARDWARE SDN BHD (AYSH) founded in 1982 with 30 years of experience in the business, is well known in the marketplace as one of the leading steel traders, stockists and distributors in the region and country.

With well-equipped warehouses, AYSH trades in large variety of flat and long steel products of various grades and dimensions such as beams and columns, steel plates and sheets, structural welded hollow sections, bars and rods, channels, angels, flat bars, sheet piles, pipes and tubes, wires and wire mesh etc, to serve a wide range of industries including construction, infrastructures, engineering, manufacturing, automotive, marine, oil and gas, etc.

With our experience and dedicated team that serve our valued customers, AYSH has contributed to the success of many major projects in the country and region.

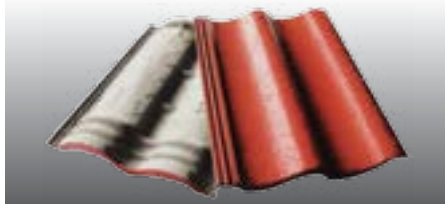


Group Activities

AYS MARKETING SDN BHD

AYS MARKETING SDN BHD (AYSM) was established in 1993. It trades in all types of building materials, steel products, exclusive finishing products, such as steel bars, wire mesh, cement, bricks, piles, finishing products, etc.

AYSM adopts a customer orientated policy by providing a wide range of building materials and quality service to our customers of various industries. They include end users, dealers in the construction, civil engineering and infrastructure sectors.



AYS METAL PRODUCTS & ENGINEERING SDN BHD

AYS METAL PRODUCTS & ENGINEERING SDN BHD (AYSMPE) is involved in the manufacturing and trading of Pressed Steel tank, components and panels of Fiberglass Reinforced Polyester (FRP) sectional storage tanks for cold water storage purpose. AYSMPE exports a substantial volume of the products to countries in the Middle East, ASEAN and Africa.



Group Activities

AYS WIRE PRODUCTS SDN BHD

AYS WIRE PRODUCTS SDN BHD (AYSWP) is a manufacturer of steel fabric (wire mesh) which is widely accepted by designers and builders as a form of reinforcement in the concrete flooring application. The fabric is produced using automatic welding machines through an electrical process which employs the fusion principle combined with a homogeneous section without losing strength or area. Standard sheets are readily available and are held in stock. The standard metric size fabrics are available in sheet of 2.2m width x 6m length.

AYSWP provides value added services such as drawing, straightening and cut-to-length, producing a wide range of mild steel round bars. These wire products are widely used as components of reinforced concrete structure and piles, and also further downstream in the manufacturing of bolt and nuts, cables, chain-link fencing and others.

AYSWP also manufactures Black Annealed Wire from carbon steel wire, run through multiple drawing and thermal annealing. The finished products are used for weaving and baling in general.



CH YODOFORM SDN BHD

CH YODOFORM SDN BHD (CHY) is involved in the manufacturing and trading of high tensile galvanized steel (HTGI) purlins. The YODOFORM 'Z' and 'C' sections are precisely cold formed, cut-to length with pre-punched holes. The advantages of YODOFORM

purlins are that it is lightweight, has corrosion protective surface and ready for immediate erection upon delivery to site. The products are in compliance with major International Standard and CHY is the leader in this niche market.



AYS METAL PRODUCTS & ENGINEERING SDN BHD (AYSMPE) SPECIFICATIONS

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AYSMPE FRP SECTIONAL WATER TANK

INTRODUCTION

AYSMPE FRP (Fibre Reinforced Polyester) sectional water storage tank provides solution to your clean water storage requirement.

AYSMPE FRP an assured high quality FRP product made in Malaysia in combination with Japanese state-of-the-art technology, design, machine and even materials.

AYSMPE FRP tank panel is made from high pressure moulding of SMC (Sheet Moulding Compound) thermosetting material reinforced with layer of glass fibre woven cloth using 600 metric tonnes hydraulic press and very high precision mould. The technology guarantees product qualities in dimension and structural uniformity, aesthetic finishing, anti leak property and added strengths (tensile, flexural, impact, compressive and shear).

FEATURES OF AYSMPE FRP TANK

- Strong & durable.
- Easy cleaning & maintenance.
- Drains completely at roof and bottom as it uses specially designed roof panel and drainage panel.
- Prevent leakage completely by using special sealing material. (PVC Foam Sealant)
- Prevent algae growth in the tank. AYSMPE FRP tank panels are made by SMC hot press method, which has high opaque quality. This opaque quality prevent the evaporation of sterilizer, and stop the algae growth.
- Safety factor of 6 design structure are realized by using strong panels and reinforcement material.
- Various shape tanks are available by combination of strong panels.

AUTHORITY CERTIFICATION

- SPAN - SURUHANJAYA PERKHIDMATAN AIR NEGARA
- SIRIM QAS SDN. BHD. (BS SS 245 : 1995)
- TECHNICAL PRINCIPLE CERTIFICATION "HIRATA PTE. LTD. OSAKA, JAPAN"
- CIVIL DEFENCE DEPARTMENT OF QATAR PRODUCT APPROVAL

PRE-INSTALLATION ADVICE

For tank to be well installed without any uneven structural load problem, the tank supporting R.C. or steel structure plinth foundation must be:

- Appropriate and adequate:
- All the top surfaces are evenly flat and smooth for tank supporting skid base to be placed on well without any gap.

Also ensure there is sufficient overhead space clearance between tank roof and building structure. (e.g. R.C. beam or Slab) The maximum distance between centre to centre of all plinths shall not be more than 2,002mm.

It is always advisable to construct plinths, especially the R.C. type, with height of not less than 600mm to facilitate future maintenance. .

If in doubt, contact our sales and marketing personnel for assistance.

POST-INSTALLATION PROCEDURE

To avoid damage to your prestige tank and ensure quality work, please:

- Begin plumbing pipe connection works from the FRP tank panel and then to other connections.
- Do not exert pressure or force on FRP tank panel during piping works such as pipe connecting, valve fixing or any other jobs that may cause damage to the panel;
- Use proper impact wrench or equivalent of not exceeding 50kg/cmz force for all bolt fastening jobs;
- Do not try using extra extension handle such as pipe to your pipe wrench;
- Do not perform any heating activities such as flame-torch cutting, welding, etc. next to the tank. FRP material is flammable;
- Do not use metal brush or equivalent. Use only soft material brush or equivalent to prevent scratch damage.

AYSMPE FRP SECTIONAL WATER TANK

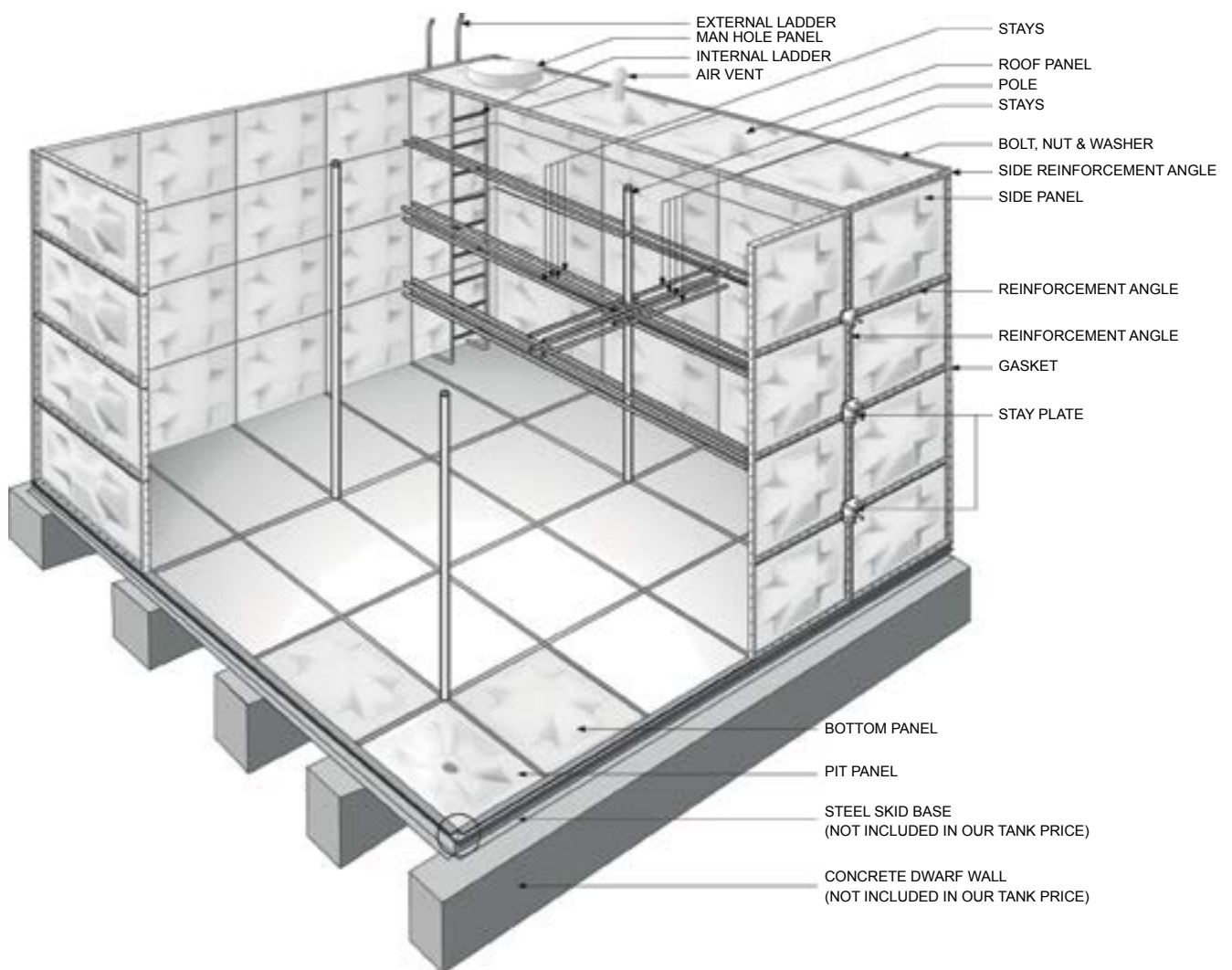
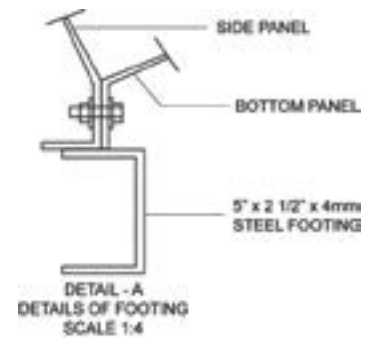


State-of-the-art 600 metric tonnes hydraulic press, one of the country's biggest units for FRP water tank panel moulding.

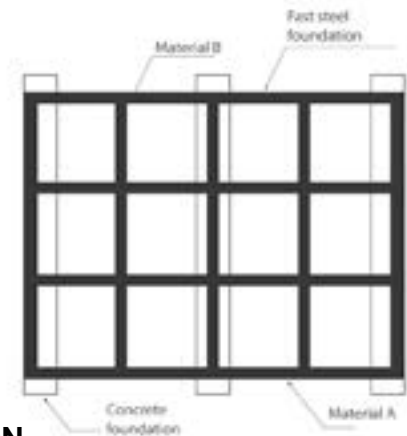


An installed FRP tank

CROSS SECTIONAL OF FRP TANK



MATERIALS USED FOR FLAT STEEL FOUNDATION

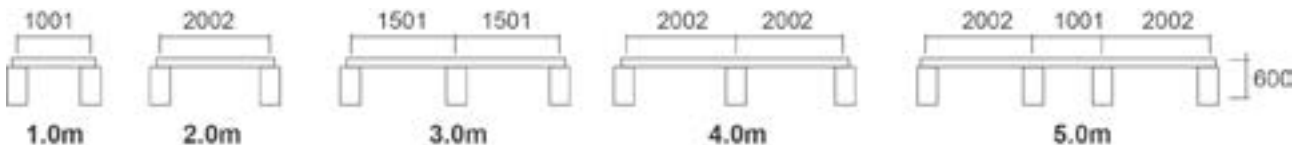


AYSMP E FRP SECTIONAL WATER TANK SPECIFICATION

Components	Specification
Panel Material	Sheet Molding Compound
Maximum Height	4 meter
Air Ventilation	ABS Plastic, Prevention of rain water, insects, or any foreign materials entering the tank
Flange of Panel	Single Flange at an Angle of 90 Degree
External Reinforcement	Hot Dip Galvanized
Internal Reinforcement	SS 304 or SS 316 (optional)
Jointing Material	PVC Foam Sealant
Cover	FRP Hot Pressed Molding
Internal Ladder	Aluminium
External Ladder	GI
Fasteners (External)	GI
Fasteners (Internal)	SS 304
Steel Skid Base	Painted
Water Level Indicator	GI

Height (m)	Plinth Distance (m)	Material A	Material B
1.0m	1	3" x 1.5" x C	3" x 1.5" x C
	2	5" x 3.0" x C	
2.0m	1	3" x 1.5" x C	3" x 1.5" x C
	2	5" x 3.0" x C	
3.0m	1	4" x 2.0" x C	3" x 1.5" x C
	2	6" x 3.0" x C	
4.0m	1	4" x 2.0" x C	3" x 1.5" x C
	2	7" x 3.0" x C	

STANDARD PLINTH DISTANCE



PANEL MATERIAL CHARACTERISTICS

Description	FRP
Specific Gravity	1.8
Glass Content	more than 30%
Tensile Strength	1,050 kg/cm ²
Young's Modulus	1.40 x 10 ⁵ kg/cm ²
Flexural Strength	1,670 kg/cm ²
Impact Strength	56.0 kg-cm/cm ²
Compressive Strength	3,000 kg/cm ²

Description	FRP
Shear Strength	1,000 kg/cm ²
Thermal Expansion	2.16 x 10 ⁻⁵ /°C
Coef. of Overall Heat Transmission	5.0 Kcal/m ² hr °C
Thermal Conductivity	0.15 Kcal/m ² hr °C
Water Absorption	less than 0.1%
Cavity	less than 1%
Light Transmittance (Grey)	<0.01%

WEIGHT TABLES

Nominal Tank Size, Length by Breadth	1-meter Height			
	Panels In Tank	Nominal Capacity	Approx. Wt.water	Approx. Wt. Panels
Meter	Pcs	Gallons	Tons	Tons
1 x 1	6	220	0.98	0.09
1 x 2	10	440	1.96	0.15
1 x 3	14	660	2.94	0.22
1 x 4	18	880	3.92	0.28
1 x 5	22	1100	4.90	0.34
2 x 2	16	880	3.92	0.25
2 x 3	22	1320	5.87	0.34
2 x 4	28	1760	7.83	0.43
2 x 5	34	2200	9.79	0.52
2 x 6	40	2640	11.75	0.62
3 x 3	30	1980	8.81	0.46
3 x 4	38	2640	11.75	0.59
3 x 5	46	3300	14.69	0.71
3 x 6	54	3960	17.62	0.83
3 x 7	62	4620	20.56	0.95
4 x 4	48	3520	15.66	0.74
4 x 5	58	4400	19.58	0.89
4 x 6	68	5280	23.50	1.05
4 x 7	78	6160	27.41	1.20
4 x 8	88	7040	31.33	1.36
5 x 5	70	5500	24.48	1.08
5 x 6	82	6600	29.37	1.26
5 x 7	94	7700	34.27	1.45
5 x 8	106	8800	39.16	1.63
5 x 9	118	9900	44.06	1.82
6 x 6	96	7920	35.24	1.48
6 x 8	124	10560	46.99	1.91
6 x 9	138	11880	52.87	2.13
7 x 7	126	10780	47.97	1.94
7 x 8	142	12320	54.82	2.19
7 x 9	158	13860	61.68	2.43
8 x 8	160	14080	62.66	2.46
8 x 9	178	15840	70.49	2.74
9 x 9	198	17820	79.30	3.05

Nominal Tank Size, Length by Breadth	2-meter Height			
	Panels In Tank	Nominal Capacity	Approx. Wt.water	Approx. Wt. Panels
Meter	Pcs	Gallons	Tons	Tons
1 x 1	10	440	1.96	0.18
1 x 2	16	880	3.92	0.28
1 x 3	22	1320	5.87	0.39
1 x 4	28	1760	7.83	0.49
1 x 5	34	2200	9.79	0.60
2 x 2	24	1760	7.83	0.42
2 x 3	32	2640	11.75	0.56
2 x 4	40	3520	15.66	0.70
2 x 5	48	4400	19.58	0.84
2 x 6	56	5280	23.50	0.99
3 x 3	42	3960	17.62	0.74
3 x 4	52	5280	23.50	0.92
3 x 5	62	6600	29.37	1.09
3 x 6	72	7920	35.24	1.27
3 x 7	82	9240	41.12	1.44
4 x 4	64	7040	31.33	1.13
4 x 5	76	8800	39.16	1.34
4 x 6	88	10560	46.99	1.55
4 x 7	100	12320	54.82	1.76
4 x 8	112	14080	62.66	1.97
5 x 5	90	11000	48.95	1.58
5 x 6	104	13200	58.74	1.83
5 x 7	118	15400	68.53	2.08
5 x 8	132	17600	78.32	2.32
5 x 9	146	19800	88.11	2.57
6 x 6	120	15840	70.49	2.11
6 x 8	152	21120	93.98	2.68
6 x 9	168	23760	105.73	2.96
7 x 7	154	21560	95.94	2.71
7 x 8	172	24640	109.65	3.03
7 x 9	190	27720	123.35	3.34
8 x 8	192	28160	125.31	3.38
8 x 9	212	31680	140.98	3.73
9 x 9	234	35640	158.60	4.12

Nominal Tank Size, Length by Breadth	3-meter Height			
	Panels In Tank	Nominal Capacity	Approx. Wt.water	Approx. Wt. Panels
Meter	Pcs	Gallons	Tons	Tons
1 x 1	14	660	2.94	0.28
1 x 2	22	1320	5.87	0.44
1 x 3	30	1980	8.81	0.59
1 x 4	38	2640	11.75	0.75
1 x 5	46	3300	14.69	0.91
2 x 2	32	2640	11.75	0.63
2 x 3	42	3960	17.62	0.83
2 x 4	52	5280	23.50	1.03
2 x 5	62	6600	29.37	1.23
2 x 6	72	7920	35.24	1.43
3 x 3	54	5940	26.43	1.07
3 x 4	66	7920	35.24	1.31
3 x 5	78	9900	44.06	1.54
3 x 6	90	11880	52.87	1.78
3 x 7	102	13860	61.68	2.02
4 x 4	80	10560	46.99	1.58
4 x 5	94	13200	58.74	1.86
4 x 6	108	15840	70.49	2.14
4 x 7	122	18480	82.24	2.42
4 x 8	136	21120	93.98	2.69
5 x 5	110	16500	73.43	2.18
5 x 6	126	19800	88.11	2.49
5 x 7	142	23100	102.80	2.81
5 x 8	158	26400	117.48	3.13
5 x 9	174	29700	132.17	3.45
6 x 6	144	23760	105.73	2.85
6 x 8	180	31680	140.98	3.56
6 x 9	198	35640	158.60	3.92
7 x 7	182	32340	143.91	3.60
7 x 8	202	36960	164.47	4.00
7 x 9	222	41580	185.03	4.40
8 x 8	224	42240	187.97	4.44
8 x 9	246	47520	211.46	4.87
9 x 9	270	53460	237.90	5.35

Nominal Tank Size, Length by Breadth	4-meter Height			
	Panels In Tank	Nominal Capacity	Approx. Wt.water	Approx. Wt. Panels
Meter	Pcs	Gallons	Tons	Tons
1 x 1	18	880	3.92	0.44
1 x 2	28	1760	7.83	0.68
1 x 3	38	2640	11.75	0.92
1 x 4	48	3520	15.66	1.16
1 x 5	58	4400	19.58	1.40
2 x 2	40	3520	15.66	0.97
2 x 3	52	5280	23.50	1.26
2 x 4	64	7040	31.33	1.55
2 x 5	76	8800	39.16	1.84
2 x 6	88	10560	46.99	2.13
3 x 3	66	7920	35.24	1.60
3 x 4	80	10560	46.99	1.94
3 x 5	94	13200	58.74	2.27
3 x 6	108	15840	70.49	2.61
3 x 7	122	18480	82.24	2.95
4 x 4	96	14080	62.66	2.32
4 x 5	112	17600	78.32	2.71
4 x 6	128	21120	93.98	3.10
4 x 7	144	24640	109.65	3.48
4 x 8	160	28160	125.31	3.87
5 x 5	130	22000	97.90	3.15
5 x 6	148	26400	117.48	3.58
5 x 7	166	30800	137.06	4.02
5 x 8	184	35200	156.64	4.45
5 x 9	202	39600	176.22	4.89
6 x 6	168	31680	140.98	4.07
6 x 8	208	42240	187.97	5.03
6 x 9	228	47520	211.46	5.52
7 x 7	210	43120	191.88	5.08
7 x 8	232	49280	219.30	5.61
7 x 9	254	55440	246.71	6.15
8 x 8	256	56320	250.62	6.20
8 x 9	280	63360	281.95	6.78
9 x 9	306	71280	317.20	7.41

AYSMPE PRESSED STEEL SECTIONAL WATER TANK



AYSMPE PRESSED STEEL SECTIONAL WATER TANK

FEATURES OF PRESSED STEEL WATER STORAGE TANK

PANEL	Material Specification: Hot rolled steel plate conformed to the requirement of BS 4360 grade 43A, BS 1449 material HR 14 or ISO equivalents. SS 316 Hot Rolled Stainless Steel Plate (No. 1 Finishing)						
NOMINAL THICKNESS SPECIFICATION OF UNIT PLATE	1220 mm x 1220 mm	Tank Height	1220mm	2440mm	3660mm	4880mm	
		Bottom Panels	5 mm	5 mm	5 mm	6 mm	
		1st Tier Panels	5 mm	5 mm	5 mm	6 mm	
		2nd Tier Panels		5 mm	5 mm	5 mm	
		3rd Tier Panels			5 mm	5 mm	
		4th Tier Panels				5 mm	
		Top Cover Panels					
	1000 mm x 1000 mm	Tank Height	1000mm	2000mm	3000mm	4000mm	5000mm
		Bottom Panels	5 mm	5 mm	5 mm	5 mm	6 mm
		1st Tier Panels	5 mm	5 mm	5 mm	5 mm	6 mm
		2nd Tier Panels		5 mm	5 mm	5 mm	5 mm
		3rd Tier Panels			5 mm	5 mm	5 mm
		4th Tier Panels				5 mm	5 mm
		5th Tier Panels					5 mm
		Top Cover Panels (Pitch / Flat)	1.5/2 mm	1.5/2 mm	1.5/2 mm	1.5/2 mm	1.5/2 mm
FLANGES OF PLATE	Combined double flanges at an angle of 45 degree & 90 degree to the face of the plate on all four sides.						
BOLT HOLES	1.5mm of hole clearance in diameter for bolt having a minimum diameter of 14mm (M14) or up to 16mm (M16). Bolt holes spacing of not exceeding 76.2mm pitch.						
FREEBOARDS, STAYS, CLEATS & PADS FOR CONNECTION	Material Specification: Hot rolled steel plate conformed to the requirement of BS 4360 grade 43A, BS 1449 material HR 14 or ISO equivalents.						
BOLTS, STUDS, NUTS & WASHERS	Material Specification: Complied with the requirement of BS 4190 or ISO 898. Dimension Specification: M14 (M16 is available upon request).						
JOINTING MATERIAL	Non-Toxic						
COVER	Manufactured to conform to the requirement of BS 449.						
ACCESS LADDERS	Will be provided for all tanks depth over 1000mm.						
WATER LEVEL INDICATOR	Standard supply with graduated mark in feet or meters.						
COATING FINISHES (TWO CHOICES)	1. One coat of Non-toxic priming coating on delivery of panels or prior to erection. Two coats of Black Bituminous paint coating on inner faces & Finishing paint on external faces after erection.						
	2. Hot dip galvanizing to BS 729.						
	3. SS316 Stainless steel sectional tank with No.1 Finishing available upon request in (1220mm x 1220mm x 3mm) and (1000mm x 1000mm x 3mm) dimension.						
	4. HDPE Lining (Internal)						

AUTHORITY CERTIFICATION

- **MANUFACTURING STANDARD**
Manufactured to comply with:
BRITISH STANDARD INSTITUTION (BS 1564 : 1975)
SINGAPORE STANDARD (SS22 : 1994)
- **SIRIM QAS SND. BHD.** (BS 1564 : 1975) - Certification No: PA 018402

WEIGHT TABLES

Nominal Tank Size, Length by Breadth	4' - 0' Deep Tank - 5mm Thick Plate			
	Panels In Tank	Nominal Capacity	Approx. Wt.water	Approx. Wt. Plates
Feet	Numbers	Gallons	Tons	Tons
4 x 4	5	400	1.78	0.39
4 x 8	8	800	3.56	0.62
4 x 12	11	1200	5.34	0.85
4 x 16	14	1600	7.12	1.09
4 x 20	17	2000	8.90	1.32
8 x 8	12	1600	7.12	0.90
8 x 12	16	2400	10.68	1.15
8 x 16	20	3200	14.24	1.43
8 x 20	24	4000	17.80	1.82
8 x 24	28	4800	21.36	2.21
12 x 12	21	3600	16.02	1.60
12 x 16	26	4800	21.36	2.01
12 x 20	31	6000	26.70	2.35
12 x 24	36	7200	32.04	2.74
12 x 28	41	8400	37.38	3.15
16 x 16	32	6400	28.48	2.58
16 x 20	38	8000	35.60	3.04
16 x 24	44	9600	42.72	3.49
16 x 28	50	11200	49.84	4.05
16 x 32	56	12800	56.96	4.66
20 x 20	45	10000	44.50	3.60
20 x 24	52	12000	53.40	4.15
20 x 28	59	14000	62.30	4.70
20 x 32	66	16000	71.20	5.25
20 x 36	73	18000	80.10	5.90
24 x 24	60	14400	64.08	4.71
24 x 28	68	16800	74.76	5.40
24 x 32	76	19200	85.44	6.09
24 x 36	84	21600	96.12	6.80
28 x 28	77	19600	87.22	6.13
28 x 32	86	22400	99.68	7.22
28 x 36	95	25200	112.14	7.94
32 x 32	96	25600	113.92	8.06
32 x 36	106	28800	128.16	8.88
36 x 36	117	32400	144.18	9.82
Nominal Tank Size, Length by Breadth	12' - 0' Deep Tank - 5mm Thick Plate			
	Panels In Tank	Nominal Capacity	Approx. Wt.water	Approx. Wt. Plates
Feet	Numbers	Gallons	Tons	Tons
12 x 12	45	10800	48.06	4.40
12 x 16	54	14400	64.08	5.40
12 x 20	63	18000	83.66	6.30
16 x 16	64	19200	85.44	6.40
16 x 20	74	24000	106.80	7.50
16 x 24	84	28800	128.16	8.60
16 x 28	94	33600	149.52	9.70
20 x 20	85	30000	133.50	8.50
20 x 24	96	36000	160.20	9.70
20 x 28	107	42000	186.90	10.90
20 x 32	118	48000	213.60	12.10
24 x 24	108	43200	192.24	10.90
24 x 28	120	50400	224.28	12.20
24 x 32	132	57600	256.32	13.50
28 x 28	133	58800	261.66	13.60
28 x 32	146	67200	299.04	14.90
28 x 36	159	75600	336.42	16.20
32 x 32	160	76800	341.76	16.30
32 x 36	174	86400	384.48	17.80
32 x 40	188	96000	427.20	19.20
36 x 36	189	97200	432.54	19.30
36 x 40	204	108000	480.60	21.34
40 x 40	220	120000	534.00	22.35
40 x 44	236	132000	587.40	24.79
40 x 48	252	144000	640.80	27.23
44 x 44	253	145200	646.14	26.72
44 x 48	270	158400	704.88	28.49
44 x 52	287	171600	763.62	30.26
48 x 48	288	172800	768.96	30.47
48 x 52	306	187200	833.04	32.35
52 x 52	325	202800	902.46	34.43

Nominal Tank Size, Length by Breadth	8' - 0' Deep Tank - 5mm Thick Plate			
	Panels In Tank	Nominal Capacity	Approx. Wt.water	Approx. Wt. Plates
Feet	Numbers	Gallons	Tons	Tons
4 x 4	9	800	3.56	0.77
4 x 8	14	1600	7.12	1.18
4 x 12	19	2400	10.68	1.59
4 x 16	24	3200	14.24	2.01
4 x 20	29	4000	17.80	2.43
8 x 8	20	3200	14.24	1.68
8 x 12	26	4800	21.36	2.18
8 x 16	32	6400	28.48	2.69
8 x 20	38	8000	35.60	3.20
8 x 24	44	9600	42.72	3.72
12 x 12	33	7200	32.04	2.77
12 x 16	40	9600	42.72	3.36
12 x 20	47	12000	53.40	3.95
12 x 24	54	14400	64.08	4.46
12 x 28	61	16800	74.76	5.07
16 x 16	48	12800	56.96	4.03
16 x 20	56	16000	71.20	4.66
16 x 24	64	19200	85.44	5.37
16 x 28	72	22400	99.68	6.08
16 x 32	80	25600	113.92	6.79
20 x 20	65	20000	89.00	5.46
20 x 24	74	24000	106.80	6.21
20 x 28	83	28000	124.60	6.97
20 x 32	92	32000	142.40	7.73
20 x 36	101	36000	160.20	8.50
24 x 24	84	28800	128.16	7.05
24 x 28	94	33600	149.52	7.89
24 x 32	104	38400	170.88	8.74
24 x 36	114	43200	192.24	9.59
28 x 28	105	39200	174.44	8.81
28 x 32	116	44800	199.36	9.74
28 x 36	127	50400	224.28	10.67
32 x 32	128	51200	227.84	10.74
32 x 36	140	57600	256.32	11.75
36 x 36	153	64800	288.36	12.84
Nominal Tank Size, Length by Breadth	16' - 0' Deep Tank - 5mm Thick Plate			
	Panels In Tank	Nominal Capacity	Approx. Wt.water	Approx. Wt. Plates
Feet	Numbers	Gallons	Tons	Tons
5mm 6mm				
12 x 12	36 21	14400	64.08	6.20
12 x 16	42 26	19200	85.44	7.50
12 x 20	48 31	24000	106.80	8.80
16 x 16	48 32	25600	113.92	8.70
16 x 20	54 38	32000	142.40	10.90
16 x 24	60 44	38400	170.88	13.10
16 x 28	66 50	44800	199.36	15.30
20 x 20	60 45	40000	178.00	11.30
20 x 24	66 52	48000	213.60	12.80
20 x 28	72 59	56000	249.20	14.30
20 x 32	78 66	64000	284.80	15.80
24 x 24	72 60	57600	256.32	14.40
24 x 28	78 68	67200	299.04	15.90
24 x 32	84 76	76800	341.76	17.40
28 x 28	84 77	78400	348.88	17.50
28 x 32	90 86	89600	398.72	19.30
28 x 36	96 95	100800	448.56	20.90
32 x 32	96 96	102400	455.68	21.10
32 x 36	102 106	115200	512.64	23.00
32 x 40	108 116	128000	569.60	24.70
36 x 36	108 117	129600	576.72	25.10
36 x 40	114 128	144000	640.80	27.33
40 x 40	120 140	160000	712.00	29.41
40 x 44	126 152	176000	783.20	31.44
40 x 48	132 164	192000	854.40	33.47
44 x 44	132 165	193600	861.52	33.72
44 x 48	138 178	211200	939.84	35.85
44 x 52	144 191	228800	1018.16	37.98
48 x 48	144 192	230400	1025.28	38.13
48 x 52	150 206	249600	1110.72	40.46
52 x 52	156 221	270400	1203.28	42.90

Note 1 : Approximate total weight includes plates, stays, cleants. nuts, washers and jointing material.

Note 2 : Nominal capacities are WITHOUT allowance for freeboard.

CH YODOFORM SDN BHD

Purlin 16



Project: Gamco Hangar, Abu Dhabi, UAE



Project: Haeco Aircraft Maintenance Hangar No. 2 Hong Kong



MRT C701, North Line Depot Sengkang Avenue, Singapore



Project: Lufthansa Technik Hangar, Philippines

PURLIN

INTRODUCTION

CH YODOFORM SDN. BHD. with its cold roll forming manufacturing facility at Jalan Kapar, Klang Selangor is strategically located to provide technical advice and service to meet production order for both local and overseas markets. All YODOFORM sections are precisely cold-formed from imported high tensile zinc coated steel which conform to all international standards.

YODOFORM Zed and C-Sections are supplied cut-to-length and pre-punched holes. This obviate any fabrication and painting at site. Thus the sections are ready for immediate erection upon delivery. Due to lightweight, high strength of the steel and the zinc coated surface, YODOFORM sections are versatile, economical and requires minimal maintenance throughout the life span of the building. Design aids and load tables are provided to enable designers to make quick selections and section properties details analysis. Our technical representatives are readily at your convenience to solve problems and to assist with design services. Quality control at our factory remain rigid - your assurance that YODOFORM will always be complied to your specific requirements.

MATERIAL SPECIFICATIONS

Base Steel Thickness	: 1.6mm, 2.0mm, 2.5mm and 3.0mm.
Steel Grade	: High Tensile AS1397 G450.
Yield Stress	: 450 MPa minimum.
Tensile Strength	: 500 MPa minimum.
Zinc / Zinc Aluminium Coating	: minimum 275 g/m ² Coating mass. (both sides)
Surface Finishing	: Regular spangle, minimize spangle and zero spangle.

TOLERANCES

Depth	: ± 1mm
Flange Width	: ± 2mm
Length	: ± 3mm
Holes Centres	: ± 1.5mm
Lips	: ± 2mm

PACKING

YODOFORM steel purlins are supplied in strapped bundles. Actual numbers vary with section size and length but bundle mass is limited to approximately one tonne.

HANDLING AND STORAGE

YODOFORM C & Z purlins should not be allowed to get wet. They should be stacked clear off the ground and protected by waterproof covering to prevent water and / or condensation becoming trapped between adjacent surfaces. If bundles become wet, the purlins should be separated, wiped with a dry cloth and placed so that air circulation completes the drying. These procedures are recommended to avoid unsightly damage to the coating which could reduce the life of the product.

Care must be taken when handling long length bundles. Lifting should only be carried out using a suitable beam with lifting points and carefully located slings.

PURLIN

ANALYSIS AND DESIGN PRINCIPLES

The limit state capacity tables are compiled based on the following assumptions:

- a) Purlins bend about the axis perpendicular to the web;
- b) At laps, the purlins are continuous. In the finite element flexural-torsional buckling analysis, lapped regions are modeled by adding the section properties of the two sections;
- c) The bridging is assumed to provide a lateral torsional restraint and a lateral translational restraint at the points of attachment to the purlins;
- d) The roof sheeting which is screw-fastened to the top flange of the purlins is assumed to provide a continuous diaphragm shear restraint against minor axis rotation.

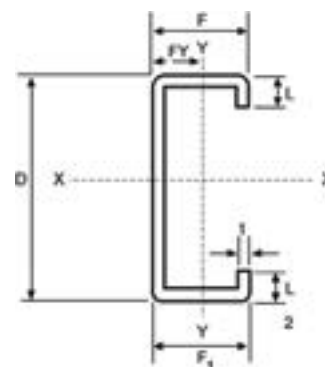
The purlin capacity tables are computed based on the Australian and New Zealand Standard, *AS/NZS 4600 - Cold-Formed Steel Structures*, 2005.

DEFLECTION

There are no specific rules governing permissible deflections or the load types which should be considered in calculations. You need to consider the specific application conditions of the purlins to decide on a acceptable deflection limit. The structures codes leave the choice of deflections to design engineers who give consideration to the nature of a building and its specific application conditions consequently, for loads less than the safe load limit, alternative deflection ratios may be determinate by proportion from the load which produces deflection of span / 150.

PURLIN

C-SECTION

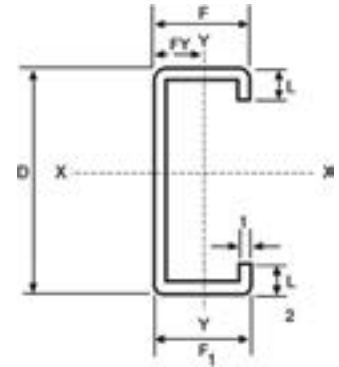


D = DEPTH
F = FLANGE
L = LIPPED
t = THICKNESS

C Section Identification	Section Dimensions				Mass Per Unit Length kg/m	Full Section Properties							
						Area	Second Moment of Area		Second Modulus		Radius of Gyration		Centroid
	D mm	F mm	L mm	t mm		A mm ²	I _x x 10 ⁶ mm ⁴	I _y x 10 ⁶ mm ⁴	Z _x x 10 ³ mm ³	Z _y x 10 ³ mm ³	R _x mm	R _y mm	X mm
YCP 1016	102	51	16.0	1.6	3.05	357	0.595	0.132	11.85	4.05	40.84	19.20	16.94
YCP 1020	102	51	16.0	2.0	3.72	442	0.730	0.160	14.60	4.95	40.64	19.01	16.74
YCP 1025	102	51	16.0	2.5	4.60	546	0.892	0.193	17.92	6.01	40.40	18.78	16.48
YCP 1030	102	51	16.0	3.0	5.29	648	1.045	0.223	21.11	7.01	40.15	18.53	16.23
YCP 1216	127	51	16.0	1.6	3.20	397	0.990	0.142	15.79	4.15	49.96	18.91	15.24
YCP 1220	127	51	16.0	2.0	3.94	492	1.218	0.172	19.48	5.07	49.76	18.72	15.04
YCP 1225	127	51	16.0	2.5	4.89	609	1.491	0.208	23.95	6.16	49.49	18.48	14.79
YCP 1230	127	51	16.0	3.0	5.90	723	1.753	0.240	28.27	7.19	49.23	18.23	14.54
YCP 1516	153	66	16.0	1.6	4.01	486	1.808	0.281	23.88	6.25	60.97	24.06	19.38
YCP 1520	153	66	16.0	2.0	4.92	604	2.230	0.344	29.54	7.67	60.77	23.86	19.18
YCP 1525	153	66	16.0	2.5	6.01	749	2.741	0.417	36.43	9.36	60.50	23.61	18.92
YCP 1530	153	66	16.0	3.0	7.35	891	3.235	0.486	43.13	10.97	60.25	23.36	18.67
YCP 1716	175	71	16.0	1.6	4.27	538	2.588	0.351	29.85	7.10	69.39	25.56	19.93
YCP 1720	175	71	16.0	2.0	5.26	668	3.197	0.430	36.96	8.72	69.19	25.36	19.73
YCP 1725	175	71	16.0	2.5	6.67	829	3.936	0.523	45.64	10.66	68.91	25.11	19.48
YCP 1730	175	71	16.0	3.0	8.08	987	4.652	0.610	54.09	12.51	68.64	24.86	19.23
YCP 2016	203	71	16.0	1.6	4.70	582	3.654	0.368	36.29	7.21	79.22	25.12	18.40
YCP 2020	203	71	16.0	2.0	5.74	724	4.517	0.450	44.95	8.85	78.99	24.92	18.20
YCP 2025	203	71	16.0	2.5	7.13	899	5.568	0.547	55.54	10.82	78.71	24.67	17.96
YCP 2030	203	71	16.0	3.0	8.79	1071	6.589	0.639	65.89	12.70	78.44	24.42	17.72
YCP 2216	225	78	18.0	1.6	5.28	646	4.988	0.498	44.66	8.89	87.85	27.76	20.33
YCP 2220	225	78	18.0	2.0	6.55	804	6.174	0.611	55.37	10.93	87.63	27.56	20.13
YCP 2225	225	78	18.0	2.5	8.16	999	7.621	0.745	68.51	13.40	87.35	27.31	19.89
YCP 2230	225	78	18.0	3.0	9.80	1191	9.031	0.872	81.36	15.76	87.08	27.06	19.65
YCP 2520	250	78	18.0	2.0	6.69	854	7.907	0.630	63.77	11.04	96.22	27.16	18.96
YCP 2525	250	78	18.0	2.5	8.34	1061	9.767	0.769	78.93	13.54	95.95	26.91	18.72
YCP 2530	250	78	18.0	3.0	10.20	1266	11.58	0.900	93.78	15.92	95.64	26.66	18.49
YCP 3020	300	96	25.0	2.0	8.63	1054	14.25	1.250	95.64	18.03	116.3	34.44	24.70
YCP 3025	300	96	25.0	2.5	10.84	1311	17.64	1.533	118.6	22.20	116.0	34.20	24.47
YCP 3030	300	96	25.0	3.0	12.10	1566	20.97	1.804	141.2	26.23	115.7	33.94	24.23
YCP 3520	350	121	28.0	2.0	9.92	1274	23.97	2.451	137.7	28.30	137.2	43.86	32.41
YCP 3525	350	121	28.0	2.5	12.37	1586	29.72	3.018	171.1	34.96	136.9	43.62	32.17
YCP 3530	350	121	28.0	3.0	15.07	1896	35.39	3.566	204.0	41.43	136.6	43.37	31.93

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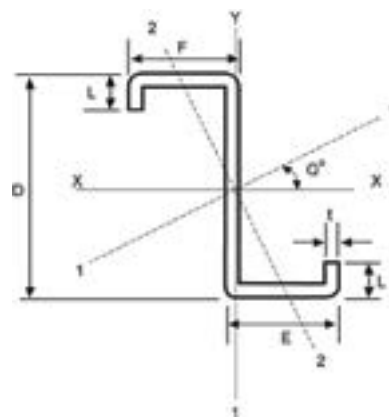


Full Section Properties				Section Modulus	Area	C Section Identification
Shear Centre	Torsion Constant	Warping Constant	Monosymmetry Section Constant			
X_o mm	J mm ⁴	I _w x 10 ⁶ mm ⁶	β_y mm	Z _{xe} x 10 ³ mm ³	A _e mm ²	
42.10	304	307	122.4	10.23	252	YCP 1016
41.62	589	369	121.6	13.92	363	YCP 1020
41.02	1138	437	120.7	17.27	500	YCP 1025
40.42	1945	497	119.7	20.49	633	YCP 1030
38.95	339	479	138.7	13.74	255	YCP 1216
38.48	656	576	138.1	18.28	369	YCP 1220
37.89	1268	685	137.4	23.19	513	YCP 1225
37.31	2170	783	136.7	27.60	656	YCP 1230
49.04	415	1305	172.5	18.90	266	YCP 1516
48.57	805	1581	171.9	24.43	374	YCP 1520
47.97	1560	1900	171.2	32.36	539	YCP 1525
47.38	2674	2191	170.4	40.00	713	YCP 1530
50.87	459	2079	194.1	22.92	269	YCP 1716
50.40	891	2525	193.6	29.97	380	YCP 1720
49.81	1727	3044	192.9	39.26	545	YCP 1725
49.22	2962	3522	192.3	49.51	738	YCP 1730
47.99	497	2884	219.8	26.41	271	YCP 2016
47.54	965	3508	219.5	36.90	383	YCP 2020
46.96	1873	4235	219.1	48.19	550	YCP 2025
46.39	3214	4907	218.7	60.62	747	YCP 2030
53.05	552	4833	243.2	30.52	285	YCP 2216
52.59	1072	5894	242.9	44.10	400	YCP 2220
52.02	2081	7142	242.5	57.77	567	YCP 2225
51.45	3574	8304	242.1	72.64	772	YCP 2230
50.32	1139	7457	270.4	48.65	402	YCP 2520
49.76	2211	9044	270.2	67.05	570	YCP 2525
49.20	3799	10530	270.1	84.14	776	YCP 2530
65.10	1405	21890	321.2	66.07	462	YCP 3020
64.54	2732	26720	320.9	93.83	642	YCP 3025
63.98	4699	31290	320.7	119.9	846	YCP 3030
84.38	1699	58630	376.7	84.78	511	YCP 3520
83.81	3305	71880	376.3	118.4	706	YCP 3525
83.24	5689	84580	375.8	158.3	926	YCP 3530

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Z-SECTION

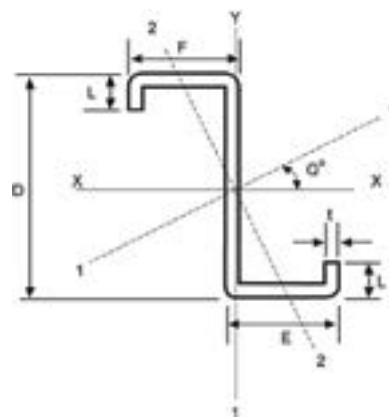


D = DEPTH
F = FLANGE
L = LIPPED
t = THICKNESS

Z Section Identification	Section Dimensions					Mass Per Unit Length kg/m	Full Section Properties					
							Principle Axes					α
							Area	Second Moment of Area		Section Modulus	Radius of Gyration	
	D mm	E mm	F mm	L mm	t mm		A mm ²	I _x x 10 ⁶ mm ⁴	I _y x 10 ⁶ mm ⁴	Z _y x 10 ³ mm ³	R _y mm	
YZP 1016	102	57	51	16.0	1.6	3.05	366	0.805	0.087	2.98	15.37	30.62°
YZP 1020	102	57	51	16.0	2.0	3.72	454	0.985	0.105	3.65	15.23	30.44°
YZP 1025	102	57	51	16.0	2.5	4.60	561	1.199	0.127	4.44	15.06	30.23°
YZP 1030	102	57	51	16.0	3.0	5.29	666	1.402	0.148	5.19	14.88	30.01°
YZP 1216	127	57	51	16.0	1.6	3.20	406	1.198	0.102	3.25	15.81	23.28°
YZP 1220	127	57	51	16.0	2.0	3.94	504	1.471	0.124	3.98	15.67	23.12°
YZP 1225	127	57	51	16.0	2.5	4.89	624	1.797	0.150	4.84	15.48	22.91°
YZP 1230	127	57	51	16.0	3.0	5.90	741	2.108	0.173	5.66	15.29	22.70°
YZP 1516	153	68	62	16.0	1.6	4.01	483	2.066	0.169	4.51	18.68	22.50°
YZP 1520	153	68	62	16.0	2.0	4.92	600	2.544	0.206	5.54	18.53	22.36°
YZP 1525	153	68	62	16.0	2.5	6.01	744	3.120	0.250	6.77	18.34	22.18°
YZP 1530	153	68	62	16.0	3.0	7.35	885	3.673	0.292	7.93	18.15	22.00°
YZP 1716	175	74	68	16.0	1.6	4.27	538	2.931	0.221	5.36	20.29	20.89°
YZP 1720	175	74	68	16.0	2.0	5.26	668	3.615	0.271	6.58	20.14	20.76°
YZP 1725	175	74	68	16.0	2.5	6.67	829	4.443	0.330	8.05	19.95	20.60°
YZP 1730	175	74	68	16.0	3.0	8.08	987	5.242	0.385	9.46	19.75	20.44°
YZP 2016	203	74	68	16.0	1.6	4.70	582	3.977	0.241	5.58	20.34	17.15°
YZP 2020	203	74	68	16.0	2.0	5.74	724	4.912	0.295	6.86	20.19	17.04°
YZP 2025	203	74	68	16.0	2.5	7.13	899	6.046	0.359	8.40	19.99	16.89°
YZP 2030	203	74	68	16.0	3.0	8.79	1071	7.144	0.420	9.86	19.79	16.74°
YZP 2216	225	78	72	18.0	1.6	5.28	637	5.257	0.300	6.52	21.70	16.30°
YZP 2220	225	78	72	18.0	2.0	6.55	792	6.500	0.368	8.03	21.55	16.20°
YZP 2225	225	78	72	18.0	2.5	8.16	984	8.012	0.448	9.84	21.35	16.06°
YZP 2230	225	78	72	18.0	3.0	9.80	1173	9.480	0.525	11.57	21.15	15.93°
YZP 2520	250	78	72	20.0	2.0	6.69	850	8.294	0.403	8.62	21.79	14.34°
YZP 2525	250	78	72	20.0	2.5	8.34	1056	10.24	0.492	10.57	21.59	14.22°
YZP 2530	250	78	72	20.0	3.0	10.20	1260	12.12	0.577	12.44	21.39	14.10°
YZP 3020	300	100	93	25.0	2.0	8.71	1056	15.37	0.845	14.25	28.29	15.80°
YZP 3025	300	100	93	25.0	2.5	10.84	1314	19.01	1.037	17.55	28.09	15.70°
YZP 3030	300	100	93	25.0	3.0	12.10	1569	22.57	1.221	20.75	27.90	15.61°
YZP 3520	350	129	121	28.0	2.0	9.92	1290	26.85	1.730	23.12	36.62	18.02°
YZP 3525	350	129	121	28.0	2.5	12.37	1606	33.27	2.131	28.57	36.43	17.94°
YZP 3530	350	129	121	28.0	3.0	15.07	1920	39.58	2.521	33.89	36.24	17.86°

