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PRODUCTS HANDBOOK

Structural Steel

2006 Edition

Subsidiary Companies:
Continental Hardware (M) Sdn Bhd
Viewforth Trading and Engineering Pte Ltd
Conblast Industries Pte Ltd
Con-Struct Engineering Technology Pte Ltd

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The Company

Being one of the biggest premier steel suppliers throughout the region, Continental Steel has the first fully covered multi-storey warehouse that occupies a floor area of 350,000 sq. ft. The warehouse has facilities that allows the following services:

a) Rust protected storage

b) Larger stockholding capacity that can accommodate 150,000 tons of material

c) 24 heavy-duty over-head cranes remotely controlled, some of which are magnetic

d) Ability to service 12 container trucks at any one time

e) Advanced handling system ensures quick delivery and turn around time

f) Conducive working environment for more productive workforce in rain or shine

g) Ability to operate 24hr shifts to meet extra large quantity deadlines.

Continental Steel Pte Ltd is a CIDB registered supplier in the L5 category for all structural steel

Apart from being the supplier of a comprehensive range of quality steel sections, Continental Steel aims to extend its commitment to customers by enhancing its services and adding new facilities. A dedicated team is tasked to provide technical support so as to advise the proper usage of steel and assist customers in using the products to its best advantage.

SERVICES

• Technical support

With a new team of highly qualified engineers we can advise our customers on the correct use of structural steel and provide help on the structural design.

• Shearing of steel plate

Shearing facility that sizes steel plates up to 20mm thickness and maximum 6.1m width.

• Auto Cut and Bend operations

In current competitive business environment, efficiency and product specialization are the essence to a business survival and profitability. So for building contractors and developers, material usage control and wastage management plus other fixed overhead investments like machinery and work-shop space should be kept at a minimum level. To meet this demand we had invested both machinery, skill workers and other infra-structure to provide cut to size and bend to shape reinforcement bars services. Thus removing building contractors and developers tons of on-site work. Our company is also a HDB approved cut and bend service provider.

Powerful hydraulic cutters are being used to cut high tensile reinforcement bars and having capacity to cut bars up to a diameter of 40mm. With auto feeding and measuring mechanism in corporate into the cutter, out-put of the cutting operation could be optimized. Furthermore overhead cranes facilities provide efficiency in both moving reinforcement bars from storage bay to production area and from production area to lorry for timely delivery.

Dimensions and bend angles checks are part of the work process to ensure the end product meet customers' requirement. All bending activities are either fully automatic or machines assisted. Optimal layout of bending machines provides valuable space for storing finished products. Furthermore it provides capacity to bend bars up to 12 meters length.

Thus out-sourcing cut and bend activities by contractors and developers assist them in managing their resources far more efficiently and effectively.

• CNC Drilling & Bandsawing Line System

The steel construction industry faces many challenges in this 21st century. Steel fabrication demands a fast track job, with complex detail and minimum tolerance to remain in competitive market. Continental Steel provides cut to length steel material, subsequently no wastage in construction site. With our automatic drilling and sawing service, we offer flexibility, productivity and reliability of steel products to meet customer's high standard requirements and tight schedule. With computerized measuring system, we ensure the highest accuracy in steel cutting and drilling. Whether your requirements call for complex or simple detail, large or small scale project, Continental Steel is your source for all CNC drilling and sawing requirements.

The Kaltenbach 3 axis CNC drilling machine KD 1015 provides state of the art drilling to suit a wide range of material requirements.

KD series have two horizontal and one vertical axis drill spindle, with a maximum drill capacity of 40 mm and are fitted as standard with an auto tool changer.

Features of the KD machine:

- Machine gantry designed with robust welded construction
- Programmed spindle speeds are automatically assigned to each drill diameter
- Automatic drill offset by touch sensing of the drill tips against the material
- Lowering program for all three drill bits
- Electro-mechanical drill feed using ball bearing spindle with servo motor
- Automatic cross-section measuring
- Fast and precise drill spindles positioning via ball screw drive and servo motors.

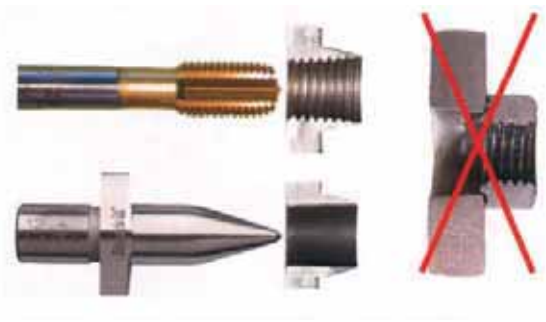
The Control Desk with graphical user interface under Windows and Touch-Screen Monitors ensures a fast and easy programming of the machine.

Working Range and Technical Data:

Angle steel max (mm)	250 x 250 x 28
U Steel max(mm)	400 x 110
H beam max (mm)	1,000 x 400

Drilling unit:

Vertical (Y-axis) (pc)	1
Horizontal (Z- and W-axes)(pc)	2
Drill diameter (mm)	10 - 40



Future expansion of new drilling technology will satisfy steel industry with advanced bolt connection for structural steel work industry. A new Thermal Friction Drilling system will bush length up to 3 times the original thickness. This system produces perfectly formed bushes using a combination of rotation speed and pressure to locally heat the material, forming a bush in various thickness of metal.

The Band saw KBS 1001 DG was developed for the special requirements of steel construction and steel suppliers and combine solid machine construction with high performance elements. The large cutting range, even for acutely angled mitre-squares on both sides, combined with compact construction, particularly distinguish this Bandsaw.

A Hydraulic saw band feed, infinitely variable at the freestanding control cabinet (feed control by proportional valve technology) and a 7.5 KW strong drive motor with infinitely cutting speeds ensures perfect cutting performance.

Features of the KBS Bandsaw:

- Short setup times due to NC-controlled mitre angle setting and automatic cycle control (clamping - sawing- releasing)

- Enhanced band life thanks to full-stroke hydraulic band tensioning with auto stand-by tension feature, plus coolant atomizer system.

- Secure material clamping via self-adjusting machine vise.

- Coolant Atomizer System for efficiently lubrification and cooling of the sawband.

Via the graphical user surface Proficut, running under Windows, the machine could be programmed. The software is able to import DSTV or CSV files from customers' software.

Different functions like a Material database, a part database or an order management module makes programming fast and very easy.

Cutting range:			
Round material	90°	mm	500
Bundles:	90°	mm	600 x 500
Square	90°	mm	1,000 x 500
Beams	45°	mm	640 X 500
	30°	mm	400 x 500
Mitre Cutting range	degrees 45 - 90 - 30		

Technical data:		
Band dimensions	mm	8,250 x 54 x 1.6
Drive capacity	KW	7.5
Cutting speeds	m/min	16-100

The efficiency and productivity of both machines are improved by auto measuring system, roller-way and material handling equipment. With a uniform control, Continental can achieve the optimum production environment

In concert with our Quality Assurance program and continuous inspection control, we are in the edge in providing best flexibility, productivity and reliability of steel saw and drill service. We welcome the challenge to become your supplier of high quality ready-to-use steel products to be delivered on time.

• Auto shot blasting and painting

For better steel finishes and protection, the fully automatic shot blasting machines attend to the steel treatment needs with the provision of in-house painting.

• Fully computerised administrative system

Computer networks that ensure quicker and more efficient administration fully support the office procedures from quotations to delivery.

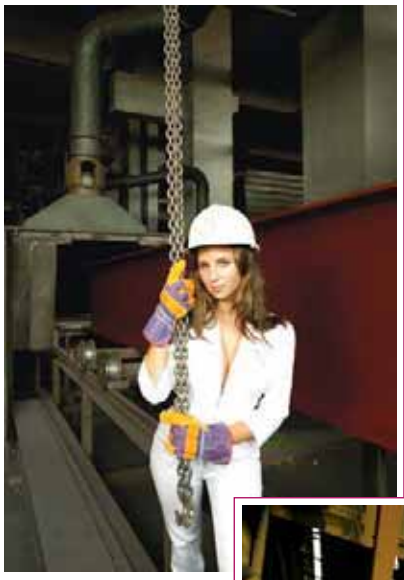
• Galvanising

Hot dip galvanising provides the permanent good appearance and freedom from maintenance that ensures long service life.

• In house delivery service

Having a highly motivated team of delivery staff and efficient transportation services, just in time requirements can be achieved. There are 24 heavy-duty over-head cranes remotely controlled, some of which are magnetic with up to 12 tons loading capacity. A mobile crane with maximum 30 tons lifting capacity is also available to ensure unloading at any construction site.

As one of the leading steel suppliers, Continental Steel has set up an industrial standard in the region. The company also has the capability of providing steels to the exact specified requirements for different needs.



General information

All weights and measures shown on invoices will be governed by standards of the respective specifications so offered.

Care has been taken to ensure that all data and information herein are factual and that numerical values are accurate. To the best of our knowledge, all information contained in this handbook is accurate at the time of publication. Continental Steel Pte Ltd assumes no responsibility for errors in or misinterpretation of the information contained in this handbook or in its use.

Introduction

To serve the increasing demands for more section types and to create the awareness on the proper use of steel, we have come up with a new product catalogue. The new handbook has a more comprehensive range of products and useful technical information, and it also functions as a design reference for the consultants and a product catalogue for our customers.

To help our customers to proper design and use of steel we have also extended the business by offering our customers technical support from our team of Structural Engineers.

The catalogue contains up-to-date materials standards specifications.
Note that new European standards supersede most of the old British Standards, see sections “Materials” and “Manufacturing tolerances” under this chapter, and the design guide BS 5950 substitutes BS 449.

The content list of our new catalogue shows that we have increased the range of section types and sizes. This is to give our customers a bigger choice when selecting material and more room for imagination, innovation and flexibility when designing and planning for new structures.
With more sections to choose from, the designers will have opportunities to make better and more cost efficient designs, by selecting the section size closest to that required.

Some of the new section types we have added to our product list are:
Structural Tees
Cellular Beams
Hot Finished Ellipcon Sections, elliptical and semi elliptical
Parallel Flange Channels
High-Tensile Galvanised C and Z Purlins.

The new catalogue also contains a comparison between hot finished and cold formed hollow sections. We included this because substitution of cold formed sections for hot finished sections are very common in this region, but not everybody knows the differences between the two section types.

The first few pages of the catalogue give a short resume of the company profile and the services we provide. The summary shows that we have extended our business by adding more value to the steel we supply to our customers.

Our steel suppliers are mills with third party certifications, such as ISO, CARES and/or Lloyd’s.

Materials - EN10025 : 2004 is the new European standard for structural steel

EN 10025 : 2004 is the new European standard for structural steel. It shows the new grades, properties and the nearest equivalent grades from former standards including EN 10025 : 1993. The grade designation system is also explained.

History of the standard

The European Committee for Iron and Steel Standardisation is responsible for producing the European Standards (ENs) for structural steels. The first of these standards, EN 10025, was published in the UK by BSI as EN 10025 : 1990, partly superseding BS 4360 : 1986, which was re-issued as BS 4360 : 1990. In 1993, a second edition of EN 10025 was made available together with EN 10113 : parts 1, 2 & 3 and EN 10155. In June 1994, EN 10210 : part 1 was published and at the same time BS 4360 was officially withdrawn. The balance of the BS 4360 steels not affected by these ENs were re-issued in new British Standards BS 7613 and BS 7668. In 1996, with the publication of EN 10137, BS 7613 was withdrawn. BS 7668 will remain until an EN for atmospheric corrosion resistant hollow sections is available

In 2004 the standard EN 10025 was revised to address the provisions of EU Construction Products Directive (89/106/EEC). It is now published in six parts to bring together almost all the 'Structural Metallic Products' into one comprehensive standard.

The new standard EN 10025 : 2004

The new standard is published in six parts and draws together earlier standards to produce one standard for the majority of structural steel products. The parts are:

- Part 1 - General technical delivery conditions.

- Part 2 - Technical delivery conditions for non-alloy structural steels.
  Supersedes EN 10025 : 1993

- Part 3 - Technical delivery conditions for normalised / normalised rolled weldable fine grain structural steels. Supersedes EN 10113 : parts 1 & 2 : 1993

- Part 4 - Technical delivery conditions for thermo mechanically rolled weldable fine grain structural steels. Supersedes EN 10113 : parts 1 & 3 : 1993

- Part 5 - Technical delivery conditions for structural steels with improved atmospheric corrosion resistance - also known as weathering steels.
  Supersedes EN 10155 : 1993

- Part 6 - Technical delivery conditions for flat products of high yield strength structural steels in the quenched and tempered condition.
  Supersedes EN 10137 : parts 1 & 2 : 1996

Grade designation systems

The designation systems used in the new standard are similar but not identical to EN 10025 : 1993 and very different to the familiar BS 4360 designations so the guide below has been prepared to assist purchasers, specifiers, designers and users of steel.

Symbols used in EN 10025 : part 2 : 2004 Non-alloy structural steels

S... Structural steel
E... Engineering steel
.235... Minimum yield strength (Reh) in MPa @ 16mm
...JR.. Longitudinal Charpy V-notch impacts 27 J @ +20°C
...J0.. Longitudinal Charpy V-notch impacts 27 J @ 0°C
...J2.. Longitudinal Charpy V-notch impacts 27 J @ -20°C
...K2.. Longitudinal Charpy V-notch impacts 40 J @ -20°C
...+AR Supply condition as rolled
...+N Supply condition normalised or normalised rolled

Customer options

...C.. Grade suitable for cold forming
...Z.. Grade with improved properties perpendicular to the surface

Examples: S235JR+AR, S355K2C+N

Symbols used in EN 10025 : part 3 : 2004
Normalised/normalised rolled weldable fine grain structural steels

S... Structural steel
.275... Minimum yield strength (Reh) in MPa @ 16mm
...N.. Longitudinal Charpy V-notch impacts at a temperature not lower than -20°C
...NL.. Longitudinal Charpy V-notch impacts at a temperature not lower than -50°C

Customer options

...Z.. Grade with improved properties perpendicular to the surface

Examples: S275N, S420NL Z35

Symbols used in EN 10025 : part 4 : 2004
Thermo mechanically rolled weldable fine grain structural steels

S... Structural steel
.275... Minimum yield strength (Reh) in MPa @ 16mm
...M.. Longitudinal Charpy V-notch impacts at a temperature not lower than -20°C
...ML.. Longitudinal Charpy V-notch impacts at a temperature not lower than -50°C

Customer options

...Z.. Grade with improved properties perpendicular to the surface

Examples: S355M, S460ML Z25

Symbols used in EN 10025 : part 5 : 2004 Structural steels with improved atmospheric corrosion resistance - also known as weathering steels

S... Structural steel
.355... Minimum yield strength (Reh) in MPa @ 16mm
...J0.. Longitudinal Charpy V-notch impacts 27 J @ 0°C
...J2.. Longitudinal Charpy V-notch impacts 27 J @ -20°C
...K2.. Longitudinal Charpy V-notch impacts 40 J @ -20°C
...W.. Improved atmospheric corrosion resistance
...P.. Greater phosphorus content (grade S355 only)
...+AR Supply condition as rolled
...+N Supply condition normalised or normalised rolled

Customer options

...Z.. Grade with improved properties perpendicular to the surface

Examples: S235J0W+AR, S355K2W+N Z25

Symbols used in EN 10025 : part 6 : 2004 Flat products of high yield strength structural steels in the quenched and tempered condition

S... Structural steel
.460... Minimum yield strength (Reh) in MPa @ 16mm
...Q.. Longitudinal Charpy V-notch impacts at a temperature not lower than -20°C
...QL.. Longitudinal Charpy V-notch impacts at a temperature not lower than -40°C
...QL1.. Longitudinal Charpy V-notch impacts at a temperature not lower than -60°C

Customer options

...Z.. Grade with improved properties perpendicular to the surface

Examples: S460Q, S690QL

Grades, properties and nearest equivalents

The tables below show the grades, properties and nearest equivalent grades from earlier standards. The grade designations are explained on the previous pages.

Comparison between grades in EN 10025 : part 2 : 2004 and nearest equivalent versions in EN 10025 : 1993 and BS 4360 : 1990

EN 10025 : part 2 : 2004					EN 10025 : 1993	BS 4360 : 1990
Grade	Yield (Reh) min	Tensile (Rm)	Charpy V-notch longitudinal		Grade	Grade
	Strength at t = 16mm (MPa)		Temp (°C)	Energy (J) t =16mm		
S185	185	290/510	-	-	S185	-
-[1]	235	360/510	-	-	S235	40A
S235JR [2]			20	27	S235JRG1/G2	40B
S235J0			0	27	S235J0	40C
S235J2			-20	27	S235J2G3/G4	40D
-[1]	275	410/560	-	-	S275	43A
S275JR [2]			20	27	S275JR	43B
S275J0			0	27	S275J0	43C
S275J2			-20	27	S275J2G3/G4	43D
-[1]	355	470/630	-	-	S355	50A
S355JR [2]			20	27	S355JR	50B
S355J0			0	27	S355J0	50C
S355J2			-20	27	S355J2G3/G4	50D
S355K2			-20	40	S355K2G3/G4	50DD
E295	295	470/610	-	-	E295	-
S335	335	570/710	-	-	S335	-
E360	360	650/830	-	-	E360	-

1 MPa = 1 N/mm ^{2}

Table 1 – EN 10025 : part 2 : 2004 Non-alloy structural steels

Notes

1 For all products to be compliant with the EU Construction Products Directive (CPD 89/106/EC) the material must offer a guaranteed minimum impact performance. This has resulted in the removal of this grade from the standard, and the lowest grade now offered is the JR version for each yield strength variation.

2 Verification of the specified impact value is only carried out when agreed at the time of the enquiry and order.

Comparison between grades in EN 10025 : part 3 : 2004 and nearest equivalent versions in EN 10113 : part 2 : 1993 and BS 4360 : 1990

EN 10025 : part 3 : 2004					EN 10113 : part 2 : 1993	BS 4360 : 1990
Grade	Yield (Reh) min	Tensile (Rm)	Charpy V-notch longitudinal		Grade	Grade
	Strength at t = 16mm (MPa)		Temp (°C)	Energy (J) t =16mm		
S275N	275	370/510	-20	40	S275N	43DD
S275NL			-50	27	S275NL	43EE
S355N	355	470/630	-20	40	S355N	50
S355NL			-50	27	S355NL	50EE
S420N	420	520/680	-20	40	S420N	-
S420NL			-50	27	S420NL	-
S460N	460	550/720	-20	40	S460N	55C
S460NL			-50	27	S460NL	55EE

1 MPa = 1 N/mm^2

Table 2 – EN 10025 : part 3 : 2004 Normalised/normalised rolled weldable fine grain structural steels

Comparison between grades in EN 10025 : part 4 : 2004 and nearest equivalent versions in EN 10113 : part 3 : 1993

EN 10025 : part 4 : 2004					EN 10113 : part 3 :1993
Grade	Yield (Reh) min	Tensile (Rm)	Charpy V-notch longitudinal		Grade
	Strength at t = 16mm (MPa)		Temp (°C)	Energy (J) t = 16mm	
S275M	275	370/510	-20	40	S275M
S275ML			-50	27	S275ML
S355M	355	470/630	-20	40	S355M
S355ML			-50	27	S355ML
S420M	420	520/680	-20	40	S420M
S420ML			-50	27	S420ML
S460M	460	550/720	-20	40	S460M
S460ML			-50	27	S460ML

1 MPa = 1 N/mm^2

Table 3 – EN 10025 : part 4 : 2004 Thermomechanically rolled weldable fine grain structural steels

Comparison between grades in EN 10025 : part 5 : 2004 and nearest equivalent versions in EN 10155 : 1993 and BS 4360 : 1990						
EN 10025 : part 5 : 2004					EN 10155 : 1993	BS 4360 : 1990
Grade	Yield (Reh) min	Tensile (Rm)	Charpy V-notch longitudinal		Grade	Grade
	Strength at t = 16mm (MPa)		Temp (°C)	Energy (J) t =16mm		
S235J0W	235	360/510	0	27	S235J0W	-
S235J2W			-20	27	S235J2W	-
S355J0WP	355	470/630	0	27	S355J0WP	WR50A
S355J2WP			-20	27	S355J2WP	-
S355J0W	355	470/630	0	27	S355J0W	WR50B
S355J2W			-20	27	S355J2W	WR50C
S355K2W			-20	40	S355K2W	WR50D

1 MPa = 1 N/mm^2

Table 4 – EN 10025 : part 5 : 2004 Structural steels with improved atmospheric corrosion resistance - also known as weathering steels

Comparison between grades in EN 10025 : part 6 : 2004 and nearest equivalent versions in EN 10137 : part 2 : 1996 and BS 4360 : 1990						
EN 10025 : part 6 : 2004					EN 10137 : part 2 : 1996	BS 4360 : 1990
Grade	Yield (Reh) min	Tensile (Rm)	Charpy V-notch longitudinal		Grade	Grade
	Strength at t = 16mm (MPa)		Temp (°C)	Energy (J) t =16mm		
S460Q	460	550/720	0	40	S460Q	-
S460QL			0	50	S460QL	-
S460QL1			0	60	S460QL1	55F
S500Q	500	590/770	0	40	S500Q	-
S500QL			0	50	S500QL	-
S500QL1			0	60	S500QL1	-
S550Q	550	640/820	0	40	S550Q	-
S550QL			0	50	S550QL	-
S550QL1			0	60	S550QL1	-
S620Q	620	700/890	0	40	S620Q	-
S620QL			0	50	S620QL	-
S620QL1			0	60	S620QL1	-
S690Q	690	770/940	0	40	S690Q	-
S690QL			0	50	S690QL	-
S690QL1			0	60	S690QL1	-
S890Q	890	940/1100	0	40	S890Q	-
S890QL			0	50	S890QL	-
S890QL1			0	60	S890QL1	-
S960Q	960	980/1150	0	40	S960Q	-
S960QL			0	50	S960QL	-

1 MPa = 1 N/mm^2

Table 5 – EN 10025 : part 6 : 2004 Flat products of high yield strength structural steels in the quenched and tempered condition

Note
1 Other impact temperatures can be specified

The other specifications of structural components referred to in this handbook are mainly as follow:

EN 10028 (1993/1997): “Flat products made of steels for pressure purposes”

+**EN 10056 -Part1 (1993)**: "Structural steel equal and unequal leg angles - Dimensions"

EN 10149 (1995/1996): “Hot-rolled flat products made of high yield strength steels for cold forming”

#**EN 10210 -Part 1 (1994)**: "Hot finished structural hollow sections of non-alloy and fine grain structural steels"

EN 10219 -Part 1 (1997): "Cold formed welded structural hollow sections of non-alloy and fine grain steels"

SS104 (1996): "Cold formed steel sections for general structures"

Some of the standards mentioned above are new European standards superseding the old British Standards BS 4360: “Weldable structural steels” (1986) and BS 6363: “Welded cold formed steel structural hollow sections” (1983).

Material to other specifications such as ASTM, AS and JIS can also be supplied.

Manufacturing tolerances

The dimensions, mass and tolerances of the sections are generally as listed in the following standards:

BS 4 -Part 1 (1993): "Structural Steel Sections" for hot rolled universal beams and columns and tees cut therefrom, channels, bearing piles and rolled tees

#**EN 10029 (1991)**: “Specifications for tolerances on dimensions, shape and mass for hot rolled steel plates 3mm thick or above”

EN 10034 (1993): “Structural steel I and H sections - Tolerances on shape and dimensions”

EN 10051 (1992): “Continuously hot-rolled uncoated plate, sheet and strip of non-alloy and alloy steels - Tolerances on dimensions and shape”

EN 10056 -Part 2 (1993): "Structural steel equal and unequal leg angles -Tolerances on shape and dimensions”

#+**EN 10210 -Part 2 (1997)**: "Hot finished structural hollow sections of non-alloy and fine grain structural steels"

EN 10219 -Part 2 (1997): "Cold formed welded structural hollow sections of non-alloy and fine grain steels"

SS104 (1996): "Cold formed steel sections for general structures" for lipped channels

Some of the standards mentioned above are new European standards superseding the old British Standards BS 4848 - Part 2: “Hot-rolled structural steel sections - Hot-finished hollow sections” (1991) and BS 6363: “Welded cold formed steel structural hollow sections” (1983).

Material to other specifications such as ASTM, AS and JIS can also be supplied.

In structural design and construction there are a lot of details to remember. For example, when buying steel beams, columns, bars, plates and pipes, **be sure to buy the correct section type, size and grade**.If the specified section is not available, check with the designer before any changes to the structure are made. For example, a parallel flange channel can not be substituted with a plain channel without reference to the design engineer. This is because the sections are different both in size and material, the plain channel is cold formed while the parallel flange channel is hot formed, and they have different sectional properties.

Standards superseding parts of BS4360 1986/1990.

+ Standards superseding parts of BS4848 1972/1980/1991.

In the section “Comparison between hot finished and cold formed hollow sections” we have explained the differences between the two sections, and why cold formed sections can not be used to substitute hot finished sections without rechecking the capacity.

Comparison between general structural steel specifications

The following specifications are normally readily available, but offers depend upon acceptance of full specification details or specifications not listed below.

Quality	Grade	Min. Yield strength		Min. Tensile strength		Chemical composition (%, max.)					
		N/mm^2	ksi	N/mm^2	ksi	C	Si	Mn	P	S	Nb
BS 4360	43A	275	40	430/580	62/84	0.25	0.50	1.60	0.050	0.05	-
(1986)	50B	355	52	490/640	71/93	0.22	0.50	1.50	0.050	0.05	0.003/0.10
(superseded)	55C	450	65	550/700	80/102	0.22	0.60	1.60	0.040	0.04	0.003/0.10
EN 10025	S275J0	275	40	410/560	59/81	0.18	-	1.50	0.040	0.04	0.009
(2004)	S355J0	355	52	490/630	71/91	0.20	0.55	1.60	0.040	0.04	0.009
EN 10113	S275N	275	40	370/510	54/74	0.20	0.40	0.5/1.40	0.035	0.03	0.050
(1993)	S355N	355	52	470/630	68/91	0.20	0.50	0.9/1.65	0.035	0.03	0.050
(superseded)	460M	460	67	530/720	77/104	0.18	0.60	1.70	0.030	0.025	0.05
ASTM A36 (2001)	-	250	36	400/550	58/80	0.26	0.40	-	0.040	0.05	-
ASTM A283 (1993)	Grade D	230	33	415/550	60/80	0.27	0.40	0.90	0.035	0.04	-
ASTM A572 (2001)	42	290	42	415	60	0.21	0.40	1.35	0.050	0.04	-
	50	345	50	450	65	0.23	0.40	1.35	0.050	0.04	-
	55	380	55	485	70	0.25	0.40	1.35	0.050	0.04	-
	60	415	60	520	75	0.26	0.40	1.35	0.050	0.04	-
	65	450	65	550	80	0.23	0.40	1.65	0.050	0.04	-
ASTM A913	50	345	50	450	65	0.12	0.40	1.60	0.040	0.03	0.05
(2001)	65	450	65	550	80	0.16	0.40	1.60	0.030	0.03	0.05
JIS G 3101	SS 400	245	36	400/510	58/74	-	-	-	0.050	0.05	-
(1995)	SS 490	285	41	490/610	71/88	-	-	-	0.050	0.05	-
JIS G 3106	SM 400B	245	36	400/510	58/74	0.20	0.35	0.6/1.40	0.035	0.035	-
(1995)	SM 490B	325	47	490/610	71/88	0.18	0.55	1.60	0.035	0.035	-
	SM 490YB	365	53	490/610	71/88	0.20	0.55	1.60	0.035	0.035	-
JIS G 3136	SN 400B	235	34	400/510	58/74	0.20	0.35	0.6/1.40	0.030	0.015	-
(1994)	SN 490B	325	47	490/610	71/88	0.18	0.55	1.60	0.030	0.015	-
JIS G 3131	SPHC	-	-	270	39	0.15	-	0.60	0.50	0.050	-
	SPHD	-	-	270	39	0.10	-	0.50	0.40	0.040	-
	SPHE	-	-	270	39	0.10	-	0.50	0.30	0.035	-
AS3679	C250LO	260	38	410	59	0.20	0.40	1.50	0.040	0.04	-
1996	C350LO	360	52	480	70	0.22	0.50	1.60	0.040	0.04	-
GB700-88	Q235	235	34	375/406	54/59	0.22	0.30	0.65	0.045	0.05	-
DIN 17100	St 37.2	235	34	340/470	49/68	0.17	-	-	0.050	0.05	-
	St 44.2	275	40	410/540	59/78	0.21	-	-	0.050	0.05	-
	St 50.2	295	43	470/610	68/88	-	-	-	0.050	0.05	-
	St 52.3	355	51	490/630	71/91	0.20	0.55	1.60	0.040	0.04	-
GOST1050-88	08 KP	-	-	260/380	38/55	0.12	0.03	0.50	0.035	0.04	-

Notes: For BS, EN and JIS the values are for sections with thickness less than 16mm.

Table 6 – Comparison between general structural steel specifications

Section Properties

The followings are taken from EN 10210-2 (1997), EN 10219-2 (1997) and BS5950 Volume 1 Design Guide, 5th edition 1997

Corner radius (r)

For hollow sections the corner radius are taken from EN 10210 and EN 10219, for hot finished hollow sections and cold formed hollow sections respectively.

For hot finished square and rectangular hollow sections:

Nominal external corner radius for calculation is r_o=1.5T

Nominal internal corner radius for calculation is r_i=1.0T

For cold formed square and rectangular hollow sections:

Nominal external corner radius for calculation is

For thickness T ≤ 6mm: r_o=2.0T

For thickness 6mm < T ≤ 10mm: r_o=2.5T

For thickness T > 10mm: r_o=3.0T

Nominal internal corner radius for calculation is

For thickness T ≤ 6mm: r_i=1.0T

For thickness 6mm < T ≤ 10mm: r_i=1.5T

For thickness T > 10mm: r_i=2.0T

For other section types the manufacturers are using rules from various standard specifications, which will take too much space to include in this handbook. Refer to the respective country's standards.

Second moment of area (I)

The second moment of area of the section, often referred to as moment of inertia, has been calculated based on first principal, by taking into account all tapers, radii and fillets of the sections.

Radius of gyration (r)

The radius of gyration is a parameter used in buckling calculation and is derived as follows:

$$r = \left[\frac{I}{A}\right]^{1/2}$$

where A is the cross-sectional area and I is the second moment of area.

For castellated sections, the radius of gyration given is calculated at the net section as required in design to BS 5950: Part 1.

Elastic Modulus (Z)

The elastic modulus is used to calculate the moment capacity based on the design strength of the section or the stress at the extreme fibre of the section from a known moment. It is derived as follows:

$$Z = \frac{I}{y}$$

where y is the distance to the extreme fibre of the section from the elastic neutral axis and I is the second moment of area.

For castellated sections the elastic modulus given are those at the net section.
For channels the modulus about the minor axis (y-y) is given at the toe of the section.
For angles the elastic modulus about both axes are given at the toes of the section.

Plastic Modulus (S)

The plastic modulus is calculated based on the first principal, by taking moment about the equal area axis. Only the full plastic modulus (S) is given in the tables. When a member is subject to both axial load and bending, the plastic modulus must be reduced to take account of the reduction in plastic moment of resistance. The details for the reduction are given in BS 5950.

Buckling parameter (u) and torsional index (x)

The buckling parameter and torsional index used in buckling calculations are derived as follows:

For bi-symmetric flanged sections and flanged sections symmetrical about the minor axis only:

$$u = \left[\frac{4S_X^{\,2} \cdot \gamma}{A^2 \cdot h^2}\right]^{1/4}$$

$$x = 0.566h\left[\frac{A}{J}\right]^{1/2}$$

For flanged sections symmetric about the major axis only:

$$u = \left[\frac{I_y \cdot S_X^{\,2} \cdot \gamma}{A^2 \cdot H}\right]^{1/4}$$

$$x = 1.132\left[\frac{A \cdot H}{I_y \cdot J}\right]^{1/2}$$

where

S_x	= is the plastic modulus about the major axis
γ	$= 1 - \frac{I_y}{I_x}$
I_x	= is the second moment of area about the major axis
I_y	= is the second moment of area about the minor axis
A	= is the cross-sectional area
h	= is the distance between the shear centres of flanges (for T sections, h is the distance between shear centre of the flange and the toe of the web)
H	= is the warping constant
J	= is the torsion constant

Warping constant (H)

For Tee sections cut from UB and UC sections, the warping constant (H) has been derived as given below.

$$H = \frac{1}{144} \cdot T^3 \cdot B^3 + \frac{1}{36}\left(d - \frac{T}{2}\right)^3 \cdot t^3$$

T, B, D, d, t *and* r are given in the section tables (*r* is the corner radius).

Because this value is very small, it is not tabulated.

The warping constants (H) for I, H and channel sections are calculated using the formulae given in the SCI publication (P057) *Design of Members Subject to Combined Bending and Torsion*.

Torsion constant (J)

For Tee sections cut from UB and UC sections, the torsion constant (J) has been derived as given below.

$$J = \frac{1}{3} \cdot B \cdot T^3 + \frac{1}{3} \cdot (d - T) \cdot t^3 + \alpha_1 D_1^{\,4} - 0.21 \cdot T^4 - 0.105 \cdot t^4$$

where

$$\alpha_1 = -0.042 + 0.2204\frac{t}{T} + 0.1355\frac{r}{T} - 0.0865\frac{t \cdot r}{T^2} - 0.0725\frac{t^2}{T^2}$$

$$D_1 = \frac{\left[(T + r)^2 + (r + 0.25t) \cdot t\right]}{\left[2r + T\right]}$$

T, B, D, d, t *and* r are given in the section tables (*r* is the corner radius).

The torsion constants (J) for I, H and channel sections are calculated using the formulae given in the SCI publication (P057) *Design of Members Subject to Combined Bending and Torsion*.

For circular hollow sections:

$$J = 2I$$

For square and rectangular hollow sections:

$$J = \frac{t^3 \cdot h}{3} + 2kA_h$$

where

I = second moment of area

t = is the thickness of section

h = is the mean perimeter = $2\left[(B - t) + (D - t)\right] - 2R_c \cdot (4 - \pi)$

A_h = is the area enclosed by mean perimeter = $(B - t)(D - t) - R_c^{\,2}(4 - \pi)$

k = $\dfrac{2A_h \cdot t}{h}$

B = is the breadth of section

D = is the depth of section

R_c = is the average of internal and external corner radii

T, B, D, d, t *and* r are given in the section tables (*r* is the corner radius).

Torsion modulus constant (C)
For circular hollow sections:

$$C = 2Z$$

where Z is the elastic modulus.

For square and rectangular hollow sections:

$$C = \frac{J}{t + \frac{k}{t}}$$

Dimensional units

The dimensions of sections are given in millimetres (mm) and the calculated properties (centroidal distances, cross-sectional areas, radii of gyration, moments of inertia, elastic and plastic modulus) are given in centimetre (cm) units. Surface areas are in square centimetres (cm^2). Some of the sections have imperial sizes but the dimensions and sectional properties for these sections are given in the metric system.

Mass and force units

The units for force, mass and acceleration are those of the Systeme International (SI). They are the Newton (N), the kilogram (kg) and the metre per second per second (m/s^2) so that $1N=1kgx1m/s^2$. The acceleration due to gravity varies slightly from place to place and for convenience a "standard" value of 9.80665 m/s^2 has become generally accepted in structural engineering. With this convention, the force exerted by a mass of 1kg under the action of gravity is the "technical unit" of 9.80665N. In the same way 9.80665 kilo Newton is the force exerted by a mass of 1 tonne (1000kg) under gravity and 1kN the force from a mass of 0.102 tonne.

Comparison Between Hot Finished and Cold Formed Hollow Sections

Introduction

The objectives of the comparison are to gain an understanding on the differences between hot and cold formed sections, and subsequently, correct applications of the sections.
Hot finished hollow sections have been successfully used in primary structures for many years, but there is yet little experience with the use of cold formed sections. Cold formed products differ from the hot finished in many respects. Therefore, their use in primary structures must be approached with caution.

Thin walled cold formed open sections have been used in construction as secondary members, such as purlins, for a long time. However, there is a growing trend of manufacturing thicker walled cold formed hollow sections and the temptation to introduce them into primary structures.
Cold formed hollow sections produced to EN 10219 are suitable for structural use. However, they should not be used as a direct substitute for hot finished hollow sections without reconsideration of the design capacity.

With the implementation of the European Standard for cold formed structural hollow sections - EN 10219 - there exists a situation of identical grade designations for the majority of the common strength grades used in both the hot finished (EN 10210) and cold formed (EN 10219) standards. For instance, sections with yield strength of 275 N/mm2 and Charpy impact strength of 27 Joules at -20 degrees will have a grade designation of S275J2H in both standards.

Common designation can lead to direct substitution and interchanging of the sections. Since cold formed sections generally are weaker than hot finished sections it is essential that products are specified accurately.
If a full designation of the steel is given to include both the standard number and the grade/quality of the steel, substitution of cold for hot finished sections can be prevented. For example, a hollow section of yield strength 275N/mm2 and a Charpy impact strength of 27 Joules at -20 degrees should be designated as EN 10210 S275J2H for hot finished and EN 10219 S275J2H for cold formed sections.

The BS 5950 Part 1 (1997) are currently being amended, and with the increasing tendency of using cold formed hollow sections in primary structures these sections will probably be included in the new edition. The design rules are not very different from those for hot finished sections, but there are some things a designer has to know and take into consideration. For example, the corner radiuses, section properties, ductility, corner cracking and welding. The differences between the two section types in production, behaviour and design are investigated in this chapter.

Specifications

Hot finished structural hollow sections of non-alloy and fine grain steels

EN 10210-1 (1994):	Technical delivery requirements
EN 10210-2 (1997):	Tolerances, dimensions and sectional properties
BS 5950-1:	Structural use of steel works in building - Code of practice for design of rolled and welded sections*.

*Subject to changes.
New BS 5950 Part 1, 1999/2000 (6th edition).

Cold formed welded structural hollow sections of non-alloy and fine grain steels

EN 10219-1 (1997):	Technical delivery requirements
EN 10219-2 (1997):	Tolerances, dimensions and sectional properties
BS 5950-1:	Structural use of steel works in building - Code of practice for design of rolled and welded sections*.

*Subject to changes.

Design of cold formed hollow sections for primary structures will be included in the new BS 5950 Part 1, 1999/2000 (6th edition).

Manufacture of hollow sections

Hot finished hollow sections

The manufacture of hot hollow sections involves a number of processes and cold forming may be used initially. However, the hot finished product is characterised by the final forming operation, which is always being carried out in the austenitic state (i.e. above 920 degrees).

As a result, the forming operations do not affect the physical properties of the final product, which are uniform around the complete periphery, including the seam weld in continuously welded sections.

Cold formed hollow sections

The physical properties of the cold formed sections are significantly affected by the method used in producing the strip, section forming processes and the final shape and dimensions of the resulting section. The strip used for the cold formed sections may be hot or cold rolled.

Plastic deformation and straining occur during the cold forming operations mentioned below:

1) uncoiling of strips
2) strip flattening
3) forming into a round section
4) welding of round sections
5) circular sections formed into square or rectangle
6) straightening of the curved walls and corners formed

Note: Square or rectangular hollow sections are not necessarily formed from round sections, some manufacturers form the square or rectangle directly from strip.

Cold forming is known to increase the yield and tensile strength of the materials due to cold working or strain hardening (see Figure 1). However, as the strength increases, ductility decreases. And the process may result in a section in which the strength and ductility vary considerably around the periphery. For example, a test specimen from the flat face of the cold formed section will only indicate the conditions applying to that face. There are also differences in the mechanical property transverse and longitudinally on the section. Thus, ***cold formed sections must be used with caution and proper design,*** especially in the use for primary structures.

There should be restrictions for the welding of cold formed sections. The corners of these sections are subjected to high residual stress due to cold working. Welding further induces the residual stress at the corners because of high local heating.Corner cracking occurs when the yield stress of these cold formed sections is exceeded by the residual stress built up at the corners.

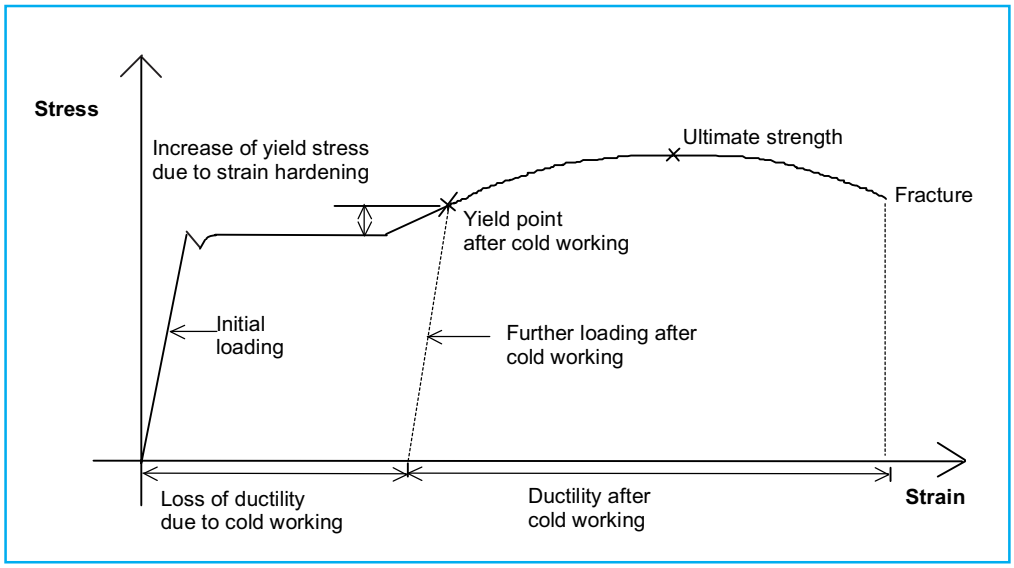
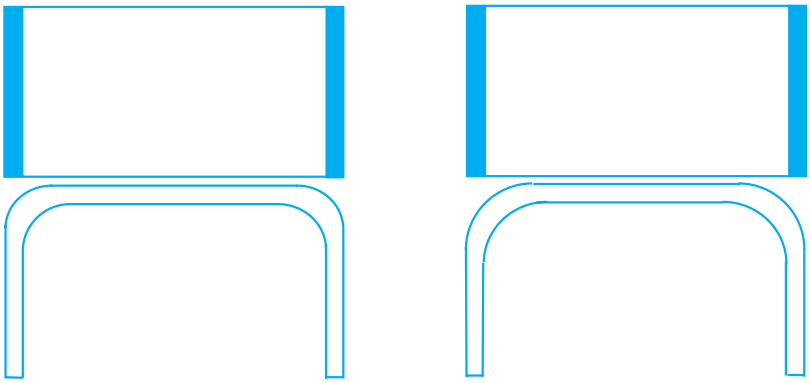


Figure 1 – Effect of cold working on material properties for cold formed hollow sections

Section properties

Cold formed rectangular and square hollow sections have rounder corners than the hot finished sections. This is to avoid corner cracking from occurring during the forming of cold formed sections, because of too sharp corner radius or too thick sections.

However, the larger or rounder the corner radius, the smaller are the cross sectional area, moment of inertia, section modulus and radius of gyration, etc. for a given size of section compared with a similar hot finished section. Larger corner radii can make fabrication difficult and require additional weld metal or profiling to produce the right fit-up. This is a problem particularly when connecting one section to the face of another section of similar size (see Figure 2), and can also add to fabrication costs.



The tight corner radii of **hot finished** sections provide good preparation for welding, especially where members of the same width are to be welded together.

The larger corner radii of **cold formed** sections will require additional weld metal or additional profiling to produce the required fit-up; both add to fabrication costs, especially where members of the same width are to be welded together.

Figure 2 – Comparison of corner radius of hot finished and cold formed hollow sections

Structural performance

For cold formed sections in tension, the variation of strength around the section could lead to local over-stressing, which together with the reduced ductility in cold formed sections could reduce the capability of the sections to redistribute loads.
As local stress redistribution often occurs even in elastic design, the maximum value of yield/ tensile strength ratio should not exceed 80%. This limitation is incorporated in some standards *(extract from "Hot formed RHS winning on points" from British Steel).*

The ductility and Charpy impact toughness for sections to EN 10219 are equivalent to hot finished hollow sections to EN 10210.
For the classification of cross sections the limiting width to thickness ratio will need minor adjustments to take into account the residual stresses in the section due to cold forming and the ductility of the material.

According to Europe Code 3 (ENV 1993-1-1:1992/A1:1994), welding of cold formed sections should not be carried out in the cold deformed zones or within the adjacent width of 5t each side, see Table 7, unless either:
-the cold-deformed zones are normalised after cold-forming but before welding;
-the thickness does not exceed the relevant value obtained from Table 7.

r/t	Strain due to cold forming (%)	Maximum thickness (mm)		
		Generally		Fully killed Aluminium-killed steel (Al ≥ 0.02%)
		Predominantly static loading	Where fatigue predominates	
≥ 25	≥ 2	Any	Any	Any
≥ 10	≥ 5	Any	16	Any
≥ 3.0	≥ 14	24	12	24
≥ 2.0	≥ 20	12	10	12
≥ 1.5	≥ 25	8	8	10
≥ 1.0	≥ 33	4	4	6

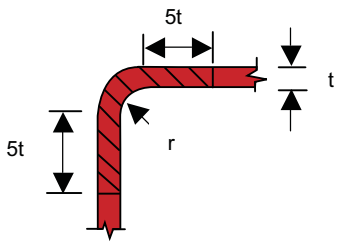


Table 7 – Conditions for welding cold-deformed zones and adjacent material

Due to stress relief effects, cold formed hollow sections are subject to greater distortion than hot finished sections when subject to shot blasting, galvanising and welding. This can cause local buckling, corner cracking and other deformations, and will obviously have a large impact on the capacity when used as beams and columns.

Compression resistance

For compression members, the design strength should be based on the yield strength of the cold finished section (as given in EN 10219) and not on that of the parent plate. Because of the lower sectional properties and the residual stresses caused by the manufacturing process, a lower column curve (curve C) is used for the cold formed sections compared to curve A for the hot finished sections. This results in a larger reduction of the compression strength. Figure 3 shows the column curves.

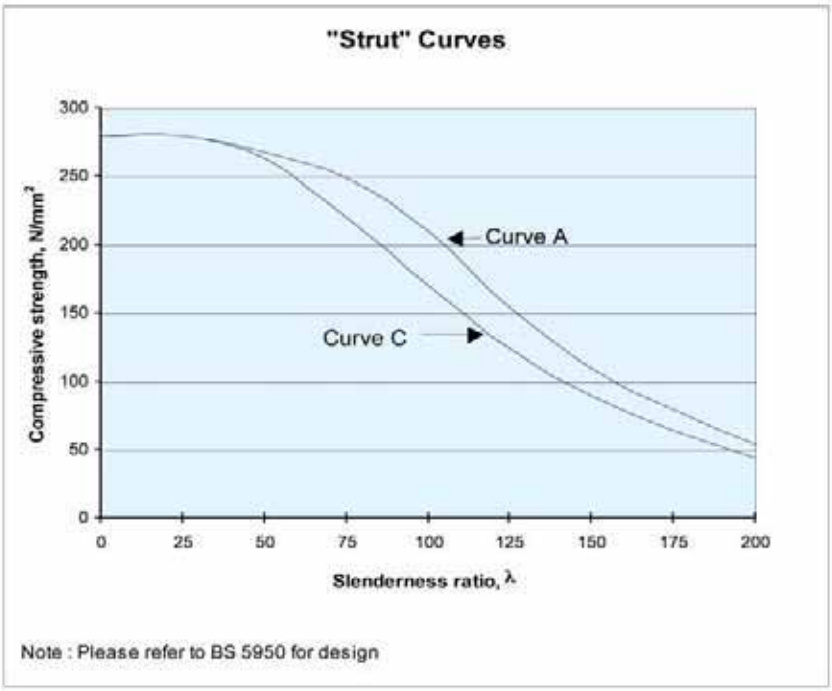


Figure 3 – Compression/Slenderness curves for columns

Web bearing and buckling

Formulae for buckling and bearing for hot finished hollow sections can be found in the SCI Publication Design Guide to the BS 5950: Part 1; Volume 1 Section Properties and member capacities and these may also be used for cold formed sections (extract from New Steel Construction, August/September 1998).

Tension, shear and bending

Cold formed members in tension, shear, bending and lateral torsional buckling may be treated in the same way as hot finished hollow sections (extract from New Steel Construction, August/September 1998).

Summary

Light gauge open cold formed sections have been widely used for secondary structures of steel-framed buildings, such as purlins. Concern is however on the use of the cold formed hollow sections for primary structures. For a cold formed hollow section of the same nominal size, thickness and grade as a hot finished hollow section, the compression capacity dependent on the slenderness, can be 34% lower than for the hot finished section.

The application of the current design rules on cold formed hollow sections might lead to optimistic results, because the rounder corner radius for these sections can affect the “web” buckling characteristics of the section.

Most design rules have restrictions on welding of cold formed sections due to the residual stresses that occurs and to avoid corner cracking.