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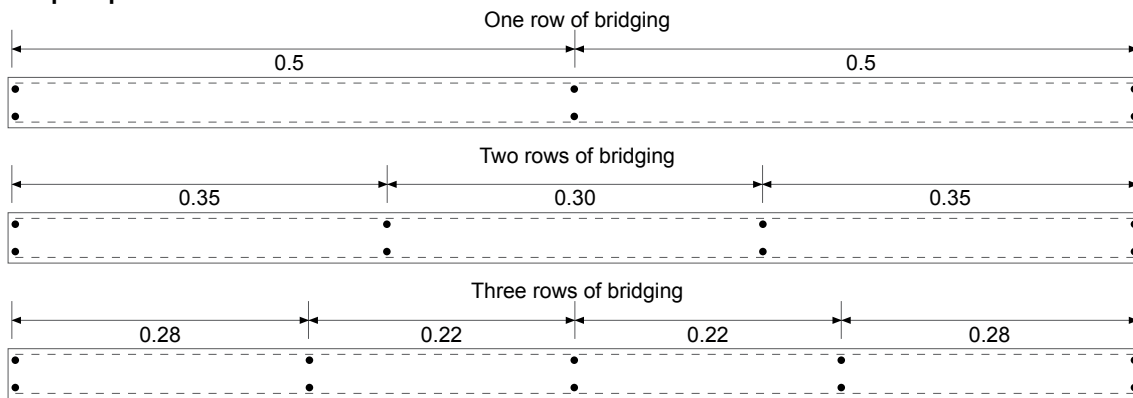
Full Section Properties							Column Properties		Effective Section Properties		Z Section Identification
Axes Perpendicular and Parallel to Web									at Yield Stress		
Second Moment of Area		Product of Moment of Area	Section Modulus		Radius of Gyration		Torsion Constant	Warping Constant	Section Modulus	Area	
Ix' x 10 ⁶ mm ⁴	Iy' x 10 ⁶ mm ⁴	Ix' y' x 10 ⁶ mm ⁴	Zx' x 10 ³ mm ³	Zy' x 10 ³ mm ³	Rx' mm	Ry' mm	J mm ⁴	Iw x 10 ⁶ mm ⁶	Zx'e x 10 ³ mm ³	Ae mm ²	
0.618	0.273	0.315	12.00	5.08	41.09	27.29	313	447	10.34	253	YZP 1016
0.759	0.331	0.384	14.79	6.22	40.90	27.01	605	538	13.81	363	YZP 1020
0.928	0.399	0.466	18.16	7.56	40.65	26.66	1169	641	17.56	499	YZP 1025
1.088	0.461	0.543	21.40	8.82	40.41	26.31	1999	732	21.36	651	YZP 1030
1.027	0.273	0.398	16.00	5.07	50.28	25.92	347	723	13.90	256	YZP 1216
1.263	0.331	0.487	19.74	6.20	50.06	25.64	672	872	18.47	369	YZP 1220
1.548	0.399	0.591	24.28	7.54	49.82	25.30	1300	1042	23.51	512	YZP 1225
1.820	0.461	0.689	28.66	8.80	49.55	24.95	2224	1194	28.69	674	YZP 1230
1.788	0.447	0.671	23.17	6.88	60.84	30.40	412	1703	18.83	265	YZP 1516
2.206	0.544	0.823	28.64	8.44	60.64	30.12	800	2065	24.32	373	YZP 1520
2.711	0.659	1.003	35.32	10.31	60.37	29.77	1550	2484	32.29	539	YZP 1525
3.199	0.766	1.175	41.80	12.07	60.11	29.42	2656	2868	39.64	709	YZP 1530
2.587	0.566	0.903	29.31	7.98	69.38	32.44	459	2845	22.92	269	YZP 1716
3.195	0.691	1.108	36.29	9.80	69.16	32.16	891	3459	29.97	380	YZP 1720
3.934	0.839	1.355	44.80	11.98	68.90	31.81	1727	4176	39.26	545	YZP 1725
4.650	0.977	1.589	53.10	14.05	68.63	31.46	2962	4837	49.51	738	YZP 1730
3.652	0.566	1.053	35.68	7.97	79.19	31.17	497	3965	26.41	271	YZP 2016
4.515	0.691	1.293	44.20	9.79	78.97	30.90	965	4826	36.90	383	YZP 2020
5.566	0.839	1.581	54.61	11.96	78.69	30.55	1873	5831	48.19	550	YZP 2025
6.586	0.977	1.855	64.77	14.03	78.42	30.21	3214	6762	60.62	747	YZP 2030
4.867	0.691	1.336	42.92	9.20	87.43	32.93	543	6038	30.44	284	YZP 2216
6.022	0.845	1.642	53.21	11.31	87.20	32.66	1056	7364	43.97	398	YZP 2220
7.433	1.028	2.011	65.81	13.85	86.92	32.32	2050	8922	57.41	567	YZP 2225
8.805	1.200	2.364	78.13	16.28	86.64	31.98	3520	10370	72.24	772	YZP 2230
7.810	0.887	1.893	62.10	11.88	95.86	32.31	1133	9826	49.91	412	YZP 2520
9.647	1.080	2.320	76.86	14.55	95.58	31.98	2201	11920	68.02	583	YZP 2525
11.44	1.262	2.728	91.31	17.11	95.29	31.65	3781	13880	85.67	796	YZP 2530
14.29	1.922	3.805	94.65	19.93	116.3	42.66	1408	30280	66.09	462	YZP 3020
17.69	2.354	4.683	117.4	24.53	116.0	42.33	2737	36980	93.87	642	YZP 3025
21.03	2.767	5.533	139.7	28.98	115.8	41.99	4708	43340	120.1	847	YZP 3030
24.45	4.134	7.390	138.8	33.04	137.7	56.61	1720	86660	84.80	511	YZP 3520
30.32	5.086	9.126	172.4	40.81	137.4	56.27	3347	106400	118.6	707	YZP 3525
36.10	6.006	10.82	205.5	48.38	137.1	55.93	5761	125300	158.6	929	YZP 3530

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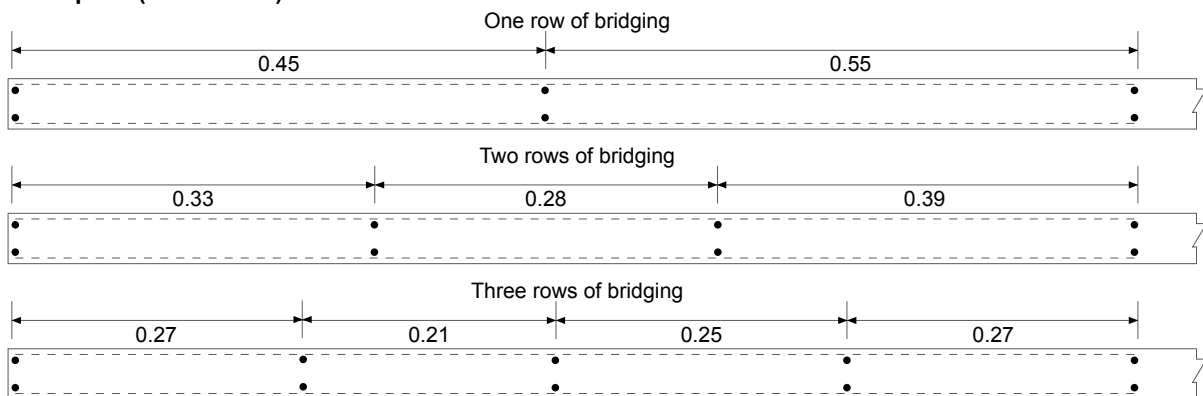
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RECOMMENDED LOCATION OF BRIDGING HOLES

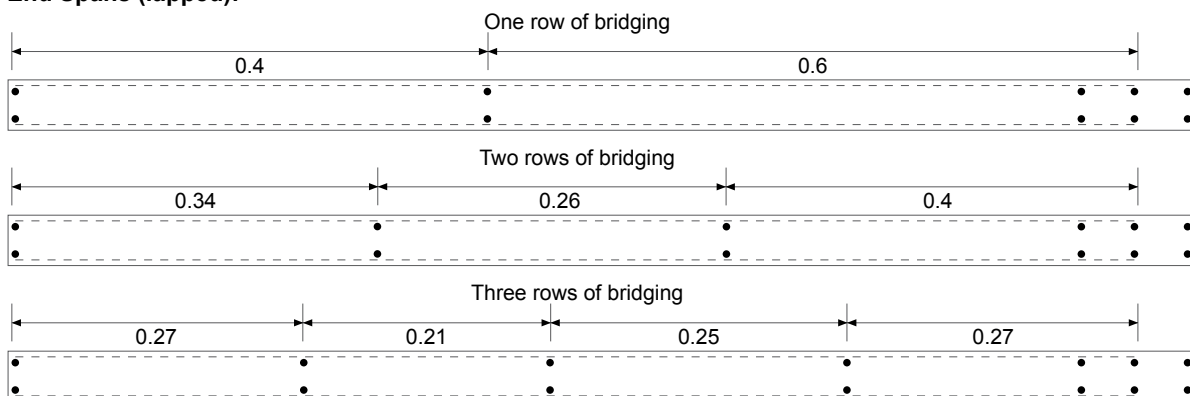
Simple Spans:



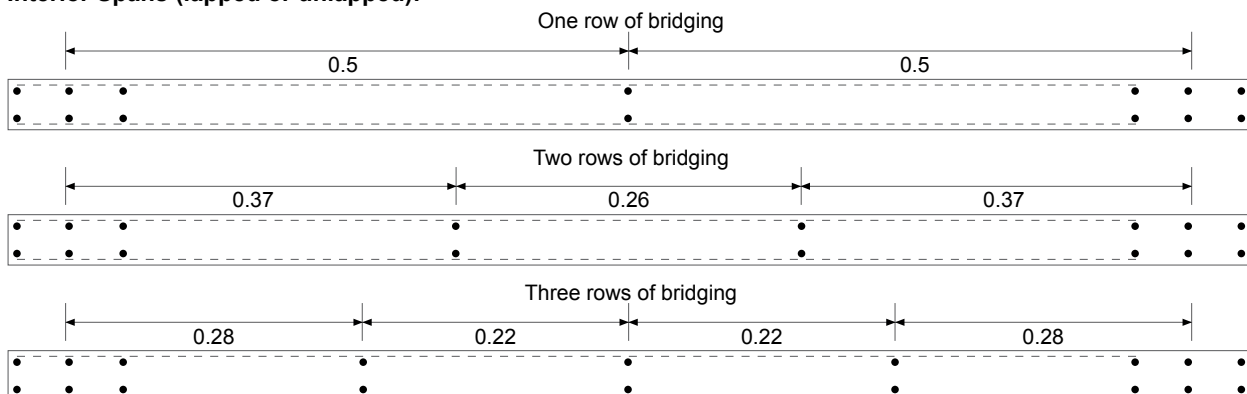
End Spans (continuous):



End Spans (lapped):



Interior Spans (lapped or unlapped):



PURLIN

POINT LOADS

LEGEND

P	= Single Point Load (kN)
L	= Span (m)
a	= Larger Distance from Support (m)
b	= Smaller Distance from Support (m)
w	= Equivalent Uniform Load (kN/m)
N	= Number of Point Load Over One Span (for 6 or more loads)

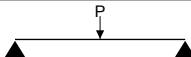
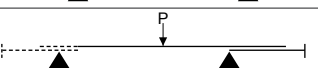
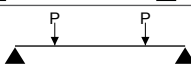
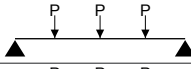
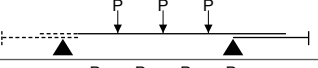
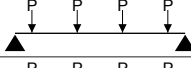
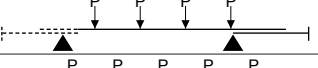
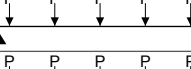
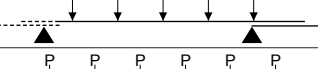
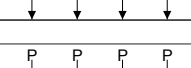
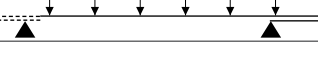
Loading conditions and formula shown give accurate conversion of Point Loads into Uniform Loads for determination of Load carrying capacity of simple spans only.

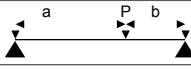
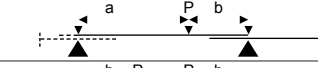
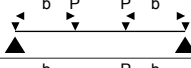
For lapped spans, the conversion depends upon the number of spans, the position of span in the continuity, and the lapping ratio. The lapped span formula shown have been devised for the worst loading condition and can be safely used for end spans, interior spans and any lapping ratio (greater than 0.10).

A separate set of conversion formulae would be required for deflection determination.

The formulae shown will give conservative (safe) conversion with a margin of error between 3.7% and 25%.

CONVERSION OF POINT LOADS INTO EQUIVALENT UNIFORM LOADS

Symmetrical Equidistant Point Loads		
Loading Condition	Diagrams	Conversion Formula
SINGLE LOAD	Simple 	$W = \frac{2P}{L}$
	Lapped 	$W = \frac{2.22P}{L}$
2 LOADS	Simple 	$W = \frac{2.67P}{L}$
	Lapped 	$W = \frac{3.16P}{L}$
3 LOADS	Simple 	$W = \frac{4P}{L}$
	Lapped 	$W = \frac{3.78P}{L}$
4 LOADS	Simple 	$W = \frac{4.80P}{L}$
	Lapped 	$W = \frac{5.12P}{L}$
5 LOADS	Simple 	$W = \frac{6P}{L}$
	Lapped 	$W = \frac{6.65P}{L}$
6 OR MORE LOADS	Simple 	$W = \frac{1.14NP}{L}$
	Lapped 	$W = \frac{1.22NP}{L}$

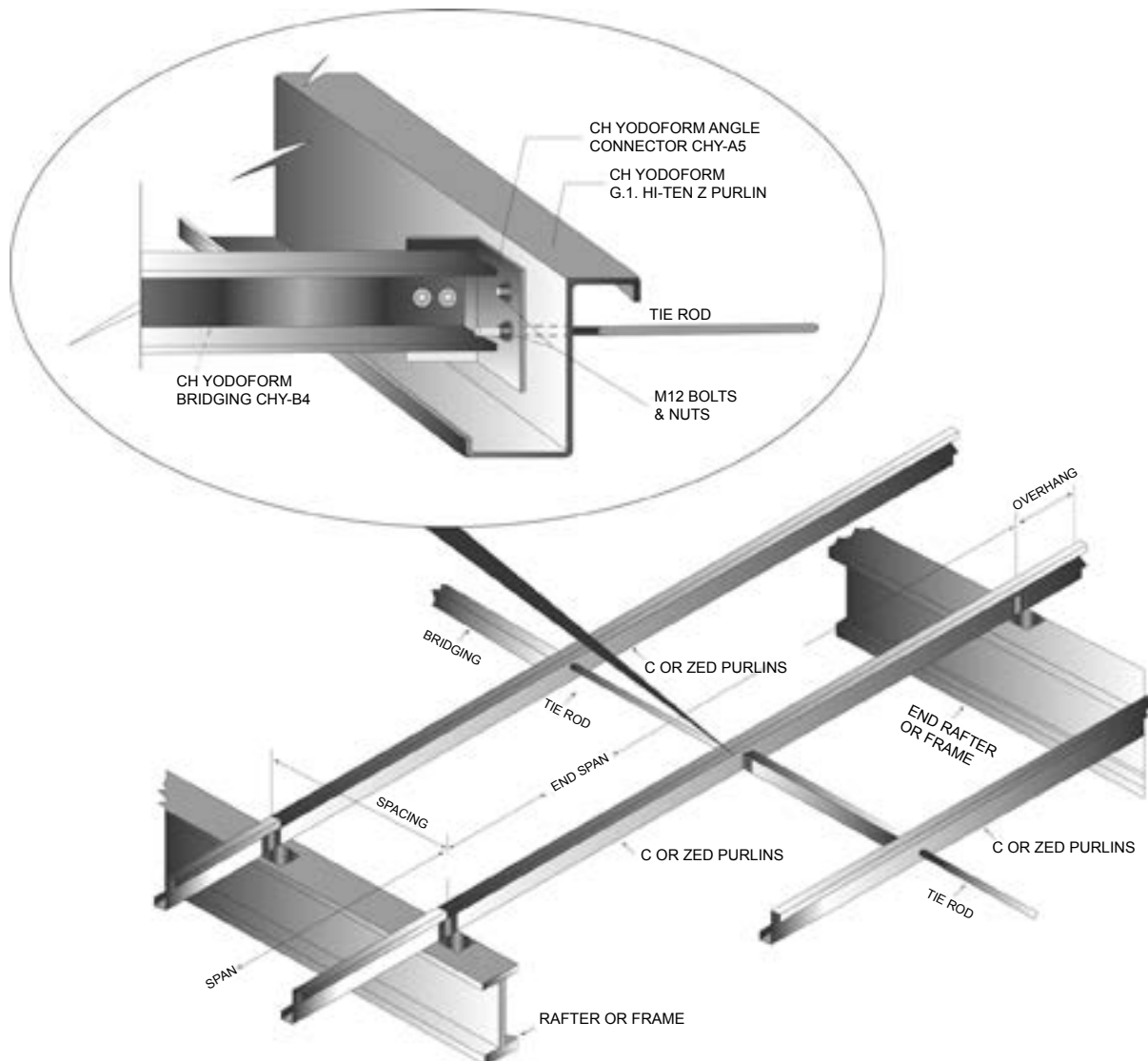
Single Eccentric and Two Symmetrical Point Loads		
Loading Condition	Diagrams	Conversion Formula
SINGLE ECCENTRIC POINT LOAD	Simple 	$W = \frac{8abP}{L^3}$
	Lapped 	$W = \frac{17.76ab^2P}{L^4}$
TWO SYMMETRICAL POINT LOAD	Simple 	$W = \frac{8bP}{L^2}$
	Lapped 	$W = \frac{9.45b(2L-3b)P}{L^3}$

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CH YODOFORM BRIDGING CONNECTION DETAILS COMPONENTS

DESCRIPTION	CODE	DIMENSION	GAUDE
Bridging Channel	CHY-B4	100mm x 50mm x 15mm	1.6mm
Connection Angle	CHY-A5	62mm x 62mm x 100mm	1.6mm

ALTERNATE BRIDGING AND THE RODS



STRUCTURAL SHAPES

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STRUCTURAL SHAPES

SPECIFICATIONS

ASTM

- ASTM A36
- ASTM A572
- ASTM A992

EN

- EN 10025-2004 (S275 JR, S355 JR & JO)

JIS

- JIS G3101 (SS400)
 - JIS G3106 (SM400A, B, C, SM490A, B, C, SM490YA, YB, SM520B, C)
 - JIS G3136 (SN400A, B, C, SN490B, C)
-

CORRESPONDING SPECIFICATIONS

TIS 1227 1996	JIS G3101 2004	JIS G3106 2004	JIS G3136 2005	EN 10025 2004	ASTM 2005	DIN 17100 1980
SS400 SS490 SS540	SS400 SS490 SS540				A36	St 50-2
SM400		SM400A SM400B SM400C	SN400A SN400B	S275JR S275JO	A572Gr.42	St 37-2 RSt 37-2
SM490		SM490A SM490B SM490C SM490YA SM490YB	SN490B SN490C	 355JR 355JO	A572Gr.50	 St 52-3
SM520 SM570		SM520B SM520C SM570				

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DIMENSIONS AND PROPERTIES

IN ACCORDANCE TO BS4 : PART 1 : 2005



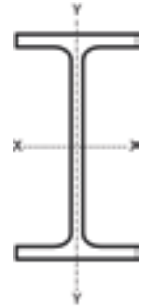
Designation	Mass per metre	Depth of Section h	Width of Section b	Thickness Web s	Thickness Flange t	Root Radius r	Depth between fillets d	Ratios for Local Buckling		Second moment of Area	
								Flange b/2t	Web d/s	Axis x-x	Axis y-y
										cm ⁴	cm ⁴
* 1016 x 305 x 487	487.0	1036.1	308.5	30.0	54.1	30.0	867.8	2.85	29.0	1020400	26720
* 1016 x 305 x 438	438.0	1025.9	305.4	26.9	49.0	30.0	868.0	3.12	32.3	908900	23440
* 1016 x 305 x 393	393.0	1016.0	303.0	24.4	43.9	30.0	868.2	3.45	35.7	806600	20490
* 1016 x 305 x 349	349.0	1008.1	302.0	21.1	40.0	30.0	868.0	3.78	41.2	722100	18460
* 1016 x 305 x 314	314.0	1000.0	300.0	19.1	35.9	30.0	868.2	4.18	45.6	643200	16230
* 1016 x 305 x 272	272.0	990.1	300.0	16.5	31.0	30.0	868.0	4.84	52.7	552900	14000
* 1016 x 305 x 249	249.0	980.2	300.0	16.5	26.0	30.0	868.0	5.77	52.7	480300	11750
* 1016 x 305 x 222	222.0	970.3	300.0	16.0	21.1	30.0	867.8	7.11	54.4	406900	9544
914 x 419 x 388	388.0	921.0	420.5	21.4	36.6	24.1	799.6	5.74	37.4	719600	45440
914 x 419 x 343	343.3	911.8	418.5	19.4	32.0	24.1	799.6	6.54	41.2	625800	39160
914 x 305 x 289	289.1	926.6	307.7	19.5	32.0	19.1	824.4	4.81	42.3	504200	15600
914 x 305 x 253	253.4	918.4	305.5	17.3	27.9	19.1	824.4	5.47	47.7	436300	13300
914 x 305 x 224	224.2	910.4	304.1	15.9	23.9	19.1	824.4	6.36	51.8	376400	11240
914 x 305 x 201	200.9	903.0	303.3	15.1	20.2	19.1	824.4	7.51	54.6	325300	9423
838 x 292 x 226	226.5	850.9	293.8	16.1	26.8	17.8	761.7	5.48	47.3	339700	11360
838 x 292 x 194	193.8	840.7	292.4	14.7	21.7	17.8	761.7	6.74	51.8	279200	9066
838 x 292 x 176	175.9	834.9	291.7	14.0	18.8	17.8	761.7	7.76	54.4	246000	7799
762 x 267 x 197	196.8	769.8	268.0	15.6	25.4	16.5	686.0	5.28	44.0	240000	8175
762 x 267 x 173	173.0	762.2	266.7	14.3	21.6	16.5	686.0	6.17	48.0	205300	6850
762 x 267 x 147	146.9	754.0	265.2	12.8	17.5	16.5	686.0	7.58	53.6	168500	5455
762 x 267 x 134	133.9	750.0	264.4	12.0	15.5	16.5	686.0	8.53	57.2	150700	4788
686 x 254 x 170	170.2	692.9	255.8	14.5	23.7	15.2	615.1	5.40	42.4	170300	6630
686 x 254 x 152	152.4	687.5	254.5	13.2	21.0	15.2	615.1	6.06	46.6	150400	5784
686 x 254 x 140	140.1	683.5	253.7	12.4	19.0	15.2	615.1	6.68	49.6	136300	5183
686 x 254 x 125	125.2	677.9	253.0	11.7	16.2	15.2	615.1	7.81	52.6	118000	4383
610 x 305 x 238	238.1	635.8	311.4	18.4	31.4	16.5	540.0	4.96	29.3	209500	15840
610 x 305 x 179	179.0	620.2	307.1	14.1	23.6	16.5	540.0	6.51	38.3	153000	11410
610 x 305 x 149	149.1	612.4	304.8	11.8	19.7	16.5	540.0	7.74	45.8	125900	9308
610 x 229 x 140	139.9	617.2	230.2	13.1	22.1	12.7	547.6	5.21	41.8	111800	4505
610 x 229 x 125	125.1	612.2	229.0	11.9	19.6	12.7	547.6	5.84	46.0	98610	3932
610 x 229 x 113	113.0	607.6	228.2	11.1	17.3	12.7	547.6	6.60	49.3	87320	3434
610 x 229 x 101	101.2	602.6	227.6	10.5	14.8	12.7	547.6	7.69	52.2	75780	2915
533 x 210 x 122	122.0	544.5	211.9	12.7	21.3	12.7	476.5	4.97	37.5	76040	3388
533 x 210 x 109	109.0	539.5	210.8	11.6	18.8	12.7	476.5	5.61	41.1	66820	2943
533 x 210 x 101	101.0	536.7	210.0	10.8	17.4	12.7	476.5	6.03	44.1	61520	2692
533 x 210 x 92	92.1	533.1	209.3	10.1	15.6	12.7	476.5	6.71	47.2	55230	2389
533 x 210 x 82	82.2	528.3	208.8	9.6	13.2	12.7	476.5	7.91	49.6	47540	2007
457 x 191 x 98	98.3	467.2	192.8	11.4	19.6	10.2	407.6	4.92	35.8	45730	2347
457 x 191 x 89	89.3	463.4	191.9	10.5	17.7	10.2	407.6	5.42	38.8	41020	2089
457 x 191 x 82	82.0	460.0	191.3	9.9	16.0	10.2	407.6	5.98	41.2	37050	1871
457 x 191 x 74	74.3	457.0	190.4	9.0	14.5	10.2	407.6	6.57	45.3	33320	1671
457 x 191 x 67	67.1	453.4	189.9	8.5	12.7	10.2	407.6	7.48	48.0	29380	1452

* Limited Stock Availability

UNIVERSAL BEAMS

DIMENSIONS AND PROPERTIES

IN ACCORDANCE TO BS4 : PART 1 : 2005



Radius of Gyration		Elastic Modulus		Plastic Modulus		Buckling Parameter	Torsional Index	Warping Constant	Torsional Constant	Area of Section	Mass per metre	Designation
Axis x-x	Axis y-y	Axis x-x	Axis y-y	Axis x-x	Axis y-y	u	x	H	J			
cm	cm	cm ³	cm ³	cm ³	cm ³	u	x	dm ⁶	cm ⁴	cm ²	kg/m	
40.6	6.57	19700	1732	23180	2799	0.867	21.2	64.4	4276	619	487.0	* 1016 x 305 x 487
40.4	6.49	17720	1535	20740	2467	0.868	23.2	55.9	3166	556	438.0	* 1016 x 305 x 438
40.2	6.40	15880	1353	18520	2167	0.868	25.6	48.4	2314	500	393.0	* 1016 x 305 x 393
40.3	6.44	14330	1222	16570	1940	0.872	28.0	43.2	1706	445	349.0	* 1016 x 305 x 349
40.1	6.37	12860	1082	14830	1712	0.871	30.8	37.7	1253	400	314.0	* 1016 x 305 x 314
40.0	6.36	11170	934	12800	1469	0.872	35.1	32.2	826	346	272.0	* 1016 x 305 x 272
39.0	6.09	9799	784	11330	1244	0.861	40.1	26.8	575	316	249.0	* 1016 x 305 x 249
38.0	5.81	8387	636	9784	1019	0.849	46.0	21.5	384	282	222.0	* 1016 x 305 x 222
38.2	9.59	15630	2161	17670	3341	0.885	26.7	88.9	1734	494	388.0	914 x 419 x 388
37.8	9.46	13730	1871	15480	2890	0.883	30.1	75.8	1193	437	343.3	914 x 419 x 343
37.0	6.51	10880	1014	12570	1601	0.867	31.9	31.2	926	368	289.1	914 x 305 x 289
36.8	6.42	9501	871	10940	1371	0.866	36.2	26.4	626	323	253.4	914 x 305 x 253
36.3	6.27	8269	739	9535	1163	0.861	41.3	22.1	422	286	224.2	914 x 305 x 224
35.7	6.07	7204	621	8351	982	0.854	46.8	18.4	291	256	200.9	914 x 305 x 201
34.3	6.27	7985	773	9155	1212	0.87	35.0	19.3	514	289	226.5	838 x 292 x 226
33.6	6.06	6641	620	7640	974	0.862	41.6	15.2	306	247	193.8	838 x 292 x 194
33.1	5.90	5893	535	6806	842	0.856	46.5	13	221	224	175.9	838 x 292 x 176
30.9	5.71	6234	610	7176	959	0.869	33.2	11.3	404	251	196.8	762 x 267 x 197
30.5	5.58	5387	514	6198	807	0.864	38.1	9.39	267	220	173.0	762 x 267 x 173
30.0	5.40	4470	411	5156	647	0.858	45.2	7.40	159	187	146.9	762 x 267 x 147
29.7	5.30	4018	362	4644	570	0.854	49.8	6.46	119	171	133.9	762 x 267 x 134
28.0	5.53	4916	518	5631	811	0.872	31.8	7.42	308	217	170.2	686 x 254 x 170
27.8	5.46	4374	455	5000	710	0.871	35.5	6.42	220	194	152.4	686 x 254 x 152
27.6	5.39	3987	409	4558	638	0.868	38.7	5.72	169	178	140.1	686 x 254 x 140
27.2	5.24	3481	346	3994	542	0.862	43.9	4.80	116	159	125.2	686 x 254 x 125
26.3	7.23	6589	1017	7486	1574	0.886	21.3	14.5	875	303	238.1	610 x 305 x 238
25.9	7.07	4935	743	5547	1144	0.886	27.7	10.2	340	228	179.0	610 x 305 x 179
25.7	7.00	4111	611	4594	937	0.886	32.7	8.17	200	190	149.1	610 x 305 x 149
25.0	5.03	3622	391	4142	611	0.875	30.6	3.99	216	178	139.9	610 x 229 x 140
24.9	4.97	3221	343	3676	535	0.873	34.1	3.45	154	159	125.1	610 x 229 x 125
24.6	4.88	2874	301	3281	469	0.870	38.0	2.99	111	144	113.0	610 x 229 x 113
24.2	4.75	2515	256	2881	400	0.864	43.1	2.52	77	129	101.2	610 x 229 x 101
22.1	4.67	2793	320	3196	500	0.877	27.6	2.32	178	155	122.0	533 x 210 x 122
21.9	4.60	2477	279	2828	436	0.875	30.9	1.99	126	139	109.0	533 x 210 x 109
21.9	4.57	2292	256	2612	399	0.874	33.2	1.81	101	129	101.0	533 x 210 x 101
21.7	4.51	2072	228	2360	356	0.872	36.5	1.6	75.7	117	92.1	533 x 210 x 92
21.3	4.38	1800	192	2059	300	0.864	41.6	1.33	51.5	105	82.2	533 x 210 x 82
19.1	4.33	1957	243	2232	379	0.881	25.7	1.18	121	125	98.3	457 x 191 x 98
19.0	4.29	1770	218	2014	338	0.88	28.3	1.04	90.7	114	89.3	457 x 191 x 89
18.8	4.23	1611	196	1831	304	0.877	30.9	0.922	69.2	104	82.0	457 x 191 x 82
18.8	4.20	1458	176	1653	272	0.877	33.9	0.818	51.8	94.6	74.3	457 x 191 x 74
18.5	4.12	1296	153	1471	237	0.872	37.9	0.705	37.1	85.5	67.1	457 x 191 x 67

UNIVERSAL BEAMS

DIMENSIONS AND PROPERTIES

IN ACCORDANCE TO BS4 : PART 1 : 2005



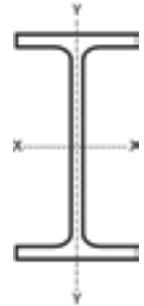
Designation	Mass per metre	Depth of Section h	Width of Section b	Thickness Web s	Thickness Flange t	Root Radius r	Depth between fillets d	Ratios for Local Buckling		Second moment of Area	
								Flange b/2t	Web d/s	Axis x-x	Axis y-y
										cm ⁴	cm ⁴
457 x 152 x 82	82.1	465.8	155.3	10.5	18.9	10.2	407.6	4.11	38.8	36590	1185
457 x 152 x 74	74.2	462.0	154.4	9.6	17.0	10.2	407.6	4.54	42.5	32670	1047
457 x 152 x 67	67.2	458.0	153.8	9.0	15.0	10.2	407.6	5.13	45.3	28930	913
457 x 152 x 60	59.8	454.6	152.9	8.1	13.3	10.2	407.6	5.75	50.3	25500	795
457 x 152 x 52	52.3	449.8	152.4	7.6	10.9	10.2	407.6	6.99	53.6	21370	645
406 x 178 x 74	74.2	412.8	179.5	9.5	16.0	10.2	360.4	5.61	37.9	27310	1545
406 x 178 x 67	67.1	409.4	178.8	8.8	14.3	10.2	360.4	6.25	41.0	24330	1365
406 x 178 x 60	60.1	406.4	177.9	7.9	12.8	10.2	360.4	6.95	45.6	21600	1203
406 x 178 x 54	54.1	402.6	177.7	7.7	10.9	10.2	360.4	8.15	46.8	18720	1021
406 x 140 x 46	46.0	403.2	142.2	6.8	11.2	10.2	360.4	6.35	53.0	15690	538
406 x 140 x 39	39.0	398.0	141.8	6.4	8.6	10.2	360.4	8.24	56.3	12510	410
356 x 171 x 67	67.1	363.4	173.2	9.1	15.7	10.2	311.6	5.52	34.2	19460	1362
356 x 171 x 57	57.0	358.0	172.2	8.1	13.0	10.2	311.6	6.62	38.5	16040	1108
356 x 171 x 51	51.0	355.0	171.5	7.4	11.5	10.2	311.6	7.46	42.1	14140	968
356 x 171 x 45	45.0	351.4	171.1	7.0	9.7	10.2	311.6	8.82	44.5	12070	811
356 x 127 x 39	39.1	353.4	126.0	6.6	10.7	10.2	311.6	5.89	47.2	10170	358
356 x 127 x 33	33.1	349.0	125.4	6.0	8.5	10.2	311.6	7.38	51.9	8249	280
305 x 165 x 54	54.0	310.4	166.9	7.9	13.7	8.9	265.2	6.09	33.6	11700	1063
305 x 165 x 46	46.1	306.6	165.7	6.7	11.8	8.9	265.2	7.02	39.6	9899	896
305 x 165 x 40	40.3	303.4	165.0	6.0	10.2	8.9	265.2	8.09	44.2	8503	764
* 305 x 127 x 48	48.1	311.0	125.3	9.0	14.0	8.9	265.2	4.47	29.5	9575	461
* 305 x 127 x 42	41.9	307.2	124.3	8.0	12.1	8.9	265.2	5.14	33.2	8196	389
* 305 x 127 x 37	37.0	304.4	123.3	7.1	10.7	8.9	265.2	5.77	37.4	7171	336
305 x 102 x 33	32.8	312.7	102.4	6.6	10.8	7.6	275.9	4.74	41.8	6501	194
305 x 102 x 28	28.2	308.7	101.8	6.0	8.8	7.6	275.9	5.78	46.0	5366	155
305 x 102 x 25	24.8	305.1	101.6	5.8	7.0	7.6	275.9	7.26	47.6	4455	123
254 x 146 x 43	43.0	259.6	147.3	7.2	12.7	7.6	219.0	5.80	30.4	6544	677
254 x 146 x 37	37.0	256.0	146.4	6.3	10.9	7.6	219.0	6.72	34.8	5537	571
254 x 146 x 31	31.1	251.4	146.1	6.0	8.6	7.6	219.0	8.49	36.5	4413	448
254 x 102 x 28	28.3	260.4	102.2	6.3	10.0	7.6	225.2	5.11	35.7	4005	179
254 x 102 x 25	25.2	257.2	101.9	6.0	8.4	7.6	225.2	6.07	37.5	3415	149
254 x 102 x 22	22.0	254.0	101.6	5.7	6.8	7.6	225.2	7.47	39.5	2841	119
203 x 133 x 30	30.0	206.8	133.9	6.4	9.6	7.6	172.4	6.97	26.9	2896	385
203 x 133 x 25	25.1	203.2	133.2	5.7	7.8	7.6	172.4	8.54	30.2	2340	308
203 x 102 x 23	23.1	203.2	101.8	5.4	9.3	7.6	169.4	5.47	31.4	2105	164
* 178 x 102 x 19	19.0	177.8	101.2	4.8	7.9	7.6	146.8	6.41	30.6	1356	137
* 152 x 89 x 16	16.0	152.4	88.7	4.5	7.7	7.6	121.8	5.76	27.1	834	89.8
* 127 x 76 x 13	13.0	127.0	76.0	4.0	7.6	7.6	96.6	5.00	24.1	473	55.7

* Limited Stock Availability

UNIVERSAL BEAMS

DIMENSIONS AND PROPERTIES

IN ACCORDANCE TO BS4 : PART 1 : 2005

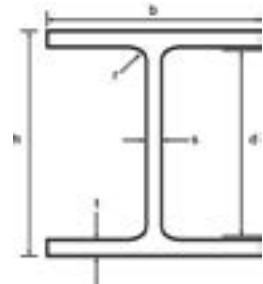


Radius of Gyration		Elastic Modulus		Plastic Modulus		Buckling Parameter	Torsional Index	Warping Constant	Torsional Constant	Area of Section	Mass per metre	Designation
Axis x-x	Axis y-y	Axis x-x	Axis y-y	Axis x-x	Axis y-y	u	x	H	J			
cm	cm	cm ³	cm ³	cm ³	cm ³	u	x	dm ⁶	cm ⁴	cm ²	kg/m	
18.7	3.37	1571	153	1811	240	0.873	27.4	0.591	89.2	105	82.1	457 x 152 x 82
18.6	3.33	1414	136	1627	213	0.873	30.1	0.518	65.9	94.5	74.2	457 x 152 x 74
18.4	3.27	1263	119	1453	187	0.869	33.6	0.448	47.7	85.6	67.2	457 x 152 x 67
18.3	3.23	1122	104	1287	163	0.868	37.5	0.387	33.8	76.2	59.8	457 x 152 x 60
17.9	3.11	950	84.6	1096	133	0.859	43.9	0.311	21.4	66.6	52.3	457 x 152 x 52
17.0	4.04	1323	172	1501	267	0.882	27.6	0.608	62.8	94.5	74.2	406 x 178 x 74
16.9	3.99	1189	153	1346	237	0.880	30.5	0.533	46.1	85.5	67.1	406 x 178 x 67
16.8	3.97	1063	135	1199	209	0.880	33.8	0.466	33.3	76.5	60.1	406 x 178 x 60
16.5	3.85	930	115	1055	178	0.871	38.3	0.392	23.1	69.0	54.1	406 x 178 x 54
16.4	3.03	778	75.7	888	118	0.871	38.9	0.207	19.0	58.6	46	406 x 140 x 46
15.9	2.87	629	57.8	724	90.8	0.858	47.5	0.155	10.7	49.7	39	406 x 140 x 39
15.1	3.99	1071	157	1211	243	0.886	24.4	0.412	55.7	85.5	67.1	356 x 171 x 67
14.9	3.91	896	129	1010	199	0.882	28.8	0.330	33.4	72.6	57.0	356 x 171 x 57
14.8	3.86	796	113	896	174	0.881	32.1	0.286	23.8	64.9	51.0	356 x 171 x 51
14.5	3.76	687	94.8	775	147	0.874	36.8	0.237	15.8	57.3	45.0	356 x 171 x 45
14.3	2.68	576	56.8	659	89.1	0.871	35.2	0.105	15.1	49.8	39.1	356 x 127 x 39
14.0	2.58	473	44.7	543	70.3	0.863	42.2	0.0812	8.79	42.1	33.1	356 x 127 x 33
13.0	3.93	754	127	846	196	0.889	23.6	0.234	34.8	68.8	54.0	305 x 165 x 54
13.0	3.90	646	108	720	166	0.891	27.1	0.195	22.2	58.7	46.1	305 x 165 x 46
12.9	3.86	560	92.6	623	142	0.889	31.0	0.164	14.7	51.3	40.3	305 x 165 x 40
12.5	2.74	616	73.6	711	116	0.873	23.3	0.102	31.8	61.2	48.1	* 305 x 127 x 48
12.4	2.70	534	62.6	614	98.4	0.872	26.5	0.0846	21.1	53.4	41.9	* 305 x 127 x 42
12.3	2.67	471	54.5	539	85.4	0.872	29.7	0.0725	14.8	47.2	37.0	* 305 x 127 x 37
12.5	2.15	416	37.9	481	60.0	0.866	31.6	0.0442	12.2	41.8	32.8	305 x 102 x 33
12.2	2.08	348	30.5	403	48.5	0.859	37.4	0.0349	7.4	35.9	28.2	305 x 102 x 28
11.9	1.97	292	24.2	342	38.8	0.846	43.4	0.0273	4.77	31.6	24.8	305 x 102 x 25
10.9	3.52	504	92.0	566	141	0.891	21.2	0.1030	23.9	54.8	43.0	254 x 146 x 43
10.8	3.48	433	78.0	483	119	0.890	24.3	0.0857	15.3	47.2	37.0	254 x 146 x 37
10.5	3.36	351	61.3	393	94.1	0.880	29.6	0.0660	8.55	39.7	31.1	254 x 146 x 31
10.5	2.22	308	34.9	353	54.8	0.874	27.5	0.0280	9.57	36.1	28.3	254 x 102 x 28
10.3	2.15	266	29.2	306	46.0	0.866	31.5	0.0230	6.42	32.0	25.2	254 x 102 x 25
10.1	2.06	224	23.5	259	37.3	0.856	36.4	0.0182	4.15	28.0	22.0	254 x 102 x 22
8.71	3.17	280	57.5	314	88.2	0.881	21.5	0.0374	10.3	38.2	30.0	203 x 133 x 30
8.56	3.10	230	46.2	258	70.9	0.877	25.6	0.0294	5.96	32.0	25.1	203 x 133 x 25
8.46	2.36	207	32.2	234	49.8	0.888	22.5	0.0154	7.02	29.4	23.1	203 x 102 x 23
7.48	2.37	153	27.0	171	41.6	0.888	22.6	0.00987	4.41	24.3	19.0	* 178 x 102 x 19
6.41	2.10	109	20.2	123	31.2	0.890	19.6	0.00470	3.56	20.3	16.0	* 152 x 89 x 16
5.35	1.84	74.6	14.7	84.2	22.6	0.895	16.3	0.00199	2.85	16.5	13.0	* 127 x 76 x 13

UNIVERSAL COLUMNS

DIMENSIONS AND PROPERTIES

IN ACCORDANCE TO BS4 : PART 1 : 2005

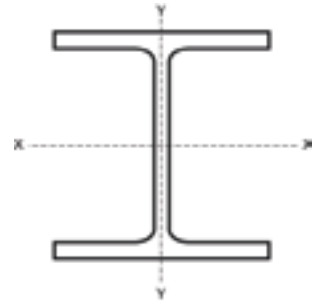


Designation	Mass per metre	Depth of Section h	Width of Section b	Thickness Web s	Thickness Flange t	Root Radius r	Depth between fillets d	Ratios for Local Buckling		Second moment of Area	
								Flange b/2t	Web d/s	Axis x-x	Axis y-y
										cm ⁴	cm ⁴
356 x 406 x 634	633.9	474.6	424.0	47.6	77.0	15.2	290.2	2.75	6.10	274800	98130
356 x 406 x 551	551.0	455.6	418.5	42.1	67.5	15.2	290.2	3.10	6.89	226900	82670
356 x 406 x 467	467.0	436.6	412.2	35.8	58.0	15.2	290.2	3.55	8.11	183000	67830
356 x 406 x 393	393.0	419.0	407.0	30.6	49.2	15.2	290.2	4.14	9.48	146600	55370
356 x 406 x 340	339.9	406.4	403.0	26.6	42.9	15.2	290.2	4.70	10.9	122500	46850
356 x 406 x 287	287.1	393.6	399.0	22.6	36.5	15.2	290.2	5.47	12.8	99880	38680
356 x 406 x 235	235.1	381.0	394.8	18.4	30.2	15.2	290.2	6.54	15.8	79080	30990
356 x 368 x 202	201.9	374.6	374.7	16.5	27.0	15.2	290.2	6.94	17.6	66260	23690
356 x 368 x 177	177.0	368.2	372.6	14.4	23.8	15.2	290.2	7.83	20.2	57120	20530
356 x 368 x 153	152.9	362.0	370.5	12.3	20.7	15.2	290.2	8.95	23.6	48590	17550
356 x 368 x 129	129.0	355.6	368.6	10.4	17.5	15.2	290.2	10.50	27.9	40250	14610
305 x 305 x 283	282.9	365.3	322.2	26.8	44.1	15.2	246.7	3.65	9.21	78870	24630
305 x 305 x 240	240.0	352.5	318.4	23.0	37.7	15.2	246.7	4.22	10.7	64200	20310
305 x 305 x 198	198.1	339.9	314.5	19.1	31.4	15.2	246.7	5.01	12.9	50900	16300
305 x 305 x 158	158.1	327.1	311.2	15.8	25.0	15.2	246.7	6.22	15.6	38750	12570
305 x 305 x 137	136.9	320.5	309.2	13.8	21.7	15.2	246.7	7.12	17.9	32810	10700
305 x 305 x 118	117.9	314.5	307.4	12.0	18.7	15.2	246.7	8.22	20.6	27670	9059
305 x 305 x 97	96.9	307.9	305.3	9.9	15.4	15.2	246.7	9.91	24.9	22250	7308
254 x 254 x 167	167.1	289.1	265.2	19.2	31.7	12.7	200.3	4.18	10.4	30000	9870
254 x 254 x 132	132.0	276.3	261.3	15.3	25.3	12.7	200.3	5.16	13.1	22530	7531
254 x 254 x 107	107.1	266.7	258.8	12.8	20.5	12.7	200.3	6.31	15.6	17510	5928
254 x 254 x 89	88.9	260.3	256.3	10.3	17.3	12.7	200.3	7.41	19.4	14270	4857
254 x 254 x 73	73.1	254.1	254.6	8.6	14.2	12.7	200.3	8.96	23.3	11410	3908
203 x 203 x 86	86.1	222.2	209.1	12.7	20.5	10.2	160.8	5.10	12.7	9449	3127
203 x 203 x 71	71.0	215.8	206.4	10.0	17.3	10.2	160.8	5.97	16.1	7618	2537
203 x 203 x 60	60.0	209.6	205.8	9.4	14.2	10.2	160.8	7.25	17.1	6125	2065
203 x 203 x 52	52.0	206.2	204.3	7.9	12.5	10.2	160.8	8.17	20.4	5259	1778
203 x 203 x 46	46.1	203.2	203.6	7.2	11.0	10.2	160.8	9.25	22.3	4568	1548
152 x 152 x 37	37.0	161.8	154.4	8.0	11.5	7.6	123.6	6.71	15.4	2210	706
152 x 152 x 30	30.0	157.6	152.9	6.5	9.4	7.6	123.6	8.13	19.0	1748	560
152 x 152 x 23	23.0	152.4	152.2	5.8	6.8	7.6	123.6	11.20	21.3	1250	400

UNIVERSAL COLUMNS

DIMENSIONS AND PROPERTIES

IN ACCORDANCE TO BS4 : PART 1 : 2005



Radius of Gyration		Elastic Modulus		Plastic Modulus		Buckling Parameter	Torsional Index	Warping Constant	Torsional Constant	Area of Section	Mass per metre	Designation
Axis x-x	Axis y-y	Axis x-x	Axis y-y	Axis x-x	Axis y-y	u	x	H	J			
cm	cm	cm ³	cm ³	cm ³	cm ³	u	x	dm ⁶	cm ⁴	cm ²	kg/m	
18.4	11.0	11580	4629	14240	7108	0.843	5.46	38.8	13720	808	633.9	356 x 406 x 634
18.0	10.9	9962	3951	12080	6058	0.841	6.05	31.1	9240	702	551.0	356 x 406 x 551
17.5	10.7	8383	3291	10000	5034	0.839	6.86	24.3	5809	595	467.0	356 x 406 x 467
17.1	10.5	6998	2721	8222	4154	0.837	7.86	18.9	3545	501	393.0	356 x 406 x 393
16.8	10.4	6031	2325	6999	3544	0.836	8.85	15.5	2343	433	339.9	356 x 406 x 340
16.5	10.3	5075	1939	5812	2949	0.835	10.2	12.3	1441	366	287.1	356 x 406 x 287
16.3	10.2	4151	1570	4687	2383	0.834	12.1	9.54	812	299	235.1	356 x 406 x 235
16.1	9.60	3538	1264	3972	1920	0.844	13.4	7.16	558	257	201.9	356 x 368 x 202
15.9	9.54	3103	1102	3455	1671	0.844	15.0	6.09	381	226	177.0	356 x 368 x 177
15.8	9.49	2684	948	2695	1435	0.844	17.0	5.11	251	195	152.9	356 x 368 x 153
15.6	9.43	2264	793	2479	1199	0.844	19.9	4.18	153	164	129.0	356 x 368 x 129
14.8	8.27	4318	1529	5105	2342	0.855	7.65	6.35	2034	360	282.9	305 x 305 x 283
14.5	8.15	3643	1276	4247	1951	0.854	8.74	5.03	1271	306	240.0	305 x 305 x 240
14.2	8.04	2995	1037	3440	1581	0.854	10.2	3.88	734	252	198.1	305 x 305 x 198
13.9	7.90	2369	808	2680	1230	0.851	12.5	2.87	378	201	158.1	305 x 305 x 158
13.7	7.83	2048	692	2297	1053	0.851	14.2	2.39	249	174	136.9	305 x 305 x 137
13.6	7.77	1760	589	1958	895	0.850	16.2	1.98	161	150	117.9	305 x 305 x 118
13.4	7.69	1445	479	1592	726	0.850	19.3	1.56	91.2	123	96.9	305 x 305 x 97
11.9	6.81	2075	744	2424	1137	0.851	8.49	1.63	626	213	167.1	254 x 254 x 167
11.6	6.69	1631	576	1869	878	0.850	10.3	1.19	319	168	132.0	254 x 254 x 132
11.3	6.59	1313	458	1484	697	0.848	12.4	0.898	172	136	107.1	254 x 254 x 107
11.2	6.55	1096	379	1224	575	0.850	14.5	0.717	102	113	88.9	254 x 254 x 89
11.1	6.48	898	307	992	465	0.849	17.3	0.562	57.6	93.1	73.1	254 x 254 x 73
9.28	5.34	850	299	977	456	0.850	10.2	0.318	137	110	86.1	203 x 203 x 86
9.18	5.30	706	246	799	374	0.853	11.9	0.250	80.2	90.4	71.0	203 x 203 x 71
8.96	5.20	584	201	656	305	0.846	14.1	0.197	47.2	76.4	60.0	203 x 203 x 60
8.91	5.18	510	174	567	264	0.848	15.8	0.167	31.8	66.3	52.0	203 x 203 x 52
8.82	5.13	450	152	497	231	0.847	17.7	0.143	22.2	58.7	46.1	203 x 203 x 46
6.85	3.87	273	91.5	309	140	0.848	13.3	0.0399	19.2	47.1	37.0	152 x 152 x 37
6.76	3.83	222	73.3	248	112	0.849	16.0	0.0308	10.5	38.3	30.0	152 x 152 x 30
6.54	3.70	164	52.6	182	80.2	0.840	20.7	0.0212	4.63	29.2	23.0	152 x 152 x 23