The advice is that there should not be direct substitution or interchanging of sections without a capacity checking.

To avoid uncertified substitution the designers and quality surveyors have to know how to visually differentiate cold formed and hot finished sections. A few things they should know are:

- Because of the cold forming process the cold formed sections have a smoother, sometimes oily surface, while the hot finished sections have a rougher surface.

If the sections are blasted or painted the corner radius and weld seam will indicate if the beam/column is hot finished or cold formed.

- As mentioned earlier the corner radius of cold formed sections are rounder than the corner radius of hot finished sections.
- The seam of welded cold formed sections are always on one of the flat sides, with a distance from the corner, and on the same place for all members of the same bundle, but for the hot finished sections the seam can be anywhere on the cross-section.

Fire resistance

There are several options to insure the fire resistance of steel structures. While hollow sections can be protected on the inside, the outside or a combination of both, the universal columns can only be protected on the outside.

Externally protected columns

For universal columns and ***unfilled structural hollow sections*** there are a number of ways to protect the columns, including casing by plasterboards, cementitious sprays, intumescent coatings or pre-formed casings, such as tube-in-tube systems. In all of these cases the fire-protected structural hollow sections will have the minimum area compared to all other similarly loaded columns in other materials.

Internally protected columns

Structural hollow sections have the advantage that fire protection material like water or concrete, can be ***filled*** inside the columns. It is very simple to design a hollow section with structural grade concrete filling. First, the column is checked for room temperature loading, and then the fire resistance is checked, if required, an external fire protection system is added. This method is very economic as it both minimises the wall thickness of the hollow section, because of the concrete, and reduces the thickness of the external protection system markedly below that of the unfilled section.

With use of concrete as internal protection of a ***structural hollow section***, external protection might not be necessary at all. The ***concrete filling*** will support the load when the temperature has reached the point where the load bearing capacity of the steel is under the actual forces imposed on the structure. The concrete core is designed to carry the whole of the load at the fire limit-state. Plain concrete filling is suitable for mainly axially loaded columns, while bar reinforced concrete is required for columns with significant moments.

For externally protected columns the composite concrete filled, intumescent-coated solution gives the smallest required columns. While for the internally protected columns the bar reinforced concrete filled solution gives the smallest footprint. Among all the four solutions the composite concrete filled, intumescent-coated column gives the most economic solution.

Cost comparisons

British Steel in the United Kingdom has made a comparison between different types of fire protection on hollow section columns and other steel sections. The study compared options for a typical 7-storey internal column carrying a loading of 6kN/m2 on a grid layout of 7.2 metres by 6 metres. Where possible steel of design grade S355 was used, in general, this gives the most economical solution for structural steelwork. In the case of internal protection, plain or bar reinforced concrete is assumed. In the case of external protection, fire resistant boards were assumed for non-circular columns, such as universal columns and rectangular/square hollow columns.
Three basic design options are possible for column design of structural hollow sections, and British Steel looked at all 3 of them in this study.

Option 1: Columns are designed on a floor by floor basis or by grouping two or three storeys together. The lightest steel section is selected for each column lift. This option produces the minimum weight column with sizes reducing through the height of the building.

Option 2: Columns are designed as in Option 1, but have constant external dimensions throughout the height of the building. The column at the lowest level is designed for the least weight solution and it is the external dimensions of this section that are used for all other sections at higher levels. At the higher levels, the wall thickness of the hollow sections is progressively reduced.

Option 3: Columns are designed as in Option 2, but the type of column selected is optimised for all the columns over the height of the building rather than just the ground floor, as in Option 2. Generally this means that the ground floor column is smaller and thicker than that in Option 2, but the column serial size chosen allows the overall weight of columns to be reduced.

Table 8 and Table 9 compares the costs of UC, CHS and RHS columns for various methods of fire protection. Circled solutions are most economical.

CHS		Fire Protection Options			
	External Board	Intumescent Paint		Internal Concrete Filling	
Columns Options	UC	Circular Hollow Sections			
		Unfilled	Composite	Plain concrete	Bar Reinforced concrete
Option 1	100	111	(88)	134	(88)
Option 2	100	159	113	186	107
Option 3	100	111	(97)	186	107

Table 8 – Fire resistance: Cost comparison – universal columns vs. circular hollows

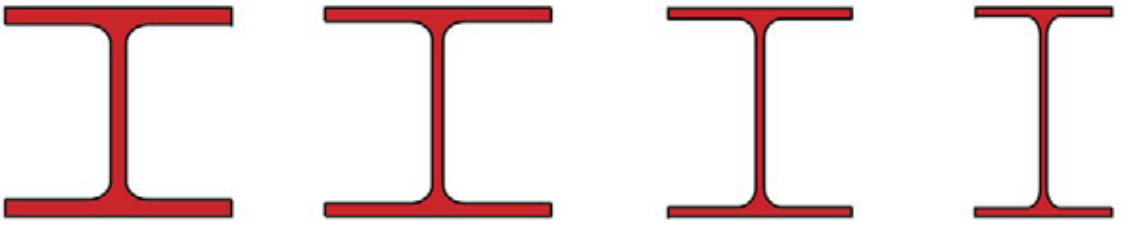
RHS		Fire Protection Options				
	External Board	External Board		Intumescent Paint	Internal Concrete Filling	
Columns Options	UC	Rectangular Hollow Sections				
		Unfilled	Composite	Composite	Plain concrete	Bar Reinforced concrete
Option 1	100	108	(92)	(90)	163	113
Option 2	100	111	121	115	231	123
Option 3	100	111	100	102	231	123

Table 9 – Fire resistance: Cost comparison – universal columns vs. rectangular hollows

General

The section sizes of universal beams and columns are given in the tables on the following pages. We have split up the sections in metric and imperial sizes because the sections are rolled after different standard specifications.

The tables cover I-beams, IPE- beams, H-beams and HE-beams. The difference between these beams is that the H/HE-beams have wider flange than the I/IPE-beams and therefore look more like the letter H than the letter I, see Figure 4. In our catalogue we put them all together to make it easier to make the ultimate choice.



Heavy Column Sections. (H/HE) | Wide Flange Sections. Web height and flange width approximately equal. (H/HE) | Medium Flange Sections. (I/IPE) | Narrow Flange Sections. (I/IPE)

Figure 4 – Universal Beams and Columns: Section shapes

The standard specifications used for production of universal beams and columns in this region are listed in this table.

Material	Yield strength N/mm²			Tensile strength N/mm²	Min. Elongation $L_0=5.65\sqrt{S_0}$	Min. Charpy V-notch. Temp. 20°C	Dimensions & Tolerances
AS 3679.1 (1996)	**≤12mm**	**12-40**	**≥40mm**				
Grade 250	260	250	230	min. 410	22 %	27J	***AS 3679.1 (1996)***
Grade 300	300	300	300	min. 430	22 %	27J	
Grade 350	360	340	330	min. 480	20 %	27J	
ASTM A36 (2001)	min. 250			400-550	20-21 %	-	
ASTM A572 (2001)							
Grade 42	min. 290			min. 415	20-24 %	-	
Grade 50	min. 345			min. 450	18-21 %	-	***ASTM A6 (1997)***
Grade 60	min. 415			min. 520	16-18 %	-	
Grade 65	min. 450			min. 550	15-17 %	-	
ASTM A913 (2001)							
Grade 50	min. 345			min. 450	18-21 %	-	
Grade 65	min. 450			min. 550	15-17 %	-	
BS 4360 (1986) **(superseded)**							***BS 4 Part 1 (1993) (superseded)***
Grade 43A	min. 275			430-580	22 %	-	
Grade 50B	min. 355			490-640	20 %	27J	
EN 10025 (2004)	**≤16mm**	**16-40**	**≥40mm**	**3-100mm**		**10<t≤150mm**	
S275JR	275	265	255	410-560	17-22 %	27J	***EN 10034 (1993)***
S355JR	355	345	335	490-630	17-22 %	27J	
S420N	420	400	390	500-660	19 %	27J	
S460N	460	440	430	530-720	17 %	27J	
JIS 3101 (1995)	**≤16mm**	**16-40**	**≥40mm**	**t<100mm**			
SS400	245	235	215	400-510	17-24 %	-	
SS490	285	275	255	490-610	15-21 %	-	
SS540	400	390	-	min 540	13-17 %	-	
JIS 3106 (1995)	**≤16mm**	**16-40**	**≥40mm**	**t<100mm**			***JIS 3192 (1994)***
SM400A, B	245	235	215	400-510	18-24 %	-	
SM490A, B	325	315	295	490-610	17-23 %	-	
SM490YA, YB	365	355	335	490-610	15-21 %	-	
SM520B	365	355	335	520-640	15-21 %	-	

Table 10 – Universal Beams and Columns: Standard specifications

Rolling tolerances - 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 the following table.

Section Height h (mm)	Tolerance (mm)	
Up to and including 180	+3	-2
Greater than 180 up to and including 400	+4	-2
Greater than 400 up to and including 700	+5	-3
Greater than 700	+5	-5

Flange width (b)

The deviation from nominal on flange width shall be within the tolerance given in the following table.

Flange width b (mm)	Tolerance (mm)	
Up to and including 110	+4	-1
Greater than 110 up to and including 210	+4	-2
Greater than 210 up to and including 325	+4	-4
Greater than 325	+6	-5

Web thickness (s)

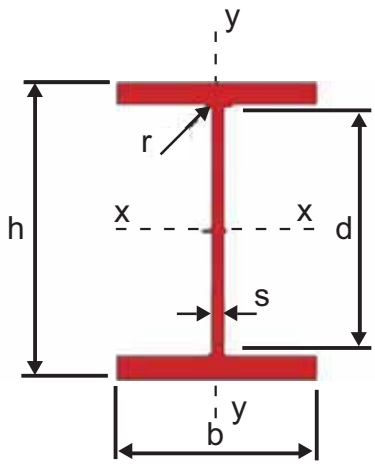
The deviation from nominal on web thickness measured at the mid-point of dimension (h) shall be within the tolerance given in the following table.

Web thickness s (mm)	Tolerance (mm)	
Less than 7	+0.7	-0.7
7 up to but excluding 10	+1.0	-1.0
10 up to but excluding 20	+1.5	-1.5
20 up to but excluding 30	+2.0	-2.0
40 up to but excluding 60	+2.5	-2.5
60 and over	+3.0	-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 the following table.

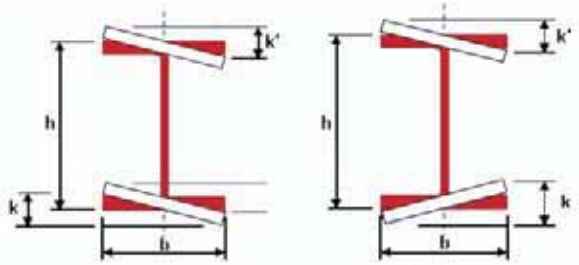
Flange thickness s (mm)	Tolerance (mm)	
Less than 6.5	+1.5	-0.5
6.5 up to but excluding 10	+2.0	-1.0
10 up to but excluding 20	+2.5	-1.5
20 up to but excluding 30	+2.0	-2.0
30 up to but excluding 40	+2.5	-2.5
40 up to but excluding 60	+3.0	-3.0
60 and over	+4.0	-4.0



Out-of-squareness (k + k')

The out-of-squareness of the section shall not exceed the maximum given in the following table.

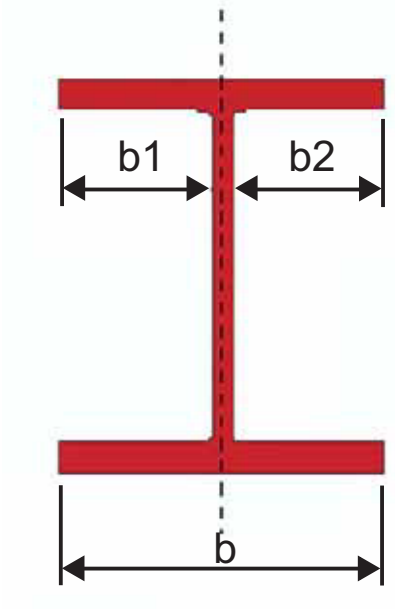
Flange width b (mm)	Tolerance (mm)
Up to and including 110	1.5
Greater than 325	2% of b (maximum 6.5mm



Web off-centre (e) on mass

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 the following table.

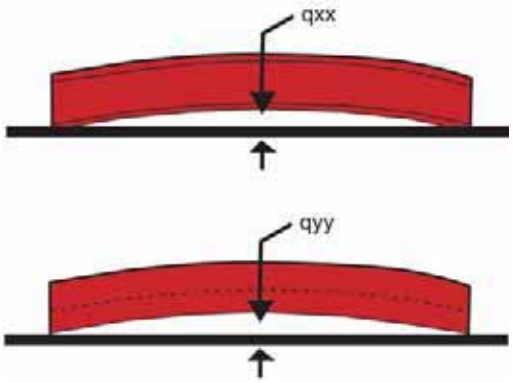
	Flange width b (mm)	Web off-centre where e= (b1-b2)/2
T < 40	Up to and including 110	+4
	Greater than 110 up to and including 325	+4
T ≥ 40	Greater than 110 up to and including 325	+4
	Greater than 325	+6



Straightness (qxx or qyy)

The straightness shall comply with the requirements given in the following table.

Section height h (mm)	Tolerance qxx or qyy on length L (%)
Greater than 80 up to and including 180	0.30 L
Greater than 180 up to and including 360	0.15 L
Greater than 360	0.1 L



Tolerance on mass

The deviation from the nominal mass of a batch or a piece shall not exceed ± 4.0%.

The mass deviation is the difference between the actual mass of the batch or a piece and the calculated mass. The calculated mass shall be determined using a density of 7850kg/m3

Tolerance on length

The sections shall be cut to ordered lengths to tolerances of

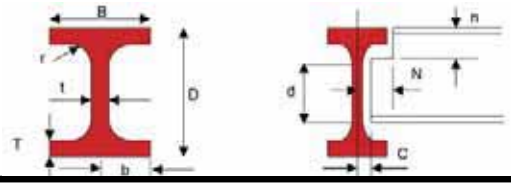
a. ± 50mm

or

b.+ 100mm where minimum lengths are requested

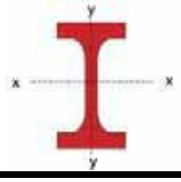
L represents the longest useable length of the section assuming that the ends of the section have been cut square.

Universal Beams and Columns



Metric units

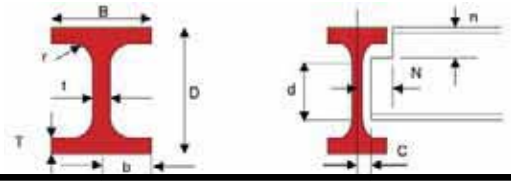
Designation Size	Mass Per Metre	Depth Of Section	Width Of Section	Thickness		Root Radius	Depth Between Fillets	Area Of Section	Ratios For Local Buckling		Dimensions For Detailing		
				Flange	Web				Flange	Web	End Clearance		Notch
		D	B	T	t	r	d	A	b/T	d/t	C	N	n
mm	kg/m	mm	mm	mm	mm	mm	mm	cm^2			mm	mm	mm
100x50	9.30	100	50	7	5	8	70	11.8	3.57	14.0	5	33	15
100x100	14.8	100	100	7	5	10	66	19.2	7.14	13.2	5	58	17
	16.9	100	100	8	6	8	68	21.6	6.25	11.3	5	57	16
	17.2	100	100	8	6	10	64	21.9	6.25	10.7	5	57	18
125x60	13.2	125	60	8	6	9	91	16.8	3.75	15.2	5	37	17
125x125	23.6	125	125	9	6.5	8	91	30.0	6.94	14.0	5	69	17
	23.8	125	125	9	6.5	10	87	30.3	6.94	13.4	5	69	19
150x75	14.0	150	75	7	5	8	120	17.8	5.36	24.0	5	45	15
150x100	20.7	148	100	9	6	8	114	26.3	5.56	19.0	5	57	17
	21.1	148	100	9	6	11	108	26.8	5.56	18.0	5	57	20
150x150	31.1	150	150	10	7	8	114	39.6	7.50	16.3	6	82	18
	31.5	150	150	10	7	11	108	40.1	7.50	15.4	6	82	21
	37.4	154	151	12	8	11	108	47.7	6.29	13.5	6	82	23
175x90	18.0	175	90	8	5	8	143	22.9	5.63	28.6	5	53	16
	18.1	175	90	8	5	9	141	23.0	5.63	28.2	5	53	17
175x125	23.3	169	125	8	5.5	12	129	29.7	7.81	23.5	5	70	20
175x175	32.8	171	174	9	6	12	129	41.7	9.67	21.5	5	94	21
	40.2	175	175	11	7.5	12	129	51.2	7.95	17.2	6	94	23
	40.4	175	175	11	7.5	13	127	51.4	7.95	16.9	6	94	24
200x100	17.8	198	99	7	4.5	8	168	22.7	7.07	37.3	4	57	15
	18.2	198	99	7	4.5	11	162	23.2	7.07	36.0	4	57	18
	20.9	200	100	8	5.5	8	168	26.7	6.25	30.5	5	57	16
	21.3	200	100	8	5.5	11	162	27.2	6.25	29.5	5	57	19
200x150	29.9	194	150	9	6	8	160	38.1	8.33	26.7	5	82	17
	30.6	194	150	9	6	13	150	39.0	8.33	25.0	5	82	22
	36.9	198	151	11	7	13	150	47.0	6.86	21.4	6	82	24
200x200	41.4	196	199	10	6.5	13	150	52.7	9.95	23.1	5	106	23
	49.9	200	200	12	8	13	150	63.5	8.33	18.8	6	106	25
	57.8	204	201	14	9	13	150	73.6	7.18	16.7	7	106	27
	65.7	208	202	16	10	13	150	83.7	6.31	15.0	7	106	29
250x125	25.1	248	124	8	5	8	216	32.0	7.75	43.2	5	70	16
	25.7	248	124	8	5	12	208	32.7	7.75	41.6	5	70	20
	29.0	250	125	9	6	8	216	37.0	6.94	36.0	5	70	17
	29.6	250	125	9	6	12	208	37.7	6.94	34.7	5	70	21
250x175	43.6	244	175	11	7	13	196	55.5	7.95	28.0	6	94	24
	44.1	244	175	11	7	16	190	56.2	7.95	27.1	6	94	27
	51.6	248	176	13	8	16	190	65.7	6.77	23.8	6	94	29
	59.1	252	177	15	9	16	190	75.3	5.90	21.1	7	94	31
250x250	66.5	248	249	13	8	16	190	84.7	9.58	23.8	6	131	29
	71.8	250	250	14	9	13	196	91.4	8.93	21.8	7	131	27
	72.4	250	250	14	9	16	190	92.2	8.93	21.1	7	131	30
	98.1	260	253	19	12	16	190	125	6.66	15.8	8	131	35
300x150	25.0	294	148	6	4.5	16	250	32.6	12.3	55.6	4	82	22
	32.0	298	149	8	5.5	13	256	40.8	9.31	46.5	5	82	21
	36.7	300	150	9	6.5	13	256	46.8	8.33	39.4	5	82	22
	41.4	304	150	11	6.5	13	256	52.8	6.82	39.4	5	82	24
	46.2	306	151	12	7.5	13	256	58.8	6.29	34.1	6	82	25
	69.0	318	154	18	11	13	256	87.9	4.28	23.3	8	82	31



Metric units

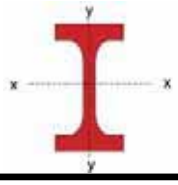
Designation Size	Unit Weight	Surface Area Per Metre	Second Moment Of Area Axis x-x	Second Moment Of Area Axis y-y	Radius Of Gyration Axis x-x	Radius Of Gyration Axis y-y	Elastic Modulus Axis x-x	Elastic Modulus Axis y-y	Plastic Modulus x-x	Plastic Modulus y-y	Buckling Parameter	Torsional Index	Warping Constant	Torsional Constant
											u	x	H	J
mm	kg/m	m^2	cm^4	cm^4	cm	cm	cm^3	cm^3	cm^3	cm^3			dm^6	cm^4
100x50	9.3	0.376	188	14.8	3.98	1.12	37.5	5.93	44.1	9.5	0.876	12.7	0.000320	2.03
100x100	14.8	0.570	344	117.0	4.20	2.47	69.0	23.0	78.0	36.0	0.843	12.3	0.00253	3.53
	16.9	0.574	378	134	4.18	2.49	75.6	26.7	86.4	41.0	0.836	11.1	0.00283	4.73
	17.2	0.571	383	134	4.18	2.47	76.5	26.8	87.6	41.2	0.837	10.7	0.00283	5.17
125x60	13.2	0.463	413	29.2	4.95	1.32	66.1	9.75	77.6	15.7	0.872	14.0	0.00100	3.75
125x125	23.6	0.723	840	293	5.29	3.13	134	46.9	152	71.7	0.839	12.8	0.00987	7.91
	23.8	0.720	847	294	5.29	3.11	136	47.0	154	71.9	0.840	12.5	0.00988	8.43
150x75	14.0	0.576	666	49.5	6.11	1.67	88.8	13.2	102	20.8	0.876	20.4	0.00253	2.81
150x100	20.7	0.670	1003	150	6.17	2.39	135	30.1	154	46.4	0.880	15.8	0.00727	6.56
	21.1	0.665	1021	151	6.17	2.37	138	30.1	157	46.7	0.881	15.0	0.00728	7.37
150x150	31.1	0.872	1623	563	6.40	3.77	216	75.1	243	114	0.841	14.1	0.0276	12.5
	31.5	0.867	1641	563	6.39	3.75	219	75.1	246	115	0.842	13.7	0.0276	13.5
	37.4	0.877	2018	690	6.51	3.80	262	91.4	298	140	0.845	11.8	0.0348	22.2
175x90	18.0	0.686	1205	97.5	7.26	2.06	138	21.7	156	33.6	0.885	21.8	0.00680	4.31
	18.1	0.685	1214	97.6	7.26	2.06	139	21.7	157	33.7	0.885	21.4	0.00680	4.50
175x125	23.3	0.806	1529	261	7.18	2.97	181	41.8	202	64.3	0.879	19.1	0.0169	6.76
175x175	32.8	1.01	2304	791	7.43	4.35	269	90.9	298	138	0.845	17.5	0.0519	11.5
	40.2	1.01	2884	984	7.50	4.38	330	112	369	171	0.844	14.7	0.0662	20.4
	40.4	1.01	2895	984	7.50	4.37	331	112	370	172	0.845	14.5	0.0662	21.0
200x100	17.8	0.769	1543	113	8.25	2.24	156	22.9	175	35.5	0.883	28.4	0.0103	3.30
	18.2	0.764	1582	114	8.26	2.22	160	23.0	180	35.7	0.884	26.5	0.0104	3.86
	20.9	0.775	1806	134	8.23	2.24	181	26.7	205	41.6	0.878	24.9	0.0123	5.08
	21.3	0.770	1844	134	8.24	2.22	184	26.8	209	41.9	0.880	23.6	0.0124	5.77
200x150	29.9	0.962	2625	507	8.30	3.65	271	67.6	301	103	0.876	21.2	0.0434	9.32
	30.6	0.954	2690	507	8.30	3.61	277	67.7	309	104	0.878	19.8	0.0434	10.9
	36.9	0.964	3331	633	8.42	3.67	336	83.8	377	128	0.879	16.9	0.0553	18.5
200x200	41.4	1.15	3846	1315	8.54	5.00	392	132	433	201	0.847	18.2	0.114	17.6
	49.9	1.16	4716	1602	8.62	5.02	472	160	525	244	0.846	15.5	0.142	29.8
	57.8	1.17	5603	1897	8.73	5.08	549	189	617	287	0.847	13.6	0.171	45.8
	65.7	1.18	6531	2201	8.83	5.13	628	218	710	332	0.848	12.2	0.203	66.7
250x125	25.1	0.968	3450	255	10.4	2.82	278	41.1	312	63.2	0.884	32.0	0.0367	5.78
	25.7	0.961	3537	255	10.4	2.79	285	41.1	319	63.6	0.886	29.9	0.0367	6.74
	29.0	0.974	3965	294	10.4	2.82	317	47.0	358	72.7	0.880	28.4	0.0426	8.51
	29.6	0.967	4052	294	10.4	2.79	324	47.0	366	73.1	0.881	26.9	0.0427	9.68
250x175	43.6	1.15	6037	984	10.4	4.21	495	112	550	172	0.883	21.3	0.134	21.2
	44.1	1.15	6122	985	10.4	4.19	502	113	558	173	0.884	20.5	0.134	23.2
	51.6	1.16	7308	1184	10.5	4.24	589	135	660	207	0.884	18.0	0.163	36.1
	59.1	1.17	8541	1390	10.7	4.30	678	157	764	241	0.885	16.0	0.195	53.2
250x250	66.5	1.45	9931	3348	10.8	6.29	801	269	883	408	0.850	17.9	0.462	46.7
	71.8	1.46	10750	3648	10.8	6.32	860	292	953	443	0.847	17.1	0.508	55.8
	72.4	1.45	10830	3649	10.8	6.29	867	292	960	444	0.848	16.7	0.508	58.7
	98.1	1.48	15340	5134	11.1	6.41	1180	406	1330	618	0.849	12.8	0.745	141
300x150	25.0	1.14	4940	326	12.3	3.16	336	44.0	375	68.4	0.878	39.7	0.0676	5.51
	32.0	1.16	6318	442	12.4	3.29	424	59.4	475	91.8	0.880	35.6	0.0930	8.65
	36.7	1.16	7210	508	12.4	3.29	481	67.7	542	105	0.876	32.0	0.107	12.4
	41.4	1.17	8578	620	12.7	3.43	564	82.7	633	128	0.888	27.8	0.133	18.8
	46.2	1.18	9514	691	12.7	3.43	622	91.5	702	142	0.884	25.6	0.149	24.9
	69.0	1.21	14820	1100	13.0	3.54	932	143	1070	223	0.884	17.9	0.248	79.0

Universal Beams and Columns



Metric units

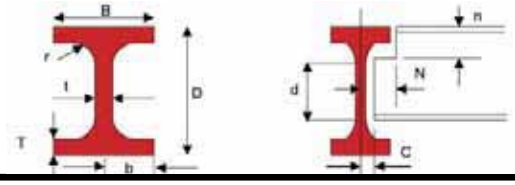
Designation Size	Mass Per Metre	Depth Of Section	Width Of Section	Thickness		Root Radius	Depth Between Fillets	Area Of Section	Ratios For Local Buckling		Dimensions For Detailing		
				Flange	Web				Flange	Web	End Clearance		Notch
		D	B	T	t	r	d	A	b/T	d/t	C	N	n
mm	kg/m	mm	mm	mm	mm	mm	mm	cm^2			mm	mm	mm
300x200	48.3	290	199	10	7	18	234	61.5	9.95	33.4	6	106	28
	55.8	294	200	12	8	13	244	71.1	8.33	30.5	6	106	25
	56.8	294	200	12	8	18	234	72.4	8.33	29.3	6	106	30
	65.4	298	201	14	9	18	234	83.4	7.18	26.0	7	106	32
	77.3	304	202	17	10	18	234	98.5	5.94	23.4	7	106	35
300x300	87.0	298	299	14	9	18	234	111	10.7	26.0	7	155	32
	93.0	300	300	15	10	13	244	118	10.0	24.4	7	155	28
	94.0	300	300	15	10	18	234	120	10.0	23.4	7	155	33
	106	304	301	17	11	18	234	135	8.85	21.3	8	155	35
	125	310	303	20	13	18	234	159	7.58	18.0	9	155	38
	130	310	305	20	15	18	234	165	7.63	15.6	10	155	38
	147	312	310	21	20	18	234	187	7.38	11.7	12	155	39
350x175	41.2	346	174	9	6	13	302	52.5	9.67	50.3	5	94	22
	41.4	346	174	9	6	14	300	52.7	9.67	50.0	5	94	23
	49.4	350	175	11	7	13	302	62.9	7.95	43.1	6	94	24
	49.6	350	175	11	7	14	300	63.1	7.95	42.9	6	94	25
	57.8	354	176	13	8	14	300	73.7	6.77	37.5	6	94	27
	66.2	358	177	15	9	14	300	84.3	5.90	33.3	7	94	29
	71.8	360	178	16	10	14	300	91.4	5.56	30.0	7	94	30
	79.7	364	177	18	11	14	300	101	4.92	27.3	8	93	32
350x250	69.2	336	249	12	8	20	272	88.2	10.4	34.0	6	131	32
	78.1	340	250	14	9	13	286	100	8.93	31.8	7	131	27
	79.7	340	250	14	9	20	272	102	8.93	30.2	7	131	34
	94.2	346	251	17	10	20	272	120	7.38	27.2	7	131	37
	108	350	253	19	12	20	272	137	6.66	22.7	8	131	39
350x350	113	344	348	16	10	13	286	144	10.9	28.6	7	179	29
	115	344	354	16	10	20	272	148	11.1	27.2	7	182	36
	135	350	350	19	12	13	286	172	9.21	23.8	8	179	32
	137	350	350	19	12	20	272	174	9.21	22.7	8	179	39
	159	356	352	22	14	20	272	202	8.00	19.4	9	179	42
	181	362	354	25	16	20	272	230	7.08	17.0	10	179	45
400x200	56.1	396	199	11	7	13	348	71.4	9.05	49.7	6	106	24
	56.6	396	199	11	7	16	342	72.2	9.05	48.9	6	106	27
	65.4	400	200	13	8	13	348	83.4	7.69	43.5	6	106	26
	66.0	400	200	13	8	16	342	84.1	7.69	42.8	6	106	29
	75.5	404	201	15	9	16	342	96.2	6.70	38.0	7	106	31
	88.2	410	202	18	10	16	342	112	5.61	34.2	7	106	34
	140	430	208	28	16	16	342	179	3.71	21.4	10	106	44
	187	446	214	36	22	16	342	239	2.97	15.5	13	106	52
400x300	94.3	386	299	14	9	22	314	120	10.7	34.9	7	155	36
	105	390	300	16	10	13	332	133	9.38	33.2	7	155	29
	107	390	300	16	10	22	314	136	9.38	31.4	7	155	38
	127	396	302	19	12	22	314	162	7.95	26.2	8	155	41
	144	402	303	22	13	22	314	184	6.89	24.2	9	155	44
400x400	140	388	402	15	15	22	314	178	13.4	20.9	10	204	37
	147	394	398	18	11	22	314	187	11.1	28.5	8	204	40
	172	400	400	21	13	22	314	219	9.52	24.2	9	204	43
	200	406	403	24	16	22	314	255	8.40	19.6	10	204	46
	232	414	405	28	18	22	314	295	7.23	17.4	11	204	50
	283	428	407	35	20	22	314	361	5.81	15.7	12	204	57
	415	458	417	50	30	22	314	529	4.17	10.5	17	204	72
	605	498	432	70	45	22	314	770	3.09	7.0	25	204	92



Metric units

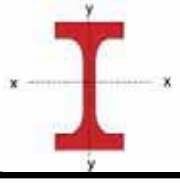
Designation Size	Unit Weight	Surface Area Per Metre	Second Moment Of Area		Radius Of Gyration		Elastic Modulus		Plastic Modulus		Buckling Parameter	Torsional Index	Warping Constant	Torsional Constant
			Axis x-x	Axis y-y	Axis x-x	Axis y-y	Axis x-x	Axis y-y	x-x	y-y	u	x	H	J
mm	kg/m	m^2	cm^4	cm^4	cm	cm	cm^3	cm^3	cm^3	cm^3			dm^6	cm^4
300x200	48.3	1.33	9431	1317	12.4	4.63	650	132	721	203	0.882	26.0	0.258	22.8
	55.8	1.35	11110	1602	12.5	4.75	756	160	842	245	0.882	24.0	0.319	31.4
	56.8	1.34	11340	1604	12.5	4.71	771	160	859	247	0.883	22.7	0.319	35.8
	65.4	1.35	13310	1900	12.6	4.77	893	189	1000	291	0.884	20.1	0.383	53.4
	77.3	1.37	16280	2341	12.9	4.88	1071	232	1204	356	0.888	17.2	0.482	87.8
300x300	87.0	1.74	18850	6242	13.0	7.51	1265	418	1389	634	0.850	20.0	1.26	71.3
	93.0	1.76	20190	6753	13.1	7.55	1346	450	1484	683	0.847	19.4	1.37	82.1
	94.0	1.75	20410	6756	13.1	7.51	1361	450	1501	684	0.848	18.8	1.37	88.1
	106	1.76	23380	7733	13.2	7.57	1538	514	1705	781	0.849	16.9	1.59	125
	125	1.78	28130	9282	13.3	7.64	1815	613	2031	932	0.849	14.6	1.95	200
	130	1.78	28630	9470	13.2	7.57	1847	621	2079	949	0.842	14.4	1.99	215
	147	1.79	31370	10450	13.0	7.48	2011	674	2295	1040	0.830	13.0	2.21	298
350x175	41.2	1.35	11040	792	14.5	3.88	638	91.0	712	140	0.881	38.1	0.225	13.2
	41.4	1.35	11100	792	14.5	3.88	641	91.0	716	140	0.882	37.5	0.225	13.6
	49.4	1.36	13500	984	14.6	3.96	771	113	864	173	0.883	32.2	0.283	22.4
	49.6	1.36	13560	985	14.7	3.95	775	113	868	174	0.884	31.8	0.283	23.0
	57.8	1.37	16100	1184	14.8	4.01	909	135	1022	208	0.885	27.6	0.344	36.1
	66.2	1.38	18710	1390	14.9	4.06	1045	157	1180	243	0.886	24.4	0.409	53.6
	71.8	1.39	20240	1508	14.9	4.06	1124	169	1276	263	0.883	22.9	0.446	66.3
	79.7	1.39	22760	1669	15.0	4.06	1250	189	1425	293	0.884	20.6	0.499	91.3
350x250	69.2	1.62	18510	3093	14.5	5.92	1102	248	1215	380	0.881	25.8	0.812	44.6
	78.1	1.64	21230	3649	14.6	6.05	1249	292	1382	445	0.881	24.2	0.969	58.0
	79.7	1.63	21680	3652	14.6	6.00	1275	292	1412	447	0.882	22.8	0.970	66.3
	94.2	1.64	26440	4488	14.8	6.12	1528	358	1699	547	0.886	19.5	1.21	109
	108	1.65	30190	5138	14.8	6.12	1725	406	1935	623	0.882	17.6	1.41	155
350x350	113	2.04	32850	11240	15.1	8.84	1910	646	2092	978	0.848	21.1	3.02	111
	115	2.05	33810	11840	15.1	8.95	1966	669	2153	1014	0.846	20.4	3.18	123
	135	2.05	39847	13583	15.2	8.89	2277	776	2515	1176	0.847	18.0	3.72	186
	137	2.04	40300	13590	15.2	8.84	2303	776	2545	1179	0.849	17.5	3.72	199
	159	2.06	47590	16000	15.3	8.90	2674	909	2979	1382	0.848	15.4	4.46	305
	181	2.07	55190	18500	15.5	8.96	3049	1045	3424	1591	0.848	13.7	5.25	445
400x200	56.1	1.55	19770	1447	16.6	4.50	999	145	1114	223	0.883	36.8	0.536	25.0
	56.6	1.55	20020	1448	16.7	4.48	1011	145	1128	224	0.884	35.6	0.536	27.1
	65.4	1.56	23460	1736	16.8	4.56	1173	174	1313	267	0.885	31.8	0.650	39.6
	66.0	1.56	23710	1737	16.8	4.54	1185	174	1326	268	0.886	30.9	0.650	42.2
	75.5	1.57	27490	2035	16.9	4.60	1361	202	1528	312	0.887	27.4	0.770	62.3
	88.2	1.58	33060	2478	17.2	4.70	1612	245	1815	378	0.891	23.4	0.952	101
	140	1.63	54850	4216	17.5	4.86	2551	405	2941	632	0.887	15.7	1.70	373
	187	1.68	75250	5919	17.8	4.98	3374	553	3968	873	0.883	12.5	2.49	825
400x300	94.3	1.91	33680	6246	16.7	7.21	1745	418	1918	637	0.880	25.8	2.16	79.9
	105	1.94	37860	7204	16.9	7.35	1942	480	2141	730	0.879	24.5	2.52	100
	107	1.92	38680	7210	16.9	7.28	1983	481	2188	733	0.881	23.2	2.52	114
	127	1.94	46660	8735	17.0	7.35	2357	578	2620	884	0.880	20.0	3.10	185
	144	1.95	54420	10220	17.2	7.45	2707	674	3022	1030	0.883	17.7	3.69	272
400x400	140	2.32	48970	16260	16.6	9.55	2524	809	2802	1237	0.830	22.5	5.66	156
	147	2.32	56150	18930	17.3	10.1	2850	951	3118	1441	0.850	20.9	6.69	194
	172	2.34	66620	22420	17.5	10.1	3331	1121	3672	1700	0.850	18.2	8.05	303
	200	2.35	78040	26200	17.5	10.1	3844	1300	4280	1977	0.846	16.1	9.56	462
	232	2.37	92770	31030	17.7	10.2	4482	1532	5026	2331	0.848	14.1	11.6	714
	283	2.41	119200	39360	18.2	10.4	5570	1934	6311	2941	0.854	11.6	15.2	1317
	415	2.49	187100	60530	18.8	10.7	8172	2903	9540	4436	0.853	8.5	25.2	3885
	605	2.60	297900	94360	19.7	11.1	11960	4369	14460	6724	0.852	6.4	43.2	11060

Universal Beams and Columns



Metric units

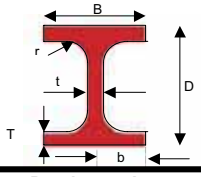
Designation Size	Mass Per Metre	Depth Of Section	Width Of Section	Thickness		Root Radius	Depth Between Fillets	Area Of Section	Ratios For Local Buckling		Dimensions For Detailing		
				Flange	Web				Flange	Web	End Clearance		Notch
		D	B	T	t	r	d	A	b/T	d/t	C	N	n
mm	kg/m	mm	mm	mm	mm	mm	mm	cm^2			mm	mm	mm
450x200	65.1	446	199	12	8	13	396	83.0	8.29	49.5	6	106	25
	66.2	446	199	12	8	18	386	84.3	8.29	48.3	6	106	30
	74.9	450	200	14	9	13	396	95.4	7.14	44.0	7	106	27
	76.0	450	200	14	9	18	386	96.8	7.14	42.9	7	106	32
	88.9	456	201	17	10	18	386	113	5.91	38.6	7	106	35
	98.9	460	202	19	11	18	386	126	5.32	35.1	8	106	37
	110	460	205	19	14	18	386	140	5.39	27.6	9	106	37
450x300	106	434	299	15	10	24	356	135	9.97	35.6	7	155	39
	121	440	300	18	11	13	378	154	8.33	34.4	8	155	31
	124	440	300	18	11	24	356	157	8.33	32.4	8	155	42
	145	446	302	21	13	24	356	184	7.19	27.4	9	155	45
500x200	77.9	496	199	14	9	13	442	99	7.11	49.1	7	105	27
	79.5	496	199	14	9	20	428	101	7.11	47.6	7	105	34
	88.2	500	200	16	10	13	442	112	6.25	44.2	7	105	29
	89.6	500	200	16	10	20	428	114	6.25	42.8	7	105	36
	102	506	201	19	11	13	442	129	5.29	40.2	8	105	32
	103	506	201	19	11	20	428	131	5.29	38.9	8	105	39
	117	512	202	22	12	20	428	148	4.59	35.7	8	105	42
500x300	111	482	300	15	11	13	426	141	10.0	38.7	8	155	28
	114	482	300	15	11	26	400	146	10.0	36.4	8	155	41
	125	488	300	18	11	13	426	159	8.33	38.7	8	155	31
	128	488	300	18	11	26	400	164	8.33	36.4	8	155	44
	150	494	302	21	13	26	400	191	7.19	30.8	9	155	47
600x200	79.0	592	197	13	8	22	522	101	7.58	65.3	6	105	35
	92.5	596	199	15	10	13	540	118	6.63	54.0	7	105	28
	94.6	596	199	15	10	22	522	120	6.63	52.2	7	105	37
	103	600	200	17	11	13	540	132	5.88	49.1	8	105	30
	106	600	200	17	11	22	522	134	5.88	47.5	8	105	39
	118	606	201	20	12	13	540	150	5.03	45.0	8	105	33
	120	606	201	20	12	22	522	152	5.03	43.5	8	105	42
	134	612	202	23	13	22	522	171	4.39	40.2	9	105	45
600x300	133	582	300	17	12	13	522	169	8.82	43.5	8	154	30
	137	582	300	17	12	28	492	174	8.82	41.0	8	154	45
	147	588	300	20	12	13	522	187	7.50	43.5	8	154	33
	151	588	300	20	12	28	492	192	7.50	41.0	8	154	48
	170	594	302	23	14	13	522	217	6.57	37.3	9	154	36
	175	594	302	23	14	28	492	222	6.57	35.1	9	154	51
	203	602	304	27	16	28	492	259	5.63	30.8	10	154	55
	217	608	304	30	16	28	492	277	5.07	30.8	10	154	58
700x300	166	692	300	20	13	28	596	211	7.50	45.8	9	154	48
	182	700	300	24	13	18	616	232	6.25	47.4	9	154	42
	185	700	300	24	13	28	596	235	6.25	45.8	9	154	52
	215	708	302	28	15	28	596	274	5.39	39.7	10	154	56
800x300	191	792	300	22	14	28	692	243	6.82	49.4	9	153	50
	207	800	300	26	14	18	712	264	5.77	50.9	9	153	44
	210	800	300	26	14	28	692	267	5.77	49.4	9	153	54
	241	808	302	30	16	28	692	308	5.03	43.3	10	153	58
	267	816	303	34	17	28	692	340	4.46	40.7	11	153	62
900x300	210	890	299	23	15	18	808	267	6.50	53.9	10	152	41
	213	890	299	23	15	28	788	271	6.50	52.5	10	152	51
	240	900	300	28	16	18	808	306	5.36	50.5	10	152	46
	243	900	300	28	16	28	788	310	5.36	49.3	10	152	56
	283	912	302	34	18	18	808	360	4.44	44.9	11	152	52
	286	912	302	34	18	28	788	364	4.44	43.8	11	152	62
	304	918	303	37	19	18	808	387	4.09	42.5	12	152	55
	307	918	303	37	19	28	788	391	4.09	41.5	12	152	65

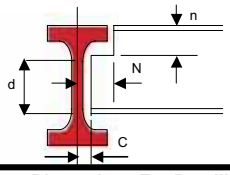


Metric units

Designation Size	Unit Weight	Surface Area Per Metre	Second Moment Of Area		Radius Of Gyration		Elastic Modulus		Plastic Modulus		Buckling Parameter	Torsional Index	Warping Constant	Torsional Constant
			Axis x-x	Axis y-y	Axis x-x	Axis y-y	Axis x-x	Axis y-y	x-x	y-y	u	x	H	J
mm	kg/m	m^2	cm^4	cm^4	cm	cm	cm^3	cm^3	cm^3	cm^3			dm^6	cm^4
450x200	65.1	1.65	28130	1579	18.4	4.36	1262	159	1423	245	0.876	38.4	0.744	33.9
	66.2	1.64	28700	1581	18.5	4.33	1287	159	1450	247	0.878	36.5	0.744	38.3
	74.9	1.66	32890	1870	18.6	4.43	1462	187	1652	290	0.878	33.6	0.889	51.6
	76.0	1.65	33450	1872	18.6	4.40	1487	187	1679	291	0.879	32.2	0.890	56.9
	88.9	1.67	40400	2308	18.9	4.51	1772	230	2003	356	0.884	27.5	1.11	92.5
	98.9	1.68	45430	2619	19.0	4.56	1975	259	2240	403	0.885	25.0	1.27	126
	110	1.68	47860	2742	18.5	4.43	2081	268	2399	423	0.869	23.9	1.33	152
450x300	106	2.00	46800	6695	18.6	7.04	2157	448	2384	686	0.883	27.0	2.94	104
	121	2.04	54730	8106	18.9	7.26	2488	540	2757	823	0.885	24.9	3.61	141
	124	2.02	56070	8114	18.9	7.18	2549	541	2825	828	0.887	23.4	3.61	163
	145	2.03	66380	9658	19.0	7.24	2977	640	3323	981	0.886	20.5	4.36	253
500x200	77.9	1.75	40840	1843	20.3	4.31	1647	185	1869	288	0.874	37.5	1.07	52.5
	79.5	1.74	41870	1846	20.3	4.27	1688	186	1914	290	0.876	35.2	1.07	60.8
	88.2	1.76	46810	2138	20.4	4.36	1872	214	2130	333	0.875	33.3	1.25	75.9
	89.6	1.75	47850	2142	20.5	4.33	1914	214	2175	335	0.877	31.6	1.25	85.9
	102	1.77	55480	2578	20.7	4.47	2193	257	2496	399	0.880	28.7	1.53	119
	103	1.76	56520	2582	20.7	4.43	2234	257	2541	401	0.881	27.5	1.53	132
	117	1.77	65450	3035	21.0	4.52	2557	300	2913	469	0.884	24.3	1.82	193
500x300	111	2.12	58270	6756	20.3	6.92	2418	450	2696	690	0.877	32.4	3.68	93.9
	114	2.10	60370	6768	20.4	6.82	2505	451	2791	695	0.880	29.4	3.69	118
	125	2.13	68860	8106	20.8	7.14	2822	540	3132	825	0.887	28.0	4.48	143
	128	2.11	70960	8118	20.8	7.05	2908	541	3228	830	0.889	25.9	4.48	172
	150	2.13	83810	9663	20.9	7.11	3393	640	3792	984	0.888	22.8	5.40	265
600x200	79.0	1.92	58240	1665	24.1	4.07	1968	169	2239	265	0.870	45.2	1.40	53.0
	92.5	1.95	66640	1976	23.8	4.10	2236	199	2576	312	0.861	42.9	1.67	69.2
	94.6	1.93	68720	1982	23.9	4.06	2306	199	2651	315	0.864	39.7	1.67	82.4
	103	1.96	75560	2274	24.0	4.16	2519	227	2904	358	0.863	38.4	1.93	97.3
	106	1.94	77630	2280	24.0	4.12	2588	228	2979	361	0.865	36.0	1.94	113
	118	1.97	88320	2716	24.3	4.26	2915	270	3357	426	0.868	33.4	2.33	147
	120	1.95	90400	2723	24.3	4.23	2983	271	3432	429	0.870	31.7	2.34	167
	134	1.97	103500	3178	24.6	4.32	3382	315	3893	498	0.873	28.3	2.76	237
600x300	133	2.32	98950	7659	24.2	6.73	3400	511	3822	786	0.876	35.5	6.11	137
	137	2.29	102700	7675	24.3	6.63	3530	512	3963	793	0.879	32.1	6.13	173
	147	2.33	114400	9009	24.7	6.94	3889	601	4348	921	0.886	31.2	7.27	199
	151	2.30	118100	9025	24.8	6.85	4018	602	4489	928	0.888	28.8	7.28	241
	170	2.35	133600	10570	24.8	6.98	4497	700	5057	1077	0.885	27.3	8.62	304
	175	2.32	137300	10590	24.9	6.90	4624	701	5197	1085	0.887	25.5	8.63	356
	203	2.34	162600	12680	25.1	7.00	5401	834	6101	1292	0.888	22.3	10.5	551
	217	2.35	179300	14090	25.4	7.13	5896	927	6653	1431	0.893	20.5	11.8	702
700x300	166	2.51	172400	9030	28.6	6.53	4984	602	5629	936	0.878	34.3	10.2	260
	182	2.54	197500	10820	29.2	6.83	5643	721	6338	1110	0.887	31.4	12.4	343
	185	2.53	201500	10830	29.3	6.78	5757	722	6464	1116	0.889	30.0	12.4	383
	215	2.55	237100	12890	29.4	6.86	6699	854	7559	1323	0.889	26.3	14.9	588
800x300	191	2.71	253600	9936	32.3	6.39	6405	662	7288	1036	0.873	36.8	14.7	341
	207	2.74	286400	11720	33.0	6.67	7159	781	8098	1210	0.882	33.9	17.6	440
	210	2.72	291700	11740	33.0	6.62	7292	782	8243	1216	0.883	32.5	17.6	486
	241	2.74	339200	13820	33.2	6.70	8397	915	9534	1426	0.883	28.7	20.9	726
	267	2.76	383600	15820	33.6	6.82	9402	1044	10680	1625	0.887	25.8	24.2	1003
900x300	210	2.92	338500	10280	35.6	6.20	7608	687	8750	1079	0.863	42.2	19.3	361
	213	2.90	345300	10290	35.7	6.16	7760	688	8913	1085	0.865	40.2	19.3	403
	240	2.94	404500	12630	36.4	6.43	8989	842	10290	1317	0.872	35.9	24.0	580
	243	2.92	411300	12650	36.4	6.39	9139	843	10450	1324	0.873	34.5	24.0	633
	283	2.97	491000	15660	36.9	6.59	10770	1037	12340	1622	0.876	30.1	30.2	979
	286	2.95	497800	15670	37.0	6.56	10920	1038	12500	1629	0.877	29.3	30.2	1050
	304	2.98	535400	17210	37.2	6.67	11660	1136	13380	1778	0.878	27.9	33.4	1234
	307	2.96	542200	17230	37.2	6.63	11810	1137	13540	1785	0.879	27.2	33.4	1316