AMERICA WIDE FLANGE SECTION

DIMENSIONS AND PROPERTIES

IN ACCORDANCE TO ASTM A6 / A6M : 2003



Designation				Depth of Section D	Width of Section B	Thickness of Web t	Thickness of Flange T	Ratios for Local Buckling		Second Moment of Area	
Serial Size	Mass per Foot	Serial Size	Mass per Metre					Flange	Web	Axis X-X	Axis Y-Y
in	lb	mm	kg					b/T	d/t	cm ⁴	cm ⁴
* W40 x 16	593	1016 x 406	883.0	1092	424	45.5	82.0	4.66	10.6	2096420	104970
* W40 x 16	503		748.0	1068	417	39.0	70.0	5.35	12.4	1731940	85110
* W40 x 16	431		642.0	1048	412	34.0	60.0	6.06	14.5	1450590	70280
* W40 x 16	397		591.0	1040	409	31.0	55.9	6.60	15.5	1331040	64010
* W40 x 16	362		539.0	1030	407	28.4	51.1	7.17	17.0	1202540	57630
* W40 x 16	324		483.0	1020	404	25.4	46.0	7.95	18.9	1067480	50710
* W40 x 16	297		443.0	1012	402	23.6	41.9	8.52	20.7	966510	45500
* W40 x 16	277		412.0	1008	402	21.1	40.0	9.53	21.7	909800	43410
* W40 x 16	249		371.0	1000	400	19.0	36.1	10.53	24.0	812100	38480
* W40 x 16	215		321.0	990	400	16.5	31.0	12.12	28.0	696400	33120
* W40 x 16	199		296.0	982	400	16.5	27.1	12.12	32.0	618700	28850
* W40 x 12	327	1016 x 305	487.0	1036.1	308.5	30.0	54.1	2.85	28.9	1021000	26730
* W40 x 12	294		438.0	1025.9	305.4	26.9	49.0	3.12	32.3	908900	23440
* W40 x 12	264		393.0	1016.0	303.0	24.4	43.9	3.45	35.7	806600	20490
* W40 x 12	235		349.0	1008.1	302.0	21.1	40.0	3.78	41.2	722100	18460
* W40 x 12	211		314.0	1000.0	300.0	19.1	35.9	4.18	45.6	643200	16230
* W40 x 12	183		272.0	990.1	300.0	16.5	31.0	4.84	52.7	552900	14000
* W40 x 12	167		249.0	980.2	300.0	16.5	26.0	5.77	52.7	480300	11750
* W40 x 12	149		222.0	970.3	300.0	16.0	21.1	7.11	54.4	406900	9544
W36 x 16½	359	914 x 419	534.0	950.0	425.0	28.4	51.1	4.16	28.2	1031300	65560
W36 x 16½	328		488.0	942.0	422.0	25.9	47.0	4.49	30.9	935500	59010
W36 x 16½	300		446.0	933.2	423.0	24.0	42.7	4.95	33.3	847300	53980
W36 x 16½	280		417.0	927.6	421.5	22.5	39.9	5.28	35.5	786100	49890
W36 x 16½	260		387.0	921.0	420.4	21.3	36.6	5.74	37.5	719000	45410
W36 x 16½	245		365.0	916.4	419.4	20.3	34.3	6.11	39.4	671800	42240
W36 x 16½	230		342.0	911.9	418.3	19.3	32.0	6.54	41.4	625200	39100
W36 x 12	318	914 x 305	474.0	970.8	315.7	29.9	54.1	2.92	27.6	884100	28570
W36 x 12	286		426.0	960.9	312.8	26.9	49.0	3.19	30.7	787600	25140
W36 x 12	256		381.0	950.7	310.3	24.4	43.9	3.53	33.8	696900	21970
W36 x 12	232		345.0	942.9	307.8	22.1	39.9	3.86	37.3	625200	19480
W36 x 12	210		313.0	931.9	309.4	21.1	34.5	4.48	39.1	548700	17110
W36 x 12	194		289.0	926.8	307.7	19.4	32.0	4.81	42.5	503900	15600
W36 x 12	182		271.0	922.8	306.7	18.4	30.0	5.11	44.8	471000	14480
W36 x 12	170		253.0	918.7	305.6	17.3	27.9	5.48	47.7	436700	13310
W36 x 12	160		238.0	914.7	304.8	16.5	25.9	5.88	50.0	406000	12260
W36 x 12	150		223.0	910.6	304.2	15.9	23.9	6.36	51.9	376700	11250
W36 x 12	135		201.0	903.0	303.5	15.2	20.1	7.55	54.3	324900	9395

* Limited Stock Availability

AMERICA WIDE FLANGE SECTION

DIMENSIONS AND PROPERTIES

IN ACCORDANCE TO ASTM A6 / A6M : 2003



Radius of Gyration		Elastic Modulus		Plastic Modulus		Buckling Parameter	Torsional Index	Warping Constant	Torsional Constant	Area of Section	Designation	
Axis xx	Axis yy	Axis xx	Axis yy	Axis xx	Axis yy	u	x	H	J	cm ²	Mass per foot	Serial Size
cm	cm	cm ³	cm ³	cm ³	cm ³			dm ⁶	cm ⁴		lb	in
43.2	9.66	38396	4952	45265	7874	0.883	14.0	265.7	18750	1125	593	* W40 x 16
42.6	9.45	32433	4082	37881	6459	0.882	16.1	210.7	11670	953	503	* W40 x 16
42.1	9.27	27683	3412	32097	5379	0.882	18.5	170.7	7440	818	431	* W40 x 16
42.1	9.22	25597	3130	29530	4916	0.883	19.8	154.3	5927	753	397	* W40 x 16
41.8	9.16	23350	2832	26824	4436	0.883	21.5	137.6	4546	687	362	* W40 x 16
41.7	9.08	20931	2510	23923	3919	0.884	23.7	119.9	3311	615	324	* W40 x 16
41.4	8.98	19101	2264	21777	3529	0.882	25.8	106.7	2545	564	297	* W40 x 16
41.7	9.10	18050	2160	20440	3348	0.887	27.1	101.5	2134	524	277	* W40 x 16
41.5	9.03	16240	1924	18330	2976	0.887	29.9	89.4	1575	472	249	* W40 x 16
41.3	9.00	14070	1656	15800	2555	0.887	34.3	76.0	1021	409	215	* W40 x 16
40.5	8.75	12600	1443	14220	2235	0.878	38.0	65.9	762.6	377	199	* W40 x 16
40.6	6.57	19720	1733	23200	2800	0.867	21.1	64.4	4299	620	327	W40 x 12
40.4	6.49	17720	1535	20740	2467	0.868	23.2	55.9	3166	556	294	W40 x 12
40.2	6.40	15880	1353	18520	2167	0.868	25.6	48.4	2314	500	264	W40 x 12
40.3	6.44	14330	1222	16570	1940	0.872	28.0	43.2	1706	445	235	W40 x 12
40.1	6.37	12860	1082	14830	1712	0.871	30.8	37.7	1253	400	211	W40 x 12
40.0	6.36	11170	934	12800	1469	0.872	35.1	32.2	826	346	183	W40 x 12
39.0	6.09	9799	784	11330	1244	0.861	40.1	26.8	575	316	167	W40 x 12
38.0	5.81	8387	636	9784	1019	0.849	46.0	21.5	384	282	149	W40 x 12
38.9	9.82	21710	3085	24830	4796	0.887	19.7	132	4516	680	359	W36 x 16½
38.8	9.75	19860	2797	22620	4336	0.887	21.3	118	3499	621	328	W36 x 16½
38.6	9.73	18160	2552	20610	3951	0.887	23.3	107	2675	570	300	W36 x 16½
38.4	9.68	16950	2367	19180	3660	0.887	24.8	98.3	2191	532	280	W36 x 16½
38.2	9.59	15610	2160	17640	3338	0.885	26.7	88.8	1729	493	260	W36 x 16½
38.0	9.53	14660	2015	16550	3112	0.884	28.3	82.2	1442	465	245	W36 x 16½
37.9	9.47	13710	1869	15460	2886	0.883	30.2	75.7	1189	436	230	W36 x 16½
38.3	6.89	18210	1810	21350	2895	0.872	19.9	60	4091	603	318	W36 x 12
38.1	6.81	16390	1608	19120	2559	0.873	21.8	52.3	3027	542	286	W36 x 12
37.9	6.72	14660	1416	17030	2247	0.872	24.1	45.2	2199	486	256	W36 x 12
37.7	6.66	13260	1266	15340	2000	0.872	26.4	39.7	1648	440	232	W36 x 12
37.1	6.55	11780	1106	13640	1752	0.866	29.7	34.4	1163	399	210	W36 x 12
37.0	6.52	10870	1014	12550	1600	0.867	32.0	31.2	923	367	194	W36 x 12
36.9	6.47	10210	944	11770	1488	0.866	33.9	28.8	769	346	182	W36 x 12
36.8	6.42	9508	871	10950	1371	0.866	36.2	26.4	626	323	170	W36 x 12
36.6	6.36	8876	805	10220	1266	0.864	38.6	24.2	514	303	160	W36 x 12
36.3	6.27	8274	739	9539	1164	0.861	41.3	22.1	422	286	150	W36 x 12
35.6	6.05	7195	619	8349	979	0.853	46.9	18.3	291	256	135	W36 x 12

AMERICA WIDE FLANGE SECTION

DIMENSIONS AND PROPERTIES

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Designation				Depth of Section D	Width of Section B	Thickness of Web t	Thickness of Flange T	Ratios for Local Buckling		Second Moment of Area	
Serial Size	Mass per Foot	Serial Size	Mass per Metre					Flange	Web	Axis X-X	Axis Y-Y
in	lb	mm	kg	mm	mm	mm	mm	b/T	d/t	cm ⁴	cm ⁴
* W33 x 15 ³ / ₄	387	838 x 400	577.0	913.0	411.0	32.0	57.9	3.55	23.8	1010700	67320
* W33 x 15 ³ / ₄	354		527.0	903.0	409.0	29.5	53.1	3.85	25.8	914000	60730
* W33 x 15 ³ / ₄	318		473.0	893.0	406.0	26.4	48.0	4.23	28.8	812100	53670
* W33 x 15 ³ / ₄	291		433.0	885.0	404.0	24.4	43.9	4.60	31.2	735200	48350
* W33 x 15 ³ / ₄	263		392.0	877.0	401.0	22.1	39.9	5.03	34.5	658600	42960
* W33 x 15 ³ / ₄	241		359.0	868.2	402.8	21.1	35.6	5.66	36.1	590600	38840
* W33 x 15 ³ / ₄	221		329.0	861.8	401.4	19.7	32.4	6.19	38.6	534900	34980
* W33 x 15 ³ / ₄	201		299.0	855.5	399.9	18.2	29.2	6.85	41.8	479900	31170
W33 x 11 ¹ / ₂	219	838 x 292	326.0	877.1	297.2	22.1	39.9	3.72	34.5	513500	17540
W33 x 11 ¹ / ₂	204		304.0	871.2	295.7	20.6	37.1	3.99	37.0	473000	16050
W33 x 11 ¹ / ₂	187		278.0	865.1	294.1	19.1	34.0	4.33	39.9	430400	14470
W33 x 11 ¹ / ₂	169		252.0	859.0	292.1	17.0	31.0	4.71	44.8	386500	12910
W33 x 11 ¹ / ₂	152		226.0	850.6	293.8	16.1	26.8	5.48	47.3	339400	11360
W33 x 11 ¹ / ₂	141		210.0	845.8	293.0	15.4	24.4	6.00	49.4	310500	10260
W33 x 11 ¹ / ₂	130		193.0	840.5	292.4	14.7	21.7	6.74	51.8	279000	9066
W33 x 11 ¹ / ₂	118		176.0	834.6	291.6	14.0	18.8	7.76	54.4	245800	7791
* W30 x 15	357	762 x 381	531.0	833.0	393.0	31.5	56.9	3.45	21.8	775300	57760
* W30 x 15	326		484.0	823.0	390.0	29.0	52.1	3.74	23.6	697400	51660
* W30 x 15	292		434.0	813.0	387.0	25.9	47.0	4.12	26.5	617500	45510
* W30 x 15	261		389.0	803.0	385.0	23.6	41.9	4.59	29.1	543800	39940
* W30 x 15	235		350.0	795.0	382.0	21.1	38.1	5.01	32.5	485500	35460
* W30 x 15	211		314.0	785.9	383.7	19.7	33.4	5.74	34.8	427100	31500
* W30 x 15	191		284.0	779.3	382.0	18.0	30.1	6.53	38.1	381600	28000
* W30 x 15	173		257.0	773.2	380.6	16.6	27.1	7.02	41.3	341600	24930
W30 x 10 ¹ / ₂	148	762 x 267	220.0	779.0	266.2	16.5	30.0	4.44	41.6	278200	9462
W30 x 10 ¹ / ₂	132		196.0	769.9	267.8	15.6	25.4	5.27	44.0	239900	8156
W30 x 10 ¹ / ₂	124		185.0	766.3	267.1	14.9	23.6	5.66	46.0	223000	7518
W30 x 10 ¹ / ₂	116		173.0	762.3	266.6	14.4	21.6	6.17	47.6	205600	6842
W30 x 10 ¹ / ₂	108		161.0	757.7	266.1	13.8	19.3	6.89	49.7	185800	6080
W30 x 10 ¹ / ₂	99		147.0	753.1	265.4	13.2	17.0	7.81	52.0	166100	5313
W30 x 10 ¹ / ₂	90		134.0	750.0	264.2	11.9	15.5	8.52	57.6	150300	4777
* W27 x 14	336	686 x 356	500.0	762.0	369.0	32.0	57.9	3.19	19.20	604800	48670
* W27 x 14	307		457.0	752.0	367.0	29.5	53.1	3.46	20.90	545100	43890
* W27 x 14	281		419.0	744.0	364.0	26.9	49.0	3.71	22.90	493900	39500
* W27 x 14	258		384.0	736.0	362.0	24.9	45.0	4.02	24.70	447400	35670
* W27 x 14	235		350.0	728.0	360.0	23.1	40.9	4.40	26.70	401900	31870
* W27 x 14	217		323.0	722.0	359.0	21.1	38.1	4.71	29.20	369600	29430
* W27 x 14	194		289.0	714.0	356.0	19.0	34.0	5.24	32.40	324800	25610
* W27 x 14	178		265.0	706.0	357.8	18.4	30.2	5.92	33.50	290600	23090
* W27 x 14	161		240.0	700.8	356.1	16.8	27.4	6.50	36.60	261100	20650
* W27 x 14	146		217.0	695.4	354.7	15.4	24.8	7.15	40.00	234500	18470

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AMERICA WIDE FLANGE SECTION

DIMENSIONS AND PROPERTIES

IN ACCORDANCE TO ASTM A6 / A6M : 2003



Radius of Gyration		Elastic Modulus		Plastic Modulus		Buckling Parameter	Torsional Index	Warping Constant	Torsional Constant	Area of Section	Designation	
Axis xx	Axis yy	Axis xx	Axis yy	Axis xx	Axis yy	u	x	H	J	cm ²	Mass per foot	Serial Size
cm	cm	cm ³	cm ³	cm ³	cm ³			dm ⁶	cm ⁴		lb	in
37.1	9.57	22140	3271	25540	5100	0.887	16.7	123	6126	734	387	* W33 x 15¾
36.9	9.51	20240	2970	23250	4620	0.887	18.1	110	4743	672	354	* W33 x 15¾
36.7	9.44	18190	2644	20770	4100	0.888	19.9	95.8	3484	603	318	* W33 x 15¾
36.5	9.36	16610	2394	18900	3706	0.887	21.6	85.5	2683	552	291	* W33 x 15¾
36.3	9.28	15020	2143	17010	3309	0.888	23.6	75.33	2009	499	263	* W33 x 15¾
35.9	9.21	13600	1929	15400	2981	0.884	26.1	67.3	1495	458	241	* W33 x 15¾
35.7	9.13	12410	1743	14020	2691	0.882	28.4	60.2	1147	420	221	* W33 x 15¾
35.5	9.04	11220	1559	12650	2404	0.881	31.2	53.2	856	381	201	* W33 x 15¾
35.1	6.49	11710	1180	13550	1864	0.874	24.4	30.70	1569	416	219	W33 x 11½
35.0	6.45	10860	1086	12530	1710	0.874	26.1	27.90	1265	386	204	W33 x 11½
34.8	6.38	9950	984	11450	1547	0.874	28.3	25.00	983	355	187	W33 x 11½
34.8	6.36	8999	884	10300	1383	0.875	30.9	22.10	735	319	169	W33 x 11½
34.3	6.27	7981	773	9150	1212	0.870	34.9	19.30	514	289	152	W33 x 11½
34.0	6.18	7341	700	8425	1098	0.867	37.8	17.30	405	268	141	W33 x 11½
33.6	6.06	6639	620	7638	974	0.862	41.6	15.20	306	247	130	W33 x 11½
33.1	5.90	5889	534	6803	841	0.856	46.4	13.00	221	224	118	W33 x 11½
33.9	9.24	18610	2939	21510	4577	0.888	15.4	87.00	5501	676	357	* W30 x 15
33.6	9.15	16950	2649	19490	4118	0.888	16.7	76.80	4229	617	326	* W30 x 15
33.4	9.08	15190	2352	17360	3644	0.889	18.3	66.80	3088	552	292	* W30 x 15
33.2	8.98	13540	2075	15410	3209	0.888	20.4	57.80	2216	495	261	* W30 x 15
33.0	8.93	12210	1856	13820	2863	0.889	22.2	50.80	1650	445	235	* W30 x 15
32.7	8.87	10870	1642	12270	2532	0.886	25.0	44.60	1161	400	211	* W30 x 15
32.5	8.80	9794	1466	11020	2257	0.885	27.5	39.30	858	362	191	* W30 x 15
32.3	8.72	8836	1310	9924	2015	0.884	30.3	34.70	637	328	173	* W30 x 15
31.5	5.81	7142	711	8197	1115	0.875	28.9	13.30	605	281	148	W30 x 10½
30.9	5.71	6232	609	7164	957	0.869	33.2	11.30	404	251	132	W30 x 10½
30.8	5.65	5821	563	6691	884	0.867	35.4	10.40	333	236	124	W30 x 10½
30.5	5.56	5394	513	6210	807	0.864	38.0	9.39	269	221	116	W30 x 10½
30.2	5.46	4903	457	5659	720	0.859	41.5	8.29	207	204	108	W30 x 10½
29.8	5.32	4412	400	5111	632	0.854	45.6	7.20	156	187	99	W30 x 10½
29.8	5.30	4008	362	4629	569	0.855	49.9	6.44	118	170	90	W30 x 10½
30.8	8.75	15870	2638	18450	4111	0.889	13.7	60.3	5373	636	336	* W27 x 14
30.6	8.68	14500	2392	16760	3720	0.889	14.8	53.6	4158	582	307	* W27 x 14
30.5	8.61	13280	2170	15270	3366	0.890	15.9	47.7	3241	532	281	* W27 x 14
30.3	8.54	12160	1971	13920	3052	0.889	17.2	42.6	2521	489	258	* W27 x 14
30.0	8.46	11040	1771	12590	2739	0.888	18.8	37.6	1913	446	235	* W27 x 14
30.0	8.45	10240	1640	11620	2530	0.890	20.1	34.4	1534	412	217	* W27 x 14
29.8	8.36	9098	1439	10280	2215	0.889	22.3	29.6	1094	367	194	* W27 x 14
29.4	8.28	8227	1291	9290	1990	0.885	24.7	26.4	811	337	178	* W27 x 14
29.2	8.22	7452	1160	8387	1785	0.884	27.0	23.4	609	306	161	* W27 x 14
29.1	8.16	6744	1041	7568	1601	0.884	29.6	20.8	456	277	146	* W27 x 14

AMERICA WIDE FLANGE SECTION

DIMENSIONS AND PROPERTIES

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Designation				Depth of Section D	Width of Section B	Thickness of Web t	Thickness of Flange T	Ratios for Local Buckling		Second Moment of Area	
Serial Size	Mass per Foot	Serial Size	Mass per Metre					Flange	Web	Axis X-X	Axis Y-Y
in	lb	mm	kg	mm	mm	mm	mm	b/T	d/t	cm ⁴	cm ⁴
W27 x 10	221	686 x 254	329.0	739.9	264.8	25.9	47.0	2.82	23.80	359400	14640
W27 x 10	201		299.0	732.0	262.8	23.9	42.9	3.06	25.80	323800	13060
W27 x 10	182		271.0	723.9	260.2	21.6	39.1	3.33	28.50	289300	11540
W27 x 10	159		237.0	714.0	257.8	19.1	34.0	3.79	32.20	247800	9750
W27 x 10	143		213.0	707.9	255.8	17.0	31.0	4.13	36.20	222000	8677
W27 x 10	129		192.0	701.8	254.3	15.5	27.9	4.56	39.70	198000	7670
W27 x 10	114		170.0	693.2	255.8	14.5	23.6	5.42	42.50	170000	6602
W27 x 10	102		152.0	688.1	254.4	13.1	21.1	6.03	47.00	150900	5804
W27 x 10	94		140.0	683.8	253.7	12.4	18.9	6.71	49.60	135900	5156
W27 x 10	84		125.0	678.4	253.0	11.7	16.3	7.76	52.60	118700	4410
* W24 x 12³/₄	306	610 x 324	455.0	689.0	340.0	32.0	57.9	2.94	17.10	444500	38090
* W24 x 12³/₄	279		415.0	679.0	338.0	29.5	53.1	3.18	18.60	399700	34300
* W24 x 12³/₄	250		372.0	669.0	335.0	26.4	48.0	3.49	20.70	353200	30170
* W24 x 12³/₄	229		341.0	661.0	333.0	24.4	43.9	3.79	22.50	318200	27090
* W24 x 12³/₄	207		307.0	653.0	330.0	22.1	39.9	4.14	24.80	283600	23950
* W24 x 12³/₄	192		285.0	647.0	329.0	20.6	37.1	4.43	26.60	260700	22060
* W24 x 12³/₄	176		262.0	641.0	327.0	19.0	34.0	4.81	28.80	235900	19850
* W24 x 12³/₄	162		241.0	635.0	329.1	17.9	31.0	5.31	30.60	215400	18450
* W24 x 12³/₄	146		217.0	628.4	327.7	16.5	27.7	5.92	33.20	190900	16270
* W24 x 12³/₄	131		195.0	621.8	326.5	15.4	24.4	6.69	35.60	167500	14170
* W24 x 12³/₄	117		174.0	616.2	325.1	14.0	21.6	7.53	39.10	147300	12380
* W24 x 12³/₄	104		155.0	611.1	323.9	12.7	19.0	8.52	43.10	128900	10770
W24 x 9	198	610 x 229	295.0	667.0	240.5	25.9	47.0	2.56	21.1	259400	10980
W24 x 9	181		270.0	658.6	238.5	23.9	42.9	2.78	22.9	232800	9768
W24 x 9	163		243.0	651.0	235.9	21.6	39.1	3.02	25.3	207900	8606
W24 x 9	146		217.0	643.0	234.1	19.6	35.1	3.33	27.9	183900	7543
W24 x 9	128		191.0	635.0	231.5	17.0	30.9	3.75	32.2	158400	6415
W24 x 9	114		171.0	628.9	229.9	15.5	27.9	4.12	35.3	141400	5670
W24 x 9	103		153.0	623.1	228.6	14.0	24.9	4.59	39.1	125000	4972
W24 x 9	94		140.0	617.5	230.3	13.1	22.2	5.19	41.8	112300	4531
W24 x 9	84		125.0	612.1	229.1	11.9	19.6	5.84	46.0	98610	3937
W24 x 9	76		113.0	607.6	228.3	11.2	17.3	6.60	48.9	87510	3439
W24 x 9	68		101.0	602.7	227.7	10.5	14.9	7.64	52.1	76190	2938
W24 x 7	62	610 x 178	92.0	603.0	178.8	10.9	15.0	5.96	50.2	64580	1436
W24 x 7	55		82.0	598.7	177.9	10.0	12.8	6.95	54.8	55890	1207

* Limited Stock Availability

AMERICA WIDE FLANGE SECTION

DIMENSIONS AND PROPERTIES

IN ACCORDANCE TO ASTM A6 / A6M : 2003



Radius of Gyration		Elastic Modulus		Plastic Modulus		Buckling Parameter	Torsional Index	Warping Constant	Torsional Constant	Area of Section	Designation	
Axis xx	Axis yy	Axis xx	Axis yy	Axis xx	Axis yy	u	x	H	J	cm ²	Mass per foot	Serial Size
cm	cm	cm ³	cm ³	cm ³	cm ³			dm ⁶	cm ⁴		lb	in
29.3	5.92	9715	1106	11390	1759	0.877	17.2	17.6	2186	418	221	W27 x 10
29.1	5.85	8847	994	10330	1577	0.877	18.6	15.5	1675	382	201	W27 x 10
29.0	5.78	7993	887	9282	1402	0.878	20.3	13.5	1260	354	182	W27 x 10
28.7	5.69	6940	756	8016	1191	0.877	23.0	11.3	840	301	159	W27 x 10
28.7	5.67	6272	678	7204	1063	0.878	25.2	9.94	627	270	143	W27 x 10
28.5	5.61	5644	603	6462	943	0.878	27.7	8.71	462	244	129	W27 x 10
28.0	5.52	4905	516	5618	808	0.872	31.9	7.40	305	216	114	W27 x 10
27.9	5.47	4386	456	5010	712	0.871	35.4	6.46	221	194	102	W27 x 10
27.6	5.38	3975	406	4545	635	0.868	38.9	5.70	167	178	94	W27 x 10
27.2	5.25	3499	349	4014	546	0.862	43.7	4.83	118	160	84	W27 x 10
27.7	8.11	12900	2241	15090	3496	0.889	12.3	37.9	4879	579	306	* W24 x 12¾
27.5	8.05	11770	2030	13690	3160	0.889	13.3	33.6	3774	529	279	* W24 x 12¾
27.3	7.98	10560	1801	12190	2795	0.890	14.5	29.1	2770	474	250	* W24 x 12¾
27.1	7.90	9629	1627	11060	2521	0.889	15.8	25.8	2130	434	229	* W24 x 12¾
26.9	7.82	8687	1452	9927	2244	0.890	17.2	22.5	1592	391	207	* W24 x 12¾
26.8	7.79	8058	1341	9173	2070	0.890	18.4	20.5	1283	363	192	* W24 x 12¾
26.6	7.72	7362	1214	8347	1871	0.890	19.9	18.3	990	333	176	* W24 x 12¾
26.4	7.74	6785	1121	7671	1726	0.888	21.6	16.8	770	308	162	* W24 x 12¾
26.2	7.66	6075	993	6846	1528	0.886	23.9	14.7	560	277	146	* W24 x 12¾
25.9	7.55	5387	868	6063	1336	0.883	26.8	12.6	396	249	131	* W24 x 12¾
25.8	7.47	4779	762	5364	1171	0.882	30.0	10.9	280	222	117	* W24 x 12¾
25.6	7.39	4220	665	4726	1021	0.880	33.7	9.44	195	197	104	* W24 x 12¾
26.3	5.41	7778	913	9173	1458	0.878	15.4	10.6	1952	376	198	W24 x 9
26.1	5.34	7069	819	8299	1304	0.877	16.7	9.26	1495	343	181	W24 x 9
25.9	5.27	6386	730	7455	1157	0.878	18.2	8.06	1123	310	163	W24 x 9
25.7	5.21	5718	644	6643	1019	0.877	20.0	6.97	819	278	146	W24 x 9
25.6	5.15	4990	554	5757	871	0.879	22.6	5.85	554	242	128	W24 x 9
25.4	5.09	4495	493	5167	773	0.878	24.8	5.12	411	218	114	W24 x 9
25.3	5.04	4012	435	4595	680	0.878	27.6	4.45	295	195	103	W24 x 9
25.1	5.04	3637	394	4159	615	0.875	30.5	4.01	219	179	94	W24 x 9
24.9	4.97	3222	344	3676	536	0.873	34.1	3.46	154	159	84	W24 x 9
24.6	4.88	2880	301	3290	470	0.869	37.9	3.00	112	145	76	W24 x 9
24.3	4.77	2528	258	2895	403	0.864	42.9	2.54	78.0	129	68	W24 x 9
23.4	3.50	2142	161	2511	258	0.848	42.8	1.24	71.0	117	62	W24 x 7
23.2	3.40	1867	136	2195	218	0.843	48.5	1.04	48.8	104	55	W24 x 7

AMERICA WIDE FLANGE SECTION

DIMENSIONS AND PROPERTIES

IN ACCORDANCE TO ASTM A6 / A6M : 2003



Designation				Depth of Section D	Width of Section B	Thickness of Web t	Thickness of Flange T	Ratios for Local Buckling		Second Moment of Area	
Serial Size	Mass per Foot	Serial Size	Mass per Metre					Flange	Web	Axis X-X	Axis Y-Y
in	lb	mm	kg					b/T	d/t	cm ⁴	cm ⁴
* W21 x 12¼	275	533 x 312	409.0	613.0	327.0	31.0	55.6	2.94	15.4	316900	32530
* W21 x 12¼	248		370.0	603.0	324.0	26.2	50.5	3.21	18.2	278900	28710
* W21 x 12¼	223		331.0	593.0	322.0	25.4	45.5	3.54	18.8	247700	25390
* W21 x 12¼	201		300.0	585.0	319.0	23.1	41.4	3.85	20.6	220700	22450
* W21 x 12¼	182		272.0	577.0	317.0	21.1	37.6	4.22	22.6	196700	20000
* W21 x 12¼	166		248.0	571.0	315.5	19.0	34.5	4.57	25.1	177700	18090
* W21 x 12¼	147		219.0	560.3	317.8	18.3	29.2	5.44	26.0	151100	15650
* W21 x 12¼	132		196.0	554.5	316.0	16.5	26.3	6.01	28.9	134300	13850
* W21 x 12¼	122		182.0	550.7	314.7	15.2	24.4	6.45	31.3	123300	12690
* W21 x 12¼	111		165.0	546.4	313.4	14.0	22.2	7.06	34.0	111300	11400
* W21 x 12¼	101		150.0	542.5	312.2	12.7	20.3	7.69	37.5	100700	10310
W21 x 8½	93	533 x 210	138.0	549.1	213.9	14.7	23.6	4.53	32.4	86090	3864
W21 x 8½	83		123.0	544.3	212.2	13.1	21.2	5.00	36.4	76240	3387
W21 x 8½	73		109.0	539.5	210.7	11.6	18.8	5.60	41.1	66800	2939
W21 x 8½	68		101.0	536.7	210.1	10.9	17.4	6.04	43.7	61650	2696
W21 x 8½	62		92.0	533.1	209.3	10.2	15.6	6.71	46.7	55330	2389
W21 x 6½	57	533 x 165	85.0	534.9	166.5	10.3	16.5	5.05	46.3	48630	1275
W21 x 6½	50		74.0	529.1	165.9	9.7	13.6	6.10	49.1	41060	1040
W21 x 6½	44		66.0	524.8	165.1	8.9	11.4	7.24	53.6	35040	859
* W18 x 11	175	457 x 279	260	509.0	289.0	22.6	40.4	3.58	18.1	143700	16300
* W18 x 11	158		235	501.0	287.0	20.6	36.6	3.92	19.8	127300	14450
* W18 x 11	143		212.8	495.0	285.0	18.5	33.5	4.25	22.0	114400	12960
* W18 x 11	130		193.5	489.0	283.5	17.0	30.5	4.65	24.0	102500	11590
* W18 x 11	119		177.1	481.8	286.1	16.6	26.9	5.31	24.5	91040	10530
* W18 x 11	106		157.7	475.7	284.5	15.0	23.9	5.96	27.2	79600	9178
* W18 x 11	97		144.4	472.2	283.1	13.6	22.1	6.40	30.0	72710	8367
* W18 x 11	86		128	467.1	281.7	12.1	19.6	7.20	33.7	63520	7295
* W18 x 11	76		113.1	462.5	280.3	10.8	17.3	8.12	37.7	55460	6344
W18 x 7½	71	457 x 191	106.0	469.1	193.9	12.6	20.6	4.71	32.3	48830	2511
W18 x 7½	65		97.0	466.1	192.8	11.4	19.0	5.07	35.8	44490	2275
W18 x 7½	60		89.0	463.2	191.9	10.5	17.7	5.42	38.8	40970	2089
W18 x 7½	55		82.0	460.0	191.3	9.9	16.0	5.98	41.2	37050	1871
W18 x 7½	50		74.0	457.0	190.4	9.0	14.5	6.57	45.3	33320	1671
W18 x 7½	45		67.1	453.4	189.9	8.5	12.7	7.48	48.0	29380	1452
W18 x 7½	41		61.0	450.0	189.0	8.1	10.8	8.75	50.4	25380	1218
W18 x 6	46	457 x 152	68.0	458.7	153.9	9.1	15.4	5.00	44.8	29640	939
W18 x 6	40		60.0	454.7	152.8	8.0	13.3	5.74	51.0	25430	793
W18 x 6	35		52.0	449.6	152.4	7.6	10.8	7.06	53.6	21210	639
W16 x 10¼	100	406 x 260	148.8	431.0	264.8	14.9	25.0	5.29	24.3	61830	7754
W16 x 10¼	89		132.4	425.4	263.3	13.3	22.2	5.92	27.0	54060	6768
W16 x 10¼	77		114.6	419.6	261.5	11.6	19.3	6.77	31.2	46110	5758
W16 x 10¼	67		99.7	414.8	260.0	10.0	16.9	7.70	36.0	39730	4951

* Limited Stock Availability

AMERICA WIDE FLANGE SECTION

DIMENSIONS AND PROPERTIES

IN ACCORDANCE TO ASTM A6 / A6M : 2003



Radius of Gyration		Elastic Modulus		Plastic Modulus		Buckling Parameter	Torsional Index	Warping Constant	Torsional Constant	Area of Section	Designation	
Axis xx	Axis yy	Axis xx	Axis yy	Axis xx	Axis yy	u	x	H	J	cm ²	Mass per foot	Serial Size
cm	cm	cm ³	cm ³	cm ³	cm ³			dm ⁶	cm ⁴		lb	in
24.7	7.91	10340	1990	12120	3096	0.890	11.2	25.3	4131	521	275	* W21 x 12¼
24.6	7.90	9250	1772	10720	2739	0.894	12.3	21.9	2996	460	248	* W21 x 12¼
24.2	7.76	8355	1577	9656	2442	0.890	13.4	19.0	2263	422	223	* W21 x 12¼
24.1	7.67	7547	1408	8670	2175	0.890	14.6	16.6	1700	382	201	* W21 x 12¼
23.9	7.61	6820	1262	7792	1947	0.890	15.9	14.6	1277	346	182	* W21 x 12¼
23.8	7.58	6226	1147	7071	1764	0.891	17.2	13.0	979	314	166	* W21 x 12¼
23.3	7.49	5395	985	6115	1518	0.884	19.8	11.0	642	279	147	* W21 x 12¼
23.2	7.44	4843	877	5463	1349	0.884	21.8	9.66	470	250	132	* W21 x 12¼
23.1	7.41	4478	807	5033	1239	0.885	23.4	8.79	374	231	122	* W21 x 12¼
23.0	7.35	4072	728	4563	1116	0.885	25.6	7.83	284	211	111	* W21 x 12¼
22.9	7.33	3712	660	4144	1011	0.885	27.8	7.03	216	192	101	* W21 x 12¼
22.1	4.68	3136	361	3613	568	0.873	25.0	2.67	250	176	93	W21 x 8¼
22.0	4.64	2801	319	3213	500	0.874	27.6	2.32	181	157	83	W21 x 8¼
21.9	4.60	2476	279	2827	435	0.875	30.9	1.99	126	139	73	W21 x 8¼
21.8	4.57	2297	257	2619	400	0.874	33.1	1.82	102	129	68	W21 x 8¼
21.7	4.50	2076	228	2366	356	0.871	36.4	1.60	76.3	118	62	W21 x 8¼
21.2	3.44	1818	153	2107	243	0.862	35.5	0.860	73.8	108	57	W21 x 6½
20.8	3.30	1552	125	1808	200	0.853	41.1	0.690	47.9	95.2	50	W21 x 6½
20.5	3.20	1336	104	1561	166	0.847	47.0	0.570	32.0	83.7	44	W21 x 6½
20.8	7.01	5646	1128	6525	1743	0.891	12.8	8.90	1423	331	175	* W18 x 11
20.6	6.95	5083	1007	5839	1554	0.890	14.0	7.80	1059	299	158	* W18 x 11
20.5	6.91	4624	910	5278	1400	0.891	15.2	6.90	800	271	143	* W18 x 11
20.4	6.86	4192	818	4761	1257	0.891	16.6	6.09	603	247	130	* W18 x 11
20.1	6.82	3779	736	4284	1132	0.885	18.4	5.44	442	226	119	* W18 x 11
19.9	6.76	3347	645	3775	991	0.884	20.5	4.68	311	201	106	* W18 x 11
19.9	6.74	3079	591	3457	906	0.886	22.1	4.24	244	184	97	* W18 x 11
19.7	6.69	2720	518	3039	792	0.886	24.8	3.65	170	163	86	* W18 x 11
19.6	6.64	2398	453	2669	692	0.885	27.9	3.14	118	144	76	* W18 x 11
19.0	4.32	2082	259	2387	405	0.877	24.4	1.26	146	135	71	W18 x 7½
19.0	4.30	1909	236	2179	368	0.879	26.4	1.14	113	123	65	W18 x 7½
19.0	4.29	1769	218	2013	338	0.880	28.2	1.04	90.7	114	60	W18 x 7½
18.8	4.23	1611	196	1831	304	0.877	30.9	0.92	69.2	104	55	W18 x 7½
18.8	4.20	1458	176	1653	272	0.877	33.9	0.82	51.8	94.6	50	W18 x 7½
18.5	4.12	1296	153	1471	237	0.872	37.9	0.71	37.1	85.5	45	W18 x 7½
18.2	3.99	1128	129	1286	201	0.865	42.6	0.60	26.0	76.0	41	W18 x 7½
18.4	3.28	1292	122	1486	192	0.870	32.8	0.460	50.9	87.2	46	W18 x 6
18.3	3.23	1119	104	1282	163	0.869	37.6	0.390	33.5	75.8	40	W18 x 6
17.9	3.10	944	83.9	1089	132	0.858	44.1	0.310	21.0	66.3	35	W18 x 6
18.0	6.39	2869	586	3246	899	0.887	17.7	3.20	322	190	100	W16 x 10¼
17.9	6.33	2541	514	2859	788	0.887	19.7	2.75	227	169	89	W16 x 10¼
17.8	6.28	2198	440	2457	673	0.887	22.4	2.31	149	146	77	W16 x 10¼
17.7	6.25	1915	381	2128	581	0.888	25.4	1.96	99.4	127	67	W16 x 10¼

AMERICA WIDE FLANGE SECTION

DIMENSIONS AND PROPERTIES

IN ACCORDANCE TO ASTM A6 / A6M : 2003



Designation				Depth of Section D	Width of Section B	Thickness of Web t	Thickness of Flange T	Ratios for Local Buckling		Second Moment of Area	
Serial Size	Mass per Foot	Serial Size	Mass per Metre					Flange	Web	Axis X-X	Axis Y-Y
in	lb	mm	kg					b/T	d/t	cm ⁴	cm ⁴
W16 x 7	57	406 x 178	85.0	417.3	180.8	10.9	18.2	4.97	33.1	31560	1797
W16 x 7	50		75.0	413.0	179.6	9.7	16.0	5.61	37.2	27440	1548
W16 x 7	45		67.0	409.7	178.7	8.8	14.4	6.20	41.0	24480	1372
W16 x 7	40		60.0	406.7	177.7	7.7	12.8	6.94	46.8	21520	1199
W16 x 7	36		53.0	402.8	177.4	7.5	10.9	8.14	48.1	18630	1016
W16 x 5½	31	406 x 140	46.13	403.4	140.3	7.0	11.1	6.32	51.5	15530	512
W16 x 5½	26		38.69	398.5	139.7	6.4	8.8	7.94	56.3	12600	401
* W14 x 16	730	356 x 406	1086.0	569.5	454.4	78.0	124.7	1.82	3.7	597000	196300
* W14 x 16	665		990.0	549.7	448.3	71.9	115.0	1.95	4.0	518500	173700
* W14 x 16	605		900.0	531.4	442.3	65.9	106.0	2.09	4.4	451400	153700
* W14 x 16	550		818.0	514.1	436.9	60.5	97.0	2.25	4.8	392300	135400
* W14 x 16	500		744.0	497.8	432.1	55.6	88.9	2.43	5.2	341900	120000
* W14 x 16	455		677.0	483.1	427.6	51.2	81.5	2.62	5.7	299400	106600
W14 x 16	426		634.0	474.2	424.1	47.6	77.1	2.75	6.1	274500	98320
W14 x 16	398		592.0	464.6	421.4	45.0	72.3	2.91	6.4	249900	90430
W14 x 16	370		551.0	455.2	418.4	42.0	67.6	3.09	6.9	226600	82730
W14 x 16	342		509.0	445.5	415.5	39.1	62.7	3.31	7.4	203800	75130
W14 x 16	311		463.0	434.8	412.2	35.8	57.4	3.59	8.1	180100	67130
W14 x 16	283		421.0	425.2	409.2	32.8	52.6	3.89	8.8	159800	60170
W14 x 16	257		382.0	416.1	406.3	29.8	48.0	4.23	9.7	141500	53730
W14 x 16	233		347.0	407.4	403.6	27.2	43.7	4.62	10.6	125100	47940
W14 x 16	219		326.0	403.1	402.0	25.5	41.2	4.88	11.4	116400	44660
W14 x 16	211		314.0	399.3	401.3	24.9	39.6	5.07	11.6	110500	42700
W14 x 16	193		287.0	393.2	399.0	22.6	36.6	5.45	12.8	99830	38780
W14 x 16	176		262.0	386.6	397.5	21.1	33.3	5.97	13.7	89100	34890
W14 x 16	159		237.0	380.4	395.4	18.9	30.2	6.55	15.3	79050	31140
W14 x 16	145		216.0	375.4	393.7	17.3	27.7	7.11	16.7	71270	28190
W14 x 14½	132	356 x 368	196.0	372.4	374.0	16.4	26.2	7.14	17.7	63800	22860
W14 x 14½	120		179.0	367.8	372.6	15.0	23.9	7.79	19.3	57330	20620
W14 x 14½	109		162.0	363.7	371.0	13.3	21.8	8.51	21.8	51460	18560
W14 x 14½	99		147.0	360.0	370.0	12.3	19.8	9.34	23.6	46300	16720
W14 x 14½	90		134.0	356.1	368.8	11.2	18.0	10.20	25.9	41530	15050
W14 x 10	82	356 x 254	122	363.5	257.3	12.9	21.7	5.92	22.5	36680	6175
W14 x 10	74		110.1	359.9	255.8	11.4	19.9	6.41	25.3	33120	5569
W14 x 10	68		101.2	356.6	254.8	10.5	18.3	6.97	27.5	30060	5048
W14 x 10	61		90.8	352.8	253.9	9.5	16.3	7.79	30.4	26540	4451
W14 x 8	53	356 x 203	78.9	353.6	204.7	9.4	16.7	6.13	30.8	22480	2391
W14 x 8	48		71.4	350.5	204.0	8.6	15.1	6.75	33.5	20170	2140
W14 x 8	43		64.0	347.0	203.1	7.8	13.4	7.58	37.4	17760	1874
W14 x 6¾	38	356 x 171	57.0	358.1	172.1	7.9	13.1	6.57	39.4	16070	1115
W14 x 6¾	34		51.0	355.1	171.3	7.2	11.6	7.38	43.3	14160	973
W14 x 6¾	30		44.8	351.5	170.9	6.9	9.8	8.72	45.1	12120	817

* Limited Stock Availability

AMERICA WIDE FLANGE SECTION

DIMENSIONS AND PROPERTIES

IN ACCORDANCE TO ASTM A6 / A6M : 2003



Radius of Gyration		Elastic Modulus		Plastic Modulus		Buckling Parameter	Torsional Index	Warping Constant	Torsional Constant	Area of Section	Designation	
Axis xx	Axis yy	Axis xx	Axis yy	Axis xx	Axis yy	u	x	H	J	cm ²	Mass per foot	Serial Size
cm	cm	cm ³	cm ³	cm ³	cm ³			dm ⁶	cm ⁴		lb	in
17.1	4.08	1513	199	1725	309	0.881	24.4	0.72	92.5	108	57	W16 x 7
17.0	4.03	1329	172	1510	268	0.880	27.5	0.61	63.6	95.3	50	W16 x 7
16.9	4.00	1195	154	1353	238	0.880	30.3	0.54	46.8	85.9	45	W16 x 7
16.9	3.98	1058	135	1192	208	0.881	33.9	0.47	32.7	75.7	40	W16 x 7
16.5	3.86	925	115	1047	177	0.873	38.5	0.39	22.6	68.1	36	W16 x 7
16..3	2.95	770	73	882	114	0.868	39.1	0.200	18.9	58.7	31	W16 x 5½
15.9	2.84	632	57.4	728	90.3	0.859	46.8	0.150	11.1	49.9	26	W16 x 5½
20.8	11.90	20970	8640	27230	13370	0.851	3.80	97.1	60230	1385	730	* W14 x 16
20.3	11.70	18870	7750	24280	11980	0.849	4.03	82.1	46960	1263	665	* W14 x 16
19.8	11.60	16990	6948	21660	10720	0.848	4.28	69.5	36470	1150	605	* W14 x 16
19.4	11.40	15260	6200	19260	9557	0.846	4.57	58.9	27860	1043	550	* W14 x 16
19.0	11.30	13740	5555	17160	8553	0.844	4.87	50.2	21380	948	500	* W14 x 16
18.6	11.10	12390	4985	15340	7666	0.843	5.21	43.0	16440	863	455	* W14 x 16
18.4	11.00	11580	4637	14230	7120	0.843	5.45	38.8	13770	808	426	W14 x 16
18.2	10.90	10760	4292	13140	6587	0.842	5.72	34.8	11370	755	398	W14 x 16
18.0	10.90	9950	3955	12070	6063	0.841	6.04	31.1	9264	702	370	W14 x 16
17.7	10.80	9147	3616	11010	5539	0.840	6.42	27.5	7387	648	342	W14 x 16
17.5	10.70	8282	3257	9877	4983	0.838	6.90	23.9	5654	590	311	W14 x 16
17.2	10.60	7519	2941	8891	4494	0.837	7.42	20.9	4342	537	283	W14 x 16
17.0	10.50	6802	2645	7973	4037	0.837	8.02	18.2	3288	487	257	W14 x 16
16.8	10.40	6143	2376	7142	3622	0.836	8.69	15.9	2480	442	233	W14 x 16
16.7	10.40	5777	2222	6681	3384	0.836	9.16	14.6	2073	415	219	W14 x 16
16.6	10.30	5535	2128	6385	3241	0.834	9.46	13.8	1852	400	211	W14 x 16
16.5	10.30	5078	1944	5817	2975	0.834	10.1	12.3	1451	366	193	W14 x 16
16.3	10.20	4610	1755	5248	2669	0.833	11.0	10.9	1104	334	176	W14 x 16
16.2	10.20	4156	1575	4697	2392	0.833	12.0	9.55	820	301	159	W14 x 16
16.1	10.10	3797	1432	4266	2173	0.832	13.0	8.52	633	275	145	W14 x 16
16.0	9.55	3426	1222	3843	1856	0.843	13.7	6.85	514	250	132	W14 x 14½
15.9	9.51	3117	1107	3478	1679	0.842	14.9	6.10	391	228	120	W14 x 14½
15.8	9.49	2830	1001	3137	1516	0.843	16.2	5.42	294	206	109	W14 x 14½
15.7	9.43	2572	904	2839	1369	0.843	17.7	4.84	223	188	99	W14 x 14½
15.6	9.39	2332	816	2562	1236	0.842	19.3	4.30	168	171	90	W14 x 14½
15.4	6.31	2018	480	2270	734	0.884	16.6	1.80	211	155	82	W14 x 10
15.3	6.29	1840	435	2058	665	0.886	18.0	1.61	161	141	74	W14 x 10
15.3	6.26	1686	396	1878	604	0.886	19.4	1.44	126	129	68	W14 x 10
15.2	6.21	1505	351	1668	534	0.886	21.5	1.26	90.3	115	61	W14 x 10
15.0	4.88	1271	234	1424	359	0.892	21.3	0.679	80.1	100	53	W14 x 8
14.9	4.84	1151	210	1285	322	0.891	23.3	0.601	60.4	91.2	48	W14 x 8
14.8	4.80	1024	185	1138	283	0.891	25.9	0.521	43.2	81.2	43	W14 x 8
14.9	3.93	898	130	1010	200	0.884	28.7	0.330	33.4	72.2	38	W14 x 6¾
14.8	3.88	798	114	895	175	0.883	32.0	0.290	23.8	64.5	34	W14 x 6¾
14.5	3.78	690	95.6	777	148	0.876	36.6	0.240	16.0	57.3	30	W14 x 6¾