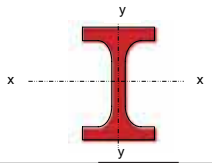
Universal Beams and Columns





Imperial units

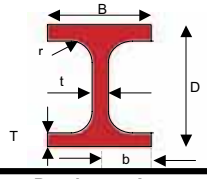
Designation Size	Mass Per Metre		Depth Of Section	Width Of Section	Thickness		Root Radius	Depth Between Fillets	Area Of Section	Ratios For Local Buckling		Dimensions For Detailing		
					Flange	Web				Flange	Web	End Clearance	Notch	
			D	B	T	t	r	d	A	b/T	d/t	C	N	n
in (mm)	lb/ft	kg/m	mm	mm	mm	mm	mm	mm	cm^2			mm	mm	mm
W4-4x4	13	19.4	105.7	103.1	8.8	7.1	6.4	75.5	24.7	5.88	10.6	6	58	15
(102x102)	13.8	21.0	102.0	102.0	9.4	8.0	6.0	71.2	26.1	5.43	8.90	6	57	15
	16.3	24.0	107.0	100.0	12.0	7.9	6.0	71.0	30.9	4.17	8.99	6	56	18
W5-5x3	9	13.0	127.0	76.0	7.6	4.0	7.6	96.6	16.5	5.00	24.2	4	46	15
(127x76)														
W5-5x5	16	23.8	127.3	127.0	9.1	6.1	7.6	93.8	30.4	6.95	15.4	5	70	17
(127x127)	19	28.3	130.8	127.8	10.9	6.9	7.6	93.8	35.8	5.86	13.7	5	70	19
W6-6x3	9	14.0	150.0	75.0	7.0	5.0	8.0	120.0	17.8	5.36	24.0	5	45	15
(152x76)	12	18.0	155.0	75.0	8.5	6.0	8.0	122.0	21.6	4.41	20.3	5	45	17
W6-6x3 1/2	11	16.0	152.4	88.7	7.7	4.5	7.6	121.8	20.3	5.76	27.1	4	52	15
(152x89)														
W6-6x4	9	13.4	149.9	100.1	5.5	4.3	6.4	126.3	17.3	9.17	29.2	4	58	12
(152x102)	12	17.9	153.2	101.6	7.1	5.8	6.4	126.3	22.9	7.14	21.6	5	58	13
	16	23.8	159.5	102.4	10.2	6.6	6.4	126.4	30.4	5.02	19.2	5	58	17
W6-6x6	15	22.3	152.1	152.1	6.6	5.8	6.4	126.2	28.5	11.5	21.6	5	83	13
(152X152)	15.7	23.0	152.4	152.2	6.8	5.8	7.6	123.6	29.2	11.2	21.3	5	83	14
	20	30.0	157.6	152.9	9.4	6.5	7.6	123.6	38.3	8.13	19.0	5	83	17
	25	37.0	161.8	154.4	11.5	8.0	7.6	123.6	47.1	6.71	15.5	6	83	19
W7-7x 3 1/2	11	16.1	173.0	90.0	7.0	4.5	8.9	141.2	20.4	6.43	31.4	4	53	16
(178x89)	12	18.1	175.0	90.0	8.0	5.0	8.9	141.2	23.0	5.63	28.2	5	53	17
	15	22.2	179.0	90.0	10.0	6.0	8.9	141.2	28.2	4.50	23.5	5	52	19
W7-7x4	13	19.0	177.8	101.2	7.9	4.8	7.6	146.8	24.3	6.41	30.6	4	58	16
(178x102)														
W8-8x4	10	14.9	200.4	100.1	5.2	4.3	7.6	174.7	19.1	9.61	40.4	4	58	13
(203x102)	13	19.4	202.9	101.6	6.5	5.8	7.6	174.7	24.8	7.84	29.9	5	58	14
	15	22.3	206.0	102.0	8.0	6.2	7.6	174.8	28.6	6.38	28.1	5	58	16
	16	23.1	203.2	101.8	9.3	5.4	7.6	169.4	29.4	5.47	31.4	5	58	17
W8-8x5 1/4	14	21.0	203.0	133.0	6.4	5.0	8.0	174.2	27.1	10.39	34.8	5	74	14
(203x133)	15	22.3	202.0	133.0	7.0	5.0	8.9	170.2	28.7	9.50	34.0	5	74	16
	17	25.1	203.2	133.2	7.8	5.7	7.6	172.4	32.0	8.54	30.2	5	74	15
	18	26.8	206.8	133.3	8.4	5.8	7.6	174.8	33.9	7.95	29.9	5	74	16
	20	30.0	206.8	133.9	9.6	6.4	7.6	172.4	38.2	6.97	26.9	5	74	17
	21	31.3	210.3	133.9	10.1	6.4	7.6	174.9	39.6	6.63	27.5	5	74	18
W8-8x6 1/2	24	35.7	201.4	165.0	10.1	6.2	10.2	160.8	45.5	8.17	25.9	5	89	20
(203x165)	28	41.7	204.7	166.0	11.8	7.2	10.2	160.7	53.2	7.03	22.2	6	89	22
W8-8x8	31	46.1	203.2	203.6	11.0	7.2	10.2	160.8	58.7	9.25	22.3	6	108	21
(203x203)	35	52.0	206.2	204.3	12.5	7.9	10.2	160.8	66.3	8.17	20.4	6	108	23
	40	60.0	209.6	205.8	14.2	9.4	10.2	160.8	76.4	7.25	17.1	7	108	24
	48	71.0	215.8	206.4	17.3	10.0	10.2	160.8	90.4	5.97	16.1	7	108	28
	58	86.1	222.2	209.1	20.5	12.7	10.2	160.8	110	5.10	12.7	8	108	31
	67	99.7	228.6	210.3	23.8	14.5	10.2	160.7	127	4.43	11.1	9	108	34
W10-10x4	12	17.9	250.7	100.6	5.3	4.8	7.6	224.8	22.8	9.44	46.5	4	58	13
(254x102)	15	22.0	254.0	101.6	6.8	5.7	7.6	225.2	28.0	7.47	39.5	5	58	14
	17	25.2	257.2	101.9	8.4	6.0	7.6	225.2	32.0	6.07	37.5	5	58	16
	19	28.3	260.4	102.2	10.0	6.3	7.6	225.2	36.1	5.11	35.7	5	58	18

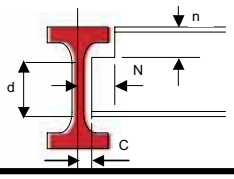


Imperial units

Designation Size	Mass Per Metre		Surface Area per Metre	Second Moment Of Area		Radius Of Gyration		Elastic Modulus		Plastic Modulus		Buckling Parameter	Torsional Index	Warping Constant	Torsional Constant
				Axis x-x	Axis y-y	Axis x-x	Axis y-y	Axis x-x	Axis y-y	Axis x-x	Axis y-y	u	x	H	J
in (mm)	lb/ft	kg/m	m^2	cm^4	cm^4	cm	cm	cm^3	cm^3	cm^3	cm^3			dm^6	cm^4
W4-4x4	13	19.4	0.599	472	160	4.38	2.55	89.4	31.1	103	47.8	0.836	10.9	0.00377	6.29
(102x102)	13.8	21.0	0.586	456	167	4.18	2.53	89.4	32.7	104	50.4	0.827	9.61	0.00357	7.78
	16.3	24.0	0.588	587	200	4.36	2.55	110	40.1	129	61.5	0.844	8.13	0.00452	13.5
W5-5x3	9	13.0	0.537	473	55.8	5.35	1.84	74.6	14.7	84.2	22.6	0.895	16.3	0.00199	2.85
(127x76)															
W5-5x5	16	23.8	0.737	892	312	5.42	3.21	140	49.2	158	75.0	0.842	13.0	0.0109	8.00
(127x127)	19	28.3	0.746	1092	380	5.52	3.25	167	59.4	190	90.6	0.845	11.2	0.0136	13.1
W6-6x3	9	14.0	0.576	666	49.5	6.11	1.67	88.8	13.2	102	20.8	0.876	20.4	0.00253	2.81
(152x76)	12	18.0	0.584	841	60.2	6.24	1.67	109	16.0	126	25.4	0.875	17.6	0.00323	4.81
W6-6x3 1/2	11	16.0	0.638	834	89.8	6.41	2.10	109	20.2	123	31.2	0.890	19.6	0.00470	3.56
(152x89)															
W6-6x4	9	13.4	0.681	683	91.4	6.29	2.30	91.1	18.3	102	28.1	0.873	26.2	0.00477	1.69
(152x102)	12	17.9	0.690	918	125	6.33	2.33	120	24.5	136	38.0	0.869	20.4	0.00665	3.76
	16	23.8	0.704	1330	183	6.61	2.45	167	35.7	190	55.2	0.882	15.4	0.0102	9.12
W6-6x6	15	22.3	0.890	1210	387	6.51	3.68	159	50.9	177	77.7	0.837	21.4	0.0205	4.21
(152X152)	15.7	23.0	0.889	1250	400	6.54	3.70	164	52.6	182	80.2	0.840	20.7	0.0212	4.63
	20	30.0	0.901	1748	560	6.76	3.83	222	73.3	248	112	0.849	16.0	0.0308	10.5
	25	37.0	0.912	2210	706	6.85	3.87	273	91.5	309	140	0.848	13.3	0.0399	19.2
W7-7x 3 1/2	11	16.1	0.682	1060	85.4	7.20	2.04	123	19.0	138	29.4	0.884	23.9	0.00588	3.15
(178x89)	12	18.1	0.685	1213	97.6	7.26	2.06	139	21.7	157	33.7	0.885	21.4	0.00680	4.48
	15	22.2	0.691	1529	122	7.36	2.08	171	27.1	195	42.3	0.886	17.8	0.00871	8.16
W7-7x4	13	19.0	0.738	1356	137	7.48	2.37	153	27.0	171	41.6	0.888	22.6	0.00987	4.41
(178x102)															
W8-8x4	10	14.9	0.779	1284	87.3	8.19	2.14	128	17.4	145	27.2	0.867	36.3	0.00832	1.78
(203x102)	13	19.4	0.787	1647	114	8.16	2.14	162	22.4	187	35.3	0.861	29.0	0.0110	3.63
	15	22.3	0.794	1999	142	8.36	2.23	194	27.8	222	43.7	0.869	25.2	0.0139	5.68
	16	23.1	0.790	2105	164	8.46	2.36	207	32.2	234	49.8	0.888	22.5	0.0154	7.02
W8-8x5 1/4	14	21.0	0.914	1980	251	8.55	3.05	195	37.8	218	58.0	0.874	29.9	0.0243	3.74
(203x133)	15	22.3	0.911	2105	275	8.56	3.09	208	41.3	232	63.4	0.879	27.9	0.0261	4.50
	17	25.1	0.915	2340	308	8.56	3.10	230	46.2	258	70.9	0.877	25.6	0.0294	5.96
	18	26.8	0.922	2578	331	8.72	3.12	249	49.7	279	76.3	0.880	24.5	0.0326	7.13
	20	30.0	0.923	2896	385	8.71	3.17	280	57.5	314	88.2	0.881	21.5	0.0374	10.3
	21	31.3	0.930	3119	405	8.87	3.20	297	60.4	333	92.7	0.885	21.0	0.0405	11.6
W8-8x6 1/2	24	35.7	1.03	3430	757	8.68	4.08	341	91.7	378	140	0.875	19.3	0.0693	14.3
(203x165)	28	41.7	1.04	4077	901	8.76	4.12	398	109	445	165	0.875	16.8	0.0838	22.4
W8-8x8	31	46.1	1.19	4568	1548	8.82	5.13	450	152	497	231	0.847	17.7	0.143	22.2
(203x203)	35	52.0	1.20	5259	1778	8.91	5.18	510	174	567	264	0.848	15.8	0.167	31.8
	40	60.0	1.21	6125	2065	8.96	5.20	584	201	656	305	0.846	14.1	0.197	47.2
	48	71.0	1.22	7618	2537	9.18	5.30	706	246	799	374	0.853	11.9	0.250	80.2
	58	86.1	1.24	9449	3128	9.28	5.34	850	299	977	456	0.850	10.2	0.318	137
	67	99.7	1.25	11310	3687	9.44	5.39	990	351	1150	536	0.852	9.0	0.387	211
W10-10x4	12	17.9	0.881	2241	90.8	9.91	1.99	179	18.0	207	28.6	0.851	44.0	0.0137	2.28
(254x102)	15	22.0	0.890	2841	119	10.1	2.06	224	23.5	259	37.3	0.856	36.4	0.0182	4.15
	17	25.2	0.897	3415	149	10.3	2.15	266	29.2	306	46.0	0.866	31.5	0.0230	6.42
	19	28.3	0.904	4005	179	10.5	2.22	308	34.9	353	54.8	0.874	27.5	0.0280	9.57

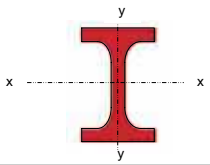
Universal Beams and Columns





Imperial units

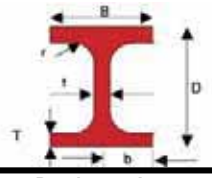
Designation Size	Mass Per Metre		Depth Of Section	Width Of Section	Thickness		Root Radius	Depth Between Fillets	Area Of Section	Ratios For Local Buckling		Dimensions For Detailing		
					Flange	Web				Flange	Web	End Clearance	Notch	
			D	B	T	t	r	d	A	b/T	d/t	C	N	n
in (mm)	lb/ft	kg/m	mm	mm	mm	mm	mm	mm	cm^2			mm	mm	mm
W10-10x5 3/4	16	24.0	253.0	145.0	6.4	5.0	7.6	224.2	31.1	11.33	44.8	5	80	14
(254x146)	21	31.1	251.4	146.1	8.6	6.0	7.6	219.0	39.7	8.49	36.5	5	80	16
	22	32.7	258.3	146.0	9.1	6.1	7.6	224.8	41.8	7.99	36.8	5	80	17
	25	37.0	256.0	146.4	10.9	6.3	7.6	219.0	47.2	6.72	34.8	5	80	19
	26	38.7	262.4	146.6	11.1	6.6	7.6	225.0	48.9	6.60	34.1	5	80	19
	29	43.0	259.6	147.3	12.7	7.2	7.6	219.0	54.8	5.80	30.4	6	80	20
	30	44.6	265.9	147.6	12.9	7.6	7.6	224.9	56.9	5.72	29.5	6	80	21
W10-10x8	33	49.1	247.1	202.2	11.0	7.4	12.7	199.7	62.5	9.19	27.1	6	107	24
(254x203)	39	58.0	252.0	202.8	13.4	8.0	12.7	199.8	73.8	7.57	25.0	6	107	26
	42	62.5	249.4	207.0	12.2	12.2	12.7	199.6	79.3	8.49	16.4	8	107	25
	45	67.0	256.5	203.7	15.7	8.9	12.7	199.7	85.4	6.49	22.5	6	107	28
	57	84.8	258.1	211.3	16.5	16.5	12.7	199.7	108	6.40	12.1	10	107	29
W10-10x10	49	73.1	254.1	254.6	14.2	8.6	12.7	200.3	93.1	8.96	23.3	6	133	27
(254x254)	54	80.4	256.3	254.8	15.6	9.4	12.7	199.7	102	8.17	21.2	7	133	28
	60	88.9	260.3	256.3	17.3	10.3	12.7	200.3	113	7.41	19.4	7	133	30
	68	101.2	264.2	257.3	19.6	11.9	12.7	199.7	129	6.58	16.7	8	133	32
	72	107.1	266.7	258.8	20.5	12.8	12.7	200.3	136	6.31	15.6	8	133	33
	77	114.6	269.2	258.8	22.1	13.5	12.7	199.6	146	5.86	14.8	9	133	35
	88	131	275.3	260.7	25.2	15.4	12.7	199.6	167	5.18	13.0	10	133	38
	89	132	276.3	261.3	25.3	15.3	12.7	200.3	168	5.16	13.1	10	133	38
	100	148.8	281.9	262.6	28.5	17.3	12.7	199.6	190	4.62	11.6	11	133	41
	112	167.1	289.1	265.2	31.7	19.2	12.7	200.3	213	4.18	10.4	12	133	44
W12-12x4	14	20.8	302.5	100.8	5.7	5.1	7.6	275.8	26.8	8.83	54.3	5	58	13
(305x102)	16	23.8	304.5	101.3	6.7	5.6	7.6	275.8	30.4	7.53	49.3	5	58	14
	16.5	24.8	305.1	101.6	7.0	5.8	7.6	275.9	31.6	7.26	47.6	5	58	15
	19	28.2	308.7	101.8	8.8	6.0	7.6	275.9	35.9	5.78	46.0	5	58	16
	22	32.8	312.7	102.4	10.8	6.6	7.6	275.9	41.8	4.74	41.8	5	58	18
W12-12x5	25	37.0	304.4	123.3	10.7	7.1	8.9	265.2	47.2	5.76	37.4	6	68	20
(305x127)	28	41.9	307.2	124.3	12.1	8.0	8.9	265.2	53.4	5.14	33.2	6	68	21
	32	48.1	311.0	125.3	14.0	9.0	8.9	265.2	61.2	4.48	29.5	7	68	23
W12-12x6 1/2	21	31.0	306.0	164.0	7.4	5.0	7.6	275.2	39.4	11.08	55.0	5	90	15
(305x165)	26	38.7	310.4	164.8	9.7	5.8	7.6	275.9	49.3	8.54	47.2	5	89	17
	27	40.3	303.4	165.0	10.2	6.0	8.9	265.2	51.3	8.09	44.2	5	90	19
	30	44.6	313.4	165.6	11.1	6.6	7.6	276.0	56.5	7.46	41.8	5	90	19
	31	46.1	306.6	165.7	11.8	6.7	8.9	265.2	58.7	7.02	39.6	5	90	21
	35	52.1	317.5	166.6	13.2	7.6	7.6	275.9	66.7	6.31	36.2	6	89	21
	36	54.0	310.4	166.9	13.7	7.9	8.9	265.2	68.8	6.09	33.6	6	90	23
W12-12x8	40	59.5	303.3	203.3	13.0	7.5	15.2	246.9	75.6	7.82	33.0	6	108	28
(305x203)	45	67.0	306.3	204.3	14.6	8.5	15.2	246.7	85.2	7.00	29.0	6	108	30
	50	74.4	309.6	205.2	16.2	9.4	15.2	246.8	94.5	6.33	26.3	7	108	31
W12-12x10	53	78.9	306.3	253.9	14.6	8.8	15.2	246.7	100	8.70	28.2	6	133	30
(305x254)	58	86.3	309.6	254.3	16.2	9.1	15.2	246.8	110	7.85	27.0	7	133	31

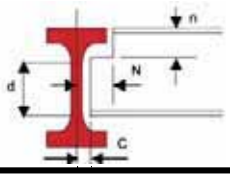


Imperial units

Designation Size	Mass Per Metre		Surface Area per Metre	Second Moment Of Area		Radius Of Gyration		Elastic Modulus		Plastic Modulus		Buckling Parameter	Torsional Index	Warping Constant	Torsional Constant
				Axis x-x	Axis y-y	Axis x-x	Axis y-y	Axis x-x	Axis y-y	Axis x-x	Axis y-y	u	x	H	J
in (mm)	lb/ft	kg/m	m^2	cm^4	cm^4	cm	cm	cm^3	cm^3	cm^3	cm^3			dm^6	cm^4
W10-10x5 3/4	16	24.0	1.06	3477	326	10.6	3.23	275	44.9	308	69.0	0.874	38.2	0.0494	4.16
(254x146)	21	31.1	1.06	4413	448	10.5	3.36	351	61.3	393	94.1	0.880	29.6	0.0660	8.55
	22	32.7	1.08	4917	475	10.8	3.37	381	65.0	426	100	0.882	28.9	0.0737	9.96
	25	37.0	1.07	5537	571	10.8	3.48	433	78.0	483	119	0.890	24.3	0.0857	15.3
	26	38.7	1.08	5974	584	11.1	3.45	455	79.6	510	122	0.888	24.5	0.0921	16.5
	29	43.0	1.08	6544	677	10.9	3.52	504	92.0	566	141	0.891	21.2	0.103	23.9
	30	44.6	1.09	7048	692	11.1	3.49	530	93.8	597	144	0.888	21.3	0.111	25.6
W10-10x8	33	49.1	1.27	7071	1517	10.6	4.93	572	150	634	229	0.873	21.5	0.211	24.0
(254x203)	39	58.0	1.28	8672	1865	10.8	5.03	688	184	765	280	0.878	18.3	0.265	40.2
	42	62.5	1.25	8430	1807	10.3	4.77	676	175	768	271	0.851	17.9	0.254	44.5
	45	67.0	1.29	10300	2214	11.0	5.09	803	217	898	331	0.880	15.9	0.321	62.3
	57	84.8	1.31	11930	2606	10.5	4.91	925	247	1067	385	0.849	13.6	0.380	109
W10-10x10	49	73.1	1.49	11410	3908	11.1	6.48	898	307	992	465	0.849	17.3	0.562	57.6
(254x254)	54	80.4	1.49	12590	4304	11.1	6.49	983	338	1091	512	0.849	15.8	0.623	75.6
	60	88.9	1.50	14270	4858	11.2	6.55	1096	379	1224	575	0.850	14.5	0.717	102
	68	101	1.51	16390	5558	11.3	6.57	1241	432	1398	657	0.849	12.9	0.832	148
	72	107	1.52	17510	5928	11.3	6.59	1313	458	1484	697	0.848	12.4	0.898	172
	77	115	1.52	18950	6391	11.4	6.61	1408	494	1599	752	0.849	11.6	0.976	213
	88	131	1.54	22210	7436	11.5	6.67	1613	570	1850	869	0.850	10.3	1.16	314
	89	132	1.55	22530	7531	11.6	6.69	1631	576	1869	878	0.850	10.3	1.19	319
	100	149	1.56	25900	8598	11.7	6.73	1838	655	2127	999	0.851	9.3	1.38	452
	112	167	1.58	30000	9870	11.9	6.81	2075	744	2424	1137	0.851	8.5	1.63	626
W12-12x4	14	20.8	0.985	3682	97.9	11.7	1.91	243	19.4	286	31.1	0.842	50.8	0.0216	2.93
(305x102)	16	23.8	0.990	4274	117	11.9	1.96	281	23.1	329	37.0	0.846	45.0	0.0260	4.27
	16.5	24.8	0.992	4455	123	11.9	1.97	292	24.2	342	38.8	0.846	43.4	0.0273	4.77
	19	28.2	1.00	5366	155	12.2	2.08	348	30.5	403	48.5	0.859	37.4	0.0349	7.40
	22	32.8	1.01	6501	194	12.5	2.15	416	37.9	481	60.0	0.866	31.6	0.0442	12.2
W12-12x5	25	37.0	1.07	7166	335	12.3	2.67	471	54.4	539	85.3	0.872	29.7	0.0723	14.8
(305x127)	28	41.9	1.08	8196	389	12.4	2.70	534	62.6	614	98.4	0.872	26.5	0.0847	21.1
	32	48.1	1.09	9575	461	12.5	2.74	616	73.6	711	116	0.873	23.3	0.102	31.8
W12-12x6 1/2	21	31.0	1.24	6554	544	12.9	3.72	428	66.4	476	102	0.881	42.4	0.121	6.3
(305x165)	26	38.7	1.26	8498	720	13.1	3.82	548	87.4	609	134	0.887	33.8	0.163	12.5
	27	40.3	1.24	8503	764	12.9	3.86	560	92.7	623	142	0.889	31.0	0.164	14.7
	30	44.6	1.26	9864	841	13.2	3.86	629	102	703	156	0.887	29.7	0.192	18.7
	31	46.1	1.25	9899	896	13.0	3.90	646	108	720	166	0.891	27.1	0.195	22.2
	35	52.1	1.27	11860	1019	13.3	3.91	747	122	838	188	0.889	25.3	0.236	30.8
	36	54.0	1.26	11700	1063	13.0	3.93	754	127	846	196	0.889	23.6	0.234	34.8
W12-12x8	40	59.5	1.38	12840	1823	13.0	4.91	847	179	938	274	0.890	22.9	0.384	39.1
(305x203)	45	67.0	1.39	14570	2078	13.1	4.94	952	203	1060	311	0.889	20.6	0.442	54.6
	50	74.4	1.40	16350	2337	13.2	4.97	1056	228	1183	349	0.889	18.8	0.503	73.5
W12-12x10	53	78.9	1.58	17700	3986	13.3	6.30	1156	314	1276	477	0.876	20.4	0.848	65.6
(305x254)	58	86.3	1.59	19740	4444	13.4	6.36	1275	349	1411	531	0.878	18.7	0.956	86.5