AMERICA WIDE FLANGE SECTION

DIMENSIONS AND PROPERTIES

IN ACCORDANCE TO ASTM A6 / A6M : 2003



Designation				Depth of Section D	Width of Section B	Thickness of Web t	Thickness of Flange T	Ratios for Local Buckling		Second Moment of Area	
Serial Size	Mass per Foot	Serial Size	Mass per Metre					Flange	Web	Axis X-X	Axis Y-Y
in	lb	mm	kg					b/T	d/t	cm ⁴	cm ⁴
W14 x 5	26	356 x 127	39.0	353.3	127.6	6.5	10.7	5.96	47.9	10230	372
W14 x 5	22		32.9	349.0	127.0	5.8	8.5	7.47	53.7	8267	291
W12 x 12	336	305 x 305	500.0	427.2	340.0	45.1	75.1	2.26	5.50	169000	49420
W12 x 12	305		454.0	414.5	336.2	41.3	68.7	2.45	6.00	147600	43690
W12 x 12	279		415.0	402.6	333.8	38.9	62.7	2.66	6.30	129500	39010
W12 x 12	252		375.0	391.4	330.3	35.4	57.2	2.89	7.00	113200	34460
W12 x 12	230		342.0	382.3	327.5	32.6	52.6	3.11	7.60	100600	30880
W12 x 12	210		313.0	373.6	324.9	30.0	48.3	3.36	8.20	89320	27680
W12 x 12	190		283.0	365.3	321.8	26.9	44.1	3.65	9.20	78800	24540
W12 x 12	170		253.0	356.4	319.3	24.4	39.6	4.03	10.10	68470	21520
W12 x 12	152		226.0	348.2	317.0	22.1	35.6	4.45	11.20	59650	18930
W12 x 12	136		202.0	340.6	315.0	20.1	31.8	4.95	12.30	51850	16590
W12 x 12	120		179.0	333.2	312.9	18.0	28.1	5.57	13.70	44590	24360
W12 x 12	106		158.0	327.2	310.6	15.5	25.1	6.19	15.90	38760	12550
W12 x 12	96		143.0	322.8	308.9	14.0	22.9	6.74	17.60	34710	11260
W12 x 12	87		129.0	318.3	308.0	13.1	20.6	7.48	18.80	30850	10040
W12 x 12	79		117.0	314.5	306.8	11.9	18.7	8.20	20.70	27610	9006
W12 x 12	72		107.0	311.2	305.8	10.9	17.0	8.99	22.60	24820	8107
W12 x 12	65		97.0	307.8	304.8	9.9	15.4	9.90	24.90	22200	7272
W12 x 10	58	305 x 254	86.3	309.6	254.3	9.1	16.2	7.85	27.0	19740	4444
W12 x 10	53		78.9	306.3	253.9	8.8	14.6	8.70	28.2	17700	3986
W12 x 8	50	305 x 203	74.4	309.6	205.2	9.4	16.2	6.33	26.3	16350	2337
W12 x 8	45		67.0	306.3	204.3	8.5	14.6	7.00	29.0	14570	2078
W12 x 8	40		59.5	303.3	203.3	7.5	13.0	7.82	33.0	12840	1823
W12 x 6½	36	305 x 165	54.0	310.4	166.9	7.9	13.7	6.09	33.6	11700	1063
W12 x 6½	31		46.1	306.6	165.7	6.7	11.8	7.02	39.6	9899	896
W12 x 6½	27		40.3	303.4	165.0	6.0	10.2	8.09	44.2	8503	764
W12 x 4	22	305 x 102	32.7	312.7	102.4	6.6	10.8	4.74	41.8	6501	194
W12 x 4	19		28.3	308.9	101.7	6.0	8.9	5.71	46.0	5410	157
W12 x 4	16		23.8	304.5	101.3	5.6	6.7	7.56	49.3	4264	117
W12 x 4	14		20.8	302.5	100.8	5.1	5.7	8.83	54.3	3682	97.9
W10 x 10	112	254 x 254	167.0	289.0	264.5	19.2	31.8	4.16	10.4	29960	9823
W10 x 10	100		149.0	282.0	262.6	17.3	28.4	4.62	11.5	25900	8583
W10 x 10	88		131.0	275.3	260.7	15.4	25.1	5.19	13.0	22180	7421
W10 x 10	77		115.0	269.3	258.8	13.5	22.1	5.86	14.8	18970	6391
W10 x 10	68		101.0	264.2	257.3	11.9	19.6	6.56	16.8	16410	5569
W10 x 10	60		89.0	259.6	256.0	10.7	17.3	7.40	18.7	14200	4841
W10 x 10	54		80.0	256.3	254.8	9.4	15.6	8.17	21.2	12590	4303
W10 x 10	49		73.0	253.5	254.0	8.6	14.2	8.94	23.2	11320	3880

AMERICA WIDE FLANGE SECTION

DIMENSIONS AND PROPERTIES

IN ACCORDANCE TO ASTM A6 / A6M : 2003



Radius of Gyration		Elastic Modulus		Plastic Modulus		Buckling Parameter	Torsional Index	Warping Constant	Torsional Constant	Area of Section	Designation	
Axis xx	Axis yy	Axis xx	Axis yy	Axis xx	Axis yy	u	x	H	J	cm ²	Mass per foot	Serial Size
cm	cm	cm ³	cm ³	cm ³	cm ³			dm ⁶	cm ⁴		lb	in
14.3	2.73	579	58.2	661	91.1	0.873	35.3	0.110	15.1	49.8	26	W14 x 5
14.1	2.64	474	45.8	542	71.8	0.866	42.5	0.080	8.59	41.7	22	W14 x 5
16.3	8.80	7913	2907	9882	4487	0.861	5.00	15.3	10110	638	336	W12 x 12
16.0	8.69	7122	2599	8807	4006	0.860	5.36	13.1	7719	578	305	W12 x 12
15.7	8.59	6435	2338	7888	3602	0.857	5.73	11.3	5946	528	279	W12 x 12
15.4	8.49	5783	2087	7020	3211	0.856	6.17	9.62	4495	478	252	W12 x 12
15.2	8.41	5261	1886	6332	2898	0.856	6.60	8.39	3490	437	230	W12 x 12
15.0	8.33	4781	1704	5707	2615	0.855	7.08	7.32	2700	399	210	W12 x 12
14.8	8.25	4314	1525	5101	2337	0.855	7.65	6.33	2034	360	190	W12 x 12
14.6	8.17	3843	1348	4501	2063	0.854	8.38	5.4	1478	323	170	W12 x 12
14.4	8.09	3426	1194	3978	1825	0.853	9.16	4.62	1077	289	152	W12 x 12
14.2	8.02	3045	1053	3506	1608	0.852	10.1	3.95	774	258	136	W12 x 12
14.0	7.94	2676	918	3055	1400	0.851	11.2	3.34	538	228	120	W12 x 12
13.9	7.90	2369	808	2679	1230	0.852	12.5	2.86	378	201	106	W12 x 12
13.8	7.86	2151	729	2417	1108	0.853	13.5	2.53	287	182	96	W12 x 12
13.7	7.80	1938	652	2167	991	0.851	14.8	2.22	213	165	87	W12 x 12
13.6	7.76	1756	587	1952	892	0.851	16.2	1.97	160	150	79	W12 x 12
13.5	7.72	1595	530	1766	805	0.850	17.6	1.75	122	136	72	W12 x 12
13.4	7.68	1443	477	1589	724	0.850	19.3	1.55	91.1	123	65	W12 x 12
13.4	6.36	1275	349	1411	531	0.878	18.7	0.956	86.5	110	58	W12 x 10
13.3	6.30	1156	314	1276	477	0.876	20.4	0.848	65.6	100	53	W12 x 10
13.2	4.97	1056	228	1183	349	0.889	18.8	0.503	73.5	94.5	50	W12 x 8
13.1	4.94	952	203	1060	311	0.889	20.6	0.442	54.6	85.2	45	W12 x 8
13.0	4.91	847	179	938	274	0.890	22.9	0.384	39.1	75.6	40	W12 x 8
13.0	3.93	754	127	846	196	0.889	23.6	0.234	34.8	68.8	36	W12 x 6½
13.0	3.90	646	108	720	166	0.891	27.1	0.195	22.2	58.7	31	W12 x 6½
12.9	3.86	560	92.6	623	142	0.889	31.0	0.164	14.7	51.3	27	W12 x 6½
12.5	2.15	416	37.9	481	60.0	0.866	31.6	0.040	12.2	41.8	22	W12 x 4
12.2	2.08	350	30.8	406	48.9	0.860	37.1	0.040	7.56	36.1	19	W12 x 4
11.8	1.96	280	23.0	328	36.9	0.846	45.1	0.030	4.25	30.4	16	W12 x 4
11.7	1.91	243	19.4	286	31.1	0.842	50.8	0.0216	2.93	26.8	14	W12 x 4
11.9	6.79	2073	743	2422	1135	0.852	8.46	1.62	630	213	112	W10 x 10
11.7	6.73	1837	654	2126	998	0.851	9.31	1.38	450	190	100	W10 x 10
11.5	6.67	1611	569	1847	868	0.85	10.4	1.16	312	167	88	W10 x 10
11.4	6.61	1409	494	1600	752	0.849	11.6	0.98	213	146	77	W10 x 10
11.3	6.57	1243	433	1399	658	0.849	12.9	0.83	149	129	68	W10 x 10
11.2	6.52	1094	378	1224	574	0.848	14.4	0.71	104	114	60	W10 x 10
11.1	6.49	983	338	1091	512	0.849	15.8	0.62	75.6	102	54	W10 x 10
11.0	6.46	893	306	987	463	0.849	17.2	0.56	57.5	92.9	49	W10 x 10

AMERICA WIDE FLANGE SECTION

DIMENSIONS AND PROPERTIES

IN ACCORDANCE TO ASTM A6 / A6M : 2003



Designation				Depth of Section D	Width of Section B	Thickness of Web t	Thickness of Flange T	Ratios for Local Buckling		Second Moment of Area	
Serial Size	Mass per Foot	Serial Size	Mass per Metre					Flange	Web	Axis X-X	Axis Y-Y
in	lb	mm	kg					b/T	d/t	cm ⁴	cm ⁴
W10 x 8	57	254 x 203	84.8	258.1	211.3	16.5	16.5	6.40	12.1	11930	2606
W10 x 8	45		67.0	256.5	203.7	8.9	15.7	6.49	22.5	10300	2214
W10 x 8	42		62.5	249.4	207.0	12.2	12.2	8.49	16.4	8430	1807
W10 x 8	39		58.0	252.0	202.8	8.0	13.4	7.57	25.0	8672	1865
W10 x 8	33		49.1	247.1	202.2	7.4	11.0	9.19	27.1	7071	1517
W10 x 5½	30	254 x 146	44.8	265.9	147.6	7.6	13.0	5.72	29.6	7085	698
W10 x 5½	26		38.5	262.4	146.6	6.6	11.2	6.60	34.1	6014	589
W10 x 5½	22		32.7	258.3	146.1	6.1	9.1	7.99	36.9	4903	474
W10 x 5½	16		24.0	253.0	145.0	5.0	6.4	11.33	44.8	3477	326
W10 x 4	19	254 x 102	28.4	260.1	102.1	6.4	10.0	5.11	35.1	4003	178
W10 x 4	17		25.3	256.8	101.9	6.1	8.4	6.07	36.9	3414	149
W10 x 4	15		22.3	253.7	101.6	5.8	6.9	7.36	38.7	2872	121
W10 x 4	12		17.9	250.7	100.6	4.8	5.3	9.44	46.5	2241	90.8
W8 x 8	67	203 x 203	100.0	228.6	210.3	14.5	23.7	4.44	11.1	11300	3679
W8 x 8	58		86.0	222.3	208.8	13.0	20.6	5.07	12.4	9493	3129
W8 x 8	48		71.0	215.9	206.0	10.2	17.4	5.92	15.8	7654	2537
W8 x 8	40		59.0	209.6	205.0	9.1	14.2	7.22	17.7	6088	2040
W8 x 8	35		52.0	206.2	203.7	7.9	12.6	8.08	20.3	5277	1776
W8 x 8	31		46.1	203.2	203.2	7.2	11.0	9.24	22.3	4560	1539
W8 x 5¼	21	203 x 133	31.3	210.3	133.9	6.4	10.2	6.56	27.3	3145	409
W8 x 5¼	18		26.6	206.8	133.4	5.8	8.4	7.94	30.1	2581	333
W8 x 5¼	14		21.0	203.0	133.0	5.0	6.4	10.39	34.8	1980	251
W8 x 4	16	203 x 102	23.1	203.2	101.8	5.4	9.3	5.47	31.4	2105	164
W8 x 4	15		22.3	206.0	102.0	6.2	8.0	6.38	28.1	1999	142
W8 x 4	13		19.4	202.9	101.6	5.8	6.5	7.84	29.9	1647	114
W8 x 4	10		14.9	200.4	100.1	4.3	5.2	9.61	40.4	1284	87.3
W6 x 6	25	152 x 152	37.1	162.1	154.4	8.1	11.6	6.66	15.3	2236	712
W6 x 6	20		29.8	157.5	152.9	6.6	9.3	8.22	18.7	1734	555
W6 x 6	15		22.5	152.1	152.1	5.8	6.6	11.5	21.3	1216	387
W6 x 4	16	152 x 102	23.8	159.5	102.4	6.6	10.2	5.02	19.2	1330	183
W6 x 4	12		17.9	153.2	101.6	5.8	7.1	7.14	21.6	918	125
W6 x 4	9		13.4	149.9	100.1	4.33	5.5	9.17	29.2	683	91.4
W5 x 5	19	127 x 127	28.3	130.8	127.8	6.9	10.9	5.86	13.7	1092	380
W5 x 5	16		23.8	127.3	127.0	6.1	9.1	6.95	15.4	892	312
W4 x 4	16.3	102 x 102	24.0	107.0	100.0	7.9	12.0	4.17	8.99	587	200
W4 x 4	13.8		21.0	102.0	102.0	8.0	9.4	5.43	8.90	456	167
W4 x 4	13		19.4	105.7	103.1	7.1	8.8	5.88	10.6	472	160

AMERICA WIDE FLANGE SECTION

DIMENSIONS AND PROPERTIES

IN ACCORDANCE TO ASTM A6 / A6M : 2003

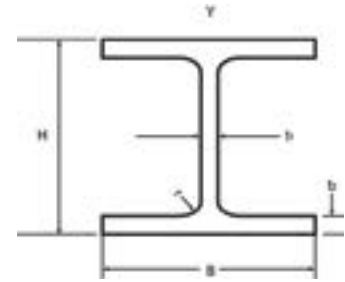


Radius of Gyration		Elastic Modulus		Plastic Modulus		Buckling Parameter	Torsional Index	Warping Constant	Torsional Constant	Area of Section	Designation	
Axis xx	Axis yy	Axis xx	Axis yy	Axis xx	Axis yy	u	x	H	J	cm ²	Mass per foot	Serial Size
cm	cm	cm ³	cm ³	cm ³	cm ³			dm ⁶	cm ⁴		lb	in
10.5	4.91	925	247	1067	385	0.849	13.6	0.380	109	108	57	W10 x 8
11.0	5.09	803	217	898	331	0.880	15.9	0.321	62.3	85.4	45	W10 x 8
10.3	4.77	676	175	768	271	0.851	17.9	0.254	44.5	79.3	42	W10 x 8
10.8	5.03	688	184	765	280	0.878	18.3	0.265	40.2	73.8	39	W10 x 8
10.6	4.93	572	150	634	229	0.873	21.5	0.211	24.0	62.5	33	W10 x 8
11.1	3.5	533	94.5	600	145	0.889	21.2	0.11	26.1	57.1	30	W10 x 5¼
11.1	3.46	458	80.3	513	123	0.888	24.3	0.09	16.8	49.2	26	W10 x 5¼
10.8	3.37	380	64.8	425	99.6	0.881	29.0	0.07	9.86	41.7	22	W10 x 5¼
10.6	3.23	275	44.9	308	69.0	0.874	38.2	0.05	4.16	31.1	16	W10 x 5¼
10.5	2.22	308	34.9	353	54.8	0.873	27.4	0.030	9.68	36.3	19	W10 x 4
10.3	2.15	266	29.2	306	46.1	0.865	31.3	0.020	6.52	32.3	17	W10 x 4
10.1	2.06	226	23.8	262	37.9	0.855	35.8	0.020	4.33	28.4	15	W10 x 4
9.91	1.99	179	18.0	207	28.6	0.851	44.0	0.0137	2.28	22.8	12	W10 x 4
9.40	5.39	988	350	1148	534	0.852	9.02	0.390	210	127	67	W8 x 8
9.30	5.32	854	300	982	457	0.850	10.2	0.320	140	110	58	W8 x 8
9.20	5.28	709	246	803	375	0.852	11.9	0.250	81.8	91.1	48	W8 x 8
9.00	5.20	581	199	651	303	0.848	14.1	0.200	46.5	75.6	40	W8 x 8
8.90	5.17	512	174	569	265	0.849	15.7	0.170	32.3	66.5	35	W8 x 8
8.80	5.12	449	151	497	230	0.847	17.7	0.140	22.1	58.6	31	W8 x 8
8.90	3.20	299	61.0	336	93.6	0.885	20.8	0.040	11.9	40.0	21	W8 x 5¼
8.70	3.13	250	49.9	279	76.6	0.880	24.5	0.030	7.14	33.9	18	W8 x 5¼
8.55	3.05	195	37.8	218	58.0	0.874	29.9	0.0243	3.74	27.1	14	W8 x 5¼
8.46	2.36	207	32.3	234	49.8	0.888	22.5	0.0154	7.02	29.4	16	W8 x 4
8.36	2.23	194	27.8	222	43.7	0.869	25.2	0.0139	5.68	28.6	15	W8 x 4
8.16	2.14	162	22.4	187	35.3	0.861	39.0	0.0110	3.63	24.8	13	W8 x 4
8.19	2.14	128	17.4	145	27.2	0.867	36.3	0.00832	1.78	19.1	10	W8 x 4
6.90	3.87	276	92.3	312	141	0.848	13.2	0.040	19.7	47.6	25	W6 x 6
6.80	3.81	220	72.5	246	110	0.848	16.1	0.030	10.3	38.1	20	W6 x 6
6.50	3.68	160	50.9	177	77.7	0.838	21.1	0.020	4.35	28.6	15	W6 x 6
6.61	2.45	167	35.7	190	55.2	0.882	15.4	0.0102	9.12	30.4	16	W6 x 4
6.33	2.33	120	24.5	136	38.0	0.869	20.4	0.00665	3.76	22.9	12	W6 x 4
6.29	2.30	91.1	18.3	102	28.1	0.873	26.2	0.00477	1.69	17.3	9	W6 x 4
5.52	3.25	167	59.4	190	90.6	0.845	11.2	0.0136	13.1	35.8	19	W5 x 5
5.42	3.21	140	49.2	158	75.0	0.842	13.0	0.0109	8.00	30.4	16	W5 x 5
4.36	2.55	110	40.1	129	61.5	0.844	8.13	0.00452	13.5	30.9	16.3	W4 x 4
4.18	2.53	89.4	32.7	104	50.4	0.827	9.61	0.00357	7.78	26.1	13.8	W4 x 4
4.38	2.55	89.4	31.1	103	47.8	0.836	10.9	0.00377	6.29	24.7	13	W4 x 4

METRIC SECTIONS

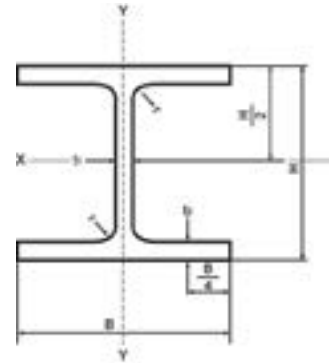
DIMENSIONS AND SECTIONAL PROPERTIES

Metric Series - JIS '94, '08



Nominal Size	Weight	Sectional Dimension					Sectional Area	Moment of Inertia	
		H	B	t ₁	t	r		I _x	I _y
mm	kg/m	mm	mm	mm	mm	mm	cm ²	cm ⁴	cm ⁴
100 x 100	17.0	100	100	6	8	8	21.59	378	134
125 x 125	23.6	125	125	6.5	9	8	30.00	840	293
150 x 75	14.0	150	75	5	7	8	17.85	666	49.5
150 x 100	20.7	148	100	6	9	8	26.35	1000	150
150 x 150	31.1	150	150	7	10	8	39.65	1620	563
200 x 100	17.8	198	99	4.5	7	8	22.69	1540	113
	20.9	200	100	5.5	8	8	26.67	1810	134
200 x 150	29.9	194	150	6	9	8	38.11	2630	507
200 x 200	49.9	200	200	8	12	13	63.53	4720	1600
250 x 125	25.1	248	124	5	8	8	31.99	3450	255
	29.0	250	125	6	9	8	36.97	3960	294
250 x 175	43.6	244	175	7	11	13	55.49	6040	984
250 x 250	71.8	250	250	9	14	13	91.43	10700	3650
300 x 150	32.0	298	149	5.5	8	13	40.80	6320	442
	36.7	300	150	6.5	9	13	46.78	7210	508
300 x 200	55.8	294	200	8	12	13	71.05	11100	1600
300 x 300	93.0	300	300	10	15	13	118.5	20200	6750
350 x 175	41.2	346	174	6	9	13	52.45	11000	791
	49.4	350	175	7	11	13	62.91	13500	984
350 x 250	78.1	340	250	9	14	13	99.53	21200	3650
350 x 350	135	350	350	12	19	13	171.9	39800	13600
400 x 200	56.1	396	199	7	11	13	71.41	19800	1450
	65.5	400	200	8	13	13	83.37	23500	1740
400 x 300	105	390	300	10	16	13	133.3	37900	7200
400 x 400	172	400	400	13	21	22	218.7	66600	22400
	232	414	405	18	28	22	295.4	92800	31000
	283	428	407	20	35	22	360.7	119000	39400
	415	458	417	30	50	22	528.6	187000	60500
	605	498	432	45	70	22	770.1	298000	94400

METRIC SECTIONS



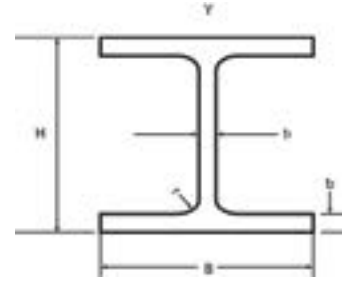
Dimension : JIS G 3192:1994 JIS G 3192:2008 JIS G 3136:2008
 Dimensional Tolerance : JIS G 3192:1994 JIS G 3192:2008 JIS G 3136:2008
 Surface Condition : JIS G 3192:1994 JIS G 3192:2008 JIS G 3136:2008

Radius of Gyration		Modulus of Section		Plastic Modulus		Warping Constant	Torsional Constant	Nominal Size
ix	iy	Sx	Sy	Zx	Zy	Cw	J	
cm	cm	cm ³	cm ³	cm ³	cm ³	cm ⁶ ,x10 ³	cm ⁴	mm
4.18	2.49	75.6	26.7	86.4	41.0	2.82	4.91	100 x 100
5.29	3.13	134	46.9	152	71.7	9.86	8.10	125 x 125
6.11	1.67	88.8	13.2	102	20.8	2.52	2.90	150 x 75
6.16	2.39	135	30.1	154	46.4	7.25	6.66	150 x 100
6.39	3.77	216	75.1	243	114	27.6	12.7	150 x 150
8.24	2.24	156	22.9	175	35.5	10.3	3.32	200 x 100
8.24	2.24	181	26.7	205	41.6	12.3	5.17	200 x 100
8.31	3.65	271	67.6	301	103	43.3	9.4	200 x 150
8.62	5.02	472	160	526	244	141	30.2	200 x 200
10.4	2.82	278	41.1	312	63.2	36.6	5.80	250 x 125
10.3	2.82	317	47.0	358	72.7	42.5	8.6	250 x 125
10.4	4.21	495	112	551	172	133	21.3	250 x 175
10.8	6.32	856	292	953	443	508	56.2	250 x 250
12.4	3.29	424	59.3	475	91.8	92.7	8.79	300 x 150
12.4	3.29	481	67.7	542	105	107	12.7	300 x 150
12.5	4.75	755	160	842	245	318	31.8	300 x 200
13.1	7.55	1350	450	1480	683	1370	82.9	300 x 300
14.5	3.88	636	91.0	713	140	224	13.3	350 x 175
14.6	3.96	771	113	864	173	282	22.5	350 x 175
14.6	6.06	1250	292	1380	445	969	58.4	350 x 250
15.2	8.89	2270	777	2520	1180	3720	187	350 x 350
16.7	4.51	1000	146	1110	223	535	25.1	400 x 200
16.8	4.57	1180	174	1310	267	649	39.7	400 x 200
16.9	7.35	1940	480	2140	730	2520	100	400 x 300
17.5	10.1	3330	1120	3670	1700	8040	304	400 x 400
17.7	10.2	4480	1530	5030	2330	11500	721	400 x 400
18.2	10.5	5560	1940	6310	2940	15200	1320	400 x 400
18.8	10.7	8170	2900	9540	4440	25100	3930	400 x 400
19.7	11.1	12000	4370	14500	6720	43100	11300	400 x 400

METRIC SECTIONS

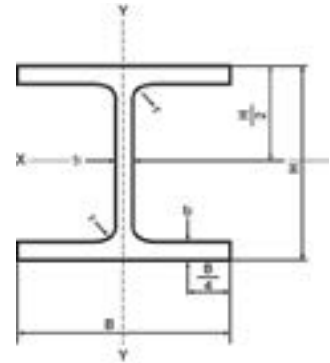
DIMENSIONS AND SECTIONAL PROPERTIES

Metric Series - JIS '94, '08



Nominal Size	Weight	Sectional Dimension					Sectional Area	Moment of Inertia	
		H	B	t _f	t	r		I _x	I _y
mm	kg/m	mm	mm	mm	mm	mm	cm ²	cm ⁴	cm ⁴
450 x 200	65.1	446	199	8	12	13	82.97	28100	1580
	74.9	450	200	9	14	13	95.43	32900	1870
450 x 300	121	440	300	11	18	13	153.9	54700	8110
500 x 200	77.9	496	199	9	14	13	99.29	40800	1840
	88.2	500	200	10	16	13	112.3	46800	2140
500 x 300	111	482	300	11	15	13	141.2	58300	6760
	125	488	300	11	18	13	159.2	68900	8110
600 x 200	92.5	596	199	10	15	13	117.8	66600	1980
	103	600	200	11	17	13	131.7	75600	2270
600 x 300	133	582	300	12	17	13	169.2	99000	7660
	147	588	300	12	20	13	187.2	114000	9010
	170	594	302	14	23	13	217.1	134000	10600
700 x 300	163	692	300	13	20	18	207.5	168000	9020
	182	700	300	13	24	18	231.5	197000	10800
800 x 300	188	792	300	14	22	18	239.5	248000	9920
	207	800	300	14	26	18	263.5	286000	11700
900 x 300	210	890	299	15	23	18	266.9	339000	10300
	240	900	300	16	28	18	305.8	404000	12600
	283	912	302	18	34	18	360.1	491000	15700
	304	918	303	19	37	18	387.4	535000	17200

METRIC SECTIONS



Dimension : JIS G 3192:1994 JIS G 3192:2008 JIS G 3136:2008
 Dimensional Tolerance : JIS G 3192:1994 JIS G 3192:2008 JIS G 3136:2008
 Surface Condition : JIS G 3192:1994 JIS G 3192:2008 JIS G 3136:2008

Radius of Gyration		Modulus of Section		Plastic Modulus		Warping Constant	Torsional Constant	Nominal Size
ix	iy	Sx	Sy	Zx	Zy	Cw	J	
cm	cm	cm ³	cm ³	cm ³	cm ³	cm ⁶ ,x10 ³	cm ⁴	mm
18.4	4.36	1260	159	1420	245	742	34.3	450 x 200
18.6	4.43	1460	187	1650	290	887	52.0	
18.9	7.26	2490	541	2760	823	3610	142	450 x 300
20.3	4.30	1650	185	1870	288	1070	52.9	500 x 200
20.4	4.37	1870	214	2130	333	1250	76.4	
20.3	6.92	2420	451	2700	690	3680	96	500 x 300
20.8	7.14	2820	541	3130	825	4470	144	
23.8	4.10	2230	199	2580	312	1660	70.0	600 x 200
24.0	4.15	2520	227	2900	358	1930	98	
24.2	6.73	3400	511	3820	786	6110	139	600 x 300
24.7	6.94	3880	601	4350	921	7260	200	
24.8	6.99	4510	702	5060	1080	8610	306	
28.5	6.59	4860	601	5500	931	10200	228	700 x 300
29.2	6.83	5630	720	6340	1110	12300	342	
32.2	6.44	6260	661	7140	1030	14700	305	800 x 300
32.9	6.66	7150	780	8100	1210	17500	440	
35.6	6.21	7620	689	8750	1080	19300	365	900 x 300
36.3	6.42	8980	840	10300	1320	24000	581	
36.9	6.60	10770	1040	12300	1620	30100	981	
37.2	6.66	11660	1140	13400	1780	33300	1240	

H BEARING PILES

IN ACCORDANCE TO JIS A 5526

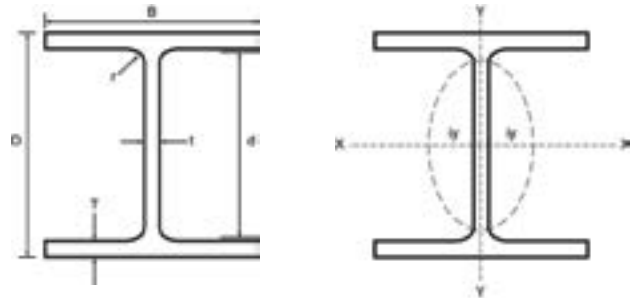
1. SCOPE

This Japanese Industrial Standard specifies the steel H piles, hereinafter referred to as the “piles”, used for the foundation of structure related to civil engineering works and architecture.

Sectional Dimension mm					Sectional Area A cm ²	Unit Mass W kg/m	Reference						
Nominal size	H x B	t ₁	t ₂	r			Geometrical Moment of Inertia I cm ⁴		Radius of Gyration of Area i cm		Section Modulus Z cm ³		Surface Area m ² /m
							I _x	I _y	i _x	i _y	Z _x	Z _y	
200 x 200	200 x 204	12	12	13	71.53	56.2	4980	1700	8.35	4.88	498	167	1.17
250 x 250	244 x 252	11	11	16	82.06	64.4	8790	2940	10.3	5.98	720	233	1.45
	250 x 255	14	14	16	104.7	82.2	11500	3880	10.5	6.09	919	304	1.46
300 x 300	294 x 302	12	12	18	107.7	84.5	16900	5520	12.5	7.16	1150	365	1.74
	300 x 300	10	15	18	119.8	94	20400	6750	13.1	7.51	1360	450	1.75
	300 x 305	15	15	18	134.8	106	21500	7100	12.6	7.26	1440	466	1.76
350 x 350	338 x 351	13	13	20	135.3	106	28200	9380	14.4	8.33	1670	534	2.02
	344 x 354	16	16	20	166.6	131	35300	11800	14.6	8.43	2050	669	2.04
	350 x 350	12	19	20	173.9	137	40300	13600	15.2	8.84	2300	776	2.04
	350 x 357	19	19	20	198.4	156	42800	14400	14.7	8.53	2450	809	2.06
400 x 400	388 x 402	15	15	22	178.5	140	49000	16300	16.6	9.54	2520	809	2.32
	394 x 405	18	18	22	214.4	168	59700	20000	16.7	9.65	3030	985	2.33
	400 x 400	13	21	22	218.7	172	66600	22400	17.5	10.1	3330	1120	2.34
	400 x 408	21	21	22	250.7	197	70900	23800	16.8	9.75	3540	1170	2.35
	414 x 405	18	28	22	295.4	232	92800	31000	17.7	10.2	4480	1530	2.38
	428 x 407	20	35	22	360.7	283	119000	39400	18.2	10.4	5570	1930	2.41
500 x 500	492 x 465	15	20	26	259.6	204	118000	33500	21.3	11.4	4800	1440	3.44
	502 x 465	15	25	26	306.1	240	147000	41900	21.9	11.7	5850	1800	3.59
	502 x 470	20	25	26	331.2	260	152000	43300	21.4	11.4	6060	1840	3.60

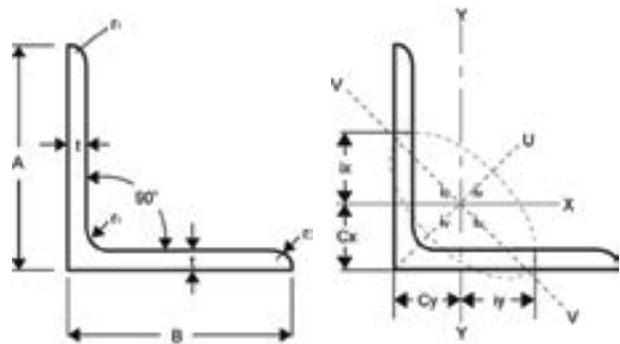
H BEARING PILES

IN ACCORDANCE TO BS4 : PART 1 : 2005



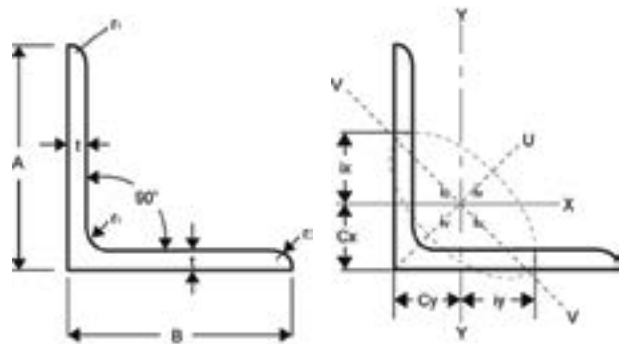
Sectional Dimension mm				Sectional Area A cm ²	Unit Mass W kg/m	Reference					
Nominal size	H x B	t	r			Geometrical Moment of Inertia I cm ⁴		Radius of Gyration of Area i cm		Section Modulus Z cm ³	
						I _x	I _y	i _x	i _y	Z _x	Z _y
203 x 203	200.0 x 205.4	9.5	10.2	57.0	45.0	4079	1539	8.46	4.90	408	133
	203.9 x 207.2	11.3	10.2	68.4	54.0	4987	1683	8.54	4.95	489	162
254 x 254	246.9 x 256.0	10.6	12.7	79.7	63.0	8775	2971	10.5	6.11	711	232
	249.9 x 257.5	12.1	12.7	91.0	71.0	10153	3451	10.6	6.10	813	268
	254.3 x 259.7	14.3	12.7	108.1	85.0	12264	4188	10.7	6.22	965	323
305 x 305	299.2 x 306.0	11.1	15.2	100.4	79.0	16400	5292	12.8	7.26	1096	346
	301.7 x 307.2	12.3	15.2	112.0	88.0	18402	5959	12.8	7.30	1220	388
	303.8 x 308.3	13.4	15.2	121.0	95.0	20111	6529	12.9	7.30	1324	424
	307.9 x 310.3	15.4	15.2	140.4	110.0	23580	7689	13.0	7.40	1532	496
	312.6 x 312.7	17.8	15.2	161.0	126.0	27526	9013	13.1	7.50	1763	577
	318.2 x 315.5	20.6	15.2	190.0	149.0	33040	10869	13.2	7.60	2075	689
	328.4 x 320.5	25.7	15.2	237.0	186.0	42625	14108	13.4	7.70	2597	881
	338.0 x 325.4	30.5	15.2	285.0	223.0	52817	17570	13.6	7.80	3126	1080
356 x 368	346.4 x 370.5	12.9	15.2	138.4	109.0	30515	10901	14.8	8.87	1762	588
	351.9 x 373.3	15.6	15.2	169.0	133.0	37840	13576	15.0	8.96	2150	727
	356.4 x 375.5	17.9	15.2	193.6	152.0	43916	15799	15.1	9.03	2464	841
	361.5 x 378.1	20.4	15.2	222.2	174.1	51134	18444	15.2	9.11	2829	976

EQUAL ANGLE



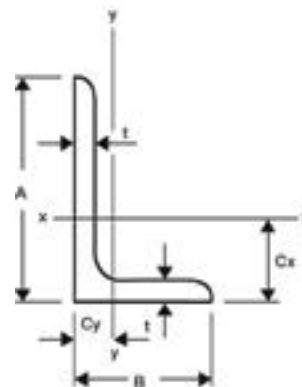
Size	Leg Length	Thick-ness	Corner Radius		Sectional Area	Weight	Centre of Gravity	Moment of Inertia				Radius of Gyration			Modulus of Section
	A-B	t	r ₁	r ₂			Cx-Cy	Jx-Jy	Max Ju	Min Jv	ix-iy	Max i _u	Min i _v	Zx-Zy	
A x B x t	mm	mm	mm	mm	cm ²	kg/m	cm	cm ⁴	cm ⁴	cm ⁴	cm	cm	cm	cm ³	
30 x 30 x 3	30	3	4	2	1.727	1.36	.85	1.42	2.26	.59	.91	1.14	.58	.66	
30 x 30 x 5	30	5	4	3	2.746	2.16	.92	2.14	3.37	.91	.88	1.11	.57	1.03	
35 x 35 x 3	35	3	4.5	2	2.036	1.60	.97	2.32	3.68	.96	1.07	1.34	.69	.92	
35 x 35 x 5	35	5	4.5	3	3.255	2.56	1.04	3.53	5.85	1.47	1.04	1.31	.67	1.44	
40 x 40 x 3	40	3	4.5	2	2.336	1.83	1.09	3.53	5.60	1.45	1.23	1.55	.79	1.21	
40 x 40 x 5	40	5	4.5	3	3.755	2.95	1.17	5.42	8.59	2.25	1.20	1.51	.77	1.91	
45 x 45 x 4	45	4	6.5	3	3.492	2.74	1.24	6.50	10.3	2.69	1.36	1.72	.88	2.00	
45 x 45 x 6	45	6	6.5	4.5	5.044	3.96	1.32	9.00	14.2	3.75	1.34	1.68	.86	2.83	
45 x 45 x 8	45	8	6.5	4.5	6.564	5.15	1.40	11.2	18.0	4.44	1.31	1.65	.82	3.61	
50 x 50 x 4	50	4	6.5	3	3.892	3.06	1.37	9.06	14.4	3.74	1.53	1.92	.98	2.49	
50 x 50 x 6	50	6	6.5	4.5	5.644	4.43	1.44	12.6	20.0	5.24	1.50	1.88	.96	3.55	
50 x 50 x 8	50	8	6.5	4.5	7.364	5.78	1.52	16.1	25.4	6.78	1.48	1.86	.96	4.62	
60 x 60 x 5	60	5	6.5	3	5.802	4.55	1.66	19.6	31.2	8.06	1.84	2.32	1.18	4.52	
60 x 60 x 7	60	7	6.5	4.5	7.914	6.21	1.73	25.9	41.0	10.7	1.81	2.28	1.16	6.06	
60 x 60 x 9	60	9	6.5	4.5	9.994	7.85	1.81	31.9	50.5	13.4	1.79	2.25	1.16	7.62	
65 x 65 x 6	65	6	8.5	4	7.527	5.91	1.81	29.4	46.6	12.1	1.98	2.49	1.27	6.27	
65 x 65 x 8	65	8	8.5	6	9.761	7.66	1.88	36.8	58.3	15.3	1.94	2.44	1.25	7.97	
65 x 65 x 10	65	10	8.5	6	12.00	9.42	1.96	44.4	70.2	18.7	1.92	2.42	1.25	9.79	
70 x 70 x 6	70	6	8.5	4	8.127	6.38	1.94	37.1	58.9	15.3	2.14	2.69	1.37	7.33	
70 x 70 x 8	70	8	8.5	6	10.560	8.29	2.01	46.6	74.0	19.3	2.10	2.65	1.35	9.34	
70 x 70 x 10	70	10	8.5	6	13.000	10.2	2.09	56.4	89.3	23.6	2.08	2.62	1.35	11.5	
75 x 75 x 5	75	5	10	4.8	7.370	5.69	2.00	38.7	61.2	16.2	2.29	2.88	1.48	7.02	
75 x 75 x 6	75	6	10	4.8	8.760	6.85	2.04	45.7	72.4	19.0	2.28	2.88	1.47	8.38	
75 x 75 x 8	75	8	10	4.8	11.500	9.03	2.13	59.0	93.5	24.5	2.27	2.85	1.46	11.0	
75 x 75 x 9	75	9	10	4.8	12.800	9.96	2.17	65.3	103.0	27.2	2.26	2.84	1.46	12.3	
75 x 75 x 10	75	10	10	4.8	14.100	10.99	2.21	71.3	113.0	29.8	2.25	2.83	1.45	13.5	
75 x 75 x 12	75	12	10	4.8	16.700	13.00	2.29	82.7	130.0	35.0	2.23	2.80	1.45	15.9	

EQUAL ANGLE



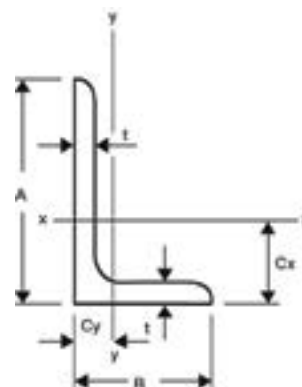
Size	Leg Length	Thick-ness	Corner Radius		Section- al Area	Weight	Centre of Gravity	Moment of Inertia				Radius of Gyration			Modulus of Section
	A-B	t	r ₁	r ₂			Cx-Cy	Jx-Jy	Max Ju	Min Jv	ix-iy	Max i _u	Min i _v	Zx-Zy	
A x B x t	mm	mm	mm	mm	cm ²	kg/m	cm	cm ⁴	cm ⁴	cm ⁴	cm	cm	cm	cm ³	
80 x 80 x 6	80	6	8.5	4	9.327	7.32	2.19	56.4	89.6	23.2	2.46	3.10	1.58	9.7	
80 x 80 x 9	80	9	8.5	6	13.59	10.7	2.30	79.2	126	32.7	2.41	3.04	1.55	13.9	
80 x 80 x 12	80	12	8.5	6	17.76	13.9	2.41	101	160	42.2	2.38	3.00	1.54	18.1	
90 x 90 x 7	90	7	10	5	12.22	9.59	2.46	93.0	148	28.3	2.76	3.48	1.77	14.2	
90 x 90 x 10	90	10	10	7	17.00	13.3	2.58	125	199	51.6	2.71	3.42	1.74	19.5	
90 x 90 x 13	90	13	10	7	21.71	17.0	2.69	156	248	65.3	2.68	3.38	1.73	24.8	
100 x 100 x 7	100	7	10	5	13.62	10.7	2.71	129	205	53.1	3.08	3.88	1.97	17.7	
100 x 100 x 8	100	8	10	5	15.47	12.1	2.75	146	234	58.7	3.07	3.89	1.95	20.1	
100 x 100 x 10	100	10	10	7	19.00	14.9	2.83	175	278	71.9	3.03	3.83	1.95	24.4	
100 x 100 x 13	100	13	10	7	24.31	19.1	2.94	220	348	91.0	3.00	3.78	1.93	31.1	
120 x 120 x 8	120	8	13	4.8	18.80	14.7	3.24	259	411	107	3.71	4.67	2.38	29.5	
120 x 120 x 10	120	10	13	4.8	23.30	18.2	3.32	316	502	130	3.69	4.64	2.37	36.4	
120 x 120 x 12	120	12	13	4.8	27.60	21.6	3.41	371	588	153	3.66	4.62	2.36	43.1	
120 x 120 x 15	120	15	13	4.8	34.00	26.6	3.52	448	710	186	3.63	4.57	2.34	52.8	
130 x 130 x 9	130	9	12	6	22.74	17.9	3.53	366	583	150	4.01	5.06	2.57	38.7	
130 x 130 x 12	130	12	12	8.5	29.76	23.4	3.64	467	743	192	3.96	5.00	2.54	49.9	
130 x 130 x 15	130	15	12	8.5	36.75	28.8	3.76	568	902	234	3.93	4.95	2.53	61.5	
150 x 150 x 11	150	11	14	7	32.00	25.1	4.10	684	1090	280	4.62	5.83	2.96	62.8	
150 x 150 x 12	150	12	14	7	34.77	27.3	4.14	740	1176	304	4.61	5.82	2.96	68.2	
150 x 150 x 15	150	15	14	10	42.74	33.6	4.24	888	1410	365	4.56	5.75	2.92	82.6	
150 x 150 x 19	150	19	14	10	53.38	41.9	4.40	1090	1730	451	4.52	5.69	2.91	103	
175 x 175 x 12	175	12	16	4.8	41.00	31.8	4.77	1208	1920	497	5.43	6.84	3.48	94.9	
175 x 175 x 15	175	15	16	4.8	50.70	39.4	4.89	1474	2342	606	5.39	6.80	4.46	117	
200 x 200 x 15	200	15	17	12	57.75	45.3	5.47	2180	3470	891	6.14	7.75	3.93	150	
200 x 200 x 20	200	20	17	12	76.00	59.7	5.67	2820	4490	1160	6.09	7.68	3.90	197	
200 x 200 x 25	200	25	17	12	93.75	73.6	5.87	3420	5420	1410	6.04	7.61	3.88	242	
200 x 200 x 29	200	29	17	12	107.6	84.5	6.01	3870	6120	1610	5.99	7.54	3.87	276	

UNEQUAL ANGLE



Section Size	Thick-ness t	Unit Wei-ght M	Leg Length		Corner Radius		Section Area A	Centre of Gravity		Moment of Inertia				Radius of Gyration				tan a	Modulus of Section	
			A	B	r ¹	r ²		Cx	Cy	Ix	Iy	Max Iu	Min Iv	ix	iy	Max Iu	Max Iv		Zx	Zy
A x B x t	mm	kg/ m	mm	mm	mm	mm	cm ²	cm	cm	cm ⁴	cm ⁴	cm ⁴	cm ⁴	cm	cm	cm	cm		cm ³	cm ³
65 x 50 x 7	7.0	5.94	65	50	6.5	4.5	7.564	2.07	1.33	30.6	15.6	37.9	8.35	2.01	1.44	2.24	1.05	.571	6.90	4.25
75 x 50 x 6	6.0	5.67	75	50	8.5	4.0	7.227	2.43	1.20	40.4	14.4	46.4	8.33	2.36	1.41	2.53	1.07	.434	7.97	3.78
75 x 50 x 8	8.0	7.35	75	50	8.5	6.0	9.261	2.50	1.27	50.8	17.8	58.1	10.4	2.33	1.38	2.49	1.05	.427	10.2	4.77
75 x 50 x 10	10.0	9.03	75	50	8.5	6.0	11.50	2.58	1.35	61.4	21.4	70.0	12.7	2.31	1.36	2.47	1.05	.421	12.5	5.85
90 x 75 x 6	6.0	7.56	90	75	8.5	4.0	9.626	2.64	1.90	76.9	48.6	101	24.2	2.83	2.25	3.25	1.58	.681	12.1	8.68
90 x 75 x 9	9.0	11.0	90	75	8.5	6.0	14.04	2.75	2.01	109	68.1	143	34.1	2.78	2.20	3.19	1.56	.676	17.4	12.4
90 x 75 x 12	12.0	14.4	90	75	8.5	6.0	18.36	2.87	2.12	139	86.8	182	44.0	2.75	2.17	3.14	1.55	.672	22.6	16.1
100 x 65 x 7	7	8.77	100	65	10	5.0	11.17	3.23	1.52	112	37.6	128	22.0	3.17	1.84	3.39	1.40	.415	16.6	7.55
100 x 65 x 8	8	9.94	100	65	10	4.8	12.70	3.27	1.55	127	42.2	144	24.8	3.16	1.83	3.37	1.40	.414	18.9	8.54
100 x 65 x 9	9	11.00	100	65	10	7.0	14.04	3.31	1.52	138	45.6	157	26.8	3.14	1.80	3.34	1.38	.411	20.6	9.28
100 x 65 x 10	10	12.30	100	65	10	4.8	15.60	3.36	1.63	154	51.0	175	30.1	3.14	1.81	3.35	1.39	.410	23.2	10.5
100 x 65 x 12	12	14.40	100	65	10	7.0	18.36	3.43	1.7	177	58.1	200	34.7	3.11	1.78	3.30	1.37	.405	27.0	12.1
100 x 75 x 7	7	9.32	100	75	10	5.0	11.87	3.06	1.84	118	57.0	144	30.7	3.15	2.19	3.49	1.61	.548	17.0	10.1
100 x 75 x 8	8	10.60	100	75	10	4.8	13.50	3.10	1.87	133	64.1	163	34.6	3.14	2.18	3.47	1.60	.547	19.3	11.4
100 x 75 x 10	10	13.00	100	75	10	7.0	16.50	3.18	1.95	159	76.1	194	41.3	3.11	2.15	3.43	1.58	.543	23.3	13.7
100 x 75 x 12	12	15.40	100	75	10	4.8	19.70	3.27	2.03	189	90.2	230	49.5	3.10	2.14	3.42	1.59	.540	28.0	16.5
100 x 75 x 13	13	16.50	100	75	10	7.0	21.06	3.30	2.06	199	94.8	242	52.2	3.08	2.12	3.39	1.57	.538	29.7	17.4
100 x 80 x 7	7	9.59	100	80	10	5.0	12.22	2.98	2.00	120	68.6	154	35.3	3.14	2.37	3.55	1.70	.625	17.2	11.4
100 x 80 x 10	10	13.30	100	80	10	7.0	17.00	3.10	2.11	163	91.9	207	47.6	3.09	2.33	3.49	1.67	.621	23.6	15.6
100 x 80 x 13	13	17.00	100	80	10	7.0	21.71	3.22	2.23	204	115	258	60.1	3.06	2.30	3.45	1.66	.616	30.1	19.9
100 x 90 x 7	7	10.10	100	90	10	5.0	12.92	2.84	2.35	125	959	177	44.5	3.11	2.73	3.70	1.85	.799	17.5	14.5
100 x 90 x 10	10	14.10	100	90	10	7.0	18.00	2.96	2.46	169	129	238	60.1	3.07	2.68	3.64	1.83	.797	24.0	19.8
100 x 90 x 13	13	18.10	100	90	10	7.0	23.01	3.07	2.58	212	162	298	76.0	3.06	2.65	3.60	1.82	.794	30.6	25.2

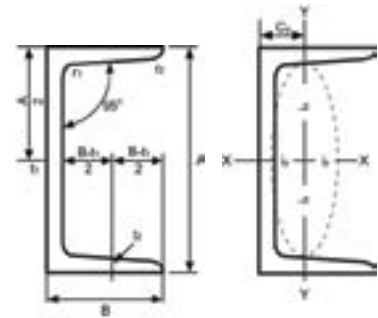
UNEQUAL ANGLE



Section Size	Thick-ness t	Unit Wei-ght M	Leg Length		Corner Radius		Section Area A	Centre of Gravity		Moment of Inertia				Radius of Gyration				tan a	Modulus of Section	
			A	B	r ¹	r ²		Cx	Cy	Ix	Iy	Max Iu	Min Iv	ix	iy	Max Iu	Max Iv		Zx	Zy
A x B x t	mm	kg/ m	mm	mm	mm	mm	cm ²	cm	cm	cm ⁴	cm ⁴	cm ⁴	cm ⁴	cm	cm	cm	cm		cm ³	cm ³
125 x 75 x 6.5	6.5	9.98	125	75	11	4.8	12.70	4.06	1.61	204	56.1	228	34.3	4.01	2.10	4.23	1.64	.360	24.2	9.50
125 x 75 x 7	7	10.70	125	75	10	5.0	13.62	4.10	1.64	219	60.4	243	36.4	4.01	2.11	4.23	1.63	.362	26.1	10.3
125 x 75 x 8	8	12.20	125	75	11	4.8	15.50	4.14	1.68	247	67.6	274	40.9	4.00	2.09	4.20	1.63	.359	29.6	11.6
125 x 75 x 10	10	15.00	125	75	10	7.0	19.00	4.23	1.75	298	80.9	330	49.0	3.86	2.06	4.17	1.61	.357	36.1	14.1
125 x 75 x 12	12	17.80	125	75	11	4.8	22.70	4.31	1.84	354	95.5	391	58.5	3.95	2.05	4.15	1.61	.353	43.2	16.9
125 x 75 x 13	13	19.10	125	75	10	7.0	24.31	4.35	1.87	376	101	414	61.9	3.92	2.04	4.13	1.60	.352	46.1	17.9
150 x 75 x 7	7	12.10	150	75	12	5.0	15.46	5.17	1.50	364	63.1	386	40.5	4.85	2.02	5.00	1.62	.265	37.0	10.5
150 x 75 x 9	9	15.30	150	75	12	8.5	19.44	5.25	1.56	446	75.6	473	48.5	4.79	1.97	4.93	1.58	.260	45.8	12.7
150 x 75 x 10	10	17.00	150	75	11	4.8	21.60	5.32	1.61	501	85.8	532	55.3	4.81	1.99	4.96	1.60	.261	51.8	14.6
150 x 75 x 12	12	20.10	150	75	12	8.5	25.56	5.39	1.68	580	97.4	614	63.3	4.76	1.95	4.90	1.57	.257	60.3	16.7
150 x 75 x 15	15	24.80	150	75	11	4.8	31.60	5.53	1.81	713	120	754	78.8	4.75	1.94	4.88	1.58	.254	75.3	21.0
150 x 90 x 9	9	16.40	150	90	12	6.0	20.94	4.96	2.00	484	133	537	80.2	4.81	2.52	5.06	1.96	.362	48.2	19.0
150 x 90 x 10	10	18.20	150	90	12	4.8	23.20	5.00	2.04	533	146	591	88.3	4.80	2.51	5.05	1.95	.360	53.3	21.0
150 x 90 x 12	12	21.60	150	90	12	8.5	27.36	5.07	2.10	619	168	684	102	4.75	2.47	5.00	1.93	.357	62.3	24.3
150 x 90 x 15	15	26.60	150	90	12	8.5	33.75	5.20	2.22	753	202	831	124	4.72	2.45	4.99	1.92	.353	76.8	29.9
150 x 100 x 9	9	17.10	150	100	12	6.0	21.84	4.77	2.32	502	179	580	101	4.79	2.86	5.15	2.15	.441	49.0	23.3
150 x 100 x 12	12	22.40	150	100	12	8.5	28.56	4.88	2.41	642	229	738	133	4.74	2.83	5.08	2.15	.435	63.4	30.2
150 x 100 x 15	15	27.70	150	100	12	8.5	35.25	5.10	2.53	781	276	896	161	4.71	2.80	5.04	2.14	.432	78.2	37.0
200 x 100 x 10	10	23.00	200	100	15	4.8	29.20	6.93	2.01	1220	210	1290	135	6.46	2.68	6.65	2.15	.263	93.2	26.3
200 x 100 x 12	12	27.30	200	100	15	4.8	34.80	7.03	2.10	1440	247	1530	159	6.43	2.67	6.63	2.14	.262	111	31.3
200 x 100 x 15	15	33.70	200	100	15	4.8	43.00	7.16	2.22	1758	299	1863	194	6.40	2.64	6.58	2.13	.259	137	38.4
200 x 150 x 12	12	32.00	200	150	15	4.8	40.80	6.08	3.61	1652	803	2024	431	6.36	4.44	7.04	3.25	.552	119	70.5
200 x 150 x 15	15	39.60	200	150	15	4.8	50.50	6.21	3.73	2022	979	2475	527	6.33	4.40	7.00	3.23	.550	147	86.9
200 x 150 x 18	18	47.10	200	150	15	4.8	60.00	6.33	3.85	2376	1146	2902	618	6.29	4.37	6.95	3.21	.548	174	103

TAPERED CHANNELS

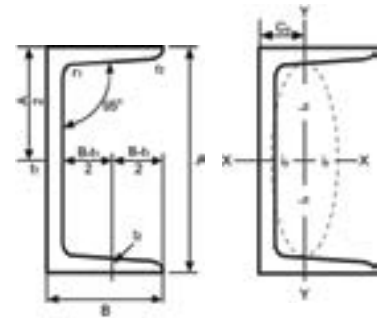
U CHANNELS



Merit Units

Section Size A x B x t	Unit Weight M	Section Depth A	Flange Width B	Web Thickness t ₁	Flange Thickness t ₂	Coner Radius		Section area A	Centre of Gravity C _y	Moment of Inertia		Radius of Gyration		Modulus of Section	
						r ₁	r ₂			I _x	I _y	i _x	i _y	Z _x	Z _y
75 x 40 x 5	6.92	75	40	5.0	7.0	8	4.0	8.818	1.27	75.9	12.4	2.93	1.19	20.2	4.54
100 x 50 x 5	9.36	100	50	5.0	7.5	8	4.0	11.92	1.55	189	26.9	3.98	1.50	37.8	7.82
125 x 65 x 6	13.4	125	65	6.0	8.0	8	4.0	17.11	1.94	425	65.5	4.99	1.96	68	14.4
150 x 75 x 6.5	18.6	150	75	6.5	10.0	10	5.0	23.71	2.31	864	122	6.04	2.27	115	23.6
150 x 75 x 9	24.0	150	75	9.0	12.5	15	7.5	30.49	2.31	1060	151	5.87	2.22	141	29.1
180 x 75 x 7	21.4	180	75	7.0	10.5	11	5.5	27.20	2.15	1380	137	7.13	2.24	154	25.5
180 x 90 x 7.5	27.1	180	90	7.5	12.5	13	6.5	34.57	2.85	1840	258	7.29	2.73	204	42.0
200 x 80 x 7.5	24.6	200	80	7.5	11.0	12	6.0	31.33	2.24	1950	177	7.89	2.38	195	30.8
200 x 90 x 8	30.3	200	90	8.0	13.5	14	7.0	38.65	2.77	2490	286	8.03	2.72	249	45.9
230 x 80 x 8	28.4	230	80	8.0	12.0	13	6.5	36.12	2.15	2900	200	8.96	2.35	252	34.2
230 x 90 x 8.5	33.1	230	90	8.5	13.5	15	7.5	42.14	2.58	3490	303	9.10	2.68	304	47.3
250 x 80 x 8	30.2	250	80	8.0	12.5	14	7.0	38.51	2.11	3630	210	9.71	2.33	291	35.7
250 x 90 x 9	34.6	250	90	9.0	13.0	14	7.0	44.07	2.42	4180	306	9.74	2.64	335	46.5
250 x 90 x 11	40.2	250	90	11.0	14.5	17	8.5	51.17	2.39	4690	342	9.47	2.58	375	51.7
280 x 100 x 9	38.8	280	100	9.0	13.0	14	7.0	49.37	2.64	5930	428	11.0	2.95	423	58.2
280 x 100 x 11.5	48.2	280	100	11.5	16.0	18	9.0	61.37	2.68	7150	515	10.8	2.90	510	70.4
300 x 90 x 9	38.1	300	90	9.0	12.0	14	7.0	48.57	2.23	6440	325	11.5	2.59	429	48.0
300 x 90 x 10	43.8	300	90	10.0	15.5	19	9.5	55.74	2.33	7400	373	11.5	2.59	494	56.0
380 x 100 x 10.5	54.5	380	100	10.5	16.0	18	9.0	69.38	2.41	14500	557	14.5	2.83	762	73.3
380 x 100 x 13	62.0	380	100	13.0	6.5	18	9.0	78.96	2.29	15600	584	14.1	2.72	822	75.8

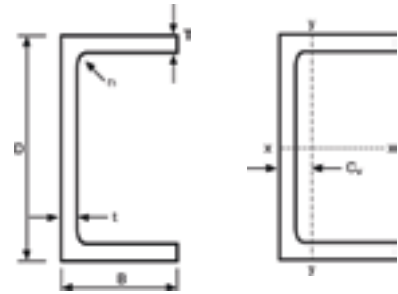
TAPERED CHANNELS



Imperial Units

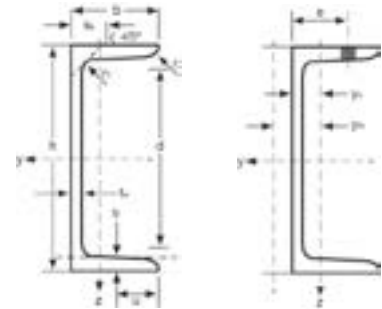
Section Size	Unit Weight M	Section Depth A	Flange Width B	Web Thickness t ₁	Flange Thickness t ₂	Coner Radius		Section area A	Centre of Gravity C _y	Moment of Inertia		Radius of Gyration		Modulus of Section	
						r ₁	r ₂			I _x	I _y	i _x	i _y	Z _x	Z _y
mm (in)	kg/ m	mm	mm	mm	mm	mm	mm	cm ²	cm	cm ⁴	cm ⁴	cm	cm	cm ³	cm ³
127 x 64 (5 x 2½)	14.9	127.00	63.5	9.2	6.4	10.7	2.4	18.98	1.94	482.5	67.23	5.04	1.88	75.99	15.25
152 x 76 (6 x 3)	17.88	152.40	76.2	9.0	6.4	12.2	2.4	22.77	2.21	851.5	113.8	6.12	2.24	111.8	21.05
152 x 89 (6 x 3½)	23.84	152.40	88.9	11.6	7.1	13.7	3.2	30.36	2.86	1166	215.1	6.20	2.66	153.0	35.70
178 x 76 (7 x 3)	20.84	177.80	76.2	10.3	6.6	12.2	3.2	26.54	2.20	1337	134.0	7.10	2.25	150.4	24.72
178 x 89 (7 x 3½)	26.81	177.80	88.9	12.3	7.6	13.7	3.2	34.15	2.76	1753	241.0	7.16	2.66	197.2	39.29
203 x 76 (8 x 3)	23.82	203.20	76.2	11.2	7.1	12.2	3.2	30.34	2.13	1950	151.3	8.02	2.23	192.0	27.59
203 x 89 (8 x 3½)	29.78	203.20	88.9	12.9	8.1	13.7	3.2	37.94	2.65	2491	264.4	8.10	2.64	245.2	42.34
229 x 76 (9 x 3)	26.06	228.60	76.2	11.2	7.6	12.2	3.2	33.20	2.00	2610	158.7	8.87	2.19	228.3	28.22
229 x 89 (9 x 3½)	32.76	228.60	88.9	13.3	8.6	13.7	3.2	41.73	2.53	3387	285.0	9.01	2.61	296.4	44.82
254 x 76 (10 x 3)	28.29	254.00	76.2	10.9	8.1	12.2	3.2	36.03	1.86	3367	162.6	9.67	2.12	265.1	28.21
254 x 89 (10 x 3½)	35.74	254.00	88.9	13.6	9.1	13.7	3.2	45.52	2.42	4448	302.4	9.88	2.58	350.2	46.70
305 x 89 (12 x 3½)	41.69	304.80	88.9	13.7	10.2	13.7	3.2	53.11	2.18	7061	325.4	11.5	2.48	463.3	48.49
305 x 102 (12 x 4)	46.18	304.80	101.6	14.8	10.2	15.2	4.8	58.83	2.66	8214	499.5	11.8	2.91	539.0	66.59
381 x 102 (15 x 4)	55.10	381.00	101.6	16.3	10.4	15.2	4.8	70.19	2.52	14894	579.7	14.60	2.87	781.8	75.86
432 x 102 (17 x 4)	65.54	431.80	101.6	16.8	12.2	15.2	4.8	83.49	2.32	21399	628.6	16.00	2.74	991.1	80.14

PARALLEL FLANGE CHANNELS



Designation		Thickness		Root Radius	Area of Section	Centre of Gravity	Second Moment Of Area		Radius of Gyration		Elastic Modulus	
Size	Mass	Web	Flange				Axis x-x	Axis y-y	Axis x-x	Axis y-y	Axis x-x	Axis y-y
D x B	Per Meter	t	T	r ₁	A	C _y	cm ⁴	cm ⁴	cm	cm	cm ³	cm ³
	kg/ m	mm	mm	mm	cm ²	cm	cm ⁴	cm ⁴	cm	cm	cm ³	cm ³
100 x 50	10.2	5.0	8.5	9	13.0	1.73	208	32.3	4.00	1.58	41.5	9.89
125 x 65	14.8	5.5	9.5	12	18.8	2.25	483	80.0	5.07	2.06	77.3	18.8
150 x 75	17.9	5.5	10.0	12	22.8	2.58	861	131	6.15	2.40	115	26.6
150 x 90	23.9	6.5	12.0	12	30.4	3.30	1162	253	6.18	2.89	155	44.4
180 x 75	20.3	6.0	10.5	12	25.9	2.41	1370	146	7.27	2.38	152	28.8
180 x 90	26.1	6.5	12.5	12	33.2	3.17	1817	277	7.40	2.89	202	47.4
200 x 75	23.4	6.0	12.5	12	29.9	2.48	1963	170	8.11	2.39	196	33.8
200 x 90	29.7	7.0	14.0	12	37.9	3.12	2523	314	8.16	2.89	252	53.4
230 x 75	25.7	6.5	12.5	12	32.7	2.30	2748	181	9.17	2.35	239	34.8
230 x 90	32.2	7.5	14.0	12	41.0	2.92	3518	334	9.27	2.86	306	55.0
250 x 90	35.5	8.0	15.0	12	45.2	2.86	4510	364	9.99	2.84	361	59.3
260 x 75	27.6	7.0	12.0	12	35.1	2.10	3619	185	10.1	2.30	278	34.4
260 x 90	34.8	8.0	14.0	12	44.4	2.74	4728	353	10.3	2.82	364	56.3
300 x 90	41.4	9.0	15.5	12	52.7	2.60	7218	404	11.7	2.77	481	63.1
300 x 100	45.5	9.0	16.5	15	58.0	3.05	8229	568	11.9	3.13	549	81.7
380 x 100	54.0	9.5	17.5	15	68.7	2.79	15030	643	14.8	3.06	791	89.2
430 x 100	64.4	11.0	19.0	15	82.1	2.62	21940	722	16.3	2.97	1020	97.9

UPN



Designation		Dimensions							Values Statiques / Section Properties							
									axe fort y-y strong axis y-y starke Achse y-y				axe faible z-z weak axis z-z schwache Achse z-z			
		Flange Width	Web Thick-ness	Flange Thick-ness	Coner Radius		Section area	Moment of Inertia	Modulus of Section		Radius of Gyration	Moment of Inertia	Modulus of Section		Radius of Gyration	
G kg/ m	h mm	b mm	t _w mm	t _f mm	r ₁ mm	r ₂ mm	A mm ²	I _y mm ⁴	W _{el,y} mm ³	W _{pl,y} mm ³	i _y mm	I _z mm ⁴	W _{el,z} mm ³	W _{pl,z} mm ³	i _z mm	
								x 10 ²	x 10 ⁴	x 10 ³	x 10 ³	x 10	x 10 ⁴	x 10 ³	x 10 ³	x 10
UPN 80*	8.65	80	45	6	8	8	4	11.02	106	26.6	32.3	3.10	19.4	6.38	11.9	1.33
UPN 100*	10.6	100	50	6	8.5	8.5	4.5	13.50	206	41.2	49.0	3.91	29.3	8.49	16.2	1.47
UPN 120	13.4	120	55	7	9	9	4.5	17.00	364	60.7	72.6	4.62	43.2	11.1	21.2	1.59
UPN 140	16.0	140	60	7	10	10	5	20.40	605	86.4	103	5.45	62.7	14.8	28.3	1.75
UPN 160	18.8	160	65	7.5	10.5	10.5	5.5	24.00	925	116	138	6.21	85.3	18.3	35.2	1.89
UPN 180	22.0	180	70	8	11	11	5.5	28.00	1350	150	179	6.95	114	22.4	42.9	2.02
UPN 200	25.3	200	75	8.5	11.5	11.5	6	32.20	1910	191	228	7.70	148	27.0	51.8	2.14
UPN 220	29.4	220	80	9	12.5	12.5	6.5	37.40	2690	245	292	8.48	197	33.6	64.1	2.30
UPN 240	33.2	240	85	9.5	13	13	6.5	42.30	3600	300	358	9.22	248	39.6	75.7	2.42
UPN 260	37.9	260	90	10	14	14	7	48.30	4820	371	442	9.99	317	47.7	91.6	2.56
UPN 280	41.8	280	95	10	15	15	7.5	53.30	6280	448	532	10.9	399	57.2	109	2.74
UPN 300	46.2	300	100	10	16	16	8	58.80	8030	535	632	11.7	495	67.8	130	2.90
UPN 320*	59.5	320	100	14	17.5	17.5	8.75	75.80	10870	679	826	12.1	597	80.6	152	2.81
UPN 350	60.6	350	100	14	16	16	8	77.30	12840	734	918	12.9	570	75.0	143	2.72
UPN 380*	63.1	380	102	13.5	16	16	8	80.40	15760	829	1014	14.0	615	78.7	148	2.77
UPN 400*	71.8	400	110	14	18	18	9	91.50	20350	1020	1240	14.9	846	102	190	3.04

PLATES

Main Specifications for Steel Plates	64
 Plate Weight	65
 Chequered (Floor) Plates	65

PLATES

MAIN SPECIFICATIONS FOR STEEL PLATES

Specifications	Yield strength N/mm²			Tensile strength N/mm²	Elongation min. % L ₀ =5.65√S ₀	Charpy V-notch Temp. (°C) Energy (J)				
	t<16mm	16<t<40mm	t>40mm			20	0	-20	-40	-50
GENERAL STRUCTURES										
ASTM A36	min. 250			400-550	50mm-200mm 23-20	-	-	-	-	-
ASTM A283 Grade A Grade B Grade C Grade D	min. 165 min. 185 min. 205 min. 230			310-415 345-450 380-515 415-550	50mm-200mm 30-27 28-25 25-22 23-20	- - - -	- - - -	- - - -	- - - -	- - - -
ASTM A572 Grade 42 Grade 50 Grade 60 Grade 65	min. 290 min. 345 min. 415 min. 450			415 450 520 550	50mm-200mm 24-20 21-18 18-16 17-15	- - - -	- - - -	- - - -	- - - -	- - - -
EN 10025-2 : 2004 S275JR S275J0 S275J2 S355JR S355J0 S355J2 S355K2	min. 275 min. 275 min. 275 min. 355 min. 355 min. 355 min. 355			410/560 410/560 410/560 470/630 470/630 470/630 470/630	18-23 18-23 18-21 18-22 18-22 18-22 17-20	27 - - 27 - - -	- 27 - - 27 - -	- - 27 - - 27 40	- - - - - - -	- - - - - - -
EN 10025-3 : 2004 S275N/NL S355N/NL S420N/NL S460N/NL	min. 275 min. 355 min. 420 min. 460			370-510 470-630 520-680 550-720	23-24 21-22 18-19 17	- - - -	- - - -	40 40 40 40	- - - -	27 27 27 27
EN 10025-4 : 2004 S275M/ML S355M/ML S420M/ML S460M/ML	min. 275 min. 355 min. 420 min. 460			360-510 450-610 500-660 530-720	24 22 19 17	- - - -	- - - -	40 40 40 40	- - - -	27 27 27 27
JIS G 3101 SS330 SS400 SS490 SS540	205 245 285 400	195 235 275 390	175 215 255 -	330-430 400-510 490-610 min.540	28-21 17-23 15-21 13-17	- - - -	- - - -	- - - -	- - - -	- - - -
JIS G 3106 SM400A, B, C SM490A, B, C SM490YA, YB SM520B, C SM570	245 325 365 365 460	235 315 355 355 450	215 295 335 335 430	400-510 490-610 490-610 520-640 570-720	18-24 17-23 15-21 15-21 16-26	0°C B/C 27/47 B/C 27/47 YB 27 B/C 27/47 - -		-5°C - - - - 47 -	- - - - - -	- - - - -
HULL STRUCTURES										
ABS / LR / BV / DNV Grade A, B, D, E Gr. AH, DH, EH, FH 32 Gr. AH, DH, EH, FH 36 Gr. AH, DH, EH, FH 40	min. 235 min. 315 min. 355 min. 390			400-550 440-590 490-620 510-650	22 22 21 20	For thickness t ≤ 50mm - 27 31 34 41 27 31 34 41 27 31 34 41 -				
PRESSURE VESSELS, GENERAL										
ASTM A285 Grade A Grade B Grade C	min. 165 min. 185 min. 205			310-450 345-485 380-515	50mm-200mm 30-27 28-25 27-23	- - -	- - -	- - -	- - -	- - -
ASTM A516 Grade 60 Grade 65 Grade 70	min. 220 min. 240 min. 260			415-550 450-585 485-620	50mm-200mm 25-21 23-19 21-17	- - -	- - -	- - -	- - -	- - -

PLATES

PLATE WEIGHT

	Plate Size										
	1219 x 2438 (4' x 8')	1219 x 6096 (4' x 20')	1524 x 3048 (5' x 10')	1524 x 6096 (5' x 20')	1524 x 9144 (5' x 30')	1524 x 12192 (5' x 40')	1829 x 6096 (6' x 20')	1829 x 12192 (6' x 40')	2438 x 6096 (8' x 20')	2438 x 9144 (8' x 30')	3048 x 9144 (10' x 30')
6	140	350	219	438	656	875	525	1050	700	1050	1313
8	187	467	292	583	875	1167	700	1400	933	1400	1750
9	210	525	328	656	985	1313	788	1575	1050	1575	1969
10	233	583	365	729	1094	1459	875	1750	1167	1750	2188
12	280	700	438	875	1313	1750	1050	2100	1400	2100	2625
12.7	296	741	463	926	1389	1852	1112	2223	1482	2223	2779
14	327	817	510	1021	1532	2042	1225	2450	1634	2450	3063
15	350	875	547	1094	1641	2187	1313	2626	1750	2625	3282
16	373	933	584	1167	1750	2334	1400	2801	1867	2800	3501
18	420	1050	656	1313	1969	2625	1575	3151	2100	3150	3938
20	467	1167	729	1459	2188	2917	1751	3501	2333	3500	4376
22	513	1283	802	1604	2406	3209	1926	3851	2567	3850	4813
25	583	1458	912	1823	2735	3646	2188	4376	2917	4375	5470
25.4	593	1482	926	1852	2778	3705	2223	4446	2963	4445	5557
28	653	1633	1021	2042	3063	4084	2450	4901	3267	4900	6126
30	700	1750	1094	2188	3282	4376	2626	5251	3500	5250	6564
32	747	1867	1167	2334	3501	4668	2801	5602	3733	5600	7001
36	840	2100	1313	2625	3938	5251	3151	6302	4200	6300	7876
38	887	2217	1386	2771	4157	5542	3326	6652	4433	6650	8314
40	933	2333	1458	2917	4376	5834	3500	7001	4667	7000	8752
45	1050	2625	1641	3282	4923	6564	3938	7877	5250	7875	9846
50	1167	2917	1823	3646	5470	7293	4376	8752	5834	8750	10940
55	1283	3209	2006	4011	6017	8022	4814	9628	6417	9625	12033
60	1400	3500	2188	4376	6564	8752	5251	10503	7000	10500	13127
65	1516	3792	2370	4740	7111	9481	5689	11378	7583	11375	14221
70	1633	4083	2553	5105	7658	10210	6127	12253	8167	12250	15315
75	1750	4375	2735	5470	8240	10939	6564	13129	8752	13125	16409
80	1867	4667	2917	5834	8751	11669	7002	14004	9335	14000	17503
85	1983	4958	3100	6199	9298	12398	7440	14879	9917	14875	18597
90	2100	5250	3282	6564	9845	13127	7877	15754	10502	15750	19691
100	2334	5833	3647	7293	10939	14586	8752	17505	11669	17500	21879
110	2567	6417	4011	8022	12033	16044	9628	19255	12836	19250	24067
120	2801	7000	4367	8752	13127	17503	10503	21006	14003	21000	26255
130	3034	7583	4740	9481	14221	18962	11378	22756	15169	22750	28442
140	3267	8167	5105	10210	15315	20420	12253	24507	16336	24500	30631
150	3501	8750	5470	10940	16409	21879	13129	26257	17503	26250	32819

CHEQUERED (FLOOR) PLATES

WEIGHT TABLE

Merit Units

Unit Weight: kg/m²

Thickness mm	Unit Weight kg/m ²	Width x Length (mm)		
		1219 x 4877	1524 x 3048	1219 x 2438
3.0	25.26	150.2	117.3	75.1
4.5	36.99	220.0	172.0	110.0
6.0	48.77	290.0	227.0	145.0
7.5	60.55	360.2	281.4	180.0
9.0	72.32	430.0	336.0	215.0
12.0	95.87	570.0	445.0	285.0

COLD FORMED HOLLOW SECTIONS *for* GENERAL STRUCTURAL PURPOSES

Main Specifications	68
Square Hollow Sections	69
Rectangular Hollow Sections	71
Circular Hollow Sections	74

HOLLOW SECTIONS

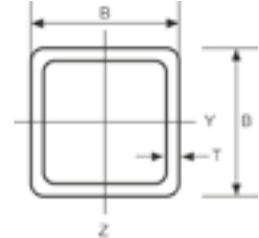
MAIN SPECIFICATIONS

Clarification	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
			N/mm²			CHS	RHS or SHS										
			t < 3mm	3mm ≤ t ≤ 40mm	N/mm²	%	Max	Max	Max	Max	Max	Max	Max	Max	°C	J	
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
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) 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	-	-	-	-	-
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	-	-	-	-	-
Circular Hollow Section	ASTM A-500	Grade A	310		230	25		0.30	-	-	0.045	0.045	-	-	-	-	-
		Grade B	400		290	23		0.30	-	-	0.045	0.045	-	-	-	-	-
		Grade C	425		315	21		0.27	-	1.35	0.035	0.035	-	-	-	-	-
		Grade D	400		250	23		0.30	-	-	0.045	0.045	-	-	-	-	-

HOLLOW SECTIONS

COLD FORMED SQUARE HOLLOW SECTIONS

EN10219 : Part 2

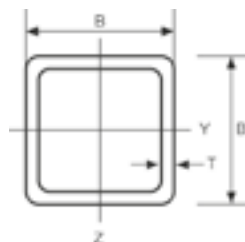


Size	Thickness	Mass	Sectional Area	Moment of Inertia	Radius of Gyration	Elastic Modulus	Plastic Modulus	Torsional Constants		Superficial area / m	Approx. length/ tonne
B x B mm	T mm	M kg/m	A cm ²	I cm ⁴	i cm	W _{el} cm ³	W _{pl} cm ³	I _t cm ⁴	C _t cm ³	A _s m ² /m	m/t
25 x 25	2.0	1.36	1.74	1.48	0.924	1.19	1.47	2.53	1.80	0.093	733
	2.5	1.64	2.09	1.69	0.899	1.35	1.71	2.97	2.07	0.091	610
30 x 30	2.0	1.68	2.14	2.72	1.13	1.81	2.21	4.54	2.75	0.113	596
	2.5	2.03	2.59	3.16	1.10	2.10	2.61	5.40	3.20	0.111	492
	3.0	2.36	3.01	3.50	1.08	2.34	2.96	6.15	3.58	0.110	423
40 x 40	2.0	2.31	2.94	6.94	1.54	3.47	4.13	11.3	5.23	0.153	434
	2.5	2.82	3.59	8.22	1.51	4.11	4.97	13.6	6.21	0.151	355
	3.0	3.30	4.21	9.32	1.49	4.66	5.72	15.8	7.07	0.150	303
	4.0	4.20	5.35	11.1	1.44	5.54	7.01	19.4	8.48	0.146	238
50 x 50	2.5	3.60	4.59	16.9	1.92	6.78	8.07	27.5	10.2	0.191	278
	3.0	4.25	5.41	19.5	1.90	7.79	9.39	32.1	11.8	0.190	236
	4.0	5.45	6.95	23.7	1.85	9.49	11.7	40.4	14.4	0.186	183
	5.0	6.56	8.36	27.0	1.80	10.8	13.7	47.5	16.6	0.183	152
60 x 60	3.0	5.19	6.61	35.1	2.31	11.7	14.0	57.1	17.7	0.230	193
	4.0	6.71	8.55	43.6	2.26	14.5	17.6	72.6	22.0	0.226	149
	5.0	8.13	10.4	50.5	2.21	16.8	20.9	86.4	25.6	0.223	123
	6.0	9.45	12.0	56.1	2.16	18.7	23.7	98.4	28.6	0.219	106
70 x 70	3.0	6.13	7.81	57.5	2.71	16.4	19.4	92.4	24.7	0.270	163
	3.5	7.06	8.99	65.1	2.69	18.6	22.2	106	28.0	0.268	142
	4.0	7.97	10.1	72.1	2.67	20.6	24.8	119	31.1	0.266	126
	5.0	9.70	12.4	84.6	2.62	24.2	29.6	142	36.7	0.263	103
	6.0	11.3	14.4	95.2	2.57	27.2	33.8	163	41.4	0.259	88.3
80 x 80	3.0	7.07	9.01	87.8	3.12	22.0	25.8	140	33.0	0.310	141
	3.5	8.16	10.4	99.8	3.10	25.0	29.5	161	37.6	0.308	123
	4.0	9.22	11.7	111	3.07	27.8	33.1	180	41.8	0.306	108
	5.0	11.3	14.4	131	3.03	32.9	39.7	218	49.7	0.303	88.7
	6.0	13.2	16.8	149	2.98	37.3	45.8	252	56.6	0.299	75.7
90 x 90	3.0	8.01	10.2	127	3.53	28.3	33.0	201	42.5	0.350	125
	3.5	9.26	11.8	145	3.51	32.2	37.9	232	48.5	0.348	108
	4.0	10.5	13.3	162	3.48	36.0	42.6	261	54.2	0.346	95.4
	5.0	12.8	16.4	193	3.43	42.9	51.4	316	64.7	0.343	77.9
	6.0	15.1	19.2	220	3.39	49.0	59.5	368	74.2	0.339	66.2
100 x 100	3.0	8.96	11.4	177	3.94	35.4	41.2	279	53.2	0.390	112
	4.0	11.7	14.9	226	3.89	45.3	53.3	362	68.1	0.386	85.2
	5.0	14.4	18.4	271	3.84	54.2	64.6	441	81.7	0.383	69.4
	6.0	17.0	21.6	311	3.79	62.3	75.1	514	94.1	0.379	58.9
	8.0	21.4	27.2	366	3.67	73.2	91.1	645	114	0.366	46.8
120 x 120	3.0	10.8	13.8	312	4.76	52.1	60.2	488	78.2	0.470	92.3
	4.0	14.2	18.1	402	4.71	67.0	78.3	637	101	0.466	70.2
	5.0	17.5	22.4	485	4.66	80.9	95.4	778	122	0.463	57.0
	6.0	20.7	26.4	562	4.61	93.7	112	913	141	0.459	48.2
	8.0	26.4	33.6	677	4.49	113	138	1163	175	0.446	37.9
	10.0	31.8	40.6	777	4.38	129	162	1376	203	0.437	31.4
140 x 140	4.0	16.8	21.3	652	5.52	93.1	108	1023	140	0.546	59.7
	5.0	20.7	26.4	791	5.48	113	132	1256	170	0.543	48.3
	6.0	24.5	31.2	920	5.43	131	155	1479	198	0.539	40.8
	8.0	31.4	40.0	1127	5.30	161	194	1901	248	0.526	31.8
	10.0	38.1	48.6	1312	5.20	187	230	2274	291	0.517	26.2

HOLLOW SECTIONS

COLD FORMED SQUARE HOLLOW SECTIONS

EN10219:Part 2

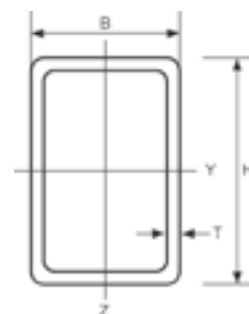


Size	Thickness	Mass	Sectional Area	Moment of Inertia	Radius of Gyration	Elastic Modulus	Plastic Modulus	Torsional Constants		Superficial area / m	Approx. length/ tonne
B x B mm	T mm	M kg/m	A cm ²	I cm ⁴	i cm	W _{el} cm ³	W _{pl} cm ³	I _t cm ⁴	C _t cm ³	A _s m ² /m	m/t
150 x 150	4.0	18.0	22.9	808	5.93	108	125	1265	162	0.586	55.5
	5.0	22.3	28.4	982	5.89	131	153	1554	197	0.583	44.9
	6.0	26.4	33.6	1146	5.84	153	180	1833	230	0.579	37.9
	8.0	33.9	43.2	1412	5.71	188	226	2364	289	0.566	29.5
	10.0	41.3	52.6	1653	5.61	220	269	2839	341	0.557	24.2
160 x 160	4.0	19.3	24.5	987	6.34	123	143	1541	185	0.626	51.9
	5.0	23.8	30.4	1202	6.29	150	175	1896	226	0.623	42.0
	6.0	28.3	36.0	1405	6.25	176	206	2239	264	0.619	35.4
	8.0	36.5	46.4	1741	6.12	218	260	2897	334	0.606	27.4
	10.0	44.4	56.6	2048	6.02	256	311	3490	395	0.597	22.5
180 x 180	5.0	27.0	34.4	1737	7.11	193	224	2724	290	0.703	37.1
	6.0	32.1	40.8	2037	7.06	226	264	3223	340	0.699	31.2
	6.3	33.3	42.4	2096	7.03	233	273	3383	354	0.693	30.0
	8.0	41.5	52.8	2546	6.94	283	336	4189	432	0.686	24.1
	10.0	50.7	64.6	3017	6.84	335	404	5074	515	0.677	19.7
	12.0	58.5	74.5	3322	6.68	369	454	5865	584	0.658	17.1
	12.5	60.5	77.0	3406	6.65	378	467	6050	600	0.656	16.5
200 x 200	5.0	30.1	38.4	2410	7.93	241	279	3763	362	0.783	33.2
	6.0	35.8	45.6	2833	7.88	283	330	4459	426	0.779	27.9
	6.3	37.2	47.4	2922	7.85	292	341	4682	444	0.773	26.8
	8.0	46.5	59.2	3566	7.76	357	421	5815	544	0.766	21.5
	10.0	57.0	72.6	4251	7.65	425	508	7072	651	0.757	17.6
	12.0	66.0	84.1	4730	7.50	473	576	8230	743	0.738	15.2
	12.5	68.3	87.0	4859	7.47	486	594	8502	765	0.736	14.6
250 x 250	6.0	45.2	57.6	5672	9.92	454	524	8843	681	0.979	22.1
	6.3	47.1	60.0	5873	9.89	470	544	9290	711	0.973	21.2
	8.0	59.1	75.2	7229	9.80	578	676	11598	878	0.966	16.9
	10.0	72.7	92.6	8707	9.70	697	822	14197	1062	0.957	13.8
	12.0	84.8	108	9859	9.55	789	944	16691	1226	0.938	11.8
	12.5	88.0	112	10161	9.52	813	975	17283	1266	0.936	11.4
300 x 300	6.0	54.7	69.6	9964	12.0	664	764	15434	997	1.18	18.3
	6.3	57.0	72.6	10342	11.9	689	795	16218	1042	1.17	17.5
	8.0	71.6	91.2	12801	11.8	853	991	20312	1293	1.17	14.0
	10.0	88.4	113	15519	11.7	1035	1211	24966	1572	1.16	11.3
	12.0	104	132	17767	11.6	1184	1402	29514	1829	1.14	9.65
	12.5	108	137	18348	11.6	1223	1451	30601	1892	1.14	9.30
350 x 350	6.0	64.1	81.6	16008	14.0	915	1049	24683	1372	1.38	15.6
	6.3	66.9	85.2	16645	14.0	951	1093	25939	1436	1.37	14.9
	8.0	84.2	107	20681	13.9	1182	1366	32557	1787	1.37	11.9
	10.0	104	133	25189	13.8	1439	1675	40127	2182	1.36	9.61
	12.0	123	156	29054	13.6	1660	1949	47598	2552	1.34	8.16
	12.5	127	162	30045	13.6	1717	2020	49393	2642	1.34	7.86
400 x 400	6.0	73.5	93.6	24104	16.0	1205	1379	37039	1808	1.58	13.6
	6.3	76.8	97.8	25096	16.0	1255	1438	38925	1892	1.57	13.0
	8.0	96.7	123	31269	15.9	1563	1800	48934	2362	1.57	10.3
	10.0	120	153	38216	15.8	1911	2214	60431	2892	1.56	8.35
	12.0	141	180	44319	15.7	2216	2587	71843	3395	1.54	7.07
	12.5	147	187	45877	15.7	2294	2683	74598	3518	1.54	6.81

HOLLOW SECTIONS

COLD FORMED RECTANGULAR HOLLOW SECTIONS

EN10219:Part 2

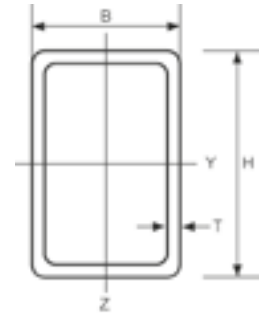


Size	Thick- ness	Mass	Sec- tional Area	Moment of Inertia		Radius of Gyration		Elastic Modulus		Plastic Modulus		Torsional Constants		Superfi- cial area / m	Approx. length/ tonne
H x B mm	T mm	M kg/m	A cm ²	I _{yy} cm ⁴	I _{zz} cm ⁴	i _{yy} cm	i _{zz} cm	W _{el,yy} cm ³	W _{el,zz} cm ³	W _{pl,yy} cm ³	W _{pl,zz} cm ³	I _t cm ⁴	C _t cm ³	A _s m ² /m	m/t
50 x 25	2.0	2.15	2.74	8.38	2.81	1.75	1.01	3.35	2.25	4.26	2.62	7.06	3.92	0.143	465
	2.5	2.62	3.34	9.89	3.28	1.72	0.991	3.95	2.62	5.11	3.12	8.43	4.60	0.141	382
	3.0	3.07	3.91	11.2	3.67	1.69	0.969	4.47	2.93	5.86	3.56	9.64	5.18	0.140	326
50 x 30	2.0	2.31	2.94	9.54	4.29	1.80	1.21	3.81	2.86	4.74	3.33	9.77	4.84	0.153	434
	2.5	2.82	3.59	11.3	5.05	1.77	1.19	4.52	3.37	5.70	3.98	11.7	5.72	0.151	355
	3.0	3.30	4.21	12.8	5.70	1.75	1.16	5.13	3.80	6.57	4.58	13.5	6.49	0.150	303
	4.0	4.20	5.35	15.3	6.69	1.69	1.12	6.10	4.46	8.05	5.58	16.5	7.71	0.146	238
60 x 40	2.5	3.60	4.59	22.1	11.7	2.19	1.60	7.36	5.87	9.06	6.84	25.1	9.72	0.191	278
	3.0	4.25	5.41	25.4	13.4	2.17	1.58	8.46	6.72	10.5	7.94	29.3	11.2	0.190	236
	4.0	5.45	6.95	31.0	16.3	2.11	1.53	10.3	8.14	13.2	9.89	36.7	13.7	0.186	183
	5.0	6.56	8.36	35.3	18.4	2.06	1.48	11.8	9.21	15.4	11.5	42.8	15.6	0.183	152
70 x 40	3.0	4.72	6.01	37.3	15.5	2.49	1.61	10.7	7.75	13.4	9.05	36.5	13.2	0.210	212
	4.0	6.08	7.75	46.0	18.9	2.44	1.56	13.1	9.44	16.8	11.3	45.8	16.2	0.206	164
	5.0	7.34	9.36	52.9	21.5	2.38	1.52	15.1	10.8	19.8	13.3	53.8	18.7	0.203	136
70 x 50	3.0	5.19	6.61	44.1	26.1	2.58	1.99	12.6	10.4	15.4	12.2	53.6	17.1	0.230	193
	4.0	6.71	8.55	54.7	32.2	2.53	1.94	15.6	12.9	19.5	15.4	68.1	21.2	0.226	149
	5.0	8.13	10.4	63.5	37.2	2.48	1.90	18.1	14.9	23.1	18.2	80.8	24.6	0.223	123
80 x 40	3.0	5.19	6.61	52.3	17.6	2.81	1.63	13.1	8.78	16.5	10.2	43.9	15.3	0.230	193
	4.0	6.71	8.55	64.8	21.5	2.75	1.59	16.2	10.7	20.9	12.8	55.2	18.8	0.226	149
	5.0	8.13	10.4	75.1	24.6	2.69	1.54	18.8	12.3	24.7	15.0	65.0	21.7	0.223	123
80 x 50	3.0	5.66	7.21	61.1	29.4	2.91	2.02	15.3	11.8	18.8	13.6	65.0	19.7	0.250	177
	4.0	7.34	9.35	76.4	36.5	2.86	1.98	19.1	14.6	24.0	17.2	82.7	24.6	0.246	136
	5.0	8.91	11.4	89.2	42.3	2.80	1.93	22.3	16.9	28.5	20.5	98.4	28.7	0.243	112
80 x 60	3.0	6.13	7.81	70.0	44.9	3.00	2.40	17.5	15.0	21.2	17.4	88.3	24.1	0.270	163
	3.5	7.06	8.99	79.3	50.7	2.97	2.37	19.8	16.9	24.1	19.8	101	27.3	0.268	142
	4.0	7.97	10.1	87.9	56.1	2.94	2.35	22.0	18.7	27.0	22.1	113	30.3	0.266	126
	5.0	9.70	12.4	103	65.7	2.89	2.31	25.8	21.9	32.2	26.4	136	35.7	0.263	103
90 x 50	3.0	6.13	7.81	81.9	32.7	3.24	2.05	18.2	13.1	22.6	15.0	76.7	22.4	0.270	163
	4.0	7.97	10.1	103	40.7	3.18	2.00	22.8	16.3	28.8	19.1	97.7	28.0	0.266	126
	5.0	9.70	12.4	121	47.4	3.12	1.96	26.8	18.9	34.4	22.7	116	32.7	0.263	103
100 x 40	3.0	6.13	7.81	92.3	21.7	3.44	1.67	18.5	10.8	23.7	12.4	59.0	19.4	0.270	163
	4.0	7.97	10.1	116	26.7	3.38	1.62	23.1	13.3	30.3	15.7	74.5	24.0	0.266	126
	5.0	9.70	12.4	136	30.8	3.31	1.58	27.1	15.4	36.1	18.5	87.9	27.9	0.263	103
100 x 50	3.0	6.60	8.41	106	36.1	3.56	2.07	21.3	14.4	26.7	16.4	88.6	25.0	0.290	152
	4.0	8.59	10.9	134	44.9	3.50	2.03	26.8	18.0	34.1	20.9	113	31.3	0.286	116
	5.0	10.5	13.4	158	52.5	3.44	1.98	31.6	21.0	40.8	25.0	135	36.8	0.283	95.4
	6.0	12.3	15.6	179	58.7	3.38	1.94	35.8	23.5	46.9	28.5	154	41.4	0.279	81.5
100 x 60	3.0	7.07	9.01	121	54.6	3.66	2.46	24.1	18.2	29.6	20.8	122	30.6	0.310	141
	3.5	8.16	10.4	137	61.9	3.63	2.44	27.4	20.6	33.8	23.8	139	34.8	0.308	123
	4.0	9.22	11.7	153	68.7	3.60	2.42	30.5	22.9	37.9	26.6	156	38.7	0.306	108
	5.0	11.3	14.4	181	80.8	3.55	2.37	36.2	26.9	45.6	31.9	188	45.8	0.303	88.7
	6.0	13.2	16.8	205	91.2	3.49	2.33	41.1	30.4	52.5	36.6	216	51.9	0.299	75.7
100 x 80	3.0	8.01	10.2	149	106	3.82	3.22	29.8	26.4	35.4	30.4	196	41.9	0.350	125
	4.0	10.5	13.3	189	134	3.77	3.17	37.9	33.5	45.6	39.2	254	53.4	0.346	95.4
	5.0	12.8	16.4	226	160	3.72	3.12	45.2	39.9	55.1	47.2	308	63.7	0.343	77.9
	6.0	15.1	19.2	258	182	3.67	3.08	51.7	45.5	63.8	54.7	357	73.0	0.339	66.2

HOLLOW SECTIONS

COLD FORMED RECTANGULAR HOLLOW SECTIONS

EN10219:Part 2

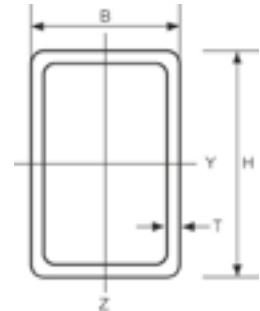


Size	Thick- ness	Mass	Sec- tional Area	Moment of Inertia		Radius of Gyration		Elastic Modulus		Plastic Modulus		Torsional Constants		Superfi- cial area / m	Approx. length/ tonne
H x B mm	T mm	M kg/m	A cm ²	I _{yy} cm ⁴	I _{zz} cm ⁴	i _{yy} cm	i _{zz} cm	W _{el,yy} cm ³	W _{el,zz} cm ³	W _{pl,yy} cm ³	W _{pl,zz} cm ³	I _t cm ⁴	C _t cm ³	A _s m ² /m	m/t
120 x 40	3.0	7.07	9.01	148	25.8	4.05	1.69	24.7	12.9	32.2	14.6	74.6	23.5	0.310	141
	4.0	9.22	11.7	187	31.9	3.99	1.65	31.1	15.9	41.2	18.5	94.2	29.2	0.306	108
	5.0	11.3	14.4	221	36.9	3.92	1.60	36.8	18.5	49.4	22.0	111	34.1	0.303	88.7
120 x 60	3.0	8.01	10.2	189	64.4	4.30	2.51	31.5	21.5	39.2	24.2	156	37.1	0.350	125
	3.5	9.26	11.8	216	73.1	4.28	2.49	35.9	24.4	44.9	27.7	179	42.2	0.348	108
	4.0	10.5	13.3	241	81.2	4.25	2.47	40.1	27.1	50.5	31.1	201	47.0	0.346	95.4
	5.0	12.8	16.4	287	96.0	4.19	2.42	47.8	32.0	60.9	37.4	242	55.8	0.343	77.9
	6.0	15.1	19.2	328	109	4.13	2.38	54.7	36.3	70.6	43.1	280	63.6	0.339	66.2
120 x 80	3.0	8.96	11.4	230	123	4.49	3.29	38.4	30.9	46.2	35.0	255	50.8	0.390	112
	4.0	11.7	14.9	295	157	4.44	3.24	49.1	39.3	59.8	45.2	331	64.9	0.386	85.2
	5.0	14.4	18.4	353	188	4.39	3.20	58.9	46.9	72.4	54.7	402	77.8	0.383	69.4
	6.0	17.0	21.6	406	215	4.33	3.15	67.7	53.8	84.3	63.5	469	89.4	0.379	58.9
	8.0	21.4	27.2	476	252	4.18	3.04	79.3	62.9	102	76.9	584	108	0.366	46.8
140 x 80	3.0	9.90	12.6	334	141	5.15	3.35	47.8	35.3	58.2	39.6	317	59.7	0.430	101
	4.0	13.0	16.5	430	180	5.10	3.30	61.4	45.1	75.5	51.3	412	76.5	0.426	77.0
	5.0	16.0	20.4	517	216	5.04	3.26	73.9	54.0	91.8	62.2	501	91.8	0.423	62.6
	6.0	18.9	24.0	597	248	4.98	3.21	85.3	62.0	107	72.4	584	106	0.419	53.0
	8.0	23.9	30.4	708	293	4.82	3.10	101	73.3	131	88.4	731	129	0.406	41.8
	10.0	28.7	36.6	804	330	4.69	3.01	115	82.6	152	103	851	147	0.397	34.8
150 x 100	3.0	11.3	14.4	461	248	5.65	4.15	61.4	49.5	73.5	55.8	507	81.4	0.490	88.4
	4.0	14.9	18.9	595	319	5.60	4.10	79.3	63.7	95.7	72.5	662	105	0.486	67.2
	5.0	18.3	23.4	719	384	5.55	4.05	95.9	76.8	117	88.3	809	127	0.483	54.5
	6.0	21.7	27.6	835	444	5.50	4.01	111	88.8	137	103	948	147	0.479	46.1
	8.0	27.7	35.2	1008	536	5.35	3.90	134	107	169	128	1206	182	0.466	36.1
	10.0	33.4	42.6	1162	614	5.22	3.80	155	123	199	150	1426	211	0.457	29.9
160 x 80	3.0	10.8	13.8	464	159	5.80	3.39	58.0	39.8	71.4	44.3	380	68.6	0.470	92.3
	4.0	14.2	18.1	598	204	5.74	3.35	74.7	50.9	92.9	57.4	494	88.0	0.466	70.2
	5.0	17.5	22.4	722	244	5.68	3.30	90.2	61.0	113	69.7	601	106	0.463	57.0
	6.0	20.7	26.4	836	281	5.62	3.26	105	70.2	132	81.3	702	122	0.459	48.2
	8.0	26.4	33.6	1001	335	5.46	3.16	125	83.7	163	100	882	150	0.446	37.9
	10.0	31.8	40.6	1146	380	5.32	3.06	143	95.0	191	117	1031	172	0.437	31.4
180 x 80	3.0	11.8	15.0	621	177	6.43	3.43	69.0	44.2	85.8	48.9	445	77.5	0.510	84.9
	4.0	15.5	19.7	802	227	6.37	3.39	89.1	56.7	112	63.5	578	99.6	0.506	64.5
	5.0	19.1	24.4	971	272	6.31	3.34	108	68.1	137	77.2	704	120	0.503	52.3
	6.0	22.6	28.8	1128	314	6.25	3.30	125	78.5	160	90.2	823	139	0.499	44.2
	8.0	28.9	36.8	1362	377	6.08	3.20	151	94.1	198	111	1036	170	0.486	34.6
	10.0	35.0	44.6	1570	429	5.94	3.10	174	107	234	131	1214	196	0.477	28.6
180 x 100	4.0	16.8	21.3	926	374	6.59	4.18	103	74.8	126	84.0	854	127	0.546	59.7
	5.0	20.7	26.4	1124	452	6.53	4.14	125	90.4	154	103	1045	154	0.543	48.3
	6.0	24.5	31.2	1310	524	6.48	4.10	146	105	181	120	1227	179	0.539	40.8
	8.0	31.4	40.0	1598	637	6.32	3.99	178	127	226	150	1565	222	0.526	31.8
	10.0	38.1	48.6	1859	736	6.19	3.89	207	147	268	177	1859	260	0.517	26.2
200 x 100	4.0	18.0	22.9	1200	411	7.23	4.23	120	82.2	148	91.7	985	142	0.586	55.5
	5.0	22.3	28.4	1459	497	7.17	4.19	146	99.4	181	112	1206	172	0.583	44.9
	6.0	26.4	33.6	1703	577	7.12	4.14	170	115	213	132	1417	200	0.579	37.9
	8.0	33.9	43.2	2091	705	6.95	4.04	209	141	267	165	1811	250	0.566	29.5
	10.0	41.3	52.6	2444	818	6.82	3.94	244	164	318	195	2154	292	0.557	24.2