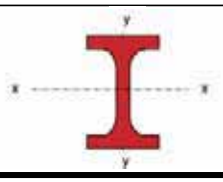
Universal Beams and Columns





Imperial units

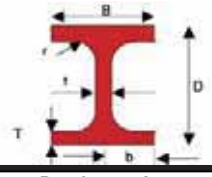
Designation Size	Mass Per Metre		Depth Of Section	Width Of Section	Thickness		Root Radius	Depth Between Fillets	Area Of Section	Ratios For Local Buckling		Dimensions For Detailing		
					Flange	Web				Flange	Web	End Clearance	Notch	
			D	B	T	t	r	d	A	b/T	d/t	C	N	n
in (mm)	lb/ft	kg/m	mm	mm	mm	mm	mm	mm	cm^2			mm	mm	mm
W12-12x12	65	96.9	307.9	305.3	15.4	9.9	15.2	246.7	123	9.91	24.9	7	158	31
(305x305)	72	107.1	311.1	305.8	17.0	10.9	15.2	246.7	136	8.98	22.6	7	157	32
	79	117.9	314.5	307.4	18.7	12.0	15.2	246.7	150	8.22	20.6	8	158	34
	87	129.5	318.3	308.0	20.6	13.1	15.2	246.8	165	7.49	18.9	9	157	36
	92	136.9	320.5	309.2	21.7	13.8	15.2	246.7	174	7.12	17.9	9	158	37
	96	142.8	322.8	308.9	22.9	14.0	15.2	246.7	182	6.76	17.7	9	157	38
	106	158.1	327.1	311.2	25.0	15.8	15.2	246.7	201	6.22	15.6	10	158	40
	120	178.6	333.2	312.9	28.1	18.0	15.2	246.7	228	5.57	13.7	11	157	43
	133	198.1	339.9	314.5	31.4	19.1	15.2	246.7	252	5.01	12.9	12	158	47
	136	202.4	340.6	315.0	31.8	20.1	15.2	246.7	258	4.96	12.3	12	157	47
	152	226.2	348.2	317.0	35.6	22.1	15.2	246.7	289	4.46	11.2	13	157	51
	161	240	352.5	318.4	37.7	23.0	15.2	246.7	306	4.22	10.7	14	158	53
	170	253	356.4	319.3	39.6	24.4	15.2	246.8	323	4.03	10.1	14	157	55
	190	282.9	365.3	322.2	44.1	26.8	15.2	246.7	360	3.65	9.21	15	158	59
	210	312.5	373.6	324.9	48.3	30.0	15.2	246.7	399	3.37	8.23	17	157	63
	230	342	382.3	327.5	52.6	32.6	15.2	246.7	437	3.11	7.57	18	157	68
	252	375	391.4	330.3	57.2	35.4	15.2	246.6	478	2.89	6.97	20	157	72
	278	413.7	402.6	333.8	62.7	38.9	15.2	246.7	529	2.66	6.35	21	157	78
	279	415	402.6	333.8	62.7	38.9	15.2	246.8	528	2.66	6.34	21	157	78
	305	454	414.5	336.2	68.7	41.3	15.2	246.7	578	2.45	5.97	23	157	84
	336	500	427.2	340.0	75.1	45.1	15.2	246.6	638	2.26	5.47	25	157	90
W14-14x5	22	33.1	349.0	125.4	8.5	6.0	10.2	311.6	42.1	7.38	51.9	5	70	19
(356x127)	26	39.1	353.4	126.0	10.7	6.6	10.2	311.6	49.8	5.89	47.2	5	70	21
W14-14x6 3/4	30	45.0	351.4	171.1	9.7	7.0	10.2	311.6	57.3	8.82	44.5	6	92	20
(356x171)	34	51.0	355.0	171.5	11.5	7.4	10.2	311.6	64.9	7.46	42.1	6	92	22
	38	57.0	358.0	172.2	13.0	8.1	10.2	311.6	72.6	6.62	38.5	6	92	23
	45	67.1	363.4	173.2	15.7	9.1	10.2	311.6	85.5	5.52	34.2	7	92	26
W14-14x8	43	64.0	347.0	203.1	13.4	7.8	15.2	289.8	81.2	7.58	37.4	6	108	29
(356x203)	48	71.4	350.3	204.0	15.1	8.6	15.2	289.7	91.2	6.75	33.5	6	108	30
	53	78.9	353.6	204.7	16.7	9.4	15.2	289.8	100	6.13	30.8	7	108	32
W14-14x10	61	90.8	352.8	253.9	16.3	9.5	15.2	289.8	115	7.79	30.4	7	132	32
(356x254)	68	101.2	356.6	254.8	18.3	10.5	15.2	289.6	129	6.97	27.5	7	132	33
	74	110.1	359.9	255.8	19.9	11.4	15.2	289.6	141	6.41	25.3	8	132	35
	82	122	363.5	257.3	21.7	12.9	15.2	289.7	155	5.92	22.5	8	132	37
W14-14x14 1/2	87	129	355.6	368.6	17.5	10.4	15.2	290.2	164	10.5	27.9	7	189	33
(356x368)	90	133.9	356.1	368.8	18.0	11.2	15.2	289.6	171	10.2	25.9	8	189	33
	99	147.3	359.7	370.0	19.8	12.3	15.2	289.7	188	9.34	23.5	8	189	35
	103	152.9	362.0	370.5	20.7	12.3	15.2	290.2	195	8.95	23.6	8	189	36
	109	162.2	363.7	371.0	21.8	13.3	15.2	289.6	207	8.49	21.7	9	189	37
	119	177	368.2	372.6	23.8	14.4	15.2	290.2	226	7.83	20.2	9	189	39
	120	178.6	367.8	372.6	23.9	15.0	15.2	289.6	228	7.80	19.3	9	189	39
	132	196.4	372.4	374.0	26.2	16.4	15.2	289.7	250	7.15	17.7	10	189	41
	136	201.9	374.6	374.7	27.0	16.5	15.2	290.2	257	6.94	17.6	10	189	42

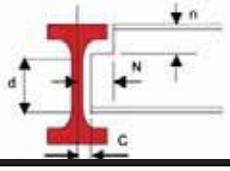


Imperial units

Designation Size	Mass Per Metre		Surface Area per Metre	Second Moment Of Area Axis x-x	Second Moment Of Area Axis y-y	Radius Of Gyration Axis x-x	Radius Of Gyration Axis y-y	Elastic Modulus Axis x-x	Elastic Modulus Axis y-y	Plastic Modulus Axis x-x	Plastic Modulus Axis y-y	Buckling Parameter	Torsional Index	Warping Constant	Torsional Constant
												u	x	H	J
in (mm)	lb/ft	kg/m	m^2	cm^4	cm^4	cm	cm	cm^3	cm^3	cm^3	cm^3			dm^6	cm^4
W12-12x12	65	96.9	1.79	22250	7308	13.4	7.69	1445	479	1592	726	0.850	19.3	1.56	91.2
(305x305)	72	107	1.80	24830	8117	13.5	7.72	1596	531	1767	806	0.850	17.6	1.75	122
	79	118	1.81	27670	9060	13.6	7.77	1760	589	1958	895	0.850	16.2	1.98	161
	87	130	1.82	30810	10030	13.7	7.80	1936	651	2164	990	0.851	14.9	2.22	212
	92	137	1.82	32820	10700	13.7	7.83	2048	692	2297	1053	0.851	14.2	2.39	249
	96	143	1.83	34670	11240	13.8	7.86	2148	728	2413	1106	0.853	13.6	2.53	285
	106	158	1.84	38750	12570	13.9	7.90	2369	808	2680	1230	0.851	12.5	2.87	378
	120	179	1.86	44560	14350	14.0	7.94	2675	917	3053	1399	0.851	11.2	3.34	537
	133	198	1.87	50900	16300	14.2	8.04	2995	1037	3440	1581	0.853	10.2	3.88	734
	136	202	1.87	51790	16560	14.2	8.02	3041	1052	3501	1606	0.852	10.1	3.95	771
	152	226	1.89	59610	18910	14.4	8.09	3424	1193	3975	1823	0.853	9.2	4.62	1074
	161	240	1.91	64200	20320	14.5	8.15	3643	1276	4247	1951	0.854	8.7	5.03	1271
	170	253	1.92	68490	21540	14.6	8.17	3844	1349	4502	2064	0.854	8.4	5.40	1480
	190	283	1.94	78870	24640	14.8	8.27	4318	1529	5105	2342	0.855	7.7	6.35	2034
	210	313	1.96	89270	27660	15.0	8.33	4779	1702	5703	2613	0.855	7.1	7.32	2693
	230	342	1.98	100600	30880	15.2	8.41	5261	1886	6332	2898	0.856	6.6	8.39	3490
	252	375	2.01	113200	34470	15.4	8.49	5783	2087	7020	3211	0.856	6.2	9.62	4495
	278	414	2.04	129600	39040	15.7	8.59	6437	2339	7890	3604	0.857	5.7	11.3	5953
	279	415	2.04	129500	39010	15.7	8.59	6435	2338	7888	3602	0.857	5.7	11.3	5946
	305	454	2.07	147600	43690	16.0	8.69	7122	2599	8807	4006	0.860	5.4	13.1	7719
	336	500	2.10	169000	49420	16.3	8.80	7913	2907	9882	4487	0.861	5.0	15.3	10110
W14-14x5	22	33.1	1.17	8250	280	14.0	2.58	473	44.7	543	70.3	0.863	42.2	0.0813	8.79
(356x127)	26	39.1	1.18	10170	358	14.3	2.68	576	56.8	659	89.1	0.871	35.2	0.105	15.1
W14-14x6 3/4	30	45.0	1.36	12070	811	14.5	3.76	687	94.8	775	147	0.874	36.8	0.237	15.8
(356x171)	34	51.0	1.36	14140	968	14.8	3.86	796	113	896	174	0.881	32.1	0.286	23.8
	38	57.0	1.37	16040	1108	14.9	3.91	896	129	1010	199	0.882	28.8	0.330	33.4
	45	67.1	1.38	19460	1362	15.1	3.99	1071	157	1211	243	0.886	24.4	0.412	55.7
W14-14x8	43	64.0	1.46	17760	1874	14.8	4.80	1024	185	1138	283	0.891	25.9	0.521	43.2
(356x203)	48	71.4	1.47	20170	2140	14.9	4.84	1151	210	1285	322	0.891	23.3	0.601	60.4
	53	78.9	1.48	22480	2391	15.0	4.88	1271	234	1424	359	0.892	21.3	0.679	80.1
W14-14x10	61	90.8	1.68	26540	4451	15.2	6.21	1505	351	1668	534	0.886	21.5	1.26	90.3
(356x254)	68	101	1.69	30060	5048	15.3	6.26	1686	396	1878	604	0.886	19.4	1.44	126
	74	110	1.69	33120	5569	15.3	6.29	1840	435	2058	665	0.886	18.0	1.61	161
	82	122	1.70	36680	6175	15.4	6.31	2018	480	2270	734	0.884	16.6	1.80	211
W14-14x14 1/2	87	129	2.14	40250	14610	15.6	9.43	2264	793	2479	1199	0.844	19.9	4.18	153
(356x368)	90	134	2.14	41580	15080	15.6	9.40	2335	818	2565	1238	0.842	19.2	4.31	169
	99	147	2.15	46240	16730	15.7	9.43	2571	904	2838	1370	0.842	17.7	4.83	223
	103	153	2.16	48590	17550	15.8	9.49	2685	948	2965	1435	0.844	17.0	5.11	251
	109	162	2.16	51540	18600	15.8	9.49	2834	1003	3142	1519	0.843	16.2	5.43	296
	119	177	2.17	57120	20530	15.9	9.54	3103	1102	3455	1671	0.844	15.0	6.09	381
	120	179	2.17	57290	20600	15.9	9.51	3115	1106	3475	1678	0.842	14.9	6.09	390
	132	196	2.18	63720	22820	16.0	9.55	3422	1221	3838	1853	0.843	13.7	6.84	511
	136	202	2.19	66260	23690	16.1	9.60	3538	1264	3972	1920	0.844	13.4	7.16	558

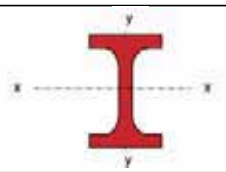
Universal Beams and Columns





Imperial units

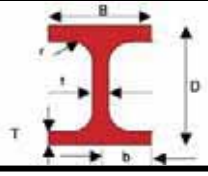
Designation Size	Mass Per Metre		Depth Of Section	Width Of Section	Thickness		Root Radius	Depth Between Fillets	Area Of Section	Ratios For Local Buckling		Dimensions For Detailing		
					Flange	Web				Flange	Web	End Clearance	Notch	
			D	B	T	t	r	d	A	b/T	d/t	C	N	n
in (mm)	lb/ft	kg/m	mm	mm	mm	mm	mm	mm	cm^2			mm	mm	mm
W14-14x16	118	175.6	360.0	396.0	20.0	20.0	15.0	290.0	224	9.90	14.5	12	198	35
(356x406)	145	215.8	375.4	393.7	27.7	17.3	15.2	289.6	275	7.11	16.8	11	198	43
	158	235.1	381.0	394.8	30.2	18.4	15.2	290.2	299	6.54	15.8	11	198	45
	159	236.6	380.5	395.4	30.2	18.9	15.2	289.6	302	6.54	15.3	11	198	45
	176	261.9	386.6	397.5	33.3	21.1	15.2	289.7	334	5.97	13.7	13	198	48
	193	287.1	393.6	399.0	36.5	22.6	15.2	290.2	366	5.47	12.8	13	198	52
	211	314	399.3	401.3	39.6	24.9	15.2	289.7	400	5.06	11.6	14	198	55
	219	326	403.1	402.0	41.2	25.5	15.2	290.3	415	4.88	11.4	15	198	56
	228	339.9	406.4	403.0	42.9	26.6	15.2	290.2	433	4.70	10.9	15	198	58
	233	346.7	407.4	403.6	43.7	27.2	15.2	289.6	442	4.62	10.7	16	198	59
	257	382.5	416.1	406.3	48.0	29.8	15.2	289.7	488	4.23	9.71	17	198	63
	264	393	419.0	407.0	49.2	30.6	15.2	290.2	501	4.14	9.48	17	198	64
	283	421.1	425.2	409.2	52.6	32.8	15.2	289.6	537	3.89	8.84	18	198	68
	311	462.8	434.8	412.2	57.4	35.8	15.2	289.6	590	3.59	8.09	20	198	73
	314	467	436.6	412.2	58.0	35.8	15.2	290.2	595	3.55	8.11	20	198	73
	342	509	445.5	415.5	62.7	39.1	15.2	289.6	649	3.31	7.40	22	198	78
	370	551	455.6	418.5	67.5	42.1	15.2	290.2	702	3.10	6.89	23	198	83
	398	592.3	464.6	421.4	72.3	45.0	15.2	289.7	755	2.92	6.44	24	198	87
	426	633.9	474.6	424.0	77.0	47.6	15.2	290.2	808	2.75	6.10	26	198	92
	455	677.1	483.1	427.6	81.5	51.2	15.2	289.6	863	2.62	5.66	28	198	97
	500	744.1	497.8	432.1	88.9	55.6	15.2	289.6	948	2.43	5.21	30	198	104
	550	818.5	514.1	436.9	97.0	60.5	15.2	289.6	1043	2.25	4.79	32	198	112
	605	900.3	531.4	442.3	105.6	65.9	15.2	289.8	1147	2.09	4.40	35	198	121
	665	989.6	549.7	448.3	114.8	71.9	15.2	289.7	1261	1.95	4.03	38	198	130
	730	1086	569.5	454.4	124.7	78.0	15.2	289.7	1385	1.82	3.72	41	198	140
W16-16x5 1/2	26	39.0	398.0	141.8	8.6	6.4	10.2	360.4	49.7	8.24	56.3	5	78	19
(406x140)	31	46.0	403.2	142.2	11.2	6.8	10.2	360.4	58.6	6.35	53.0	5	78	21
W16-16x7	36	54.1	402.6	177.7	10.9	7.7	10.2	360.4	69.0	8.15	46.8	6	95	21
(406x178)	40	60.1	406.4	177.9	12.8	7.9	10.2	360.4	76.5	6.95	45.6	6	95	23
	45	67.1	409.4	178.8	14.3	8.8	10.2	360.4	85.5	6.25	41.0	6	95	25
	50	74.2	412.8	179.5	16.0	9.5	10.2	360.4	94.5	5.61	37.9	7	95	26
	57	84.8	417.3	180.8	18.2	10.9	10.2	360.6	108	4.98	33.0	7	95	28
W16-16x10 1/4	67	99.7	414.8	260.0	16.9	10.0	10.2	360.6	127	7.70	36.0	7	135	27
(406x260)	77	114.6	419.6	261.5	19.3	11.6	10.2	360.6	146	6.77	31.2	8	135	30
	89	132.4	425.4	263.3	22.2	13.3	10.2	360.6	169	5.92	27.0	9	135	32
	100	148.8	431.0	264.8	25.0	14.9	10.2	360.6	190	5.29	24.3	9	135	35
W18-18x6	35	52.3	449.8	152.4	10.9	7.6	10.2	407.6	66.6	6.99	53.6	6	82	21
(457x152)	40	59.8	454.6	152.9	13.3	8.1	10.2	407.6	76.2	5.75	50.3	6	82	24
	45	67.2	458.0	153.8	15.0	9.0	10.2	407.6	85.6	5.13	45.3	7	82	25
	46	68.5	458.7	153.9	15.3	9.1	10.2	407.7	87.1	5.03	44.6	7	82	26
	50	74.2	462.0	154.4	17.0	9.6	10.2	407.6	94.5	4.54	42.5	7	82	27
	55	82.1	465.8	155.3	18.9	10.5	10.2	407.6	105	4.11	38.8	7	82	29
W18-18x7 1/2	41	61	450.0	189.0	10.8	8.1	10.2	408.4	76	8.75	50.4	6	750	21
(457x191)	45	67.1	453.4	189.9	12.7	8.5	10.2	407.6	85.5	7.48	48.0	6	101	23
	50	74.3	457.0	190.4	14.5	9.0	10.2	407.6	94.6	6.57	45.3	7	101	25
	55	82.0	460.0	191.3	16.0	9.9	10.2	407.6	104	5.98	41.2	7	101	26
	60	89.3	463.4	191.9	17.7	10.5	10.2	407.6	114	5.42	38.8	7	101	28
	65	96.7	466.1	192.8	19.1	11.4	10.2	407.6	123	5.06	35.7	8	101	29
	66	98.3	467.2	192.8	19.6	11.4	10.2	407.6	125	4.92	35.8	8	101	30
	71	105.7	469.1	193.9	20.6	12.6	10.2	407.6	134	4.71	32.4	8	101	31

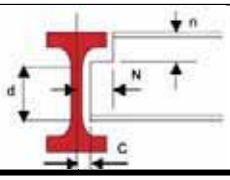


Imperial units

Designation Size	Mass Per Metre		Surface Area per Metre	Second Moment Of Area Axis x-x	Second Moment Of Area Axis y-y	Radius Of Gyration Axis x-x	Radius Of Gyration Axis y-y	Elastic Modulus Axis x-x	Elastic Modulus Axis y-y	Plastic Modulus Axis x-x	Plastic Modulus Axis y-y	Buckling Parameter	Torsional Index	Warping Constant	Torsional Constant
												u	x	H	J
in (mm)	lb/ft	kg/m	m^2	cm^4	cm^4	cm	cm	cm^3	cm^3	cm^3	cm^3			dm^6	cm^4
W14-14x16	118	176	2.24	51770	20730	15.2	9.61	2876	1047	3235	1603	0.810	16.1	5.99	322
(356x406)	145	216	2.26	71240	28180	16.1	10.1	3796	1432	4264	2172	0.832	13.0	8.52	632
	158	235	2.28	79090	30990	16.3	10.2	4151	1570	4687	2383	0.834	12.1	9.54	812
	159	237	2.28	79160	31170	16.2	10.2	4161	1577	4702	2394	0.833	12.0	9.56	822
	176	262	2.29	89040	34860	16.3	10.2	4606	1754	5244	2667	0.833	11.0	10.9	1101
	193	287	2.31	99880	38680	16.5	10.3	5075	1939	5812	2949	0.835	10.2	12.3	1441
	211	314	2.33	110500	42720	16.6	10.3	5537	2129	6387	3243	0.834	9.5	13.8	1854
	219	326	2.34	116400	44660	16.7	10.4	5777	2222	6681	3384	0.836	9.2	14.6	2073
	228	340	2.35	122500	46850	16.8	10.4	6031	2325	6999	3544	0.836	8.8	15.5	2343
	233	347	2.35	125100	47930	16.8	10.4	6141	2375	7140	3621	0.836	8.7	15.9	2478
	257	383	2.37	141500	53750	17.0	10.5	6803	2646	7975	4038	0.837	8.0	18.2	3292
	264	393	2.38	146600	55370	17.1	10.5	6998	2721	8222	4154	0.837	7.9	18.9	3545
	283	421	2.40	159800	60150	17.2	10.6	7516	2940	8887	4492	0.837	7.4	20.9	4336
	311	463	2.42	180100	67130	17.5	10.7	8283	3257	9877	4983	0.838	6.9	23.9	5655
	314	467	2.42	183000	67830	17.5	10.7	8383	3291	10000	5034	0.839	6.9	24.3	5809
	342	509	2.45	203800	75180	17.7	10.8	9151	3619	11010	5543	0.840	6.4	27.5	7401
	370	551	2.47	226900	82670	18.0	10.9	9962	3951	12080	6058	0.841	6.1	31.1	9240
	398	592	2.50	249800	90380	18.2	10.9	10750	4289	13130	6583	0.842	5.7	34.8	11350
	426	634	2.52	274800	98130	18.4	11.0	11580	4629	14240	7108	0.843	5.5	38.8	13720
	455	677	2.55	299400	106600	18.6	11.1	12400	4987	15340	7669	0.843	5.2	43.0	16460
	500	744	2.59	341900	120000	19.0	11.3	13740	5555	17160	8553	0.844	4.9	50.2	21390
	550	819	2.63	392400	135500	19.4	11.4	15260	6202	19260	9560	0.846	4.6	58.9	27870
	605	900	2.67	450600	153100	19.8	11.6	16960	6922	21610	10680	0.848	4.3	69.4	36130
	665	990	2.72	518100	173400	20.3	11.7	18850	7736	24250	11960	0.849	4.0	82.0	46760
	730	1086	2.77	597000	196300	20.8	11.9	20970	8640	27230	13370	0.851	3.8	97.1	60230
W16-16x5 1/2	26	39.0	1.33	12510	410	15.9	2.87	629	57.8	724	90.8	0.858	47.5	0.155	10.7
(406x140)	31	46.0	1.34	15690	538	16.4	3.03	778	75.7	888	118	0.871	38.9	0.207	19.0
W16-16x7	36	54.1	1.48	18720	1021	16.5	3.85	930	115	1055	178	0.871	38.3	0.392	23.1
(406x178)	40	60.1	1.49	21600	1203	16.8	3.97	1063	135	1199	209	0.880	33.8	0.466	33.3
	45	67.1	1.50	24330	1365	16.9	3.99	1189	153	1346	237	0.880	30.5	0.533	46.1
	50	74.2	1.51	27310	1546	17.0	4.04	1323	172	1501	267	0.882	27.6	0.608	62.8
	57	84.8	1.52	31520	1794	17.1	4.07	1511	198	1724	309	0.881	24.5	0.714	92.2
W16-16x10 1/4	67	99.7	1.83	39730	4951	17.7	6.25	1915	381	2128	581	0.888	25.4	1.96	99.4
(406x260)	77	115	1.84	46110	5758	17.8	6.28	2198	440	2457	673	0.887	22.4	2.31	149
	89	132	1.86	54060	6768	17.9	6.33	2541	514	2859	788	0.887	19.7	2.75	227
	100	149	1.87	61830	7754	18.0	6.39	2869	586	3246	899	0.887	17.7	3.20	322
W18-18x6	35	52.3	1.48	21370	645	17.9	3.11	950	84.7	1096	133	0.859	43.9	0.311	21.4
(457x152)	40	59.8	1.49	25500	795	18.3	3.23	1122	104	1287	163	0.868	37.5	0.387	33.8
	45	67.2	1.50	28930	913	18.4	3.27	1263	119	1453	187	0.869	33.6	0.448	47.7
	46	68.5	1.50	29530	933	18.4	3.27	1288	121	1482	191	0.869	33.0	0.458	50.4
	50	74.2	1.50	32670	1047	18.6	3.33	1414	136	1627	213	0.873	30.1	0.518	65.9
	55	82.1	1.51	36590	1185	18.7	3.37	1571	153	1811	240	0.873	27.4	0.591	89.2
W18-18x7 1/2	41	61.0	1.62	25380	1218	18.2	3.99	1128	129	1286	201	0.865	42.6	0.6	26
(457x191)	45	67.1	1.63	29380	1452	18.5	4.12	1296	153	1471	237	0.872	37.9	0.705	37.1
	50	74.3	1.64	33320	1671	18.8	4.20	1458	176	1653	272	0.877	33.9	0.818	51.8
	55	82.0	1.65	37050	1871	18.8	4.23	1611	196	1831	304	0.877	30.9	0.922	69.2
	60	89.3	1.66	41020	2089	19.0	4.29	1770	218	2014	338	0.880	28.3	1.04	90.7
	65	96.7	1.66	44590	2281	19.0	4.30	1913	237	2184	369	0.879	26.3	1.14	114
	66	98.3	1.67	45730	2347	19.1	4.33	1957	243	2232	379	0.881	25.7	1.18	121
	71	106	1.67	48760	2507	19.0	4.32	2079	259	2383	404	0.877	24.4	1.26	145