HOLLOW SECTIONS

COLD FORMED RECTANGULAR HOLLOW SECTIONS

EN10219:Part 2

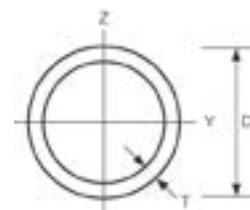


Size	Thick- ness	Mass	Sec- tional Area	Moment of Inertia		Radius of Gyration		Elastic Modulus		Plastic Modulus		Torsional Constants		Superfi- cial area / m	Approx. length/ tonne
H x B mm	T mm	M kg/m	A cm ²	I _{yy} cm ⁴	I _{zz} cm ⁴	i _{yy} cm	i _{zz} cm	W _{el,yy} cm ³	W _{el,zz} cm ³	W _{pl,yy} cm ³	W _{pl,zz} cm ³	I _t cm ⁴	C _t cm ³	A _s m ² /m	m/t
200 x 120	4.0	19.3	24.5	1353	618	7.43	5.02	135	103	164	115	1345	172	0.626	51.9
	5.0	23.8	30.4	1649	750	7.37	4.97	165	125	201	141	1652	210	0.623	42.0
	6.0	28.3	36.0	1929	874	7.32	4.93	193	146	237	166	1947	245	0.619	35.4
	8.0	36.5	46.4	2386	1079	7.17	4.82	239	180	298	209	2507	308	0.606	27.4
	10.0	44.4	56.6	2806	1262	7.04	4.72	281	210	356	250	3007	364	0.597	22.5
200 x 150	4.0	21.2	26.9	1584	1021	7.67	6.16	158	136	187	154	1942	219	0.686	47.3
	5.0	26.2	33.4	1935	1245	7.62	6.11	193	166	230	189	2391	267	0.683	38.2
	6.0	31.1	39.6	2268	1457	7.56	6.06	227	194	271	223	2826	313	0.679	32.1
	8.0	40.2	51.2	2829	1816	7.43	5.95	283	242	344	283	3665	396	0.666	24.9
	10.0	49.1	62.6	3348	2143	7.31	5.85	335	286	413	339	4428	471	0.657	20.4
250 x 150	5.0	30.1	38.4	3304	1508	9.28	6.27	264	201	320	225	3285	337	0.783	33.2
	6.0	35.8	45.6	3886	1768	9.23	6.23	311	236	378	266	3886	396	0.779	27.9
	6.3	37.2	47.4	4001	1825	9.18	6.20	320	243	391	276	4078	412	0.773	26.8
	8.0	46.5	59.2	4886	2219	9.08	6.12	391	296	482	340	5050	504	0.766	21.5
	10.0	57.0	72.6	5825	2634	8.96	6.02	466	351	582	409	6121	602	0.757	17.6
	12.0	66.0	84.1	6458	2925	8.77	5.90	517	390	658	463	7088	684	0.738	15.2
	12.5	68.3	87.0	6633	3002	8.73	5.87	531	400	678	477	7315	704	0.736	14.6
300 x 100	6.0	35.8	45.6	4777	842	10.2	4.30	318	168	411	188	2403	306	0.779	27.9
	8.0	46.5	59.2	5978	1045	10.0	4.20	399	209	523	238	3080	385	0.766	21.5
	10.0	57.0	72.6	7106	1224	9.90	4.11	474	245	631	285	3681	455	0.757	17.6
300 x 200	6.0	45.2	57.6	7370	3962	11.3	8.29	491	396	588	446	8115	651	0.979	22.1
	6.3	47.1	60.0	7624	4104	11.3	8.27	508	410	610	463	8524	680	0.973	21.2
	8.0	59.1	75.2	9389	5042	11.2	8.19	626	504	757	574	10627	838	0.966	16.9
	10.0	72.7	92.6	11313	6058	11.1	8.09	754	606	921	698	12987	1012	0.957	13.8
	12.0	84.8	108	12788	6854	10.9	7.96	853	685	1056	801	15236	1167	0.938	11.8
	12.5	88.0	112	13179	7060	10.8	7.94	879	706	1091	828	15768	1204	0.936	11.4
400 x 200	6.0	54.7	69.6	14789	5092	14.6	8.55	739	509	906	562	12069	877	1.18	18.3
	6.3	57.0	72.6	15330	5286	14.5	8.53	766	529	942	585	12673	916	1.17	17.5
	8.0	71.6	91.2	18974	6517	14.4	8.45	949	652	1173	728	15820	1133	1.17	14.0
	10.0	88.4	113	23003	7864	14.3	8.36	1150	786	1434	888	19368	1373	1.16	11.3
	12.0	104	132	26248	8977	14.1	8.24	1312	898	1656	1027	22782	1591	1.14	9.65
	12.5	108	137	27100	9260	14.1	8.22	1355	926	1714	1062	23594	1644	1.14	9.30
450 x 250	6.0	64.1	81.6	22724	9245	16.7	10.6	1010	740	1221	817	20687	1253	1.38	15.6
	6.3	66.9	85.2	23606	9615	16.6	10.6	1049	769	1271	851	21730	1310	1.37	14.9
	8.0	84.2	107	29335	11916	16.5	10.5	1304	953	1588	1063	27222	1628	1.37	11.9
	10.0	104	133	35737	14470	16.4	10.4	1588	1158	1948	1302	33473	1983	1.36	9.61
	12.0	123	156	41137	16662	16.2	10.3	1828	1333	2264	1515	39591	2314	1.34	8.16
	12.5	127	162	42536	17219	16.2	10.3	1890	1377	2346	1569	41057	2394	1.34	7.86
500 x 300	6.0	73.5	93.6	33012	15151	18.8	12.7	1320	1010	1581	1117	32420	1688	1.58	13.6
	6.3	76.8	97.8	34346	15777	18.7	12.7	1374	1052	1647	1165	34062	1766	1.57	13.0
	8.0	96.7	123	42805	19624	18.6	12.6	1712	1308	2063	1458	42767	2202	1.57	10.3
	10.0	120	153	52328	23933	18.5	12.5	2093	1596	2537	1791	52736	2693	1.56	8.35
	12.0	141	180	60603	27726	18.3	12.4	2424	1848	2962	2093	62581	3156	1.54	7.07
	12.5	147	187	62731	28687	18.3	12.4	2509	1912	3071	2169	64954	3269	1.54	6.81

HOLLOW SECTIONS

COLD FORMED CIRCULAR HOLLOW SECTIONS

EN10219:Part 2

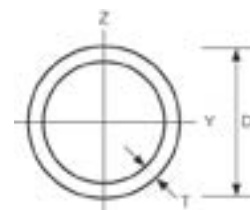


Outside Diameter	Thickness	Mass	Sectional Area	Moment of Inertia	Radius of Gyration	Elastic Modulus	Plastic Modulus	Torsional Constants		Superficial area / m	Approx. length/ tonne
D mm	T mm	M kg/m	A cm ²	I cm ⁴	i cm	W _{el} cm ³	W _{pl} cm ³	I _t cm ⁴	C _t cm ³	A _s m ² /m	m/t
33.7	3.0	2.27	2.89	3.44	1.09	2.04	2.84	6.88	4.08	0.106	440
42.4	3.0	2.91	3.71	7.25	1.40	3.42	4.67	14.5	6.84	0.133	343
48.3	3.0	3.35	4.27	11.0	1.61	4.55	6.17	22.0	9.11	0.152	298
	4.0	4.37	5.57	13.8	1.57	5.70	7.87	27.5	11.4	0.152	229
60.3	3.0	4.24	5.40	22.2	2.03	7.37	9.86	44.4	14.7	0.189	236
	4.0	5.55	7.07	28.2	2.00	9.34	12.7	56.3	18.7	0.189	180
76.1	3.0	5.41	6.89	46.1	2.59	12.1	16.0	92.2	24.2	0.239	185
	4.0	7.11	9.06	59.1	2.55	15.5	20.8	118	31.0	0.239	141
88.9	3.0	6.36	8.10	74.8	3.04	16.8	22.1	150	33.6	0.279	157
	3.5	7.37	9.39	85.7	3.02	19.3	25.5	171	38.6	0.279	136
	4.0	8.38	10.7	96.3	3.00	21.7	28.9	193	43.3	0.279	119
	5.0	10.3	13.2	116	2.97	26.2	35.2	233	52.4	0.279	96.7
	6.0	12.27	15.63	134.9	2.94	30.4	41.3	267	60.7	0.279	81.5
114.3	3.0	8.23	10.5	163	3.94	28.4	37.2	325	56.9	0.359	121
	3.5	9.56	12.2	187	3.92	32.7	43.0	374	65.5	0.359	105
	4.0	10.9	13.9	211	3.90	36.9	48.7	422	73.9	0.359	91.9
	5.0	13.5	17.2	257	3.87	45.0	59.8	514	89.9	0.359	74.2
	6.0	16.0	20.4	300	3.83	52.5	70.4	600	105	0.359	62.4
139.7	3.0	10.1	12.9	301	4.83	43.1	56.1	602	86.2	0.439	98.9
	4.0	13.4	17.1	393	4.80	56.2	73.7	786	112	0.439	74.7
	5.0	16.6	21.2	481	4.77	68.8	90.8	961	138	0.439	60.2
	6.0	19.8	25.2	564	4.73	80.8	107	1129	162	0.439	50.5
	8.0	26.0	33.1	720	4.66	103	139	1441	206	0.439	38.5
	10.0	32.0	40.7	862	4.60	123	169	1724	247	0.439	31.3
168.3	4.0	16.2	20.6	697	5.81	82.8	108	1394	166	0.529	61.7
	4.5	18.2	23.2	777	5.79	92.4	121	1554	185	0.529	55.0
	5.0	20.1	25.7	856	5.78	102	133	1712	203	0.529	49.7
	6.0	24.0	30.6	1009	5.74	120	158	2017	240	0.529	41.6
	8.0	31.6	40.3	1297	5.67	154	206	2595	308	0.529	31.6
	10.0	39.0	49.7	1564	5.61	186	251	3128	372	0.529	25.6
	12.5	48.0	61.2	1868	5.53	222	304	3737	444	0.529	20.8
193.7	4.0	18.7	23.8	1073	6.71	111	144	2146	222	0.609	53.4
	4.5	21.0	26.7	1198	6.69	124	161	2395	247	0.609	47.6
	5.0	23.3	29.6	1320	6.67	136	178	2640	273	0.609	43.0
	6.0	27.8	35.4	1560	6.64	161	211	3119	322	0.609	36.0
	8.0	36.6	46.7	2016	6.57	208	276	4031	416	0.609	27.3
	10.0	45.3	57.7	2442	6.50	252	338	4883	504	0.609	22.1
	12.5	55.9	71.2	2934	6.42	303	411	5869	606	0.609	17.9
219.1	4.5	23.8	30.3	1747	7.59	159	207	3494	319	0.688	42.0
	5.0	26.4	33.6	1928	7.57	176	229	3856	352	0.688	37.9
	6.0	31.5	40.2	2282	7.54	208	273	4564	417	0.688	31.7
	8.0	41.6	53.1	2960	7.47	270	357	5919	540	0.688	24.0
	10.0	51.6	65.7	3598	7.40	328	438	7197	657	0.688	19.4
	12.0	61.3	78.1	4200	7.33	383	515	8400	767	0.688	16.3
	12.5	63.7	81.1	4345	7.32	397	534	8689	793	0.688	15.7
	16.0	80.1	102	5297	7.20	483	661	10593	967	0.688	12.5

HOLLOW SECTIONS

COLD FORMED CIRCULAR HOLLOW SECTIONS

EN10219:Part 2



Outside Diameter	Thickness	Mass	Sectional Area	Moment of Inertia	Radius of Gyration	Elastic Modulus	Plastic Modulus	Torsional Constants		Superficial area / m	Approx. length/ tonne
D mm	T mm	M kg/m	A cm ²	I cm ⁴	i cm	W _{el} cm ³	W _{pl} cm ³	I _t cm ⁴	C _t cm ³	A _s m ² /m	m/t
244.5	5.0	29.5	37.6	2699	8.47	221	287	5397	441	0.768	33.9
	6.0	35.3	45.0	3199	8.43	262	341	6397	523	0.768	28.3
	8.0	46.7	59.4	4160	8.37	340	448	8321	681	0.768	21.4
	10.0	57.8	73.7	5073	8.30	415	550	10146	830	0.768	17.3
	12.0	68.8	87.8	5938	8.23	486	649	11877	972	0.768	14.5
	12.5	71.5	91.1	6147	8.21	503	673	12295	1006	0.768	14.0
	16.0	90.2	115	7533	8.10	616	837	15066	1232	0.768	11.1
273.0	4.0	26.5	33.8	3058	9.51	224	289	6116	448	0.858	37.7
	4.5	29.8	38.0	3422	9.49	251	324	6843	501	0.858	33.6
	5.0	33.0	42.1	3781	9.48	277	359	7562	554	0.858	30.3
	6.0	39.5	50.3	4487	9.44	329	428	8974	657	0.858	25.3
	8.0	52.3	66.6	5852	9.37	429	562	11703	857	0.858	19.1
	10.0	64.9	82.6	7154	9.31	524	692	14308	1048	0.858	15.4
	12.0	77.2	98.4	8396	9.24	615	818	16792	1230	0.858	12.9
	12.5	80.3	102	8697	9.22	637	849	17395	1274	0.858	12.5
	16.0	101	129	10707	9.10	784	1058	21414	1569	0.858	9.86
323.9	5.0	39.3	50.1	6369	11.3	393	509	12739	787	1.02	25.4
	6.0	47.0	59.9	7572	11.2	468	606	15145	935	1.02	21.3
	8.0	62.3	79.4	9910	11.2	612	799	19820	1224	1.02	16.0
	10.0	77.4	98.6	12158	11.1	751	986	24317	1501	1.02	12.9
	12.0	92.3	118	14320	11.0	884	1168	28639	1768	1.02	10.8
	12.5	96.0	122	14847	11.0	917	1213	29693	1833	1.02	10.4
	16.0	121	155	18390	10.9	1136	1518	36780	2271	1.02	8.23
355.6	5.0	43.2	55.1	8464	12.4	476	615	16927	952	1.12	23.1
	6.0	51.7	65.9	10071	12.4	566	733	20141	1133	1.12	19.3
	8.0	68.6	87.4	13201	12.3	742	967	26403	1485	1.12	14.6
	10.0	85.2	109	16223	12.2	912	1195	32447	1825	1.12	11.7
	12.0	102	130	19139	12.2	1076	1417	38279	2153	1.12	9.83
	12.5	106	135	19852	12.1	1117	1472	39704	2233	1.12	9.45
	16.0	134	171	24663	12.0	1387	1847	49326	2774	1.12	7.46
406.4	6.0	59.2	75.5	15128	14.2	745	962	30257	1489	1.28	16.9
	8.0	78.6	100	19874	14.1	978	1270	39748	1956	1.28	12.7
	10.0	97.8	125	24476	14.0	1205	1572	48952	2409	1.28	10.2
	12.0	117	149	28937	14.0	1424	1867	57874	2848	1.28	8.57
	12.5	121	155	30031	13.9	1478	1940	60061	2956	1.28	8.24
	16.0	154	196	37449	13.8	1843	2440	74898	3686	1.28	6.49
457.0	6.0	66.7	85.0	21618	15.9	946	1220	43236	1892	1.44	15.0
	8.0	88.6	113	28446	15.9	1245	1613	56893	2490	1.44	11.3
	10.0	110	140	35091	15.8	1536	1998	70183	3071	1.44	9.07
	12.0	132	168	41556	15.7	1819	2377	83113	3637	1.44	7.59
	12.5	137	175	43145	15.7	1888	2470	86290	3776	1.44	7.30
	16.0	174	222	53959	15.6	2361	3113	107919	4723	1.44	5.75
508.0	6.0	74.3	94.6	29812	17.7	1174	1512	59623	2347	1.60	13.5
	8.0	98.6	126	39280	17.7	1546	2000	78560	3093	1.60	10.1
	10.0	123	156	48520	17.6	1910	2480	97040	3820	1.60	8.14
	12.0	147	187	57536	17.5	2265	2953	115072	4530	1.60	6.81
	12.5	153	195	59755	17.5	2353	3070	119511	4705	1.60	6.55
	16.0	194	247	74909	17.4	2949	3874	149818	5898	1.60	5.15

STEEL PIPES

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WELDED STEEL PIPE

IN ACCORDANCE TO BS 1387: 1985

GENERAL INFORMATION ON BS 1387: 1985 WELDED STEEL TUBE

Descriptions	Maruichi BS 1387: 1985 welded steel tube is produced in three thickness classes-Light, Medium and Heavy-and available in black finish or hot dipped galvanized finish in 6-meter uniform mill lengths.		
Applications	For ordinary conveyance of steam, gas, water, etc.		
End finish & 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 specification.		
Identification Marking	Tubes are marked by color bands about 50mm wide, painted about 300mm from each end, as follows:		
	Light Tubes-Brown	Medium Tubes-Blue	Heavy Tubes-Red

PERTINENT EXCERPTS FROM 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 as given in table below:			
	Tensile Strength (N/mm ²)		320 to 460	
	Yield Strength (N/mm ²)		195min	
	Elongation on Gauge Length (L _e)		5.60 So (%): 20 min	
Tolerances on Dimensions & Mass	Outside Diameter		As shown in following tables	
	Wall Thickness		Light tubes Medium and Heavy tubes	-8% + not specified -10% +not specified
	Mass		The mean consignment mass for quantities of 150m & over of one size shall not deviate by more than ± 4% from the mass of consignment calculated from the mass given in tables as appropriate. No single tube shall deviate by more than +10%, -8% from the mass given in table as appropriate.	
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.			
Bend Test	Black tubes up to and including DN 50 shall be bent cold without any signs of fracture, through 180°C round a former having a radius at the bottom of the groove equal to 6 times the outside diameter of the tubes as given in table. Hot-Dip-Zinc coated tubes shall be bent cold without cracking of the steel, through 90°C round a former having a radius at the bottom of the groove equal to 8 times the outside diameter of 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 selected tube shall be flattened cold between parallel flat plates without showing either crack or flaw until the distance between the plates, 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 plates is less than 60% of original diameter. The weld shall be placed at 90°C 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 ⁵ N/M ²), or alternatively, an eddy current test.			
Bore Test For Hot-Dip Coated Tubes	Hot-Dip-Zinc coated tubes up to and including DN 25 shall have a rod 230mm in length, of the appropriate diameter specified below, passed though them and shall have a free bore			
	Rod Diameters			
	Nominal Size (DN)		Diameter of rod (mm)	
	15		9.5	
	20		14.3	
25		20.6		

WELDED STEEL PIPE

IN ACCORDANCE TO BS 1387: 1985

CLASS LIGHT

MS 863/BS 1387: 1985/ MANUFATURER'S STANDARD

Nominal Size		Outside Diameter		Wall Thickness	Calculated Weight				No. of Threads Per Inch	Socket		Test Pressure	
		Max.	Min.		Plain Ends		Threads & coupling			Outer Dia.	Min. Length		
mm	in	mm	mm	mm	kg/ m	kg/ ft	kg/ m	kg/ ft		mm	mm	Bar	psi
15	½	21.4	21.0	2.0	0.947	0.289	0.956	0.291	14	27.8	38.1	50	700
20	¾	26.9	26.4	2.3	1.380	0.421	1.390	0.424	14	34.1	41.3	50	700
25	1	33.8	33.2	2.6	1.980	0.604	2.000	0.610	11	42.1	47.6	50	700
32	1¼	42.5	41.9	2.6	2.540	0.774	2.570	0.783	11	51.6	54.0	50	700
40	1½	48.4	47.8	2.9	3.230	0.985	3.270	0.997	11	57.9	57.2	50	700
50	2	60.2	59.6	2.9	4.080	1.240	4.150	1.260	11	70.6	63.5	50	700
65	2½	76.0	75.2	3.2	5.710	1.740	5.830	1.780	11	87.3	69.9	50	700
80	3	88.7	87.9	3.2	6.720	2.050	6.890	2.100	11	101.6	76.2	50	700
100	4	113.9	113.0	3.6	9.750	2.970	10.00	3.050	11	128.6	88.9	50	700

CLASS LIGHT

MS 863/BS 1387: 1985/ MANUFATURER'S STANDARD

Nominal Size		Outside Diameter		Wall Thickness	Calculated Weight				No. of Threads Per Inch	Socket		Test Pressure	
		Max.	Min.		Plain Ends		Threads & coupling			Outer Dia.	Min. Length		
mm	in	mm	mm	mm	kg/ m	kg/ ft	kg/ m	kg/ ft		mm	mm	Bar	psi
15	½	21.7	21.1	2.6	1.21	0.369	1.22	0.372	14	27.8	38.1	50	700
20	¾	27.2	26.6	2.6	1.56	0.475	1.57	0.479	14	34.1	41.3	50	700
25	1	34.2	33.4	3.2	2.41	0.735	2.43	0.741	11	42.1	47.6	50	700
32	1¼	42.9	42.1	3.2	3.10	0.945	3.13	0.954	11	51.6	54.0	50	700
40	1½	48.8	48.0	3.2	3.57	1.090	3.61	1.100	11	57.9	57.2	50	700
50	2	60.8	59.8	3.6	5.03	1.530	5.10	1.550	11	70.6	63.5	50	700
65	2½	76.6	75.4	3.6	6.43	1.960	6.55	2.000	11	87.3	69.9	50	700
80	3	89.5	88.1	4.0	8.37	2.550	8.54	2.600	11	101.6	76.2	50	700
100	4	114.9	113.3	4.5	12.20	3.720	12.5	3.810	11	128.6	88.9	50	700
125	5	140.6	138.7	4.85	16.60	5.060	17.1	5.210	11	155.6	95.3	50	700
150	6	166.1	164.1	5.0	19.70	6.000	20.3	6.190	11	184.2	95.3	50	700

CLASS HEAVY

MS 863/BS 1387: 1985/ MANUFATURER'S STANDARD

Nominal Size		Outside Diameter		Wall Thickness	Calculated Weight				No. of Threads Per Inch	Socket		Test Pressure	
		Max.	Min.		Plain Ends		Threads & coupling			Outer Dia.	Min. Length		
mm	in	mm	mm	mm	kg/ m	kg/ ft	kg/ m	kg/ ft		mm	mm	Bar	psi
15	½	21.7	21.1	3.2	1.44	0.439	1.45	0.442	14	27.8	38.1	50	700
20	¾	27.2	26.6	3.2	1.87	0.570	1.88	0.573	14	34.1	41.3	50	700
25	1	34.2	33.4	4.0	2.94	0.896	2.96	0.902	11	42.1	47.6	50	700
32	1¼	42.9	42.1	4.0	3.80	1.160	3.83	1.170	11	51.6	54.0	50	700
40	1½	48.8	48.0	4.0	4.38	1.340	4.42	1.350	11	57.9	57.2	50	700
50	2	60.8	59.8	4.5	6.19	1.890	6.26	1.910	11	70.6	63.5	50	700
65	2½	76.6	75.4	4.5	7.93	2.420	8.05	2.450	11	87.3	69.9	50	700
80	3	89.5	88.1	5.0	10.3	3.140	10.5	3.200	11	101.6	76.2	50	700
100	4	114.9	113.3	5.4	14.5	4.420	14.8	4.510	11	128.6	88.9	50	700
125	5	140.6	138.7	5.4	17.9	5.460	18.4	5.610	11	155.6	95.3	50	700
150	6	166.1	164.1	5.4	21.3	6.490	21.9	6.680	11	184.2	95.3	50	700

WELDED STEEL PIPE

IN ACCORDANCE TO JIS G 3452: 1988/ MANUFATURER'S STANDARD

Nominal Size		Outside Diameter		Wall Thickness		Weight (Plain Ends)					Test Pressure	
mm	in	mm	in	mm	in	kg/m	kg/6m	kg/ft	lb/ft	lb/20ft	kg/cm ²	psi
100	4	114.3	4.500	4.5	0.177	12.2	73.2	3.72	8.20	164.0	25	360
125	5	139.8	5.504	4.5	0.177	15.0	90.0	4.57	10.1	202.0	25	360
150	6	165.2	6.504	5.0	0.197	19.8	118.8	6.04	13.3	266.0	25	360
175	7	190.7	7.508	5.3	0.209	24.2	145.2	7.38	16.3	326.0	25	360
200	8	216.3	8.516	5.8	0.228	30.1	180.6	9.17	20.2	404.0	25	360
225	9	241.8	9.520	6.2	0.244	36.0	216.0	11.0	24.2	484.0	25	360
250	10	267.4	10.528	6.6	0.260	42.4	254.5	12.9	28.5	570.0	25	360
300	12	318.5	12.539	6.9	0.272	53.0	318.0	16.2	35.6	712.0	25	360
350	14	355.6	14.000	7.9	0.311	67.7	406.2	20.6	45.5	910.0	25	360
400	16	406.4	16.000	7.9	0.311	77.6	465.6	23.7	52.1	1042.0	25	360

TOLERANCE

Wall thickness	-12.50% / not specified
Outside Diameter	± 1%

SEAMLESS CARBON STEEL PIPE

Standards: API / ASTM / ASME

Available sizes: NPS 1/8" ~ 24" (OD 10.3mm~610.0mm)

Nominal Pipe Size (DN) (inch)		OD (mm)	Wall Thickness Unit Weight	SCHEDULE NUMBER												
				10	20	30	STD	40	60	XH	80	100	120	140	160	XXH
6	1/8	10.3	mm kg/m				1.73 0.37	1.73 0.37		2.41 0.47	2.41 0.47				-	
8	1/4	13.7	mm kg/m				2.24 0.63	2.24 0.63		3.02 0.80	3.02 0.80				-	
10	3/8	17.1	mm kg/m				2.31 0.84	2.31 0.84		3.20 1.10	3.20 1.10				-	
15	1/2	21.3	mm kg/m				2.77 1.27	2.77 1.27		3.73 1.62	3.73 1.62				4.78 1.95	7.47 2.55
20	3/4	26.7	mm kg/m				2.87 1.69	2.87 1.69		3.91 2.20	3.91 2.20				5.56 2.90	7.82 3.64
25	1	33.4	mm kg/m				3.38 2.50	3.38 2.50		4.55 3.24	4.55 3.24				6.35 4.24	9.09 5.45
32	1¼	42.2	mm kg/m				3.56 3.39	3.56 3.39		4.85 4.47	4.85 4.47				6.35 5.61	9.70 7.77
40	1½	48.3	mm kg/m				3.68 4.05	3.68 4.05		5.08 5.41	5.08 5.41				7.14 7.25	10.16 9.56
50	2	60.3	mm kg/m				3.91 5.44	3.91 5.44		5.54 7.48	5.54 7.48				8.74 11.11	11.07 13.44
65	2½	73.0	mm kg/m				5.16 8.63	5.16 8.63		7.01 11.41	7.01 11.41				9.52 14.90	14.02 20.39
80	3	88.9	mm kg/m				5.49 11.29	5.49 11.29		7.62 15.27	7.62 15.27				11.13 21.35	15.24 27.68
90	3½	101.6	mm kg/m				5.74 13.57	5.74 13.57		8.08 18.63	8.08 18.63				-	-
100	4	114.3	mm kg/m				6.02 16.07	6.02 16.07		8.56 22.32	8.56 22.32		11.13 28.32		13.49 33.54	17.12 41.03
125	5	141.3	mm kg/m				6.55 21.77	6.55 21.77		9.52 30.94	9.52 30.94		12.70 40.28		15.88 49.11	19.05 57.43
150	6	168.3	mm kg/m				7.11 28.26	7.11 28.26		10.97 42.56	10.97 42.56		14.27 54.20		18.26 67.56	21.95 79.22
200	8	219.1	mm kg/m		6.35 33.31	7.04 36.31	8.18 42.55	8.18 42.55	10.31 53.08	12.70 64.64	12.70 64.64	15.09 75.92	18.26 90.44	20.62 100.92	23.01 111.27	22.22 107.88
250	10	273.0	mm kg/m		6.35 41.75	7.80 51.01	9.27 60.29	9.27 60.29	12.70 81.52	12.70 81.52	15.09 95.97	18.26 114.70	21.44 133.00	25.40 155.09	28.57 172.21	25.40 155.09
300	12	323.8	mm kg/m		6.35 49.71	8.38 65.18	9.52 73.78	10.31 79.70	14.27 108.92	12.70 97.43	17.48 132.04	21.44 159.86	25.40 186.91	28.57 208.00	33.32 238.68	25.40 186.91
350	14	355.6	mm kg/m	6.35 54.69	7.92 67.90	9.52 81.25	9.52 81.25	11.13 94.55	15.09 126.71	12.70 107.39	19.05 158.10	23.83 194.96	27.79 224.65	31.75 253.56	35.71 281.70	
400	16	406.4	mm kg/m	6.35 62.64	7.92 77.83	9.52 93.17	9.52 93.17	12.70 123.30	16.66 160.12	12.70 123.30	21.44 203.53	26.19 245.56	30.96 286.64	36.53 333.19	40.49 365.35	
450	18	457.0	mm kg/m	6.35 70.60	7.92 87.75	11.13 122.43	9.52 105.10	14.27 155.87	19.05 205.83	12.70 139.20	23.83 254.67	29.36 309.76	34.92 363.64	39.67 408.45	45.24 459.59	
500	20	508.0	mm kg/m	6.35 78.55	9.52 117.02	12.70 155.12	9.52 117.02	15.09 183.42	20.62 247.83	12.70 155.12	26.19 311.17	32.54 381.53	38.1 441.49	44.45 508.11	50.01 564.81	
550	22	559.0	mm kg/m	6.35 86.54	9.53 129.13	12.70 171.09	9.5 129.13	-	22.2 294.25	12.70 171.09	28.6 373.83	34.9 451.42	41.3 527.02	47.6 600.63	54.0 672.26	
600	24	610.0	mm kg/m	6.35 94.46	9.52 140.88	14.27 209.50	9.52 140.88	17.48 255.24	24.61 355.02	12.70 186.94	30.96 441.78	38.89 547.33	46.02 639.58	52.37 719.63	59.54 807.63	
650	26	660.4	mm kg/m	7.92 127.36	12.70 202.72	-	9.50 152.87	-	-	12.70 202.72						
700	28	711.2	mm kg/m	7.92 137.32	12.70 218.69	15.88 271.21	9.50 164.85	-	-	12.70 218.69						

API SPECIFICATIONS

TOLERANCES FOR SEAMLESS API PIPE

Pipe Specification		API 5L		
Outside Diameter	Pipe Body	<60.3mm	+0.4mm	-0.8mm
		>60.3mm to <610mm	+0.0075D	-0.0075D
	Pipe Ends	60.3mm & smaller	+1.6mm (measured with ring gage)	-0.4mm
		>60.3mm to 168.3mm	+1.6mm (measured with ring gage)	-0.4mm
		>168.3mm to 610mm	±0.005D but maximum of ±1.6mm (measured with diameter gage)	
Wall Thickness		Seamless Pipe: 4mm thickness & smaller >4mm to <25mm 25mm & above	Grade A & B	
			+6mm +0.15T +3.7mm or +0.1T, whichever is greater	-0.5mm -0.125T -3.0mm or -0.1T, whichever is greater

TOLERANCES FOR WELDED API PIPE

Pipe Specification		API 5L		
Outside Diameter	Pipe Body	<60.3mm	+0.4mm	-0.8mm
		60.3mm to 168.3mm	+0.0075D	-0.0075D
		>168.3mm to <610mm	±0.0075D with maximum of ±3.2mm	
		>610mm to <1422mm	±0.005D with maximum of ±4.0mm	
	Pipe Ends	up to 168.3mm	+1.6mm	-0.4mm
		>168.3mm to <610mm	±0.005D but maximum of ±1.6mm (measured with ring gage)	
		>610mm to <1422mm	+1.6mm (measured with ring gage)	-1.6mm
Wall Thickness		Welded Pipe: 5mm thickness & smaller >5mm to <15mm 15mm & above	Grade A & B	
			+0.5mm	-0.5mm
			+0.1T	-0.1T
			+1.5mm	-1.5mm

SEAMLESS API PIPES SPECIFICATIONS

Specification				API 5L										API 5CT						
				A25		A	B	x42	x46	x52	x56	x60	x65	x70	x80	H40	J55	K55	N80	
Classification		Class I	Class II																	
Application				Line pipe										Casing Tubing						
Chemical Composition	C(Max.)			0.21	0.21	0.21	0.26	0.28	0.3	0.3	0.26	0.26	0.26	0.23	0.18	-				
	Si(Max.)			-	-	-	-	-	-	-	-	-	-	-	-					
	Mn(Max.)			0.30-0.60	0.30-0.61	0.9	1.15	1.25	1.35	1.35	1.35	1.35	1.35	1.6	1.8	-				
	P(Max.)			0.030	0.045-0.080	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030				
	S(Max.)			0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.018	0.030				
	Others			-	-	-	-	-	-	-	-	-	-	-	-	-				
Mechanical Properties.	Tensile Strength (Min.)	PSI	45000		48000	60000	60000	63000	66000	71000	75000	77000	82000	80000-120000	60000	75000	95000	120000		
		Mpa	310		331	413	413	434	455	489	517	530	565	620-827	414	517	655	689		
		kgf/mm²	31.7		33.7	42.2	42.2	44.3	46.5	50.0	52.6	54.2	57.7	63.3-84.5	42.2	52.7	66.8	70.3		
	Yield point (Min.)	PSI	25000		30000	35000	42000	46000	52000	56000	60000	65000	70000	80000	40000-80000	55000-80000		80000-110000		
		Mpa	172		207	241	289	317	358	386	413	448	482	551	276-552	379-552		552-758		
		kgf/mm²	17.6		21.1	24.6	29.5	32.3	36.6	39.4	42.2	45.7	49.2	56.3	28.1-56.2	38.7-56.2		56.2-77.3		
	Elongation (Min.) (%)		• U.S. customary Equation e = 625,000 (A ^{0.2} / U ^{0.9}) • Metric Equation e = 1942,57 (A ^{0.2} / U ^{0.9}) e: Minimum elongation in 2 in. (50.80mm) in percent to nearest 1/2 percent A: Cross-sectional area of the tensile test specimen in sq. in. (mm) U: Specified minimum ultimate tensile strength, PSI (Mpa)												e: Mfminimum elongation in 50.80mm in percent rounded to nearest 0.5% A: Cross-sectional area of the tensile test specimen in sq.mm U: Specified tensile strength in N/mm²					
	Flattening		H:Distance between flattening plates (mm) D:Outside diameter of the pipe (mm) Wall thickness of the pipe	Welded part H=3/4D base metal H=0.6D • Flattening test Welded part H=2/3D base metal H=1/3D		• weld ductility test H= $\frac{3.07t}{0.07+3t/D}$ (Grades less than x 52) H= $\frac{3.05t}{0.05+3t/D}$ (Grades x 52 or higher)										• D/t ≥ 16 H= 0.5D • D/t < 16 H= D (0.83-0.0206D/t)		• D/t ≥ 16 H= 0.65D • 3.93 ≤ D/t < 16 H= D(0.98-0.0206D/t) • D/t < 3.93 H= D(1.104-0.0518D/t)		9 ≤ D/t < 28 H= D (1.074-0.0194D/t)
Bending Test		Bending angle x Inside diameter (D: Outside diameter of the pipe)	90° x 12D (Nominal size 2 or below)		-															
Hydrostatic Test	P: Test pressure, PSI (Kpa) S: Fiber stress, PSI (Mpa) t: Wall thickness, in. (mm) D: Outside diameter, in. (mm)		U.S. Customary Formula P= $\frac{2st}{D}$ • Metric formula P= $\frac{2000st}{D}$				Grade	Size Designation	Percent of specified minimum yield strength (%)		P=2st/D									
											F factor									
											Grade STD ALT									
							A25	5 ⁹ / ₁₆	60 -		Smaller than 10 ³ / ₄ 10 ³ / ₄ and larger All Sizes									
						A	2 ³ / ₈ over	60 75		H 40 0.8 0.6 0.8										
						B	2 ³ / ₈ over	60 75		J 55 0.8 0.6 0.8										
						C	5 ⁹ / ₁₆ below	60 75		K 55 0.8 0.6 0.8										
						x42-x80	6 ⁵ / ₈ - 8 ⁵ / ₈	75 -		N80 0.8 0.8 -										
							10 ³ / ₄ - 18	85 -												
							20 over	90 -												
NDT (Non-destructive Test)			-			Electric resistance welded pipe: Ultrasonic Test or Electromagnetic Test (Eddy Current test) Submerged-arc weld pipe: Radiographic test									Ultrasonic Test or Electromagnetic Test					
Others			-												-					

BOILER AND HEAT EXCHANGER TUBES

SPECIFICATIONS

1. STANDARDS	ASTM A 106 ASTM A 192 ASTM A 210 ASTM A 213 ASTM A 335	DIN 17175 / 2448	BS 3059/1 BS 3059/2	NF A 40-211	JIS G 3461
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2. TOLERANCES

Standard	Outside Diameter	Wall Thickness	Weight
ASTM A106	O.D. ≤ 48.3mm ±0.40mm 48.3mm < O.D. ≤ 114.3mm ±0.79mm	-12.5%	+10/ -3.5% for any length of pipe
ASTM A192 ASTM A213 ASTM A210	H O.D. ≤ 101.6mm ±0.4/ -0.8mm O.D. < 101.6mm ±0.4/ -1.2mm	H S ≤ 2.4mm +40/ 0% 2.4 < S ≤ 3.8mm +35/ 0% 3.8 < S ≤ 4.6mm +33/ 0% S > 4.6mm +28/ 0%	H +16/ 0%
	C O.D. < 25.4mm ±0.10mm 25.4 ≤ O.D. < 38.1mm ±0.15mm 38.1 < O.D. ≤ 50.8mm ±0.20mm 50.8 < O.D. ≤ 63.5mm ±0.25mm	C O.D. ≤ 38.1mm +20/ 0% O.D. > 38.1mm +22/ 0%	C O.D. ≤ 38.1mm +12/ 0% O.D. > 38.1mm +13/ 0%
ASTM A335	O.D. ≤ 48.3mm +0.4/ -0.8mm O.D. > 48.3mm ±0.8mm	-12.5%	-10/ -3.5% for any length of pipe
JIS G3461	H O.D. < 100mm ±0.4/ -0.8mm O.D. ≥ 100mm ±0.4/ -1.2mm	H 2 ≤ S < 2.4mm +40/ 0% 2.4 ≤ S < 3.8mm +35/ 0% 3.8 ≤ S < 4.6mm +33/ 0% S ≥ 4.6mm +28/ 0%	
	C O.D. < 25mm ±0.10mm 25 ≤ O.D. < 40mm ±0.15mm 40 ≤ O.D. < 50mm ±0.20mm 50 ≤ O.D. < 60mm ±0.25mm	C O.D. < 40mm S < 2mm +0.4/ 0mm S > 2mm +20/ 0% O.D. ≥ 40mm +22/ 0%	
NFA 49-211	O.D. ≤ 48.3mm +0.4/ -0.8mm 60.3 ≤ O.D. ≤ 114.3mm ±0.8mm	S ≤ 3.2mm +0.5mm/ -0.15S S > 3.2mm +0.15S/ -0.125S	+10/ -3.5% for each tube -1.75% for lots over 18t
BS 3059/1	H ±1% (admissible 0.5mm)	H ±12.5%	
	C ±0.5% (admissible 0.10mm)	C ±7.5%	
BS 3059/2	Seamless Class 2 (S2)		
	H ±0.75% (admissible ±0.3mm)	H ±10%	
	C ±0.5% (admissible ±0.15mm)	C S ≤ 3.25mm ±10% S > 3.25mm ±7.5%	
DIN 17175	H O.D. ≤ 100mm ±0.75% (admissible 0.5mm) O.D. > 100mm ±0.90%	S ≤ 2Sn +15/ -10% 2Sn < S ≤ 4Sn +12.5/ -10% 4Sn < S ±9%	+10* -8% for each tube ±7.5% for lots over 10t
	C ±0.6% (admissible ±0.25mm)		

H – Hot Rolled

C – Cold Drawn

Sn – Nominal Wall Thickness according to DIN 2448

S – Wall Thickness

BOILER AND HEAT EXCHANGER TUBES

3. CHEMICAL REQUIREMENTS (%)

Standard	Grade	C	Si	Mn	Cr	Mo	Al max.	P max.	S max.
DIN 17175	ST 35.8	max. 0.17	0.10-0.35	0.40-0.80	-	-	-	0.040	0.040
	ST 45.8	max. 0.21	0.10-0.35	0.40-1.20	-	-	-	0.040	0.040
	15 Mo 3	0.12-0.20	0.10-0.35	0.40-0.80	-	0.25-0.35	-	0.035	0.035
	13 CrMo 4 4	0.10-0.18	0.10-0.35	0.40-0.70	0.70-1.10	0.45-0.65	-	0.035	0.035
	10 CrMo 9 10	0.08-0.15	max. 0.50	0.40-0.70	2.00-2.50	0.90-1.20	-	0.035	0.035
ASTM A 106	Grade A*	max. 0.25	min.0.10	0.27-0.93	-	-	-	0.035	0.035
	Grade B*	max. 0.30	min.0.10	0.29-1.06	-	-	-	0.035	0.035
ASTM A192		0.06-0.18	max. 0.25	0.27-0.63	-	-	-	0.035	0.035
ASTM A210	Grade A-1	max. 0.27	min.0.10	max. 0.93	-	-	-	0.035	0.035
	Grade C	max. 0.35	min.0.10	0.29-1.06	-	-	-	0.035	0.035
ASTM A213	T 12	0.05-0.15	max. 0.50	0.30-0.61	0.80-1.25	0.44-0.65	-	0.025	0.025
	T 22	0.05-0.15	max. 0.50	0.30-0.60	1.90-2.60	0.87-1.13	-	0.025	0.025
ASTM A335	P 22	0.05-0.15	max. 0.50	0.30-0.60	1.90-2.60	0.87-1.13	-	0.025	0.025
BS 3059/ 1	320	max. 0.16	0.10-0.35	0.30-0.70	-	-	-	0.040	0.040
BS 3059/ 2	360	max. 0.17	max. 0.35	0.40-0.80	-	-	-	0.045	0.045
	243	0.12-0.20	0.10-0.35	0.40-0.80	-	0.25-0.35	0.012	0.040	0.040
	440	0.12-0.18	0.10-0.35	0.90-1.20	-	-	-	0.040	0.035
	620	0.10-0.15	0.10-0.35	0.40-0.70	0.70-1.10	0.45-0.65	0.020	0.040	0.040
	622-440	0.08-0.15	max. 0.50	0.40-0.70	2.00-2.50	0.90-1.20	0.020	0.040	0.040
NF A49-211	TU E 220	max. 0.15	max. 0.30	max. 0.80	-	-	-	0.025	0.025
	TU E 250	max. 0.21	max. 0.35	max. 1.00	-	-	-	0.025	0.025
	TU E 270	max. 0.23	max. 0.40	max. 1.35	-	-	-	0.025	0.025
JIS G3461	STB 340	max. 0.18	max. 0.35	0.30-0.60	-	-	-	0.035	0.035
	STB 410	max. 0.32	max. 0.35	0.30-0.80	-	-	-	0.035	0.035

*The sum of Cu, Cr, Mo, Ni and V not exceed 1%

Cu = max. 0.40%; Cr = max. 0.40%; Mo = max. 0.15%; Ni = max. 0.40%; V = max. 0.08%

BOILER AND HEAT EXCHANGER TUBES

4. MECHANICAL REQUIREMENTS

Standard	Steel Grade	Yield Strength N/mm ² ; min.	Tensile Strength N/mm ²	Elongation min. (%)
DIN 17175	ST 35.8	235	360-480	25
	ST 45.8	255	410-560	21
	15 Mo 3	270	450-600	22
	13 CrMo 4 4	290	440-590	22
	10 CrMo 9 10	280	450-600	20
BS 3059/ 1	320	195	320-480	25
BS 3059/ 2	360	215	360-500	24
	243	250	450-600	22
	440	245	440-580	21
	620	180	460-610	22
	622-440	175	440-590	20
NF A49-211	TU E 220	220	370-490	26
	TU E 250	250	410-530	23
	TU E 270	275	470-590	20
JIS G3461	STB 340	175	MIN. 340	35
	STB 410	255	MIN. 410	25

Standard	Grade	Yield Strength min. PSI (MPa)	Tensile Strength min. PSI (MPa)	Elongation	Hardness HRB Max.
ASTM A106	Grade A*	30000 (205)	48000 (330)	Calculation acc. To the wall thickness	-
	Grade B*	35000 (240)	60000 (415)		-
ASTM A192		26000 (180)	47000 (325)	min. 35	77
ASTM A210	Grade A-1	37000 (255)	60000 (415)	min. 30	79
	Grade C	40000 (275)	70000 (485)	min. 30	89
ASTM A213	T 12	32000 (220)	60000 (415)	min. 30	85
	T 22	30000 (205)	60000 (415)	min. 30	85
ASTM 1335	P 22	30000 (205)	60000 (415)	Calculation	-

*The sum of Cu, Cr, Mo, Ni and V not exceed 1%

Cu = max.0.40%; Cr = max.0.40%; Mo = max.0.15%; Ni = max.0.40%; V = max.0.08%

STEEL SHEET PILES

Chemical & Mechanical Properties	88
U Type Pile	89

STEEL SHEET PILES - TO JIS A5528

1. APPLICABLE STANDARDS

Grades of steels

CHEMICAL COMPOSITION

Notation	C	Si	Mn	P	S	Cu
SY 295	---	---	---	0.040 max.	0.040 max.	0.25 min.
SY 390	---	---	---	0.040 max.	0.040 max.	0.25 min.

MECHANICAL PROPERTIES

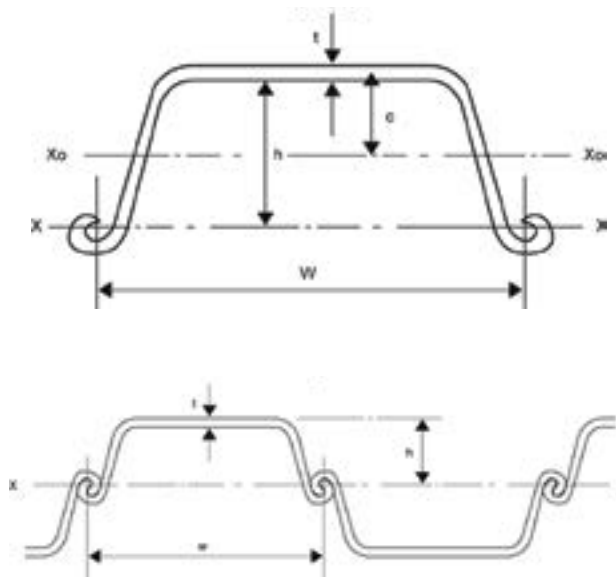
Notation	Tensile Strength N/mm ²	Yield Point N/mm ²	Elongation %
SY 295	490 min.	295 min.	17 min.
SY 390	540 min.	390 min.	15 min.