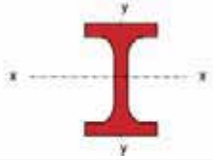
Universal Beams and Columns





Imperial units

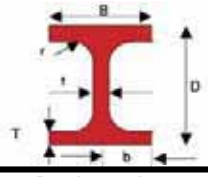
Designation Size	Mass Per Metre		Depth Of Section	Width Of Section	Thickness		Root Radius	Depth Between Fillets	Area Of Section	Ratios For Local Buckling		Dimensions For Detailing		
					Flange	Web				Flange	Web	End Clearance	Notch	
			D	B	T	t	r	d	A	b/T	d/t	C	N	n
in (mm)	lb/ft	kg/m	mm	mm	mm	mm	mm	mm	cm^2			mm	mm	mm
W18-18x11	76	113.1	462.5	280.3	17.3	10.8	10.2	407.6	144	8.12	37.7	7	145	27
(457x279)	86	128	467.1	281.7	19.6	12.1	10.2	407.6	163	7.20	33.7	8	145	30
	97	144.4	472.2	283.1	22.1	13.6	10.2	407.6	184	6.40	30.0	9	145	32
	106	157.7	475.7	284.5	23.9	15.0	10.2	407.5	201	5.96	27.2	9	145	34
	119	177.1	481.8	286.1	26.9	16.6	10.2	407.6	226	5.31	24.5	10	145	37
	130	193.5	489.0	283.5	30.5	17.0	10.2	407.6	247	4.65	24.0	11	143	41
	143	212.8	495.0	285.0	33.5	18.5	10.2	407.5	271	4.25	22.0	11	143	44
	158	235	501.0	287.0	36.6	20.6	10.2	407.8	299	3.92	19.8	12	143	47
	175	260	509.0	289.0	40.4	22.6	10.2	408.2	331	3.58	18.1	13	143	50
W21-21x6 1/2	44	65.5	524.8	165.1	11.4	8.9	12.7	476.6	84	7.24	53.6	6	88	24
(533x165)	50	74.4	529.1	165.9	13.5	9.7	12.7	476.7	95	6.14	49.4	7	88	26
	57	84.8	534.9	166.5	16.5	10.3	12.7	476.5	108	5.04	46.3	7	88	29
W21-21x8 1/4	48	71.4	523.2	206.8	10.9	8.9	12.7	476.5	91	11.62	43.7	6	109	23
(533x210)	55	82.2	528.3	208.8	13.2	9.6	12.7	476.5	105	7.91	49.6	7	110	26
	62	92.1	533.1	209.3	15.6	10.1	12.7	476.5	117	6.71	47.2	7	110	28
	68	101	536.7	210.0	17.4	10.8	12.7	476.5	129	6.03	44.1	7	110	30
	73	109	539.5	210.8	18.8	11.6	12.7	476.5	139	5.61	41.1	8	110	32
	82	122	544.5	211.9	21.3	12.7	12.7	476.5	155	4.97	37.5	8	110	34
	83	123.5	544.3	212.2	21.2	13.1	12.7	476.5	157	5.00	36.4	9	110	34
	93	138.4	549.1	213.9	23.6	14.7	12.7	476.5	176	4.53	32.3	9	110	36
W21-21x12 1/4	101	150.3	542.5	312.2	20.3	12.7	12.7	476.5	192	7.68	37.5	8	160	33
(533x312)	111	165.2	546.4	313.4	22.2	14.0	12.7	476.6	211	7.05	34.1	9	160	35
	122	181.6	550.7	314.7	24.4	15.2	12.7	476.5	231	6.45	31.3	10	160	37
	132	196.4	554.5	316.0	26.3	16.5	12.7	476.5	250	6.01	28.9	10	160	39
	147	218.8	560.3	317.8	29.2	18.3	12.7	476.5	279	5.44	26.1	11	160	42
	166	247	571.0	315.5	34.5	19.1	12.7	476.5	315	4.57	25.0	12	158	47
	182	270.8	577.1	317.8	37.6	21.1	12.7	476.5	346	4.23	22.6	13	158	50
	201	300	585.0	319.0	41.4	23.1	12.7	476.8	382	3.85	20.6	14	158	54
	223	331	593.0	322.0	45.5	25.4	12.7	476.6	422	3.54	18.8	15	158	58
	248	370	603.0	324.0	50.5	26.2	12.7	476.6	460	3.21	18.2	15	159	63
	275	409	613.0	327.0	55.6	31.0	12.7	476.4	521	2.94	15.4	18	158	68
W24-24x7	55	81.9	598.7	177.9	12.8	10.0	12.7	547.6	105	6.93	54.6	7	94	26
(610x178)	61	91.0	602.5	178.4	15.0	10.6	12.7	547.1	116	5.95	51.6	7	94	28
	62	92.3	603.0	178.8	15.0	10.9	12.7	547.6	118	5.96	50.1	7	94	28
W24-24x9	68	101.2	602.6	227.6	14.8	10.5	12.7	547.6	129	7.69	52.2	7	119	28
(610x229)	76	113	607.6	228.2	17.3	11.1	12.7	547.6	144	6.60	49.3	8	119	30
	84	125.1	612.2	229.0	19.3	11.9	12.7	548.2	158	5.93	46.1	8	119	32
	94	139.9	617.2	230.2	22.1	13.1	12.7	547.6	178	5.21	41.8	9	119	35
	103	153	623.1	228.6	24.9	14.0	12.7	547.9	195	4.59	39.1	9	117	38
	114	171	628.9	229.9	27.9	15.5	12.7	547.7	218	4.12	35.3	10	117	41
	128	191	635.0	231.5	30.9	17.0	12.7	547.8	242	3.75	32.2	11	117	44
	146	217	643.1	234.1	35.1	19.6	12.7	547.5	278	3.33	27.9	12	117	48
	163	243	651.0	235.9	39.1	21.6	12.7	547.4	310	3.02	25.3	13	117	52
	181	270	658.6	238.5	42.9	23.9	12.7	547.4	343	2.78	22.9	14	117	56
	198	295	667.0	240.5	47.0	25.9	12.7	547.6	376	2.56	21.1	15	117	60
	218	325	675.1	243.1	51.0	28.4	12.7	547.7	412	2.38	19.3	16	117	64
	239	356	685.0	245.6	55.9	31.0	12.7	547.8	454	2.20	17.7	18	117	69
W24-24x12	100	149.1	612.4	304.8	19.7	11.8	16.5	540.0	190	7.74	45.8	8	157	36
(610x305)	120	179	620.2	307.1	23.6	14.1	16.5	540.0	228	6.51	38.3	9	157	40
	160	238.1	635.8	311.4	31.4	18.4	16.5	540.0	303	4.96	29.3	11	157	48

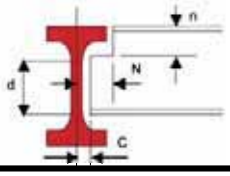


Imperial units

Designation Size	Mass Per Metre		Surface Area per Metre	Second Moment Of Area Axis x-x	Second Moment Of Area Axis y-y	Radius Of Gyration Axis x-x	Radius Of Gyration Axis y-y	Elastic Modulus Axis x-x	Elastic Modulus Axis y-y	Plastic Modulus Axis x-x	Plastic Modulus Axis y-y	Buckling Parameter	Torsional Index	Warping Constant	Torsional Constant
				x-x	y-y	x-x	y-y	x-x	y-y	x-x	y-y	u	x	H	J
in (mm)	lb/ft	kg/m	m^2	cm^4	cm^4	cm	cm	cm^3	cm^3	cm^3	cm^3			dm^6	cm^4
W18-18x11	76	113	2.01	55460	6344	19.6	6.64	2398	453	2669	692	0.885	27.9	3.14	118
(457x279)	86	128	2.02	63520	7295	19.7	6.69	2720	518	3039	792	0.886	24.8	3.65	170
	97	144	2.03	72710	8367	19.9	6.74	3079	591	3457	906	0.886	22.1	4.24	244
	106	158	2.04	79600	9178	19.9	6.76	3347	645	3775	991	0.884	20.5	4.68	311
	119	177	2.06	91040	10530	20.1	6.82	3779	736	4284	1132	0.885	18.4	5.44	442
	130	194	2.06	102500	11590	20.4	6.86	4192	818	4761	1257	0.891	16.6	6.09	603
	143	213	2.08	114400	12960	20.5	6.91	4624	910	5278	1400	0.891	15.2	6.90	800
	158	235	2.09	127300	14450	20.6	6.95	5083	1007	5839	1554	0.890	14.0	7.8	1059
	175	260	2.11	143700	16300	20.8	7.01	5646	1128	6525	1743	0.891	12.8	8.9	1423
W21-21x6 1/2	44	65.5	1.67	35030	859	20.5	3.20	1335	104	1561	166	0.847	47.0	0.566	31.9
(533x165)	50	74.4	1.68	40810	1032	20.8	3.30	1543	124	1797	199	0.853	41.4	0.686	47.1
	57	84.8	1.69	48640	1276	21.2	3.44	1819	153	2107	243	0.862	35.5	0.857	73.8
W21-21x8 1/4	48	71	1.85	39917	1611	20.9	4.2	1524	156	1753	244	0.858	47.9	1.1	33.4
(533x210)	55	82.2	1.85	47540	2008	21.3	4.38	1800	192	2059	300	0.864	41.6	1.33	51.5
	62	92.1	1.86	55230	2389	21.7	4.51	2072	228	2360	356	0.872	36.5	1.60	75.7
	68	101	1.87	61520	2692	21.9	4.57	2292	256	2612	399	0.874	33.2	1.82	101
	73	109	1.88	66820	2943	21.9	4.60	2477	279	2828	436	0.875	30.9	1.99	126
	82	122	1.89	76040	3388	22.1	4.67	2793	320	3196	500	0.877	27.6	2.32	178
	83	124	1.89	76240	3389	22.0	4.65	2801	319	3212	500	0.874	27.6	2.32	181
	93	138	1.90	86170	3868	22.1	4.68	3139	362	3617	569	0.873	24.9	2.67	251
W21-21x12 1/4	101	150	2.29	100800	10320	22.9	7.33	3715	661	4147	1012	0.885	27.8	7.03	217
(533x312)	111	165	2.30	111300	11410	23.0	7.36	4074	728	4565	1117	0.885	25.6	7.84	284
	122	182	2.31	123300	12680	23.1	7.40	4476	806	5032	1238	0.885	23.4	8.78	373
	132	196	2.32	134200	13850	23.2	7.44	4842	876	5462	1348	0.884	21.8	9.66	469
	147	219	2.33	151200	15650	23.3	7.49	5396	985	6116	1519	0.884	19.8	11.0	643
	166	247	2.34	178000	18110	23.8	7.58	6233	1148	7080	1766	0.891	17.2	13.0	983
	182	271	2.36	197200	20150	23.9	7.63	6834	1268	7807	1956	0.890	15.9	14.7	1278
	201	300	2.38	220700	22450	24.1	7.67	7547	1408	8670	2175	0.890	14.6	16.6	1700
	223	331	2.40	247700	25390	24.2	7.76	8355	1577	9656	2442	0.890	13.4	19.0	2263
	248	370	2.43	278900	28710	24.6	7.90	9250	1772	10730	2739	0.894	12.3	21.9	2996
	275	409	2.45	316900	32530	24.7	7.91	10340	1990	12120	3096	0.890	11.2	25.3	4131
W24-24x7	55	81.9	1.87	56020	1210	23.2	3.40	1871	136	2200	219	0.843	48.3	1.04	49.2
(610x178)	61	91.0	1.88	63880	1426	23.5	3.51	2120	160	2480	256	0.850	43.2	1.23	68.6
	62	92.3	1.88	64580	1436	23.4	3.49	2142	161	2512	258	0.848	42.8	1.24	71.0
W24-24x9	68	101	2.07	75780	2915	24.2	4.76	2515	256	2881	400	0.864	43.1	2.52	77.0
(610x229)	76	113	2.08	87320	3434	24.6	4.88	2874	301	3281	469	0.870	38.0	2.99	111
	84	125	2.09	97540	3872	24.8	4.95	3187	338	3639	528	0.872	34.5	3.40	149
	94	140	2.11	111800	4505	25.0	5.03	3622	391	4142	611	0.875	30.6	3.99	216
	103	153	2.11	125000	4972	25.3	5.04	4012	435	4595	680	0.878	27.6	4.45	295
	114	171	2.12	141400	5670	25.4	5.09	4495	493	5167	773	0.878	24.8	5.12	411
	128	191	2.14	158400	6415	25.6	5.15	4990	554	5757	871	0.879	22.6	5.85	554
	146	217	2.16	183900	7544	25.7	5.21	5718	644	6643	1019	0.877	20.0	6.97	819
	163	243	2.18	207900	8606	25.9	5.27	6386	730	7455	1157	0.878	18.2	8.06	1123
	181	270	2.20	232800	9768	26.1	5.34	7069	819	8299	1304	0.877	16.7	9.26	1495
	198	295	2.22	259400	10980	26.3	5.41	7778	913	9173	1458	0.878	15.4	10.6	1952
	218	325	2.24	287700	12330	26.4	5.47	8522	1014	10110	1625	0.877	14.3	12.0	2517
	239	356	2.27	322200	13950	26.6	5.55	9406	1136	11220	1826	0.877	13.2	13.8	3309
W24-24x12	100	149	2.39	125900	9308	25.7	7.00	4111	611	4594	937	0.886	32.7	8.17	200
(610x305)	120	179	2.41	153000	11410	25.9	7.07	4935	743	5547	1144	0.886	27.7	10.2	340
	160	238	2.45	209500	15840	26.3	7.23	6589	1017	7486	1574	0.886	21.3	14.5	785

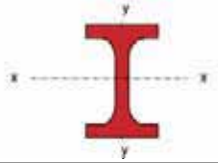
Universal Beams and Columns





Imperial units

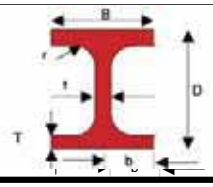
Designation Size	Mass Per Metre		Depth Of Section	Width Of Section	Thickness		Root Radius	Depth Between Fillets	Area Of Section	Ratios For Local Buckling		Dimensions For Detailing		
					Flange	Web				Flange	Web	End Clearance	Notch	
			D	B	T	t	r	d	A	b/T	d/t	C	N	n
in (mm)	lb/ft	kg/m	mm	mm	mm	mm	mm	mm	cm^2			mm	mm	mm
W24-24x12 3/4	104	154.8	611.1	323.8	19.1	12.7	12.7	547.6	198	8.50	43.1	8	166	32
(610x324)	117	174.1	616.2	325.1	21.6	14.0	12.7	547.6	222	7.53	39.2	9	166	34
	131	194.9	621.8	326.5	24.4	15.4	12.7	547.6	249	6.70	35.6	10	166	37
	146	217.3	628.4	327.7	27.7	16.5	12.7	547.6	277	5.92	33.2	10	166	40
	162	241.1	635.0	329.1	31.0	17.9	12.7	547.6	308	5.31	30.6	11	166	44
	176	261.9	641.1	327.4	34.0	19.1	12.7	547.6	333	4.81	28.7	12	164	47
	192	285.7	646.9	328.9	37.1	20.6	12.7	547.3	363	4.44	26.6	12	164	50
	207	308	653.0	330.5	39.9	22.1	12.7	547.8	392	4.14	24.8	13	164	53
	229	341	661.0	333.0	43.9	24.4	16.5	540.2	435	3.79	22.1	14	164	60
	250	372	669.0	335.0	48.0	26.4	16.5	540.0	475	3.49	20.5	15	164	65
	279	415	679.0	338.0	53.1	29.5	16.5	539.8	530	3.18	18.3	17	164	70
	306	455	689.0	340.0	57.9	32.0	16.5	540.2	579	2.94	16.9	18	164	74
	335	498	699.0	343.0	63.0	35.1	13.0	547.0	635	2.72	15.6	20	164	76
	370	551	711.0	347.0	69.1	38.6	13.0	546.8	702	2.51	14.2	21	164	82
W27-27x10	84	125.2	677.9	253.0	16.2	11.7	15.2	615.1	159	7.81	52.6	8	131	31
(686x254)	94	140.1	683.5	253.7	19.0	12.4	15.2	615.1	178	6.68	49.6	8	131	34
	102	152.4	687.5	254.5	21.0	13.2	15.2	615.1	194	6.06	46.6	9	131	36
	114	170.2	692.9	255.8	23.7	14.5	15.2	615.1	217	5.40	42.4	9	131	39
	129	192	701.8	254.3	27.9	15.5	15.2	615.6	244	4.56	39.7	10	129	43
	143	213	707.9	255.8	31.0	17.0	15.2	615.5	270	4.13	36.2	11	129	46
	159	237	714.0	257.8	34.0	19.1	15.2	615.6	301	3.79	32.2	12	129	49
	182	271	723.9	260.2	39.1	21.6	15.2	615.3	345	3.33	28.5	13	129	54
	201	299	732.0	262.8	42.9	23.9	15.2	615.8	382	3.06	25.8	14	129	58
	221	329	739.9	264.8	47.0	25.9	15.2	615.5	418	2.82	23.8	15	129	62
	247	368	749.8	267.7	52.1	28.9	15.2	615.2	468	2.57	21.3	16	129	67
	271	404	760.0	270.3	56.9	31.5	15.2	615.8	513	2.38	19.5	18	129	72
	302	449	771.9	273.8	63.0	35.1	15.2	615.5	574	2.17	17.5	20	129	78
W27-27x14	146	217.3	695.5	354.7	24.8	15.4	15.2	615.6	277	7.16	40.1	10	180	40
(686x356)	161	239.6	700.8	356.1	27.4	16.8	15.2	615.5	306	6.49	36.7	10	180	43
	178	264.9	706.4	357.8	30.2	18.4	15.2	615.5	337	5.92	33.4	11	180	45
	194	288.7	714.0	356.4	34.0	19.1	15.2	615.5	368	5.24	32.3	12	179	49
	217	322.9	722.1	358.5	38.1	21.1	15.2	615.5	411	4.70	29.2	13	179	53
	235	349.7	728.0	360.4	40.9	23.1	15.2	615.8	446	4.41	26.6	14	179	56
	258	383.9	736.1	362.5	45.0	24.9	15.2	615.8	489	4.03	24.7	14	179	60
	281	418.2	744.0	364.5	49.0	26.9	15.2	615.6	533	3.72	22.9	15	179	64
	307	456.9	752.1	366.9	53.1	29.5	15.2	615.5	582	3.46	20.9	17	179	68
	336	500	762.0	369.0	57.9	32.0	15.2	615.8	636	3.19	19.2	18	179	73
W30-30x10 1/2	90	133.9	750.0	264.4	15.5	12.0	16.5	686.0	171	8.53	57.2	8	136	32
(762x267)	99	146.9	754.0	265.2	17.5	12.8	16.5	686.0	187	7.58	53.6	8	136	34
	108	160.7	757.7	266.1	19.3	13.8	16.5	686.1	205	6.89	49.6	9	136	36
	116	173	762.2	266.7	21.6	14.3	16.5	686.0	220	6.17	48.0	9	136	38
	124	184.5	766.3	267.1	23.6	14.9	16.5	686.1	235	5.65	46.2	9	136	40
	132	196.8	769.8	268.0	25.4	15.6	16.5	686.0	251	5.28	44.0	10	136	42
	148	220	779.0	266.2	30.0	16.5	16.5	686.0	281	4.44	41.6	10	135	47
	165	246	785.1	268.1	33.0	18.5	16.5	686.1	312	4.06	37.1	11	135	50
	185	275	793.0	270.1	37.1	20.6	16.5	685.8	351	3.64	33.3	12	135	54
	207	308	801.1	272.7	40.9	23.1	16.5	686.3	392	3.33	29.7	14	135	57
	226	337	809.0	274.6	44.9	24.9	16.5	686.2	428	3.06	27.6	14	135	61
	246	366	817.1	276.6	48.0	26.9	16.5	688.1	462	2.88	25.6	15	135	65
	269	401	825.0	279.1	53.1	29.5	16.5	685.8	511	2.63	23.2	17	135	70
	295	439	835.2	281.7	57.9	32.0	16.5	686.4	559	2.43	21.5	18	135	74