2. DIMENSIONAL TOLERANCES

Description		Tolerance
Width		+ 10mm - 5mm
Height		± 4%
Thickness	Under 10mm	± 1.0mm
	10mm & over to 16mm, excl	± 1.2mm
	16mm & over	± 1.5mm

STEEL SHEET PILES

U TYPE



Designation	Dimension			Sectional Area		Surface Area		Centre of Gravity	Weight		Moment of Inertia		Radius of Gyration	Section Modulus	
	W	h	t	per pile	per wall width	per pile	per wall width	C	per pile	per wall width	per pile	per wall width	per pile	per pile	per wall width
	mm	mm	mm	cm ²	cm ² /m	m ² /m	m ² /m ²	cm	kg / m	kg / m ²	cm ⁴	cm ⁴ /m	cm	cm ³	cm ³ /m
YSP II	400	100	10.5	61.18	153.0	1.24	1.55	3.62	48	120	986	8690	4.01	121	869
FSP II	400	100	10.5	61.18	153.0	1.33	1.66	4.04	48	120	1240	8740	4.5	152	874
YSP III	400	125	13.0	76.42	191.0	1.33	1.66	4.72	60	150	1920	16400	5.01	196	1310
FSP III	400	125	13.0	76.42	191.0	1.44	1.80	4.9	60	150	2220	16800	5.39	223	1340
FSP IIIA	400	150	13.1	74.40	186.0	1.44	1.80	5.84	58.4	146	2790	22800	6.12	250	1520
YSP IV	400	155	15.5	96.99	242.5	1.47	1.84	5.85	76.1	190	3690	31900	6.15	311	2060
FSP IV	400	170	15.5	96.99	242.5	1.61	2.01	6.45	76.1	190	4670	38600	6.94	362	2270
YSP V	420	175	22.0	134.0	319.0	1.59	1.99	6.15	105	250	5950	55200	6.67	433	3150
FAP VL	500	200	24.3	133.8	267.6	1.75	1.75	6.94	105	210	7960	63000	7.71	520	3150
FSP VIL	500	225	27.6	153.0	306.0	1.83	1.83	8.09	120	240	11400	86000	8.63	680	3820

Remark

- 1) Weight per linear meter of wall is calculated using the formula given below and rounded off in accordance to JIS Z8401.

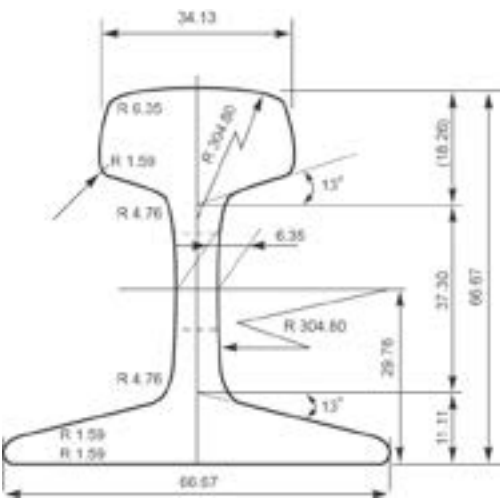
Weight per pile X 1000

W (effective width)

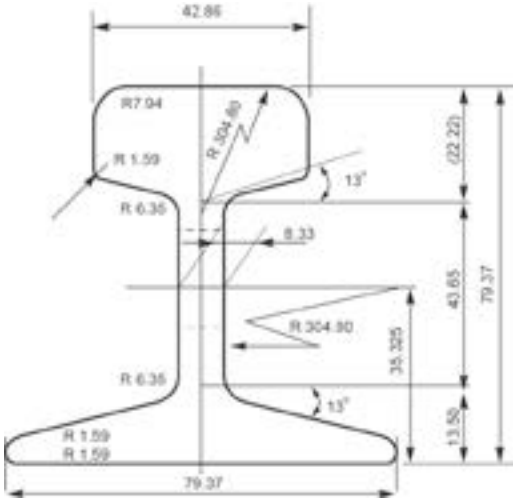
- 2) Surface area per pile includes both sides of the pile.
- 3) Values of the surface area per linear meter of wall are for one side of a pile into position.
- 4) Section modulus per pile is about the neutral $X_0 - X_0$ of each individual pile before assembly into a wall.
- 5) Section modulus per linear meter of wall is about the neutral axis $X - X$ of piles assembled into a wall.

RAILS

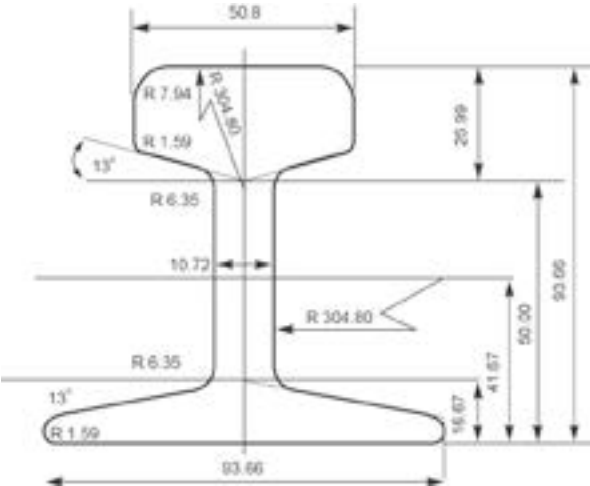
Light Rails (JIS E 1103)	92
British Standard Light Rail Sections	93



10KG RAIL



15KG RAIL



22KG RAIL

RAILS

LIGHT RAILS IN ACCORDANCE TO JIS E 1103

Class	Notation	Note
		Calculated Mass (kg/ m)
6 kg rail	6	5.98
9 kg rail	9	8.94
10 kg rail	10	10.1
12 kg rail	12	12.2
15 kg rail	15	15.2
22 kg rail	22	22.3

CHEMICAL COMPOSITION AND MECHANICAL PROPERTIES

Class	Chemical Composition %				
	C	Si	Mn	P	S
6kg, 9kg, 10kg, 12kg, and 15kg rails	0.40 TO 0.60	0.40 max	0.50 TO 0.90	0.045 max	0.050 max
22kg rail	0.45 TO 0.65				

MECHANICAL PROPERTIES

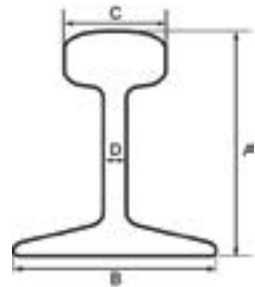
Class	Tensile Strength kgf / mm ² {N/mm ² }	Elongation %
6kg, 9kg, 10kg, 12kg, and 15kg rails	58 {569} min	12 min
22kg rail	65 {637} min	10 min

STANDARD LENGTHS

Class	Standard Length	Remark
		Short Rails
6 kg rail	5.5	5
9 kg rail		4.5
10 kg rail		
12 kg rail	10.0	9
15 kg rail		8
		7
22 kg rail		6

RAILS

BRITISH STANDARD LIGHT RAIL SECTIONS



		BS 20M	BS 30M	BS 35M	BS 35R	BS 40	S 10	S 14	S 18	S 20
Head Crown	Single Radius 5"	▪	▪	▪	0"	▪				
	Single Radius mm				(127)		140	160	180	200
Gauge Corner	Radius 5/16"	1/4"	▪	▪	▪	23/64"				
	Radius mm						6	8	8	9
Head Width	Parallel	▪	▪	▪	▪	▪	▪	▪	▪	▪
Upper Fishing	Taper 1:4	▪	▪	▪	1:03	▪	▪	▪	▪	▪
Upper Fillet	Radius 3/16"	▪	▪	▪	▪	9/32"				
	Radius mm						5	6	6	7
Web	Fully Parallel Web	▪	▪	▪		▪	▪	▪	▪	▪
	Upper Web Parallel				▪					
	Lower Web Radius 7 1/2"				▪					
Lower Fillet	Radius 1/4"	3/16"	▪	▪	▪	17/64"				
	Radius mm						5	6	6	7
Lower Fishing	Taper 1:4	▪	▪	▪	1:06	▪	▪	▪	▪	▪
Rail Section										
		BS 20M	BS 30M	BS 35M	BS 35R	BS 40	S 10	S 14	S 18	S 20
Rail Height A	in mm	2 9/16 65.09	2 31/32 75.41	3 3/16 80.96	3 3/8 85.73	3 15/32 88.11	70	80	90	100
Foot Width B	in mm	2 3/16 55.56	2 3/4 69.85	3 76.2	3 1/4 82.55	3 11/64 80.57	58	70	82	82
Head Width C	in mm	1 7/32 30.96	1 1/2 38.1	1 11/16 42.86	1 3/4 44.45	1 51/64 45.64	32	38	43	44
Min Web Thickness D	in mm	19/64 6.5	23/64 9.13	23/64 9.13	21/64 8.33	31/64 12.3	6	9	10	10
Head Area	in ² mm ²	0.82 530	1.20 777	1.60 1030	16.00 1031	1.78 1149	593	707	934	1018
Web Area	in ² mm ²	0.37 239	0.56 359	0.57 369	0.65 422	0.90 579	241	428	553	604
Foot Area	in ² mm ²	0.76 490	1.16 748	1.26 816	1.18 7.64	1.25 806	437	637	824	904
Total Area	in ² mm ²	1.95 1259	2.92 1883	3.43 22.15	3.44 2216	3.93 2534	1272	1771	2312	2526
Section Weight	lb/yd kg/m	19.91 9.88	29.80 14.79	35.05 17.39	35.07 17.4	40.10 19.89	9.98	13.9	18.15	19.81
Moment of Inertia Ixx	in ⁴ cm ⁴	1.70 71	3.34 139	4.53 188	5.34 222	5.91 2.46	85	152	271	343
Section Modulus Zxx	in ³ cm ³	1.26 21	2.10 34	2.76 45	3.12 51	3.39 56	24	36	56	66
Distance of Neutral Axis from Top of Rail	in mm	1.35 34.34	1.59 40.37	1.64 41.61	1.71 43.48	1.74 44.26	34.92	41.77	48.33	52.01
Moment of Inertia Iyy	in ⁴ cm ⁴	0.34 14	0.79 33	1.08 45	1.21 50	1.22 51	14	27	47	53
Section Modulus Zyy	in ³ cm ³	0.31 5	0.57 9	0.72 12	0.74 12	0.77 13	5	8	12	13

STEEL BARS *for* GENERAL STRUCTURAL PURPOSES

Flat Bar	96
Round Bar	97
Square Bar & Deformed Bar	98
Steel Bars for Concrete Reinforcement	99

STEEL BARS FOR GENERAL STRUCTURAL PURPOSES

FLAT BAR

Metric units

Section Size		Unit Weight M kg/ m	Section Area A cm ²
Thickness mm	Width mm		
3.0	12.0	0.283	0.36
3.0	16.0	0.377	0.48
3.0	19.0	0.447	0.57
3.0	25.0	0.589	0.75
3.0	32.0	0.754	0.96
3.0	38.0	0.895	0.14
3.0	50.0	1.178	1.50
4.5	12.0	0.424	0.54
4.5	16.0	0.565	0.72
4.5	19.0	0.671	0.85
4.5	25.0	0.883	1.125
4.5	32.0	1.134	1.44
4.5	38.0	1.342	1.71
4.5	44.0	1.554	1.98
4.5	50.0	1.766	2.25
4.5	65.0	2.296	2.93
4.5	75.0	2.649	3.37
4.5	100.0	3.553	4.5
5.0	25.0	0.981	1.25
5.0	50.0	1.963	2.50
6.0	12.0	0.565	0.72
6.0	16.0	0.754	0.96
6.0	19.0	0.895	1.14
6.0	25.0	1.178	1.50
6.0	32.0	1.507	1.92
6.0	38.0	1.780	2.28
6.0	44.0	2.072	2.64
6.0	50.0	2.355	3.00
6.0	65.0	3.062	3.90
6.0	75.0	3.533	4.50
6.0	90.0	4.239	5.40
6.0	100.0	4.710	6.00
6.0	125.0	5.888	7.50
6.0	150.0	7.065	9.00
6.0	200.0	9.420	12.00
6.0	250.0	11.775	15.00
6.0	300.0	14.130	18.00
9.0	19.0	1.342	1.71
9.0	25.0	1.766	2.25
9.0	32.0	2.261	2.88
9.0	35.0	2.473	3.15
9.0	38.0	2.685	3.42
9.0	44.0	3.109	3.96
9.0	50.0	3.533	4.50
9.0	65.0	4.592	5.85
9.0	75.0	5.299	6.75
9.0	90.0	6.359	8.10
9.0	100.0	7.065	10.00
9.0	125.0	8.831	11.25
9.0	150.0	10.590	13.50
9.0	180.0	12.717	16.20
9.0	200.0	14.130	18.00
9.0	230.0	16.250	20.70
9.0	250.0	17.663	22.50
9.0	300.0	21.195	27.00
12.0	25.0	2.355	3.00
12.0	32.0	3.014	3.84
12.0	35.0	3.297	4.20
12.0	38.0	3.580	4.56
12.0	44.0	4.145	5.28
12.0	50.0	4.710	6.00
12.0	65.0	6.123	7.80
12.0	75.0	7.065	9.00
12.0	90.0	8.478	10.80
12.0	100.0	9.420	12.00
12.0	125.0	11.775	15.00
12.0	150.0	14.130	18.00
12.0	180.0	16.956	21.60
12.0	200.0	18.840	24.00
12.0	230.0	21.666	27.60
12.0	250.0	23.550	30.00
12.0	280.0	26.576	33.60
12.0	300.0	28.260	36.00

Section Size		Unit Weight M kg/ m	Section Area A cm ²
Thickness mm	Width mm		
16.0	25.0	3.140	4.00
16.0	32.0	4.192	5.12
16.0	38.0	4.773	6.08
16.0	44.0	5.526	7.04
16.0	50.0	6.280	8.00
16.0	65.0	8.164	10.40
16.0	75.0	9.420	12.00
16.0	90.0	11.304	14.40
16.0	100.0	12.560	16.00
16.0	125.0	15.700	20.00
16.0	150.0	18.840	24.00
16.0	180.0	22.608	28.00
16.0	200.0	25.120	32.00
16.0	230.0	28.880	36.80
16.0	250.0	31.400	50.00
16.0	280.0	35.168	44.80
16.0	300.0	37.680	48.00
18.0	50.0	7.065	9.00
18.0	75.0	10.590	13.50
18.0	100.0	14.130	18.00
18.0	125.0	18.663	22.50
18.0	150.0	21.195	27.00
18.0	200.0	28.260	36.00
18.0	225.0	31.793	40.50
18.0	250.0	35.325	45.00
18.0	275.0	38.850	49.50
18.0	300.0	42.390	54.00
19.0	38.0	5.668	7.22
19.0	44.0	6.563	8.36
19.0	50.0	7.458	9.50
19.0	65.0	9.695	12.35
19.0	75.0	11.186	14.25
19.0	90.0	13.424	17.10
19.0	100.0	14.915	19.00
19.0	125.0	18.644	23.75
19.0	150.0	22.373	28.50
19.0	180.0	26.847	34.20
19.0	200.0	29.830	38.00
19.0	230.0	34.305	43.70
19.0	250.0	37.288	47.50
19.0	280.0	41.762	53.20
19.0	300.0	44.745	57.00
22.0	50.0	8.635	11.00
22.0	65.0	11.226	14.30
22.0	75.0	12.953	16.50
22.0	90.0	15.543	19.80
22.0	100.0	17.270	22.00
22.0	125.0	21.588	27.50
22.0	150.0	25.905	33.00
22.0	180.0	31.086	39.60
22.0	200.0	34.540	44.00
22.0	230.0	39.721	50.60
22.0	250.0	43.175	55.00
22.0	280.0	48.356	61.00
22.0	300.0	51.810	66.00
25.0	50.0	9.813	12.50
25.0	65.0	12.756	16.25
25.0	75.0	14.719	18.75
25.0	90.0	17.663	22.50
25.0	100.0	19.625	25.00
25.0	125.0	24.531	31.25
25.0	150.0	29.438	37.50
25.0	180.0	35.325	45.00
25.0	200.0	39.250	50.00
25.0	230.0	45.138	57.50
25.0	250.0	49.063	62.50
25.0	280.0	54.950	70.00
25.0	300.0	58.875	75.00s

STEEL BARS DIMENSIONAL INFORMATION

ROUND BAR

Size	Diameter		Weight			Sectional Area		Moment of Inertial I	Radius of Gyration i	Modulus of Section S
	mm	in	kg/m	kg/ft	lb/ft	cm ²	in ²	in ⁴	in	in ³
6	6	0.236	0.222	0.0667	0.149	0.2827	.04382	0.0002	0.0591	0.0012
7	7	0.276	0.302	0.0921	0.203	0.3848	.05964	0.0002	0.0709	0.0018
8	8	0.315	0.395	0.120	0.265	0.5027	.07792	0.0005	0.0787	0.0031
9	9	0.354	0.499	0.152	0.335	0.6362	.09861	0.0007	0.0906	0.0043
10	10	0.394	0.617	0.188	0.415	0.7854	0.1217	0.0012	0.0984	0.0061
11	11	0.433	0.746	0.227	0.501	0.9503	0.1473	0.0017	0.110	0.0079
12	12	0.472	0.888	0.271	0.597	1.131	0.1753	0.0024	0.118	0.0104
13	13	0.512	1.042	0.318	0.700	1.327	0.2057	0.0034	0.130	0.0134
14	14	0.551	1.208	0.368	0.812	1.539	0.2385	0.0046	0.138	0.0165
15	15	0.591	1.387	0.423	0.932	1.767	0.2739	0.0060	0.150	0.0201
16	16	0.630	1.578	0.481	1.060	2.011	0.3117	0.0077	0.157	0.0244
17	17	0.669	1.782	0.543	1.197	2.270	0.3519	0.0099	0.169	0.0293
18	18	0.709	1.998	0.609	1.343	2.545	0.3945	0.0125	0.177	0.0348
19	19	0.748	2.226	0.678	1.496	2.835	0.4394	0.0154	0.189	0.0409
20	20	0.787	2.466	0.752	1.657	3.142	0.4870	0.0190	0.197	0.0482
21	21	0.827	2.719	0.829	1.827	3.464	0.5369	0.0228	0.209	0.0555
22	22	0.866	2.984	0.910	2.005	3.801	0.5892	0.0276	0.217	0.0641
23	23	0.906	3.261	0.994	2.191	4.155	0.6440	0.0329	0.228	0.0726
24	24	0.945	3.551	1.082	2.386	4.524	0.7012	0.0392	0.236	0.0830
25	25	0.984	3.853	1.174	2.589	4.909	0.7609	0.0461	0.248	0.0934
26	26	1.024	4.168	1.270	2.801	5.309	0.8229	0.0538	0.256	0.106
27	27	1.063	4.494	1.370	3.020	5.726	0.8875	0.0627	0.268	0.118
28	28	1.102	4.833	1.473	3.247	6.158	0.9545	0.0726	0.276	0.132
29	29	1.142	5.185	1.580	3.484	6.605	1.024	0.0834	0.287	0.146
30	30	1.181	5.549	1.691	3.729	7.069	1.096	0.0956	0.295	0.162
31	31	1.220	5.925	1.806	3.981	7.548	1.170	0.1090	0.307	0.179
32	32	1.260	6.313	1.924	4.242	8.042	1.247	0.124	0.315	0.196
34	34	1.339	7.127	2.172	4.790	9.079	1.407	0.158	0.335	0.236
35	35	1.378	7.552	2.302	5.074	9.621	1.491	0.177	0.346	0.257
36	36	1.417	7.990	2.435	5.369	10.18	1.578	0.198	0.354	0.279
38	38	1.496	8.902	2.713	5.982	11.34	1.758	0.245	0.374	0.329
40	40	1.575	9.864	3.006	6.628	12.57	1.948	0.303	0.394	0.383
42	42	1.654	10.875	3.315	7.307	13.85	2.147	0.368	0.413	0.444
44	44	1.732	11.936	3.638	8.020	15.21	2.358	0.442	0.433	0.510
46	46	1.811	13.045	3.976	8.765	16.62	2.576	0.529	0.453	0.583
48	48	1.890	14.204	4.329	9.544	18.10	2.805	0.627	0.472	0.665
50	50	1.969	15.413	4.698	10.356	19.63	3.043	0.738	0.492	0.751
55	55	2.165	18.650	5.684	12.531	23.76	3.683	1.079	0.543	0.995
60	60	2.362	22.195	6.759	14.913	28.27	4.382	1.528	0.591	1.294
65	65	2.559	26.048	7.939	17.502	33.18	5.143	2.105	0.642	1.648
70	70	2.756	30.209	9.207	20.297	38.48	5.964	2.835	0.689	2.056
75	75	2.953	34.679	10.570	23.301	44.18	6.848	3.724	0.740	2.526
80	80	3.150	39.457	12.026	26.511	50.27	7.792	4.829	0.787	3.069
85	85	3.346	44.543	13.576	29.928	56.75	8.796	6.150	0.839	3.680
90	90	3.543	49.938	15.220	33.553	63.62	9.861	7.736	0.886	4.369
95	95	3.740	55.640	16.958	37.385	70.88	10.99	9.610	0.937	5.138
100	100	3.937	61.651	18.790	41.423	78.54	12.17	11.795	0.984	5.992
105	105	4.134	67.971	20.717	45.670	86.59	13.42	14.342	1.035	6.957
110	110	4.331	74.598	22.736	50.122	95.03	14.73	17.273	1.083	7.994
115	115	4.528	81.534	24.850	54.785	103.9	16.10	20.637	1.134	9.092
120	120	4.724	88.778	27.058	59.653	113.1	17.53	24.504	1.181	10.374
125	125	4.921	96.330	29.360	64.727	122.7	19.02	28.829	1.232	11.716
130	130	5.118	104.191	31.756	70.009	132.7	20.57	33.634	1.280	13.181
135	135	5.315	112.360	34.246	75.498	143.1	22.18	39.159	1.331	14.768
140	140	5.512	120.837	36.829	80.873	153.9	23.85	45.405	1.378	16.415
145	145	5.709	129.622	39.507	87.097	165.1	25.59	52.132	1.429	18.246
150	150	5.906	138.716	42.279	93.207	176.7	27.39	59.820	1.476	20.199
160	160	6.299	157.828	48.104	106.049	201.1	31.17	77.357	1.575	24.531
170	170	6.693	178.173	54.304	119.720	227.0	35.19	98.498	1.673	29.431
180	180	7.087	199.751	60.881	134.219	254.5	39.45	123.72	1.772	34.966
190	190	7.480	222.562	67.834	149.546	283.5	43.94	153.75	1.870	41.068
200	200	7.874	246.606	75.162	165.702	314.2	48.70	188.59	1.969	47.903

STEEL BARS FOR GENERAL STRUCTURAL PURPOSES

SQUARE BAR

Metric units

Section Size	Unit Weight M		Side Length A		Section Area A		Moment of Inertia	Radius of Gyration	Modulus of Section
	kg/m	lb/ft	mm	in	cm ²	in ²			
9	0.636	0.427	9	0.354	0.81	0.1260	-	-	-
10	0.785	0.527	10	0.393	1.00	0.1549	-	-	-
12	1.130	0.759	12	0.470	1.44	0.2231	-	-	-
16	2.010	1.351	16	0.630	2.56	0.3968	0.0132	0.181	0.0415
18	2.543	1.709	18	0.709	3.24	0.5022	0.0209	0.205	0.0592
19	2.834	1.904	19	0.748	3.61	0.5596	0.0262	0.217	0.0696
20	3.140	2.110	20	0.787	4.00	0.6120	-	-	-
22	3.800	2.553	22	0.886	4.84	0.7502	0.0468	0.252	0.108
25	4.906	3.296	25	0.984	6.25	0.9688	0.0783	0.283	0.159
28	6.154	4.135	28	1.102	7.84	1.2150	0.1230	0.319	0.223
30	7.065	4.747	30	1.181	9.00	1.3950	0.1620	0.343	0.275
32	8.038	5.401	32	1.260	10.24	1.5870	0.2100	0.362	0.333
35	9.616	6.461	35	1.378	12.25	1.8990	0.3000	0.398	0.436
36	10.174	6.836	36	1.417	12.96	2.0090	0.3360	0.409	0.475
38	11.335	7.616	38	1.496	14.44	2.2380	0.4180	0.433	0.558
44	15.198	10.211	44	1.732	19.36	3.0010	-	-	-
50	19.625	13.186	50	1.969	25.00	3.8750	1.252	0.567	1.269
55	23.746	15.955	55	2.165	30.25	4.6890	1.833	0.626	1.690
60	28.260	18.988	60	2.362	36.00	5.5800	2.595	0.681	2.197
65	33.166	22.284	65	2.559	42.25	6.5490	3.580	0.740	2.795
70	38.465	25.845	70	2.756	49.00	7.5950	4.805	0.795	3.491
75	44.156	29.668	75	2.953	56.25	8.7190	6.342	0.854	4.290
80	50.240	33.756	80	3.150	64.00	9.9200	8.192	0.909	5.205
85	56.716	38.107	85	3.346	72.25	11.200	10.450	0.965	6.224
90	63.585	42.723	90	3.543	81.00	12.560	13.141	1.024	7.384
95	70.846	47.601	95	3.740	90.25	13.990	16.312	1.079	8.726
100	78.500	52.744	100	3.937	100.00	15.500	20.012	1.138	10.191
110	94.985	63.820	110	4.331	121.00	18.760	29.309	1.252	13.547
120	113.040	75.952	120	4.724	144.00	22.320	41.562	1.362	17.575
130	132.165	89.138	130	5.118	169.00	26.200	57.177	1.476	22.334
140	154.860	103.379	140	5.512	196.00	30.380	76.877	1.591	27.888
150	176.625	118.674	150	5.906	225.00	34.880	101.381	1.705	34.295
160	200.960	135.025	160	6.229	256.00	39.680	131.195	1.819	41.295

DEFORMED BAR

Section Size mm	Unit Weight M kg/m	Cross Sectional Area A cm ²
6	0.222	0.283
10	0.617	0.785
12	0.888	1.131
13	1.042	1.327
14	1.208	1.539
16	1.578	2.011
18	1.998	2.545
19	2.226	2.835
20	2.466	3.142
22	2.984	3.801
24	3.551	4.524
25	3.853	4.909
26	4.168	5.309
28	4.833	6.158
29	5.185	6.605
30	5.549	7.069
32	6.313	8.042
35	7.552	9.621
38	8.902	11.34

STEEL BARS FOR CONCRETE REINFORCEMENT

SPECIFICATIONS AND GRADES

SPECIFICATION	GRADE	CHEMICAL COMPOSITION					TENSILE AND BEND TEST REQUIREMENTS			
		C.E. %	C %	P %	S %	N %	Yield Strength N/mm ² (min.)	Tensile Strength N/mm ² (min.)	Min. Elongation (Gauge Length L)	Bend Test
BS 4449:88 (Hot Rolled Steel Bars)	Grade 460 (High Yield Steel Bars)	Max 0.51	Max 0.25	Max 0.05	Max 0.05	Max 0.012	460	Actual Yield Stress x 1.10	12% (L = 5d)	Bend Angle (3d) = 180° Rebend (5d) = 1st bend 45° Rebend 23°
	Grade 250 (Mild Steel Bars)	Max 0.42	Max 0.25	Max 0.06	Max 0.06	Max 0.012	250		22% (L = 5d)	For All Sizes 2d former
MS 146:88 (Hot Rolled Steel Bars)	High Yield Steel Bars	Max 0.51	Max 0.25	Max 0.05	Max 0.05	N.A.	410 460	Actual Yield Stress	14% 12% (L = 5.56√So)	Bend Angle (3d) = 180° Rebend (5d) = 1st bend 45° Rebend 23°
	Mild Steel Bars	Max 0.42	Max 0.25	Max 0.06	Max 0.06	N.A.	250	x 1.05	22% (L = 5.56√So)	For All Sizes 2d former
ASTM A615-86 (Deformed and Plain Billet Steel Bars)	Grade 60 (Deformed and Plain Round Bars)	N.A.	- - -	Max 0.06	- - -	N.A.	60,000 (psi)	90,000 (psi)	Bar No. 3, 4, 5, 6, 7, 8, 9, 10, 11, 14 Elong 9%, 8%, 7% (L = 8 inches)	Bar No. 3, 4, 5, 6, 7, 8, 9, 10, 11, 14 Dia 3½d, 5d, 7d, 9d
	Grade 40 (Deformed and Plain Round Bars)	N.A.	- - -	Max 0.06	- - -	N.A.	40,000 (psi)	70,000 (psi)	Bar No. 3, 4, 5, 6, 7, 8, 9, 10, 11, 14 Elong 11%, 12% (L = 8 inches)	Bar No. 3, 4, 5, 6, 7, 8, 9, 10, 11, 14 Dia 3½d, 5d

Remark: Chemical composition based on cast analysis.

BS = British Standard
MS = Malaysian Standard
ASTM = American Society for Testing Materials
d = nominal size of bar
So = the original cross-sectional area of the test piece
C.E. = $C + \frac{Mn}{6} + \frac{Cr}{5} + \frac{Mo}{15} + V + \frac{Ni}{15} + \frac{Cu}{15}$

WEIGHT TABLE-REBARS

Nominal Diameter mm	6	8	9	10	12	16	20	22	25	28	32	40
Cross-Sectional Area mm ²	28.3	50.3	63.6	78.5	113.1	201.1	314.2	380.1	490.9	615.8	804.2	1256.6
Kg Per metre	0.222	0.395	0.499	0.6616	0.888	1.579	2.466	2.984	3.854	4.834	6.313	9.864

DELIVERY CONDITION & ROLLING TOLERANCE

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DELIVERY CONDITION

DELIVERY CONDITION OF HOT ROLLED STEEL PRODUCTS

In general, all Hot Rolled Steel products shall be delivered free of defects and imperfections however there may be some discontinuities of harmless nature, minor imperfections, e.g. pitting, rolled in scale, indentations, roll marks, scratches and grooves which cannot be avoided completely despite proper manufacturing and which will not be objected to provided they do not exceed the acceptable limits as per specification such as BS EN 10163.

Some of the most common discontinuities are describe as below -

1. Rolled-in Scale and Pitting - marks on the rolled surface varying in shape, thickness and frequency results from inherent surface scaling of the stock before or during hot-rolling or processing.
2. Indentations and roll marks - normally attributed to the natural wear of rolls or pinch rolls. These discontinuities can be distributed at definite distances apart or irregularly throughout the length and width of stock.
3. Scratches, grooves - mechanical scoring at the surface. Scratches are mostly parallel or at right angles to the rolling direction. They may be slightly rolled over and seldom contain scale. This scoring is caused by friction between the stock and parts of the equipment due to relative movements.
4. Spills, slivers - minute surface discontinuities of an irregular and shell like nature. Spills and slivers are elongated in the direction of rolling, their extent depending on the degree of reduction. They are still connected, as minute particles of shell, to the base metal at certain points.
5. Blisters - Blow hole located closely beneath the surface, often appear during hot-rolling.
6. Sand Patches - Non-metallic internal inclusions, elongated in the direction of rolling and distinctly coloured.
7. Cracks - Narrow line of fracture on the surface, cracks are due mainly to material stresses which often develop during the cooling of the feedstock.
8. Shell - Overlapping material partially connected with the base material. There is a preponderance of non metallic inclusions and/or scale among the shell.
9. Seams - Caused mainly when imperfections in the semi-product are elongated and extended during rolling.

Discontinuities not exceeding the limits of respective specification are regarded as being inherent of the manufacturing process and are permissible irrespective of their number. Procedures to determine acceptance shall involve differentiation of Discontinuities in terms of imperfections and defects based on the depth and affected area as defined in the specification. Repair guidelines are provided in specification to rectify the imperfections and some extracts on repair procedures from EM10163 are included herein for reference.

REPAIR AND PROCEDURES BY GRINDING AND WELD PATCHING

Grinding

- If the discontinuity has to be repaired, it shall be removed completely by grinding to its full depth.
- The ground areas shall have a smooth transition to the surrounding surface of the product.
- The maximum permitted grinding allowance below the minimum thickness to follow respective specification.

Welding

- Defects shall be completely eliminated before any weld repair is commenced.
- The procedure shall not reduce the thickness of the product to less than 70% of its nominal thickness.
- The deposited weld material shall reach above the place surface and shall subsequently be ground smooth and level with the product surface.

ROLLING TOLERANCES TO JIS G 3192

IN ACCORDANCE TO JIS G 3192

1. SCOPE

1.1 This Japanese Industrial Standard specifies the dimensions, mass and tolerances thereof of hot rolled steel sections as well as the appearance, shapes and permissible variations thereof

1.2 This Standard is applicable to the relevant product standards

2. DEFINITION

The steel section referred to this standard shall be the hot rolled steels to the sectional shape specified in 3, and then cut in specified length to be supplied

3. SECTIONAL SHAPE AND CLASSIFICATION

The standard sectional shapes of the steel sections and their classification shall be as given in Table 1

Table 1 Sectional Shape of Steel Section and Classification

Classification		Sectional Shape Diagram		
Angles	(A) Equal legs			
	(B) Unequal legs	A	B	C
	(C) Unequal legs and thicknesses			
I sections (or beam)				
Channels				
Bulb flats				
T sections				
H sections (or columns)				

4. EXPRESSION OF SIZE

The size of the steel section shall be expressed by each sectional dimension in millimeter, and the length in meter.

5. STANDARD DIMENSION

The standard dimensions shall be as follows:

(1) The standard lengths of the steel section shall be as given in Table 2

Table 2 Standard Length

Unit: m

Standard Length										
6.0	6.5	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0

6. SHAPE & DIMENSIONAL TOLERANCES

The shape and dimensional tolerances of the steel section shall be as follows:

The tolerances of the steel section other than those specified in (1) and (2), however, shall be agreed upon between the purchaser and supplier

(1) The shape and dimensional tolerances of the angles, I sections, channels, bulb flats and T sections shall be as given in Table 3.

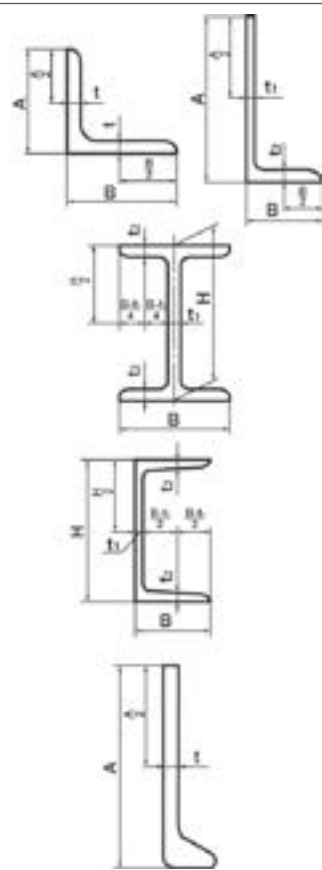
(2) The shape and dimensional tolerances of the H sections shall be as given in Table 4. The tolerances on ends-out-of-square, however, shall be applied on request by the purchaser.

ROLLING TOLERANCES TO JIS G 3192

IN ACCORDANCE TO JIS G 3192

Table 3 Shape and Dimensional Tolerances of Angles, I Sections, Channels, Bulb Flats and T Sections

Unit: m

Dimension			Tolerance	Remark
Leg length (A or B)		Under 50	± 1.5	
		50 or over to and excl. 100	± 2.0	
		100 or over to and excl. 200	± 3.0	
		200 or over	± 4.0	
Depth (H)		Under 100	± 1.5	
		100 or over to and excl. 200	± 2.0	
		200 or over to and excl. 400	± 3.0	
		400 or over	± 4.0	
Thickness (t, t1, t2)	- For leg length A (B for T section): under 130 in depth	Under 6.3	± 0.6	
		6.3 or over to and excl. 10	± 0.7	
		10 or over to and excl. 16	± 0.8	
		16 or over	± 1.0	
	- For leg length A (B for T section): under 130 in depth	Under 6.3	± 0.7	
		6.3 or over to and excl. 10	± 0.8	
		10 or over to and excl. 16	± 1.0	
		16 or over to and excl. 25	± 1.2	
		25 or over	± 1.5	
Length		7 m or under	+40.0 0	
		Over 7 m	Add 5 mm to the plus side tolerance given in the above column for every 1 m increase in lengths or its fraction	
Out-of-square (T)		I section	2.0% or under of width B	
		Sections excluding I and T sections	2.5% or under of width of flange B (or leg length)	
Bend		I section	0.20% or under of length	To be applied to bend such as sweep and camber
		Sections excluding I and T sections	0.30% or under of length	
web-off-center (S)		300 or under in width B	± 3.0	
		T section		

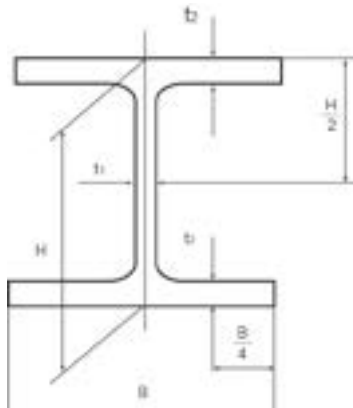
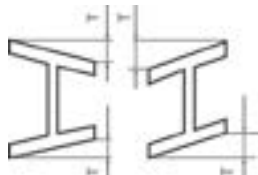
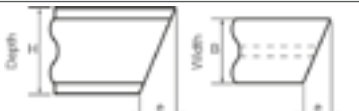
Remark: The purchaser may designate that the out-of-square shall be 2% and under of the leg length for equal leg angles 200mm or more in leg length

ROLLING TOLERANCES TO JIS G 3192

IN ACCORDANCE TO JIS G 3192

Table 4 Shape and Dimensional Tolerances of H Section

Unit: m

		Dimension	Tolerance	Remark	
Width (B)		Under 100	± 2.0		
		100 or over to and excl. 200	± 2.5		
		200 or over	± 3.0		
Depth (H)		Under 400 in nominal depth	± 2.0		
		400 or over to and excl. 600	± 3.0		
		600 or over	± 4.0		
Thickness	t1	Under 16	± 1.0		
		16 or over to and excl. 25	± 1.5		
		25 or over to and excl. 40	± 1.7		
		40 or over	± 2.0		
	t2	Under 16	± 0.7		
		16 or over to and excl. 25	± 1.0		
		25 or over to and excl. 40	± 1.5		
		40 or over	± 2.0		
Length		7 m or under	+40 0		
		Over 7 m	Add 5 mm to the plus side tolerance given in the above column for every 1 m increase in lengths or its fraction		
Out-of-square (T)		300 or under in nominal depth	1.0% or under of width B, provided that 1.5mm is the maximum		
		Over 300 in nominal depth	1.2% or under of width B, provided that 1.5mm is the maximum		
Bend		300 or under in nominal depth	0.15% or under of length		To be applied to bend such as sweep and camber
		Over 300 in nominal depth	0.10% or under of length		
Web-off-center (S)		300 or under in nominal depth and 200 or under in nominal width	± 2.5		
		Over 300 in nominal depth and over 200 in nominal width	± 3.5		
Concavity of web (W)		Under 400 in nominal depth	2.0		
		400 or over to and excl. 600	2.5		
		600 or over	3.0		
Ends-out-of-square (e)			1.6% or under of width B or of depth H, provided that 3.0mm is the maximum		

ROLLING TOLERANCES TO JIS G 3192

IN ACCORDANCE TO JIS G 3192

7. MASS

The mass of the steel sections shall be as follows:

- 1) The mass of the steel section shall, as a rule, be expressed by theoretical mass in kilogram.
- 2) The method for calculation of mass of the steel section shall be in accordance with Table 5 based on the nominal dimensions.

Table 5 Method for Calculation of Mass

Calculating Step	Calculation Method	Number of Figures in Calculated Result
Basic Mass Kg / cm ² .m	0.785 (Mass per cm ² sectional area per meter length)	
Sectional Area cm ²	The values calculated by the following formulas shall be multiplied by 1/100. For equal leg. angles $t (2A - t) + 0.215 (r_1^2 + 2 r_2^2)$ For unequal leg angles $t (A + B - t) + 0.215 (r_1^2 + 2 r_2^2)$ For unequal leg angles and unequal thicknesses $At_1 + t^2 (B - t_1) + 0.215 (r_1^2 + r_2^2)$ For I sections $Ht_1 + 2t_2 (B - t_1) + 0.615 (r_1^2 + r_2^2)$ For channels $Ht_1 + 2t_2 (B - t_1) + 0.349 (r_1^2 + r_2^2)$ For bulb flats $At + r dr_1 + 0.289d (2 r_1 + d) - 0.215 (r_1^2 + r_2^2)$ For T Sections $Bt_2 + 0.307 r_1^2 + 482.6$ For H sections $T_1 (H - 2t_2) + 2Bt_2 + 0.858 r^2$	Round off to 4 significant figures
Unit Mass kg/ m	Basic weight (kg/ cm ² . m) x Sectional area (cm ²)	Round off to 3 significant figures. For those exceeding 1000 kg, round off to integer in kg.
Mass of Single Piece kg	Unit mass (kg/ m) x length (m)	Round off to 3 significant figures. For those exceeding 1000 kg, round off to integer in kg.
Total Mass kg	Mass of single piece (kg) x total number of pieces of the same size	Round off to integer in kg.

Remarks:

- 1) The calculation methods for the sectional area of the steel section others than those given in the above Table shall be agreed upon between the purchaser and supplier.
- 2) The rounding off of the numerical values shall be in accordance with JIS Z 8401.

8. Tolerance on Mass

When the mass tolerances for steel section are designated by the purchaser, they shall confirm to Table 6. In this case, the tolerances on mass shall be expressed in percentage of the difference between the theoretical mass and actual mass to the theoretical mass.

Table 6 Tolerance on Mass

Thickness	Tolerance	Remark
Under 10mm	±5%	(1) Thicker nominal values shall be applied
10mm or over	±4%	(2) To be applied to one lot of the same size (1t or over), provided that, when the number of pieces corresponding tp 1t does not amount to 10 pieces, it shall be applied to each lot of 10 or more pieces

ROLLING TOLERANCES TO JIS G 3192

IN ACCORDANCE TO JIS G 3192

Table 4 **Shape and Dimensional Tolerances of H Section**

Unit: m

9. **APPEARANCE**

The appearance of the steel sections shall be as follows:

- 1) The steel section shall be free from defects that are detrimental to practical use.
- 2) In the case where there is any harmful defect on the surface of the steel section, the manufacturer may remove or repair the defects by grinding or welding. In this case, the operation shall be as follows :

(2 – 1) Conditioning with Grinder

- a) The sectional dimensions of the steel section after conditioning shall fall within the range of the tolerances. When approved by the purchaser, however, this restriction may be applied flexibly according to its application.
- b) The conditioned parts of the steel section shall be finished neatly, and the boundary between the repaired portions and as rolled surface shall be smoothly finished.

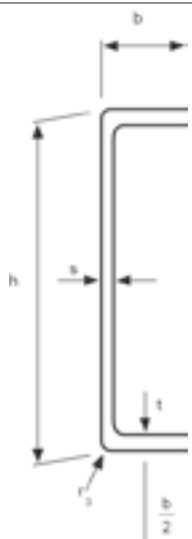
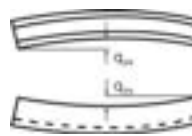
(2 – 2) Repair by Welding

- a) The harmful defects of the steel section shall be repaired by buildup welding after complete removal by means of appropriate method such as chipping or grinding.
- b) The depth of the defect removed portion previous to repair by welding shall be not more than 30% of the nominal thickness. For the toe of the flange of the steel section, however, the depth shall fall within the nominal thickness of the flange from the edge (12 mm max.)
- c) The repaired area by welding shall fall within 2% of the whole surface area of the steel section.
- d) The weld repairing shall be carried out by suitable means for the kind of steel product.
- e) The welded part of the steel section shall be free from undercut or overlaps around the fringe of welds the reinforcement of weld shall be at least 1.5mm or over height from the rolled surface, and this shall be removed by chipping, grinding, etc. and neatly finished as high as the rolled surface.
- f) The heat-treated steel sections themselves shall be heat treated once again after the repair by welding.

ROLLING TOLERANCES TO EN 10034

BS EN 10034: 1993

TOLERANCES FOR PARALLEL FLANGE CHANNELS

Designation	Property	Range mm	Tolerance mm	Designation	Property	Range mm	Tolerance mm
	Height h	h ≤ 65 65 < h ≤ 200 200 < h ≤ 400 400 < h	+1.5 -1.5 +2.0 -2.0 +3.0 -3.0 +4.0 -4.0		Out of Square k+k ₁	b ≤ 100 100 < b	2.0 2.5% x b
	Flange Width b	b ≤ 50 50 < b ≤ 100 100 < b ≤ 125 125 < b	+1.5 -1.5 +2.0 -2.0 +2.5 -2.5 +3.0 -3.0				
	Web Thickness s	s ≤ 10 10 < s ≤ 15 15 < s	+0.5 -0.5 +0.7 -0.7 +1.0 -0.1		Straightness q _{xx}	h ≤ 150 150 < h ≤ 300 300 < h	0.30% x L 0.20% x L 0.15% x L
	Flange Thickness t	t ≤ 10 10 < t ≤ 15 15 < t	Tolerance -0.5 limited -1.0 by weight -1.5		q _{yy}	h ≤ 150 150 < h ≤ 300 300 < h	0.50% x L 0.30% x L 0.20% x L
	Heel Radius r ₃	All Sizes	< 0.3 x t	Mass Per Unit Length	kg/m	h ≤ 125 125 < h	±6% ±4%
				Standard	Length	All	+100 -0
				Alternative Standard (by agreement)	L	All	+50 -50

MASS TOLERANCES FOR JOISTS

Tolerances shall be applied to the actual mass per unit length of the joist. The rolling tolerances shall either be:

- a) ± 2.5% of the actual mass per unit length
- or
- b) + 5.0% of the actual mass per unit length where a minimum mass per unit length is ordered.

LENGTH TOLERANCES FOR JOISTS

Joists ordered as "specified" or as "exact" lengths shall be supplied as follows:

- a) Specified lengths. When a joist is cut to a specified length, it shall be cut to within ± 25mm of that length. When a minimum length is specified, it shall be cut to within +50mm of that minimum length.
-0
- b) Exact lengths. When a section is to be cut to an exact length, it shall be cold sawn to within ± 3.2mm of that length.

TOLERANCE ON DEPTH OF SECTION FOR JOISTS

The tolerance on the nominal depth of section shall be as given in Table 1.

Table 1. Tolerance on Nominal Depth of Joists

Nominal Depth	Maximum Permissible Variation from Specified Depth	
mm	mm	mm
Up to 305	+3.2	-0.8

ROLLING TOLERANCES TO EN 10034

BS EN 10034: 1993

This European Standard specifies tolerances on shape dimensions and mass of structural steel universal beams and columns. These requirements do not apply to taper flange sections.

SECTION HEIGHT (h)

The deviation from nominal on section height measured at the centre line of web thickness shall be within the tolerance given in Table 1(a).

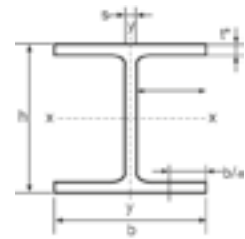


Table 1 (a) Tolerance on Height and Cross-Section.

Section Height h mm	Tolerance mm
Up to and including 180	+3.0 -2.0
Greater than 180 up to & including 400	+4.0 -2.0
Greater than 400 up to & including 700	+5.0 -3.0
Greater than 700	±5.0

FLANGE WIDTH (b)

The deviation from nominal on flange width shall be within the tolerance given in Table 1(b).

Table 1 (b) Tolerances on Flange Width.

Flange Width b mm	Tolerance mm
Up to and including 110	+4.0 -1.0
Greater than 110 up to & including 210	+4.0 -2.0
Greater than 210 up to & including 325	±4.0
Greater than 325	+6.0 -5.0

WEB THICKNESS (s)

The deviation from nominal on web thickness measured at the mid-point of dimension (h) shall be within the tolerance given in Table 1(c).

Table 1 (c) Tolerances on Web Thickness

Web Thickness s mm	Tolerance mm
Less than 7	±0.7
7 up to but excluding 10	±1.0
10 up to but excluding 20	±1.5
20 up to but excluding 40	±2.0
40 up to but excluding 60	±2.5
60 and over	±3.0

FLANGE THICKNESS (t)

The deviation from nominal on flange thickness measured at the quarter flange width point shall be within the tolerance given in Table 1(d).

Table 1 (d) Tolerances on Flange Thickness.

Flange Thickness t mm	Tolerance mm
Less than 6.5	+1.5 -0.5
6.5 up to but excluding 10	+2.0 -1.0
10 up to but excluding 20	+2.5 -1.5
20 up to but excluding 30	+2.5 -2.0
30 up to but excluding 40	±2.5
40 up to but excluding 60	±3.0
60 and over	±4.0

ROLLING TOLERANCES TO EN 10034

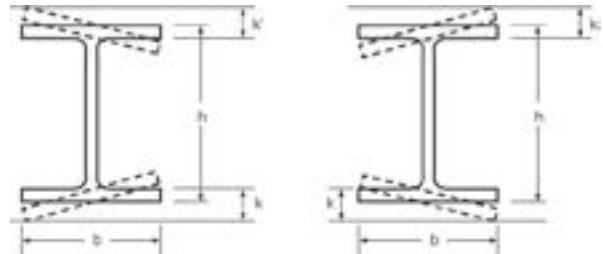
BS EN 10034: 1993

OUT-OF-SQUARENESS ($k + k'$)

The out-of-squareness of the section shall not exceed the maximum given in Table 2(a).

Table 2 (a) Tolerances on Out-of-Squareness of Universal Beams & Columns.

Flange width b	Out-of-squareness of flanges $k + k'$
mm	mm
Up to and including 110	1.5
Greater than 110	2% of b (maximum 6.5mm)

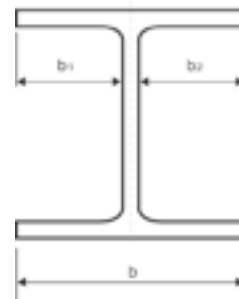


WEB OFF-CENTRE (e)

The mid-thickness of the web shall not deviate from the mid-width position on the flange by more than the distance (e) given in Table 2(b).

Table 2 (b) Tolerances on Web Off-Centre of Universal Beams & Columns.

	Flange Width B	Web off-centre where $e = \frac{b_1 - b_2}{2}$
	mm	mm
t < 40	Up to & including 110	2.5
	Greater than 110 up to & including 325	3.5
t ≥ 40	Greater than 110 up to & including 325	5.0
	Greater than 325	8.0

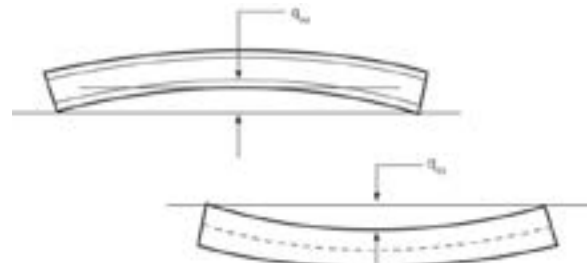


STRAIGHTNESS (q_{xx} or q_{yy})

The straightness shall comply with the requirements given in Table 3.

Table 3 Tolerances on Straightness of Universal Beams and Columns.

Section Height h	Tolerance q_{xx} or q_{yy} on Length L
mm	%
Greater than 80 up to & including 180	0.30L
Greater than 180 up to & including 360	0.15L
Greater than 360	0.10L



TOLERANCE ON MASS

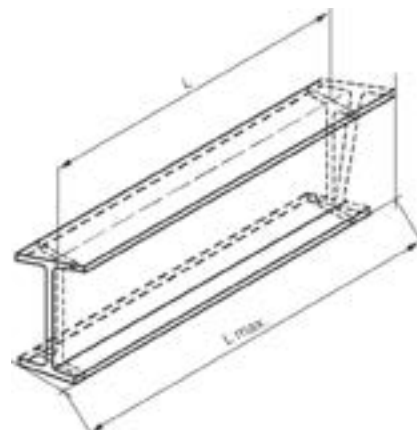
The deviation from the nominal mass of a batch or a piece shall not exceed $\pm 4.0\%$

The mass deviation is the difference between the actual mass of the batch or piece and the calculated mass.
The calculated mass shall be determined using a density of 7850 kg/m^3 .

TOLERANCE ON LENGTH

The sections shall be cut to ordered lengths to tolerances of:

- a) $\pm 50 \text{ mm}$
- or
- b) $+ 100 \text{ mm}$ where minimum lengths are requested.



L represents the longest length of the section assuming that the ends of the section have been cut square.

ROLLING TOLERANCES TO EN10056

BS EN 10056-2: 1993

This European standard specifies tolerances on shape dimensions & mass of hot-rolled structural steel equal & unequal leg angles.

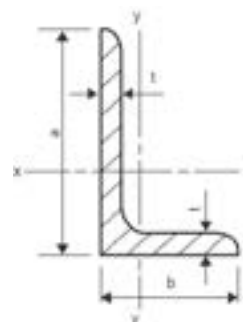
TOLERANCES ON SHAPES & DIMENSIONS

LEG LENGTH (a or b)

The deviation from nominal on leg length shall be within the tolerance given in Table 1(a). For unequal leg angles, the longer leg length (a) shall be used to determine the tolerance band.

Table 1 (a) Dimensional Tolerances.

Leg Length a	Tolerance
mm	mm
Up to & including 50	±1.0
Greater than 50 up to & including 100	±2.0
Greater than 100 up to & including 150	±3.0
Greater than 150 up to & including 200	±4.0
Greater than 200	+6.0 -4.0



SECTION THICKNESS (t)

The deviation from nominal on thickness shall be within the tolerances given in Table 1(b).

Table 1 (b) Thickness Tolerances.

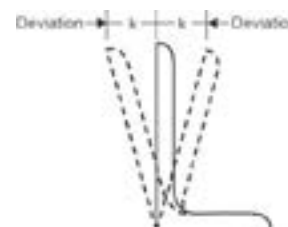
Section Thickness T	Tolerance
mm	mm
Up to & including 5	±0.50
Greater than 5 up to & including 10	±0.75
Greater than 10 up to & including 15	±1.00
Greater than 15	±1.20

OUT-OF-SQUARE (k)

Out-of-squareness of the section shall not exceed the maximum given in Table 1(c). For unequal leg angles, the longer leg length (a) shall be used to determine the tolerance band.

Table 1(c) Squareness Tolerances.

Out of square-Leg Length mm	Tolerance mm
Up to & including 100	1.0
Greater than 100 up to & including 150	1.5
Greater than 150 up to & including 200	2.0
Greater than 200	3.0



STRAIGHTNESS (q)

The deviation from straightness shall not exceed the tolerances given in Table 1(d). For unequal leg angles, the longer leg length (a) shall be used to determine the tolerance band.

Table 1 (d) Straightness Tolerances.

Leg Length a mm	Tolerance (mm)		
	Over Full Bar Length	Over Any Part Bar Length	
	Deviation q (mm)	Length Considered (mm)	Deviation q (mm)
Up to & including 150	0.4% L	1500	6.0
Up to & including 200	0.2% L	2000	
Greater than 200	0.1% L	3000	3.0



TOLERANCE ON MASS

The deviation from the nominal mass of any individual piece shall not exceed:

- ± 6% for thickness for $t \leq 4\text{mm}$ or
- ± 4% for thickness for $t > 4\text{mm}$.

The deviation from the nominal mass is the difference between the actual mass of the piece and the calculated mass. The calculated mass shall be determined using a density of 7850kg/m^3 .

TOLERANCE ON LENGTH

The tolerance on ordered length shall be either:

- ± 50mm
 - or
 - + 100mm where minimum lengths are require.
- 0

ROLLING TOLERANCES ON FLAT PRODUCT TO JIS G 3193

IN ACCORDANCE TO JIS G 3193 DIMENSIONS, AMSS AND PERMISSIBLE VARIATIONS

1. SCOPE

- 1.1 This Japanese Industrial Standard specifies the dimensions, mass and tolerances thereon of the hot rolled steel plates, sheets and strip as well as the appearance, shape and permissible variations thereof. However, this standard is not applicable to the flat steel.
- 1.2 This standard is applicable to the relevant product standards

Remark: The units and numerical values given in { } in this Standard are based on the International System of units (SI) and are appended for informative reference.

2. EXPRESSION OF SIZE

The expression of size of the steel plates, sheets and strip shall be as follows:

- 1) The size of the steel plates and sheets shall be expressed by thickness, width and length in millimeters
- 2) The size of the steel strip shall be expressed by thickness and width in millimeters

3. STANDARD DIMENSIONS

The standard dimensions shall be as follows:

- 1) The standard thickness of the steel plates, sheet and strip shall as given in Table 1.

Table 1. **Standard Thickness**

Unit: mm

1.2	1.4	1.6	1.8	2.0	2.3	2.5	(2.6)	2.8	(2.9)	3.2
3.6	4.0	4.5	5.0	5.6	6.0	6.3	7.0	8.0	9.0	10.0
11.0	12.0	12.7	13.0	14.0	15.0	16.0	(17.0)	18.0	19.0	20.0
22.0	25.0	25.4	28.0	(30.0)	32.0	36.0	38.0	40.0	45.0	50.0

Remarks

1. The standard thickness not in parentheses should preferably by used.
2. For the steel strip and cut lengths therefrom, the standard thickness of 12.7mm or under shall be applied.
 - 2) The standard widths of the steel plates, sheets and strip shall be as given in Table 2.

Table 2. **Standard Width**

Unit: mm

600	630	670	710	750	800	850	900	914
950	1000	1060	1100	1120	1180	1200	1219	1250
1300	1320	1400	1500	1524	1600	1700	1800	1829
1900	2000	2100	2134	2438	2500	2600	2800	3000
3048								

Remarks

1. For the steel strip and cut lengths therefrom, the standard widths of 2000mm or under shall be applied
2. For the steel plates, excluding the cut lengths from the steel strip, the standard widths of 914mm , 1219mm and 1400mm or over shall be applied.

- 3) The standard lengths of the steel plates and sheets shall be as given in Table 3.

Table 3. **Standard Length of Steel Plates and Sheets**

1929	2438	3048	6000	6096	7000	8000	9000	9144
10000	12000	12192						

Remark

1. The lengths given in the above Table shall not be applied to the cut lengths from the steel strip.

ROLLING TOLERANCES ON FLAT PRODUCT TO JIS G 3193

IN ACCORDANCE TO JIS G 3193

4. TOLERANCES ON SHAPE AND DIMENSION

The tolerances on shape and dimension for the steel plates, sheets and strip shall be as follows: However, they shall not be applied to the irregular portions of both ends of the steel strip.

1) The tolerances on thickness of the steel plates, sheets and strip shall be as given in Table 4

Table 4 Tolerances Thickness

Unit: mm

Thickness	Width					
	Under 1600	1600 or over to and excl. 2000	2000 or over to and excl. 2500	2500 or over to and excl. 3150	3150 or over to and excl. 4000	4000 or over to and excl. 5000
Under 1.25	±0.16					
1.25 or over to and excl. 1.60	±0.18					
1.60 or over to and excl. 2.00	±0.19	±0.23				
2.00 or over to and excl. 2.50	±0.20	±0.25				
2.50 or over to and excl. 3.15	±0.22	±0.29	±0.29			
3.15 or over to and excl. 4.00	±0.24	±0.34	±0.34			
4.00 or over to and excl. 5.00	±0.45	±0.55	±0.55	±0.65		
5.00 or over to and excl. 6.30	±0.50	±0.60	±0.60	±0.75	±0.75	
6.30 or over to and excl. 10.0	±0.55	±0.65	±0.65	±0.80	±0.80	±0.90
10.0 or over to and excl. 16.0	±0.55	±0.65	±0.65	±0.80	±0.80	±1.00
16.0 or over to and excl. 25.0	±0.65	±0.75	±0.75	±0.95	±0.95	±1.10
25.0 or over to and excl. 40.0	±0.70	±0.80	±0.80	±1.00	±1.00	±1.20
40.0 or over to and excl. 63.0	±0.80	±0.95	±0.95	±1.10	±1.10	±1.30
63.0 or over to and excl. 100	±0.90	±1.10	±1.10	±1.30	±1.30	±1.50
100 or over to and excl. 160	±1.30	±1.50	±1.50	±1.70	±1.70	±1.90
160 or over to and excl. 200	±1.60	±1.80	±1.80	±1.90	±1.90	±2.10
200 or over to and excl. 250	±1.80	±1.90	±1.90	±2.00	±2.00	±2.20
250 or over to and excl. 300	±2.0	±2.10	±2.10	±2.20	±2.20	±2.50
300 or over to and excl. 350	±2.1	±2.30	±2.30	±2.40	±2.40	±2.80

Remarks

1. Either plus side or minus side of the thickness tolerances given in the above table may be limited on request. The total tolerances in this case shall be equal to those given in Table 4.
2. Thickness shall be measured at any point on the steel strip not less than 25mm from a side edge for the mill edge strip 50mm or over in width and cut lengths therefrom, and on the center line for those less than 50mm in width. For the cut edge steel strip 30mm or over in width and cut lengths therefrom, measurement shall be made at any point not less than 15mm from a side edge and on the center line for those less than 30mm in width.

ROLLING TOLERANCES ON FLAT PRODUCT TO JIS G 3193

IN ACCORDANCE TO JIS G 3193

2) The tolerances in width of the steel plates, sheets and strip shall be a given in table 5.

Table 5. Tolerances on Width

Unit: mm

Width	Thickness	Tolerance						
		Mill Edge		Cut Edge				
		Steel Plate as rolled (with untrimmed edge)	Steel strip and cut lengths therefrom	A Normal Cut Edge		B Resheared or Fine Cut Edge		C Slitted Edge
				+	-	+	-	
Under 160	Under 3.15	-	±2.0	5	0	2.0	0	±0.3
	3.15 or over to and excl. 6.00			5		3.0		±0.5
	6.00 or over to and excl. 20.0			10		4.0		-
	20.0 or over			10		-		-
160 or over to and excl. 250	Under 3.15	-	±2.0	5	0	2.0	0	±0.4
	3.15 or over to and excl. 6.00			5		3.0		±0.5
	6.00 or over to and excl. 20.0			10		4.0		-
	20.0 or over			15		-		-
250 or over to and excl. 400	Under 3.15	0 +Not specified	±5.0	5	0	2.0	0	±0.5
	3.15 or over to and excl. 6.00			5		3.0		±0.5
	6.00 or over to and excl. 20.0			10		4.0		-
	20.0 or over			15		-		-
400 or over to and excl. 630	Under 3.15	0 +Not specified	±20.00 0	10	0	3.0	0	±0.5
	3.15 or over to and excl. 6.00			10		3.0		±0.5
	6.00 or over to and excl. 20.0			10		5.0		-
	20.0 or over			15		-		-
630 or over to and excl. 1000	Under 3.15	0 +Not specified	±30.00 0	10	0	4.0	0	-
	3.15 or over to and excl. 6.00			10		4.0		-
	6.00 or over to and excl. 20.0			10		6.0		-
	20.0 or over			15		-		-
1000 or over to and excl. 1250	Under 3.15	0 +Not specified	±35.00 0	10	0	4.0	0	-
	3.15 or over to and excl. 6.00			10		4.0		-
	6.00 or over to and excl. 20.0			15		6.0		-
	20.0 or over			15		-		-
1250 or over to and excl. 1600	Under 3.15	0 +Not specified	±40.00 0	10	0	4.0	0	-
	3.15 or over to and excl. 6.00			10		4.0		-
	6.00 or over to and excl. 20.0			15		6.0		-
	20.0 or over			15		-		-
1600 or over	Under 3.15	0 +Not specified	±2.0	10	0	4.0	0	-
	3.15 or over to and excl. 6.00			10		4.0		-
	6.00 or over to and excl. 20.0			1.2%		6.0		-
	20.0 or over			1.2%		-		-

Remark

- For the mill edge steel strip less than 400mm in width and cut lengths therefrom, the width tolerance on minus side may be limited to zero. In this case, the tolerance on plus side shall be twice the values given in Table 5 above.

ROLLING TOLERANCES ON FLAT PRODUCT TO JIS G 3193

IN ACCORDANCE TO JIS G 3193

3) The tolerances on length for the steel plate and sheet shall be as given in Table 6.

Table 6. Tolerance on Length of Steel Plate and Sheet

Unit: mm

Length	Thickness	Tolerance	
		A Normal cutting	B Reshearing or fine Cutting
Under 6300	Under 6.00	+25.0 0	+5.0 0
	6.00 or over	+25.0 0	+10.0 0
6300 or over	Under 6.00	+0.5% 0	+10.0 0
	6.00 or over	+0.5% 0	+15.0 0

Remark

1. Tolerance B does not apply to that of 20mm or over in width
- 4) The maximum value of camber for the steel plates, sheets and strip shall be as given in Tables 7 and 8.

Table 7. Camber for Steel Plates and Sheets

Unit: mm

Length	Width		
	250 or over to and excl. 630	630 or over to and excl. 1000	1000 or over
Under 2500	5	4	3
2500 or over to and excl. 4000	8	6	5
4000 or over to and excl. 6300	12	10	8
6300 or over to and excl. 10000	20	16	12
10000 or over	20 in any 10000 length	16 in any 10000 length	16 in any 10000 length

Remarks

1. For the tolerances on camber of the steel plates and sheets under 250mm in width, Table 8 shall be applied.
2. This table shall not be applied to the steel plates and sheets as rolled (with untrimmed edge)
3. For determination of camber of the steel plates and sheets, it shall be in accordance with Figure 1

Figure 1. Application of Camber of Steel Plates and Sheets

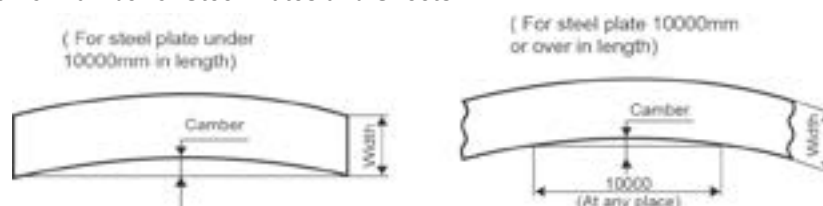


Table 8. Camber of Steel Strip

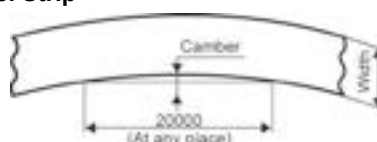
Unit: mm

Width	Maximum Value
Under 250	8 in any 20000 length
250 or over	5 in any 20000 length

Remark

1. The application of camber of the steel strip shall be in accordance with Figure 2.

Figure 2. Application of Camber of Steel Strip



ROLLING TOLERANCES ON FLAT PRODUCT TO JIS G 3193

IN ACCORDANCE TO JIS G 3193

2) The maximum deviation of flatness of the steel plates and sheets shall be as given in Table 9

Table 9. Flatness of Steel plates and Sheets

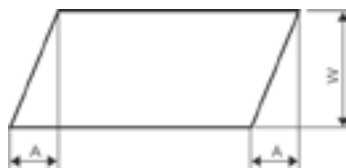
Unit: mm

Thickness	Width				
	Under 1250	1250 or over to and excl. 1600	1600 or over to and excl. 2000	2000 or over to and excl. 3000	3000 or over
Under 1.60	18	20	-	-	-
1.60 or over to and excl. 3.15	16	18	20	-	-
3.15 or over to and excl. 4.00	16			-	-
4.00 or over to and excl. 6.00	14			24	25
6.00 or over to and excl. 10.0	13			21	22
10.0 or over to and excl. 25.00	12			16	17
25.00 or over to and excl. 40.0	9			13	14
40.0 or over to and excl. 63.0	8			11	11
63.0 or over to and excl. 200	7			10	10
200 or over to and excl. 350	20				

Remarks

1. This table shall not be applied to the stretcher leveled steel plates and sheet for delivery.
2. The values given in the above table shall be applied to any 2000mm length. For the steel plate and sheet less than 2000mm in length, the values shall be applied to the full length.
For the steel plate and sheet over 2000mm in wave pitch, the values given in the above Table shall be applied to any pitch of the wave. For those over 4000mm in wave pitch, however, the above values shall be applied to any 4000mm length.
3. The deviation from the flatness shall be determined as the difference between the maximum deviation of convex side uppermost from the flat surface and the thickness of the steel plate and sheet themselves.
4. This table shall not be applied to the as-rolled steel plates and sheets (with untrimmed edge).
5. Measurement of flatness, as a rule, shall be made on a flat surface plate.
- 6) The out-of-square of cut length from cut edged steel strip shall be expressed in A.w as shown in Figure 3 and shall not exceed 1.0%.

Fig. 3. Out-of-square of Cut Lengths from Strip



Remark: A is the measured value, and W is the nominal width.

ROLLING TOLERANCES ON FLAT PRODUCT TO JIS G 3193

IN ACCORDANCE TO JIS G 3193

5. MASS

5.1 Mass of Steel Plates and Sheets

The mass of the steel plates and sheets shall be as follows:

- The mass of the steel plates and sheet shall generally be the theoretical mass expressed in kilogrammes.
- The method for calculation of mass of the steel plates and sheet shall be in accordance with Table 10 based on their nominal dimensions. For the steel plates and sheets which are specified to limit either plus side or minus side of their thickness tolerance given in Table 4 in accordance with 4. (1), the mean value of the maximum and minimum thicknesses in each range of tolerance shall be used of the normal thicknesses.

Table 10. Method for calculation of Mass of Steel Plates and Sheets

Step of Calculation		Calculation method	Number if figures in Calculated Result
Basic Mass kg /mm.m ²		7.85 (mass per mm thickness per m ² area)	-
Unit Mass kg/m ²		Basic mass (kg/mm.m ²) x thickness of plates or sheets (mm)	Round off to 4 significant figures
Area of Steel Plates of Sheets M ²		Width (m) x Length (m)	Round off to 4 significant figures
Mass of Single Plates or Sheets kg		Unit mass (kg/m ²) x area (m ²)	Round off to 3 significant figures. For those exceeding 1000 kg, integer, round off to in kg.
Neither bundled Nor packed	Total mass kg	Mass of single plate or sheet (kg) x number of plates or sheets of the same size	Round off to integer in kg
Bundled or Packed	Mass of Single Bundle kg	Mass of single plate or sheet (kg) x number of plates or sheets per bundle of the same size	Round off to integer in kg
	Total Mass kg	Sum of mass of each bundle	Integer in kg.

Remarks

- Rounding off the numerical values shall be in accordance with JIS Z 8401.
- When the steel plates or sheets are bundle (or packed) the total mass may be calculated as follows:
Mass of single sheets (kg) x Number of plates or sheets of the same size

5.2 Mass of Steel Strip

The mass of the steel strip shall be as follows:

- The mass of the steel strip shall generally be the actual mass expressed in kilogrammes.
- For the mass of the steel strip, the maximum mass of each coil shall generally be specified by agreement, where not less than 75% of the total number of steel strip shall be not less 70% of the specified mass and the rest may include shorter steel strip of 30% to 70% excluding in specified mass.

6 APPEARANCE

The appearance of the steel plates, sheets and strip shall be as follows:

- The steel plates, sheets and strip shall be free from defects that are detrimental to practical use. For the steel strip, however, some irregular portions may be included therein, since generally the steel strip is affordable no opportunity to inspect readily and remove such defective parts.
- For the steel strip and cut lengths the therefrom, the provision concerning harmful surface defects shall generally be applied to one side of the surfaces. The term "one side of the surfaces" means the outside surface for the steel strip and the upper side surface for the cut lengths therefrom.
- In the case where there is any harmful defect on the surface of the steel plates and sheets, the manufacturer may remove or repair the defect by grinding or welding. In this case, the operation shall be as follows:
 - conditioning with grinder
 - The thickness of the steel plates and sheets after conditioning shall fall within the tolerances on thickness.
 - The conditioning parts of the steel plate and sheet shall be finished neatly, and the boundary between the repaired portions on the as-rolled surface shall be smoothly finished.
 - Repair by Welding
 - The harmful defects of the steel plate and sheet shall be removed thoroughly by suitable means such as chipping or grinding prior to selding. The depth of the removed part shall be not more than 20% of the nominal thickness, and the total conditioned area on the side surface shall not exceed 2% of the area of one side of the steel plates and sheets.
 - The repair by welding shall be carried out by suitable means for the kind of steel products.
 - The welded part of the steel plates and sheet shall be free from undercuts or overlaps around the fringe of welds. The reinforcements of weld shall be at least 1.5mm or over height from the rolled surface and this shall be removed by chipping, grinding, etc. and neatly finished as high as the rolled surface.
 - The heat-treated steel plates and sheets themselves shall be heat treated once again after the repair by welding.

STEEL GRADE SPECIFICATION

STRUCTURAL STEEL AND SHEET PILE

Type of Product	Classifications		Mechanical Properties							
			Yield Point N/mm²(min.)		Tensile Strength N/mm²	Yield Ratio % (max.)	Elongation % (min.)			Impact J (min.)
							Thickness			
			Thickness			Thickness	Thickness			Thickness
t ≤ 16	16 < t ≤ 40	t ≥ 12	t ≤ 5	5 < t ≤ 16	t > 16	t > 12				
Structural Steel	TIS 1227 1996	SM400	245	235	400-510 490-610 540 min	-	23	18	22	27 ^A
		SM490	325	315		-	22	17	21	27 ^A
		SM520	365	355		-	19	15	19	27 ^A
		SS400	245	235		-	21	17	21	-
		SS490	285	275		-	19	15	19	-
		SS540	400	390		-	16	13	17	-
	JIS G3101 1995	SS400	245	235	400-510	-	21	17	21	-
		SS490	285	275	490-610	-	19	15	19	-
		SS540	400	390	540 min	-	16	14	17	-
	JIS G3106 1995	SM400A	245	235	400-510	-	23	18	22	-
		SM400B	245	235	400-510	-	23	18	22	27 ^A
		SM490A	325	315	490-610	-	22	17	21	-
		SM490B	325	315	490-610	-	22	17	21	27 ^A
		SM490YA	365	355	490-610	-	19	15	19	-
		SM490YB	365	355	490-610	-	19	15	19	27 ^A
	JIS G3136 1994	SN400A	235	235	400-510	-	17	17	21	-
		SN400B	235-355 ^G	235-355	400-510	80 ^H	18	18	22	27 ^A
		SN490B	325-445 ^G	325-445	490-610	80 ^H	17	17	21	27 ^A
	BS4360 1986	43A	275	265	430-580	-	20	20	20	-
		43C	275	265	430-580	-	20	20	20	27 ^A
		50A	355	345	490-640	-	18	18	18	-
		50B	355	345	490-640	-	18	18	18	27 ^B
		50C	355	345	490-640	-	18	18	18	27 ^A
	BS EN 10025 1993	S275JR	275	265	410-560	-	22	22	22	27 ^B
		S355JR	355	345	490-630	-	22	22	22	27 ^B
	ASTM 1994	A36	250		400-560	-	20			-
		A572 Gr.42	290		415 min	-	20			-
A572 Gr.50		345		450 min ^E	-	18			-	
DIN 17100 1980	St 33	185	175	290	-	16			-	
	St 37-2	235	225	340-470	-	24			-	
	St 44-2	275	265	410-540	-	20			-	
	St 50-2	295	285	470-610	-	18			-	
		t ≤ 12	12 < t ≤ 40							
AS/NZS 3679.1 1996	250	260	250	410	-	22			-	
	250L0	260	250	410	-	22			-	
	350	360	340	480	-	20			-	
	350L0	360	340	480	-	20			-	
		t< 11	11≤t≤17	t > 17						
	300	320	300	280	440	-	22			-
CAN/CSA G40.21-M92 1992	300L0	320	300	280	440	-	22			-
	230G	230		380-500	-	21			-	
	260W	260		410-590	-	20			-	
	300W	300		450-620	-	20			-	
	350W	350		450-650	-	19			-	
	380W	380		480-650	-	18			-	
Sheet Pile	JIS A5528 1988 TIS 1390-1996	SY295	295		490 min	-	17			-
		SY390	390		540 min	-	15			-

Remarks

Carbon Equivalent (%) = C + Mn/6 + Si/24 + Ni/40 + Cr/5 + Mo/4 + V/14 (JIS STANDARD)

Carbon Equivalent (%) = C + Mn/6 + (Cr + Mo + V)/5 + (Ni + Cu)/15 (AS STANDARD)

Chemical Composition on sensitivity of welding crack = C + Si/30 + Mn/20 + Cu/20 + Ni/60 + Cr/20 + Mo/15 + V/10 + 5B

A: Impact test on material grades S<400, SM490, 43C and 50C with thickness 12mm at 0°C.

B: Impact test on material grades 50B, S257JR and S355JR with thickness 12mm at 20°C.

C: It is permissible to vary the carbon and manganese contents (ladle analysis) for grades 50B, 50C, 50D, 50DD and 50EE on the basis of an increase of 0.06% manganese content for each decrease of 0.01% carbon or vice versa up to a maximum manganese content of 1.60% and a maximum carbon content of 0.22% for grades 50B and 50C and 0.20% for grades 50D, 50DD and 50EE.

STEEL GRADE SPECIFICATION

STRUCTURAL STEEL AND SHEET PILE

Chemical Compositions											
C (max)	Si (max)	Mn	P (max)	S (max)	Carbon Equivalent % (max)	Sensitivity of Welding Crack % (max)	Nb	V	N (max)	Cu (min)	Type of Product
0.20	0.35	0.60-1.40	0.035	0.035	-	-	-	-	-	-	Structural Steel
0.18	0.55	1.60 max	0.035	0.035	-	-	-	-	-	-	
0.20	0.55	1.60 max	0.035	0.035	-	-	-	-	-	-	
-	-	-	0.050	0.050	-	-	-	-	-	-	
-	-	-	0.050	0.050	-	-	-	-	-	-	
0.30	-	1.60 max	0.040	0.040	-	-	-	-	-	-	
-	-	-	0.050	0.050	-	-	-	-	-	-	
-	-	-	0.050	0.050	-	-	-	-	-	-	
0.30	-	1.60 max	0.040	0.040	-	-	-	-	-	-	
0.23	-	2.5 x C min	0.035	0.035	-	-	-	-	-	-	
0.20	0.35	0.60-1.40	0.035	0.035	-	-	-	-	-	-	
0.20	0.55	1.60 max	0.035	0.035	-	-	-	-	-	-	
0.18	0.55	1.60 max	0.035	0.035	-	-	-	-	-	-	
0.20	0.55	1.60 max	0.035	0.035	-	-	-	-	-	-	
0.20	0.55	1.60 max	0.035	0.035	-	-	-	-	-	-	
0.24	-	-	0.050	0.050	-	-	-	-	-	-	
0.20	0.35	0.60-1.40	0.030	0.015	0.36	0.26	-	-	-	-	
0.18	0.55	1.60 max	0.030	0.015	0.44	0.29	-	-	-	-	
0.25	0.50	1.60 max	0.050	0.050	-	-	-	-	-	-	
0.18	0.50	1.50 max	0.040	0.040	-	-	-	-	-	-	
0.23	0.50	1.60 max	0.050	0.050	-	-	0.003-0.100	0.003-0.100	-	-	
0.20 ^c	0.50	1.50 ^c max	0.050	0.050	-	-	0.003-0.100	0.003-0.100	-	-	
0.20 ^c	0.50	1.50 ^c max	0.040	0.040	-	-	0.003-0.100	0.003-0.100	-	-	
0.21	-	1.50 max	0.045	0.045	-	-	-	-	0.009*	-	
0.24	0.55	1.60 max	0.045	0.045	-	-	-	-	0.009*	-	
0.26	0.40	-	0.040	0.050	-	-	-	-	-	-	
0.21	0.40	1.35 ^F max	0.040	0.050	-	-	-	-	-	-	
0.23	0.40	1.35 ^F max	0.040	0.050	-	-	-	0.01-0.15	-	-	
-	-	-	-	-	-	-	-	-	-	-	
0.20	-	-	0.050	0.050	-	-	-	-	0.009*	-	
0.21	-	-	0.050	0.050	-	-	-	-	0.009*	-	
-	-	-	0.050	0.050	-	-	-	-	0.009*	-	
0.25	0.40	-	0.40	0.40	0.43	-	-	-	-	-	
0.20	0.40	1.50 max	0.40	0.40	0.42	-	-	-	-	-	
0.22	0.50	1.60 max	0.40	0.40	0.45	-	-	-	-	-	
0.22	0.50	1.60 max	0.40	0.40	0.45	-	-	-	-	-	
0.22	0.50	1.60 max	0.40	0.40	0.44	-	-	-	-	-	
0.22	0.50	1.60 max	0.40	0.40	0.44	-	-	-	-	-	
0.26	0.40	1.2 ^F max	0.50	0.50	-	-	-	-	-	-	
0.20	0.40	0.5-1.50	0.40	0.50	-	-	-	-	-	-	
0.22	0.40	0.5-1.50	0.40	0.50	-	-	-	-	-	-	
0.23	0.40	0.5-1.50	0.40	0.50	-	-	-	-	-	-	
0.23	0.40	0.5-1.50	0.40	0.50	-	-	-	-	-	-	
-	-	-	0.040	0.040	-	-	-	-	-	0.25	Sheet Pile
-	-	-	0.040	0.040	-	-	-	-	-	0.25	

E: For grade 50 steel of thicknesses 20mm and under, the tensile strength shall be a minimum of 485 N / mm².

F: A Maximum of manganese of 1.50% is permissible, with an associated reduction of the carbon maximum of 0.03%.

G: For the H Section, when the t_f is 9 mm or less, the upper limit of the yield point or proof stress shall not be applied.

H: For the H Section, when the t_f is 9 mm or less, the upper limit of the yield ratio shall be 85%.

* : Nitrogen control excluded.

- Materials under TIS compulsory standard are for domestic use only, while material under other standards are for exportation.

CONVERSION FACTORS

METRIC EQUIVALENTS OF LENGTH, AREA, VOLUME & WEIGHT

LINEAR MEASURE

	Millimeter mm	Centimeter cm	Meter m	Inch in	Foot ft	yard yd	Mile mi
Millimeter (mm)	1	0.1	0.001	0.03937	0.0032808	0.0010936	0.0000006214
Centimeter (cm)	10	1	0.01	0.3937	0.032808	0.010936	0.000006214
Meter (m)	1 000	100	1	39.37	3.28083	1.0936	0.0006214
Inch (in)	25.4	2.54	0.0254	1	0.0833	0.02778	0.00001578
Foot (ft)	304.8	30.48	0.3048	12	1	0.3333	0.0001894
Yard (yd)	914.4	91.44	0.9144	36	3	1	0.0005682
Mile (mi)	1 609 347	160 934.7	1 609.35	63 360	5 280	1.76	1

WEIGHT MEASURE

	Kilogram kg	Ounce oz	Pound lb	Net Ton nt	Gross ton (2240 kg) gt	Metric Ton (1000 kg) t
Kilogram (kg)	1	35.274	2.20462	0.001102	0.0009842	0.001
Ounce (oz)	0.02835	1	0.0625	0.00003125	0.0000279	0.00002835
Pound (lb)	0.45359	16	1	0.0005	0.0004464	0.0004536
Net Ton (nt)	907.185	32 000	2 000	1	0.89286	0.90719
Gross ton (gt)	1 016.05	35 840	2 240	1.12	1	1.01605
Metric Ton (t)	1 000	35 274	2 204.62	1.10231	0.98421	1

SQUARE MEASURE

	Square Millimeter mm ²	Square Centimeter cm ²	Square Meter m ²	Square Inch in ²	Square Foot ft ²	Square yard yd ²
Square Millimeter (mm ²)	1	0.01	0.000001	0.00155	0.000010764	0.00000119599
Square Centimeter (cm ²)	100	1	0.0001	0.154999	0.0010764	0.000119599
Square Meter (m ²)	1 000 000	10 000	1	1 549.99	10.7639	1.19599
Square Inch (in ²)	645.2	6.452	0.006452	1	0.006944	0.0007616
Square Foot (ft ²)	92 900	929	0.0929	144	1	0.11111
Square Yard (yd ²)	836 100	8 361	0.8361	1 296	9	1

CONVERSION FACTORS

in.→mm (1/64 in. ~ 11 63/64 in.)

1 in. = 25.4mm

in. fraction	in. Decimal	0 mm	1 mm	2 mm	3 mm	4 mm	5 mm	6 mm	7 mm	8 mm	9 mm	10 mm	11 mm
		-	25.40	50.80	76.20	101.60	127.00	152.40	177.80	203.20	228.60	254.00	279.40
1/64	0.016	0.397	25.80	51.20	76.60	102.00	127.40	152.80	178.20	203.60	229.00	254.40	279.80
1/32	0.031	0.794	26.19	51.59	76.99	102.39	127.79	153.19	178.59	203.99	229.39	254.79	280.19
3/64	0.047	1.191	26.59	51.99	77.39	102.79	128.19	153.59	178.99	204.39	229.79	255.19	280.59
1/16	0.063	1.588	27.38	52.39	77.79	103.19	128.59	153.99	179.39	204.79	230.19	255.59	280.99
5/64	0.078	1.984	27.38	52.78	78.18	103.58	128.98	154.38	179.78	205.18	230.58	255.98	281.38
3/32	0.094	2.381	27.78	53.18	78.58	103.98	129.38	154.78	180.18	205.58	230.98	256.38	281.78
7/64	0.109	2.778	28.18	53.58	78.98	104.38	129.78	155.18	180.58	205.98	231.38	256.78	282.18
1/8	0.125	3.175	28.58	53.98	79.38	104.78	130.18	155.58	180.98	206.38	231.78	257.18	282.58
9/64	0.141	3.572	28.97	54.37	79.79	105.17	130.57	155.97	181.37	206.77	232.17	257.57	282.97
5/32	0.156	3.969	29.37	54.77	80.17	105.57	130.97	156.37	181.77	207.17	232.57	257.97	283.37
11/64	0.172	4.366	29.77	55.17	80.57	105.97	131.37	156.77	182.17	207.57	232.97	258.37	283.77
3/16	0.188	4.763	30.16	55.56	80.96	106.37	131.76	157.16	182.56	207.96	233.36	258.76	284.16
13/64	0.203	5.159	30.56	55.96	81.36	106.76	132.16	157.56	182.96	208.36	233.76	259.16	284.56
7/32	0.219	5.556	30.96	56.36	81.76	107.16	132.56	157.96	183.36	208.76	234.16	259.56	284.96
15/64	0.234	5.953	31.35	56.75	82.15	107.56	132.95	158.35	183.75	209.15	234.55	259.95	285.35
1/4	0.250	6.350	31.75	56.15	82.55	107.95	133.35	158.75	184.15	209.55	234.95	260.35	285.75
17/64	0.266	6.747	32.15	57.55	82.95	108.35	133.75	159.15	184.55	209.95	235.35	260.75	286.15
9/32	0.281	7.144	32.54	57.94	83.34	108.75	134.14	159.54	184.94	210.34	235.74	261.14	286.54
19/64	0.297	7.541	32.94	58.34	83.74	109.14	134.54	159.94	185.34	210.74	236.14	261.54	286.94
5/16	0.313	7.938	33.34	58.74	84.14	109.54	134.94	160.34	185.74	211.14	236.54	261.94	287.34
21/64	0.328	8.334	33.73	59.13	84.53	109.93	135.33	160.73	186.13	211.53	236.93	262.33	287.73
11/32	0.344	8.731	34.13	59.59	84.93	110.33	135.73	161.13	186.53	211.93	237.33	262.73	288.13
23/64	0.359	9.128	34.53	59.93	85.33	110.73	136.13	161.53	186.93	212.33	237.73	263.13	288.53
3/8	0.375	9.525	34.93	60.33	85.73	111.13	136.53	161.93	187.33	212.73	238.13	263.53	288.93
25/64	0.391	9.922	35.32	60.72	86.12	111.53	136.92	162.32	187.72	213.12	238.52	263.92	289.32
13/32	0.406	10.32	35.72	61.12	86.52	111.92	137.32	162.72	188.12	213.52	238.92	264.32	289.72
27/64	0.422	10.72	36.12	61.52	86.92	112.32	137.72	163.12	188.52	213.92	239.32	264.72	290.12
7/16	0.438	11.11	36.51	61.91	87.31	112.72	138.11	163.51	188.91	214.31	239.71	265.11	290.51
29/64	0.453	11.51	36.91	62.31	87.71	113.11	138.51	163.91	189.31	214.71	240.11	265.51	290.91
15/32	0.469	11.91	37.31	62.71	88.11	113.51	138.91	164.31	189.71	215.11	240.51	265.91	291.31
31/64	0.484	12.30	37.70	63.10	88.50	113.91	139.30	164.70	190.10	215.50	240.90	266.30	291.70
1/2	0.500	12.70	38.10	63.50	88.90	114.30	139.70	165.10	190.50	215.90	241.30	266.70	292.10
33/64	0.516	13.10	38.50	63.90	89.30	114.70	140.10	165.50	190.20	216.30	241.70	267.10	292.50
17/32	0.531	13.49	38.89	64.29	89.69	115.09	140.49	165.89	191.29	216.69	242.09	267.49	292.89
35/64	0.547	13.89	39.29	64.69	90.09	115.49	140.89	166.29	191.69	217.09	242.49	267.89	293.29
9/16	0.563	14.29	39.69	65.09	90.49	115.89	141.29	166.69	192.09	217.49	242.89	268.29	293.69
37/64	0.578	14.68	40.08	65.48	90.88	116.29	141.68	167.08	192.48	217.88	243.28	268.68	294.08
19/32	0.594	15.08	40.48	65.88	91.28	116.68	142.08	167.48	192.88	218.28	243.68	269.08	294.48
39/64	0.609	15.48	40.88	66.28	91.68	117.08	142.48	167.88	193.28	218.68	244.08	269.48	294.88
5/8	0.625	15.88	41.28	66.68	92.08	117.48	142.88	168.28	193.68	219.08	244.28	269.88	295.28
41/64	0.641	16.27	41.67	67.07	92.47	117.87	143.27	168.67	194.07	219.47	244.87	270.27	295.67
21/32	0.656	16.67	42.07	67.47	92.87	118.27	143.67	169.07	194.47	219.87	245.27	270.67	296.07
43/64	0.672	17.07	42.47	67.87	93.27	118.67	144.07	169.47	194.87	220.27	245.67	271.07	296.47
11/16	0.688	17.46	42.86	68.26	93.66	119.07	144.46	169.86	195.26	220.66	246.06	271.46	296.86
45/64	0.703	17.86	43.26	68.88	94.06	119.46	144.86	170.26	195.66	221.06	246.46	271.86	297.26
23/32	0.719	18.26	43.66	69.06	94.46	119.86	145.26	170.66	196.06	221.46	246.86	272.26	297.66
47/64	0.734	18.65	44.05	69.45	94.85	120.26	145.65	171.05	196.45	221.85	247.25	272.65	298.05
3/4	0.750	19.05	44.45	69.85	95.25	120.65	146.05	171.45	196.85	222.25	247.65	273.05	298.45
49/64	0.766	19.45	44.85	70.25	95.65	121.05	146.45	171.85	197.25	222.65	248.05	273.45	298.85
25/32	0.781	19.84	45.24	70.64	96.04	121.44	146.84	172.24	197.64	223.02	248.44	273.84	299.24
51/64	0.797	20.24	45.64	71.04	96.44	121.84	147.24	172.64	198.04	223.44	248.84	274.24	299.64
13/16	0.813	20.64	46.04	71.44	96.84	122.24	147.64	173.04	198.44	223.84	249.24	274.64	300.04
53/64	0.828	21.03	46.43	71.83	97.23	122.63	148.03	173.43	198.83	224.23	249.63	275.03	300.43
27/32	0.844	21.43	46.83	72.23	97.63	123.03	148.43	173.83	199.23	224.63	250.03	275.43	300.83
55/64	0.859	21.83	47.23	72.63	98.03	123.43	148.83	174.23	199.63	225.03	250.43	275.83	301.23
7/8	0.875	22.23	47.63	73.03	98.43	123.83	149.23	174.63	200.03	225.43	250.83	276.23	301.63
57/64	0.891	22.62	48.02	73.42	98.82	124.22	149.62	175.02	200.42	225.82	251.22	276.62	302.02
29/32	0.906	23.02	48.42	73.82	99.22	124.62	150.02	175.42	201.82	226.20	251.62	277.02	302.42
59/64	0.922	23.42	48.82	74.22	99.62	125.02	150.42	175.82	201.22	226.62	252.02	277.42	302.82
15/16	0.938	23.81	49.21	74.61	100.01	125.41	150.81	176.21	201.61	227.01	252.41	277.81	303.21
61/64	0.953	24.21	49.61	75.01	100.41	125.81	151.21	176.61	202.01	227.41	252.81	278.21	303.61
31/32	0.969	24.61	50.01	75.41	100.81	126.21	151.61	177.07	202.41	227.81	253.21	278.61	304.01
63/64	0.984	25.00	50.40	75.80	101.20	126.60	152.00	177.40	202.80	228.20	253.60	279.00	304.40

CONVERSION FACTORS

in → cm

1 in = 2.5400000 cm

	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
1	2.54	2.794	3.480	3.302	3.556	3.810	4.064	4.318	4.572	4.826
2	5.08	5.334	5.588	5.842	6.096	6.350	6.604	6.858	7.112	7.366
3	7.62	7.874	8.128	8.382	8.636	8.890	9.144	9.398	9.652	9.906
4	10.16	10.414	10.668	10.922	11.176	11.430	11.684	11.938	12.192	12.446
5	12.7	12.954	13.208	13.462	13.716	13.970	14.224	14.478	14.732	14.986
6	15.24	15.494	15.748	16.002	16.256	16.510	16.764	17.018	17.272	17.526
7	17.78	18.034	18.288	18.542	18.796	19.050	19.304	19.558	19.812	20.066
8	20.32	20.574	20.828	21.082	21.336	21.590	21.844	22.098	22.362	22.606
9	22.86	23.114	23.368	23.622	23.876	24.130	24.384	24.638	24.892	25.146
10	25.40	25.654	25.908	23.162	26.416	26.670	26.924	27.178	27.432	27.666

cm → in

1 cm = 0.39370079 in

	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
1	0.393701	0.433071	0.472441	0.511811	0.551181	0.590551	0.629921	0.669291	0.708661	0.748032
2	0.787402	0.826772	0.866142	0.905512	0.944882	0.984252	1.023622	1.062992	1.102362	1.141732
3	1.181102	1.220472	1.259843	1.299213	1.338583	1.377953	1.417323	1.456693	1.496063	1.535433
4	1.574803	1.614173	1.653543	1.692913	1.732283	1.771654	1.811024	1.850394	1.889764	1.929134
5	1.968504	2.007874	2.047244	2.086614	2.125984	2.165354	2.04724	2.244095	2.283465	2.322835
6	2.362205	2.401575	2.440945	2.480315	2.519685	2.559055	2.598425	2.637795	2.677165	2.716535
7	2.755906	2.795276	2.834646	2.874016	2.913386	2.952756	2.992126	3.031496	3.070866	3.110236
8	3.149606	3.188976	3.228346	3.267717	3.307087	3.346457	3.385827	3.425197	3.464567	3.503937
9	3.5433307	3.582677	3.622047	3.661417	3.700787	3.740158	3.779528	3.188898	3.858268	3.897638
10	3.937008	3.976378	4.015748	4.055119	4.094488	4.133858	4.173228	4.212598	4.251969	4.291339

ft² → m²

1 ft² = 0.092903040 m²

	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
1	0.092903	0.102193	0.111484	0.120774	0.130064	0.139355	0.148645	0.157935	0.167225	0.176516
2	0.185806	0.195096	0.204387	0.213677	0.222967	0.232258	0.241548	0.250838	0.260129	0.269419
3	0.278709	0.287999	0.297290	0.306580	0.315870	0.325161	0.334451	0.343741	0.353032	0.362322
4	0.371612	0.380902	0.390193	0.399483	0.408773	0.418064	0.427354	0.436644	0.445935	0.455225
5	0.464515	0.473806	0.483096	0.492386	0.501676	0.510967	0.520257	0.529547	0.538838	0.548128
6	0.557418	0.566709	0.575999	0.585289	0.594579	0.60387	0.613160	0.62245	0.631741	0.641301
7	0.650321	0.659612	0.668902	0.678192	0.687482	0.696773	0.706063	0.715353	0.724644	0.733934
8	0.743224	0.752515	0.761805	0.771095	0.780386	0.789676	0.798966	0.808256	0.817547	0.826837
9	0.836127	0.845418	0.854708	0.863998	0.873289	0.882579	0.891869	0.901159	0.910450	0.919740
10	0.92903	0.938321	0.947611	0.956901	0.966192	0.975482	0.984772	0.994063	1.003353	1.012643

m² → ft²

1 m² = 10.763910 ft²

	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
1	10.7639	11.8403	12.9167	13.9931	15.0691	16.1459	17.2223	18.2986	19.3750	20.4514
2	21.5278	22.6042	23.6808	24.7570	25.8334	26.9098	27.9862	29.0626	30.1389	31.2153
3	32.2917	33.3681	34.4445	35.5209	36.5973	37.6737	38.7501	39.8265	40.9029	41.9792
4	43.0556	44.1320	45.2084	46.2848	47.3612	48.4376	49.5140	50.5904	51.6668	52.7432
5	53.8196	54.8959	55.9723	57.0487	58.1251	59.2015	60.2779	61.3543	62.4307	63.5071
6	64.5835	65.6599	66.7362	67.8126	68.8890	69.9654	71.0418	72.1182	73.1946	74.2710
7	75.3474	76.4238	77.5002	78.5765	79.6529	80.7293	81.8057	82.8821	83.9585	85.0349
8	86.1113	87.1877	88.2641	89.3405	90.4168	91.4932	92.5696	93.6460	94.7224	95.7988
9	96.8752	97.9516	99.0280	100.1044	101.1808	102.2571	103.3335	104.4099	105.4863	106.5627
10	107.6391	108.7155	109.7919	110.8683	111.9447	113.0211	114.0975	115.1738	116.2502	117.3266

lb → kg

1 lb = 0.45399243 kg (1 lb = 0.45359243 kg as determined by agreement between the USA and Britain in 1963)

	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
1	0.453592	0.498952	0.544311	0.58967	0.635029	0.680389	0.725748	0.771107	0.816466	0.861826
2	0.907185	0.952544	0.997903	1.043263	1.088622	1.133981	1.179340	1.224700	1.270059	1.315418
3	1.360777	1.406137	1.451496	1.496855	1.542214	1.587574	1.632933	1.678292	1.723651	1.769010
4	1.814370	1.859729	1.905088	1.950447	1.995807	2.041166	2.086525	2.131884	2.177244	2.222603
5	2.267962	2.313321	2.358681	2.404040	2.449399	2.494758	2.540118	2.585477	2.630836	2.676195
6	2.721555	2.766914	2.812273	2.857632	2.902992	2.948351	2.993710	3.039069	3.084429	3.129788
7	3.175147	3.220506	3.265865	3.311225	3.356584	3.401943	3.447302	3.492662	3.538021	3.583380
8	3.628739	3.674099	3.719458	3.764817	3.810176	3.855536	3.900895	3.946254	3.991613	4.036973
9	4.082332	4.127691	4.173050	4.218410	4.263769	4.309128	4.354487	4.399847	4.445206	4.490565
10	4.535924	4.581284	4.626643	4.672002	4.717361	4.762721	4.808080	4.853439	4.898798	4.944157

kg → lb

1 kg = 2.2046223 lb

	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
1	2.20462	2.42508	2.64555	2.86601	3.08647	3.30693	3.5274	3.74786	3.96832	4.18878
2	4.40924	4.62971	4.85017	5.07063	5.29109	5.51156	5.73202	5.95248	6.17294	6.39340
3	6.61387	6.83433	7.05479	7.27525	7.49572	7.71618	7.93664	8.15710	8.37756	8.59803
4	8.81849	9.03895	9.25941	9.47988	9.70034	9.92080	10.14126	10.36172	10.58219	10.80265
5	11.02311	11.24357	11.46404	11.6845	11.90496	12.12542	12.34588	12.56635	12.78681	13.00727
6	13.22773	13.44820	13.66866	13.88912	14.10958	14.33004	14.55051	14.77097	214.99143	15.21189
7	15.43236	15.65282	15.87328	16.09374	16.31421	16.53467	16.75513	16.97559	17.19605	17.41652
8	17.63693	17.85744	18.07790	18.29837	18.51883	18.73929	18.95975	19.18021	19.40068	19.62114
9	19.84160	20.06206	20.28253	20.50299	20.72345	20.94391	21.16437	21.38484	21.60530	21.82576
10	22.04622	22.26669	22.48715	22.70761	22.92807	23.14853	23.36900	23.58946	23.80992	24.03038

Note: The pound in this table is equivalent to 1 lb avdp (U.S.) = 0.4535924277 kg

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NOTES