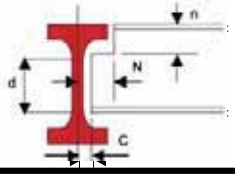


Imperial units

Designation Size	Mass Per Metre		Surface Area per Metre	Second Moment Of Area		Radius Of Gyration		Elastic Modulus		Plastic Modulus		Buckling Parameter	Torsional Index	Warping Constant	Torsional Constant
				Axis x-x	Axis y-y	Axis x-x	Axis y-y	Axis x-x	Axis y-y	Axis x-x	Axis y-y	u	x	H	J
in (mm)	lb/ft	kg/m	m^2	cm^4	cm^4	cm	cm	cm^3	cm^3	cm^3	cm^3			dm^6	cm^4
W24-24x12 3/4	104	155	2.47	129200	10790	25.6	7.39	4227	666	4734	1023	0.880	33.6	9.46	196
(610x324)	117	174	2.48	147200	12380	25.8	7.47	4776	762	5360	1170	0.882	30.0	10.9	280
	131	195	2.50	167300	14160	25.9	7.55	5383	867	6057	1335	0.883	26.8	12.6	395
	146	217	2.51	190800	16260	26.2	7.66	6074	993	6845	1527	0.886	23.9	14.7	559
	162	241	2.53	215400	18440	26.4	7.74	6784	1121	7670	1726	0.888	21.6	16.8	770
	176	262	2.53	236600	19950	26.6	7.73	7380	1218	8369	1878	0.890	19.9	18.4	995
	192	286	2.55	260400	22030	26.8	7.79	8050	1340	9163	2068	0.890	18.4	20.5	1280
	207	308	2.56	283900	24050	26.9	7.84	8695	1455	9936	2250	0.890	17.2	22.6	1593
	229	341	2.58	319000	27090	27.1	7.90	9652	1627	11090	2523	0.890	15.7	25.8	2162
	250	372	2.60	353900	30170	27.3	7.97	10580	1801	12220	2797	0.890	14.5	29.1	2809
	279	415	2.62	400500	34310	27.5	8.04	11800	2030	13720	3162	0.889	13.2	33.6	3824
	306	455	2.65	445200	38100	27.7	8.11	12920	2241	15120	3498	0.889	12.2	37.9	4940
	335	498	2.68	494700	42580	27.9	8.19	14150	2483	16670	3885	0.889	11.3	42.9	6420
	370	551	2.71	557510	48400	28.2	8.30	15682	2790	18599	4377	0.889	10.4	49.6	8525
W27-27x10	84	125	2.32	118000	4383	27.2	5.24	3481	347	3994	542	0.862	43.9	4.80	116
(686x254)	94	140	2.33	136300	5184	27.6	5.39	3987	409	4558	638	0.868	38.7	5.72	169
	102	152	2.34	150400	5784	27.8	5.46	4374	455	5000	710	0.871	35.5	6.42	220
	114	170	2.35	170300	6631	28.0	5.53	4916	518	5631	811	0.872	31.8	7.42	308
	129	192	2.36	198000	7670	28.5	5.61	5644	603	6462	943	0.878	27.7	8.71	462
	143	213	2.38	222000	8678	28.7	5.67	6272	678	7204	1063	0.878	25.2	9.94	627
	159	237	2.39	247800	9750	28.7	5.69	6940	756	8016	1191	0.877	23.0	11.3	840
	182	271	2.42	289300	11540	29.0	5.78	7993	887	9282	1402	0.878	20.3	13.5	1260
	201	299	2.44	323800	13060	29.1	5.85	8847	994	10330	1577	0.877	18.6	15.5	1675
	221	329	2.46	359400	14640	29.3	5.92	9715	1106	11390	1759	0.877	17.2	17.6	2186
	247	368	2.49	406900	16800	29.5	5.99	10850	1255	12810	2005	0.877	15.6	20.4	2993
	271	404	2.51	453800	18910	29.7	6.07	11940	1399	14170	2243	0.877	14.4	23.4	3897
	302	449	2.54	515400	21790	30.0	6.16	13350	1592	15950	2565	0.876	13.2	27.4	5322
W27-27x14	146	217	2.75	234200	18440	29.1	8.16	6735	1040	7558	1598	0.884	29.7	20.7	454
(686x356)	161	240	2.77	261200	20670	29.2	8.22	7455	1161	8389	1787	0.885	27.0	23.4	610
	178	265	2.78	290800	23120	29.4	8.28	8233	1292	9297	1992	0.885	24.6	26.4	813
	194	289	2.79	325500	25720	29.8	8.36	9118	1444	10300	2223	0.889	22.3	29.7	1100
	217	323	2.81	369200	29310	30.0	8.44	10230	1635	11610	2523	0.890	20.1	34.3	1532
	235	350	2.83	402300	31970	30.0	8.47	11050	1774	12600	2745	0.888	18.8	37.7	1914
	258	384	2.85	447800	35780	30.3	8.56	12170	1974	13930	3057	0.889	17.2	42.7	2518
	281	418	2.87	494700	39680	30.5	8.63	13300	2177	15290	3377	0.890	15.9	47.9	3250
	307	457	2.89	545000	43850	30.6	8.68	14990	2390	16750	3717	0.889	14.8	53.6	4152
	336	500	2.91	604800	48670	30.8	8.75	15870	2638	18450	4111	0.889	13.7	60.3	5373
W30-30x10 1/2	90	134	2.51	150700	4788	29.7	5.30	4018	362	4644	570	0.854	49.8	6.46	119
(762x267)	99	147	2.51	168500	5456	30.0	5.40	4470	411	5156	647	0.858	45.2	7.40	159
	108	161	2.52	185900	6080	30.1	5.45	4907	457	5665	720	0.859	41.5	8.29	208
	116	173	2.53	205300	6850	30.5	5.58	5387	514	6198	807	0.864	38.1	9.39	267
	124	185	2.54	223100	7525	30.8	5.65	5821	563	6689	885	0.867	35.4	10.4	333
	132	197	2.55	240000	8175	30.9	5.71	6234	610	7167	959	0.869	33.2	11.3	404
	148	220	2.56	278200	9463	31.5	5.81	7142	711	8197	1115	0.875	28.9	13.3	605
	165	246	2.58	310700	10640	31.5	5.84	7914	794	9129	1251	0.874	26.4	15.0	815
	185	275	2.60	353200	12240	31.7	5.91	8909	906	10320	1433	0.874	23.7	17.5	1147
	207	308	2.62	397200	13900	31.8	5.96	9916	1020	11550	1620	0.873	21.6	20.1	1555
	226	337	2.64	440500	15600	32.1	6.04	10890	1136	12720	1808	0.874	19.9	22.8	2029
	246	366	2.66	480200	17050	32.2	6.08	11750	1233	13790	1971	0.873	18.7	25.2	2500
	269	401	2.68	536500	19400	32.4	6.16	13010	1390	15330	2229	0.874	17.0	28.9	3361
	295	439	2.70	595900	21780	32.7	6.24	14270	1546	16900	2486	0.874	15.8	32.9	4345

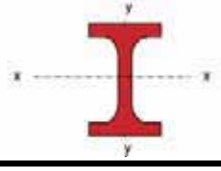
Universal Beams and Columns





Imperial units

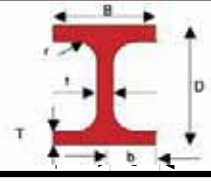
Designation Size	Mass Per Metre		Depth Of Section	Width Of Section	Thickness Flange	Thickness Web	Root Radius	Depth Between Fillets	Area Of Section	Ratios For Local Buckling Flange	Ratios For Local Buckling Web	Dimensions For Detailing End Clearance	Dimensions For Detailing Notch	
			D	B	T	t	r	d	A	b/T	d/t	C	N	n
in (mm)	lb/ft	kg/m	mm	mm	mm	mm	mm	mm	cm^2			mm	mm	mm
W30-30x15	173	257.5	773.2	380.6	27.1	16.6	16.5	686.1	328	7.04	41.2	10	192	44
(762x381)	191	284.2	779.3	382.0	30.1	18.0	16.5	686.1	362	6.35	38.1	11	192	47
	211	314	785.9	383.7	33.4	19.7	16.5	686.1	400	5.74	34.9	12	192	50
	235	349.7	795.0	382.4	38.1	21.1	16.5	685.8	445	5.02	32.5	13	191	55
	261	388.4	802.9	384.9	41.9	23.6	16.5	686.1	495	4.59	29.0	14	191	58
	292	434.5	813.1	387.5	47.0	25.9	16.5	686.1	553	4.12	26.5	15	191	63
	326	485.1	823.0	390.4	52.1	29.0	16.5	685.9	617	3.75	23.7	16	191	69
	357	531	833.0	393.0	56.9	31.5	20.0	679.2	677	3.45	21.6	18	191	77
W33-33x11 1/2	118	175.9	834.9	291.7	18.8	14.0	17.8	761.7	224	7.76	54.4	9	149	37
(838x292)	130	193.8	840.7	292.4	21.7	14.7	17.8	761.7	247	6.74	51.8	9	149	40
	141	209.8	845.8	293.0	24.4	15.4	17.8	761.4	268	6.01	49.5	10	149	42
	152	226.5	850.9	293.8	26.8	16.1	17.8	761.7	289	5.48	47.3	10	149	45
	169	252	859.0	292.1	31.0	17.0	17.8	761.4	319	4.71	44.8	11	148	49
	187	278	865.1	294.1	34.0	19.1	17.8	761.5	355	4.33	39.9	12	148	52
	204	304	871.2	295.7	37.1	20.6	17.8	761.4	386	3.99	37.0	12	148	55
	219	326	877.1	297.2	39.9	22.1	17.8	761.7	416	3.72	34.5	13	148	58
	243	362	885.2	299.7	43.9	24.4	17.8	761.8	460	3.41	31.2	14	148	62
	271	404	895.1	302.1	49.0	26.9	17.8	761.5	513	3.08	28.3	15	148	67
	301	449	905.0	305.2	54.1	30.0	17.8	761.2	572	2.82	25.4	17	148	72
	332	494	915.2	308.1	58.9	33.0	17.8	761.8	629	2.62	23.1	19	148	77
	361	537	925.1	310.6	64.0	35.6	17.8	761.5	684	2.43	21.4	20	148	82
W33-33x15 3/4	201	299.1	855.5	399.9	29.2	18.2	17.8	761.5	381	6.85	41.9	11	201	47
(838x400)	221	328.9	861.8	401.4	32.4	19.7	17.8	761.4	420	6.20	38.7	12	201	50
	241	358.6	868.2	402.8	35.6	21.1	17.8	761.5	457	5.66	36.1	13	201	53
	263	391.4	877.1	401.4	39.9	22.1	17.8	761.7	499	5.03	34.5	13	200	58
	291	433.1	884.9	404.0	43.9	24.4	17.8	761.4	552	4.60	31.2	14	200	62
	318	473.2	893.1	406.0	48.0	26.4	17.8	761.5	603	4.23	28.8	15	200	66
	354	526.8	903.0	408.9	53.1	29.5	17.8	761.2	672	3.85	25.8	17	200	71
	387	575.9	913.1	411.5	57.9	32.0	17.8	761.7	734	3.55	23.8	18	200	76
	424	631	923.0	414.0	63.0	35.1	20.0	757.0	805	3.29	21.6	20	199	83
	468	697	935.0	418.0	69.1	38.6	20.0	756.8	889	3.02	19.6	21	200	89
W36-36x12	135	200.9	903.0	303.3	20.2	15.1	19.1	824.4	256	7.51	54.6	10	154	39
(914x305)	150	224.2	910.4	304.1	23.9	15.9	19.1	824.4	286	6.36	51.8	10	154	43
	160	238.1	914.7	304.8	25.9	16.5	19.0	824.9	304	5.88	50.0	10	154	45
	170	253.4	918.4	305.5	27.9	17.3	19.1	824.4	323	5.47	47.7	11	154	47
	182	270.8	922.8	306.7	30.0	18.4	19.0	824.9	346	5.12	44.8	11	154	49
	194	289.1	926.6	307.7	32.0	19.5	19.1	824.4	368	4.81	42.3	12	154	51
	210	312.5	931.9	309.4	34.5	21.1	19.0	824.8	399	4.48	39.1	13	154	54
	232	345	942.9	307.8	39.9	22.1	19.1	824.9	440	3.86	37.3	13	153	59
	256	381	950.7	310.3	43.9	24.4	19.1	824.7	486	3.53	33.8	14	153	63
	286	426	960.9	312.8	48.0	26.9	19.1	826.7	536	3.26	30.7	15	153	67
	318	474	970.8	315.7	54.1	29.9	19.1	824.4	603	2.92	27.6	17	153	73
	350	521	980.7	318.8	58.9	33.0	19.1	824.7	663	2.71	25.0	19	153	78
	387	576	992.9	321.8	65.0	36.1	19.1	824.7	733	2.48	22.8	20	153	84

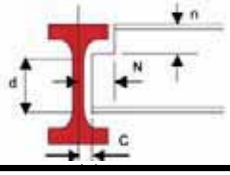


Imperial units

Designation Size	Mass Per Metre		Surface Area per Metre	Second Moment Of Area Axis x-x	Second Moment Of Area Axis y-y	Radius Of Gyration Axis x-x	Radius Of Gyration Axis y-y	Elastic Modulus Axis x-x	Elastic Modulus Axis y-y	Plastic Modulus Axis x-x	Plastic Modulus Axis y-y	Buckling Parameter	Torsional Index	Warping Constant	Torsional Constant
												u	x	H	J
in (mm)	lb/ft	kg/m	m^2	cm^4	cm^4	cm	cm	cm^3	cm^3	cm^3	cm^3			dm^6	cm^4
W30-30x15	173	258	3.01	341200	24890	32.3	8.71	8827	1308	9916	2012	0.883	30.3	34.6	635
(762x381)	191	284	3.02	381700	28000	32.5	8.80	9796	1466	11030	2258	0.885	27.5	39.3	859
	211	314	3.04	427000	31500	32.7	8.87	10870	1642	12270	2531	0.886	25.0	44.6	1161
	235	350	3.05	485900	35570	33.0	8.94	12220	1860	13830	2869	0.889	22.2	50.9	1651
	261	388	3.07	543700	39920	33.1	8.98	13540	2074	15410	3208	0.888	20.3	57.8	2218
	292	435	3.10	618300	45680	33.4	9.09	15210	2358	17380	3653	0.889	18.3	67.0	3090
	326	485	3.12	697600	51790	33.6	9.16	16950	2653	19500	4123	0.888	16.7	77.0	4224
	357	531	3.14	776600	57770	33.9	9.24	18650	2940	21550	4579	0.888	15.3	87.0	5563
W33-33x11 1/2	118	176	2.78	246000	7800	33.1	5.90	5893	535	6808	842	0.856	46.5	13.0	221
(838x292)	130	194	2.79	279200	9067	33.6	6.06	6642	620	7640	974	0.862	41.6	15.2	306
	141	210	2.80	310200	10250	34.0	6.18	7334	700	8416	1097	0.867	37.9	17.3	404
	152	227	2.81	339700	11360	34.3	6.27	7985	773	9155	1212	0.870	35.0	19.3	514
	169	252	2.82	386500	12920	34.8	6.36	8999	884	10310	1383	0.875	30.9	22.1	735
	187	278	2.84	430400	14470	34.8	6.38	9950	984	11450	1547	0.874	28.3	25.0	983
	204	304	2.85	473000	16050	35.0	6.45	10860	1086	12530	1710	0.874	26.1	27.9	1265
	219	326	2.87	513500	17540	35.1	6.49	11710	1180	13550	1864	0.874	24.4	30.7	1569
	243	362	2.89	573400	19800	35.3	6.56	12960	1321	15060	2095	0.874	22.3	35.0	2095
	271	404	2.91	648200	22660	35.5	6.64	14480	1500	16910	2385	0.875	20.2	40.5	2884
	301	449	2.94	729200	25820	35.7	6.72	16120	1692	18920	2704	0.874	18.4	46.7	3910
	332	494	2.97	810000	28960	35.9	6.79	17700	1880	20890	3018	0.873	17.0	53.1	5088
	361	537	2.99	892800	32280	36.1	6.87	19300	2078	22880	3346	0.873	15.8	59.8	6494
W33-33x15 3/4	201	299	3.24	479800	31180	35.5	9.05	11220	1559	12640	2405	0.881	31.2	53.2	855
(838x400)	221	329	3.26	534700	34970	35.7	9.13	12410	1742	14020	2690	0.882	28.4	60.1	1146
	241	359	3.27	590000	38800	35.9	9.21	13590	1927	15380	2977	0.884	26.1	67.3	1491
	263	391	3.29	659000	43070	36.3	9.29	15030	2146	17020	3314	0.888	23.6	75.5	2008
	291	433	3.31	735400	48390	36.5	9.36	16620	2396	18910	3709	0.887	21.6	85.6	2687
	318	473	3.33	812500	53680	36.7	9.43	18200	2644	20780	4101	0.888	19.9	95.8	3488
	354	527	3.35	913500	60680	36.9	9.50	20330	2968	23230	4616	0.887	18.1	110	4737
	387	576	3.38	1012000	67480	37.1	9.59	22170	3280	25570	5113	0.887	16.7	123	6135
	424	631	3.40	1120000	74810	37.3	9.64	24260	3614	28140	5652	0.886	15.5	138	7983
	468	697	3.43	1253000	84520	37.6	9.75	26810	4044	31270	6342	0.886	14.2	158	10569
W36-36x12	135	201	2.96	325300	9424	35.7	6.07	7204	621	8351	982	0.854	46.8	18.4	291
(914x305)	150	224	2.97	376400	11240	36.3	6.27	8269	739	9535	1163	0.861	41.3	22.1	422
	160	238	2.98	406100	12270	36.6	6.36	8879	805	10230	1266	0.864	38.6	24.2	515
	170	253	2.99	436300	13300	36.8	6.42	9501	871	10940	1371	0.866	36.2	26.4	626
	182	271	3.00	470700	14460	36.9	6.47	10200	943	11770	1487	0.866	33.9	28.8	767
	194	289	3.01	504200	15600	37.0	6.51	10880	1014	12570	1601	0.867	31.9	31.2	926
	210	313	3.03	549000	17130	37.1	6.55	11780	1107	13650	1754	0.866	29.7	34.5	1164
	232	345	3.04	625200	19480	37.7	6.66	13260	1266	15340	2000	0.872	26.4	39.7	1648
	256	381	3.06	696900	21980	37.9	6.72	14660	1416	17030	2247	0.872	24.1	45.2	2199
	286	426	3.09	777000	24640	38.1	6.78	16170	1575	18870	2510	0.871	22.2	51.3	2891
	318	474	3.11	884100	28580	38.3	6.89	18210	1810	21350	2895	0.872	19.9	60.0	4091
	350	521	3.14	981300	32080	38.5	6.95	20010	2013	23590	3235	0.871	18.4	68.1	5337
	387	576	3.17	110100	36460	38.8	7.05	22180	2266	26260	3654	0.871	16.8	78.5	7127

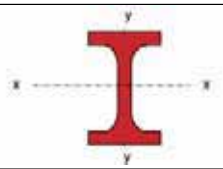
Universal Beams and Columns





Imperial units

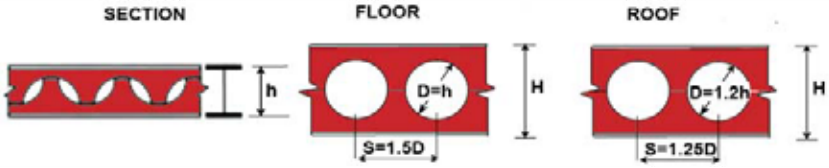
Designation Size	Mass Per Metre		Depth Of Section	Width Of Section	Thickness		Root Radius	Depth Between Fillets	Area Of Section	Ratios For Local Buckling		Dimensions For Detailing		
					Flange	Web				Flange	Web	End Clearance	Notch	
			D	B	T	t	r	d	A	b/T	d/t	C	N	n
in (mm)	lb/ft	kg/m	mm	mm	mm	mm	mm	mm	cm^2			mm	mm	mm
W36-36x16 1/2	230	343.3	911.8	418.5	32.0	19.4	24.1	799.6	437	6.54	41.2	12	210	56
(914x419)	245	364.6	916.4	419.4	34.3	20.3	24.1	799.6	465	6.12	39.4	12	210	58
	260	388	921.0	420.5	36.6	21.4	24.1	799.6	494	5.74	37.4	13	210	61
	280	416.7	927.6	421.5	39.9	22.5	24.1	799.6	532	5.28	35.6	13	210	64
	300	446.4	933.2	423.0	42.7	24.0	24.1	799.7	569	4.96	33.3	14	210	67
	328	488.1	942.1	422.4	47.0	25.9	24.1	799.9	622	4.49	30.9	15	208	71
	359	534.2	950.0	424.9	51.1	28.5	24.1	799.7	680	4.16	28.1	16	208	75
	393	584.8	960.1	427.5	55.9	31.0	24.1	800.1	746	3.83	25.8	17	208	80
	439	653	972.0	431.0	62.0	34.5	24.0	800.0	832	3.48	23.2	19	208	86
	527	784	996.0	437.0	73.9	40.9	24.0	800.2	998	2.96	19.6	22	208	98
	650	967	1028.0	446.0	89.9	50.0	24.0	800.2	1232	2.48	16.0	27	208	114
W40-40x12	149	222	970.3	300.0	21.1	16.0	30.0	868.1	283	7.11	54.3	10	152	51
(1016x305)	167	249	980.2	300.0	26.0	16.5	30.0	868.2	317	5.77	52.6	10	152	56
	183	272	990.1	300.0	31.0	16.5	30.0	868.1	347	4.84	52.6	10	152	61
	211	314	1000.0	300.0	35.9	19.1	30.0	868.2	400	4.18	45.5	12	150	66
	235	349	1008.1	302.0	40.0	21.1	30.0	868.1	445	3.78	41.1	13	150	70
	264	393	1016.0	303.0	43.9	24.4	30.0	868.2	500	3.45	35.6	14	149	74
	278	415	1020.0	304	46.0	26.0	30	868.0	529	3.30	33.4	15	149	76
	294	438	1025.9	305.4	49.0	26.9	30.0	867.9	557	3.12	32.3	15	149	79
	327	487	1036.1	308.5	54.1	30.0	30.0	867.9	620	2.85	28.9	17	149	84
	331	494	1036.0	309.0	54.0	31.0	30	868.0	629	2.86	28.0	18	149	84
	359	535	1046.0	311.4	58.9	33.0	30.0	868.2	681	2.64	26.3	19	149	89
	392	584	1056.0	314.0	64.0	36.0	30	868.0	744	2.45	24.1	20	149	94
W40-40x16	199	296	982	400	27.1	16.5	30	868.0	377	12.12	32.0	10	202	57
(1016x406)	215	321	990	400	31.0	16.5	30	868.0	409	12.12	28.0	10	202	61
	249	371	1000	400	36.1	19.0	30	868.0	472	10.53	24.0	12	201	66
	277	412	1008	402	40.0	21.1	30	868.0	524	9.53	21.7	13	200	70
	297	443	1012	402	41.9	23.6	30	868.2	564	8.52	20.7	14	199	72
	324	483	1020	404	46.0	25.4	30	868.0	615	7.95	18.9	15	199	76
	362	539	1030	407	51.1	28.4	30	867.8	687	7.17	17.0	16	199	81
	397	591	1040	409	55.9	31.0	30	868.2	753	6.60	15.5	18	199	86
	431	642	1048	412	60.0	34.0	30	868.0	818	6.06	14.5	19	199	90
	503	748	1068	417	70.0	39.0	30	868.0	953	5.35	12.4	22	199	100
	593	883	1092	424	82.0	45.5	30	868.0	1125	4.66	10.6	25	199	112
W44-4x16	230	343	1090	400	31.0	18.0	20	988.0	437	11.11	31.9	11	201	51
(1118x406)	262	390	1100	400	36.0	20.0	20	988.0	497	10.00	27.4	12	200	56
	290	433	1108	402	40.0	22.0	20	988.0	551	9.14	24.7	13	200	60
	335	499	1118	405	45.0	26.0	20	988.0	635	7.79	22.0	15	200	65



Imperial units

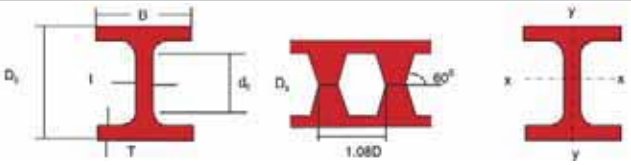
Designation Size	Mass Per Metre		Surface Area per Metre	Second Moment Of Area		Radius Of Gyration		Elastic Modulus		Plastic Modulus		Buckling Parameter	Torsional Index	Warping Constant	Torsional Constant
				Axis x-x	Axis y-y	Axis x-x	Axis y-y	Axis x-x	Axis y-y	Axis x-x	Axis y-y	u	x	H	J
in (mm)	lb/ft	kg/m	m^2	cm^4	cm^4	cm	cm	cm^3	cm^3	cm^3	cm^3			dm^6	cm^4
W36-36x16 1/2	230	343	3.42	625800	39160	37.8	9.46	13730	1871	15480	2890	0.883	30.1	75.8	1193
(914x419)	245	365	3.43	671700	42240	38.0	9.53	14660	2014	16550	3111	0.884	28.3	82.2	1442
	260	388	3.44	719600	45440	38.2	9.59	15630	2161	17670	3341	0.885	26.7	88.9	1734
	280	417	3.45	785700	49870	38.4	9.68	16940	2366	19170	3658	0.887	24.8	98.3	2188
	300	446	3.47	846900	53940	38.6	9.73	18150	2550	20600	3948	0.887	23.3	107	2671
	328	488	3.48	936400	59170	38.8	9.76	19880	2801	22640	4344	0.887	21.4	119	3500
	359	534	3.50	1031000	65450	38.9	9.81	21700	3081	24820	4790	0.886	19.8	132	4508
	393	585	3.53	1144000	73000	39.2	9.89	23840	3415	27390	5320	0.887	18.2	149	5890
	439	653	3.56	1292000	83050	39.4	9.99	26590	3854	30730	6014	0.887	16.5	171	8124
	527	784	3.62	1593000	103300	40.0	10.2	31980	4728	37340	7439	0.887	14.0	218	13730
	650	967	3.70	2033000	133900	40.6	10.4	39540	6003	46810	9504	0.886	11.8	292	24930
W40-40x12	149	222	3.06	408000	9553	38.0	5.81	8409	637	9807	1020	0.850	45.7	21.5	390
(1016x305)	167	249	3.08	481300	11760	39.0	6.09	9821	784	11350	1245	0.861	39.9	26.8	582
	183	272	3.10	554000	14010	40.0	6.36	11190	934	12830	1470	0.873	35.0	32.2	835
	211	314	3.11	644200	16240	40.1	6.37	12880	1083	14850	1713	0.872	30.7	37.7	1264
	235	349	3.13	723100	18470	40.3	6.44	14350	1223	16590	1941	0.872	27.9	43.3	1718
	264	393	3.14	807700	20500	40.2	6.40	15900	1353	18540	2168	0.868	25.5	48.4	2330
	278	415	3.15	853100	21710	40.2	6.41	16728	1428	19571	2298	0.868	24.2	51.1	2713
	294	438	3.17	909900	23450	40.4	6.49	17740	1536	20760	2469	0.868	23.1	56.0	3185
	327	487	3.19	1021000	26730	40.6	6.57	19720	1733	23200	2800	0.867	21.1	64.4	4299
	331	494	3.19	1028000	26820	40.4	6.53	19845	1736	23413	2818	0.867	20.8	64.0	4433
	359	535	3.22	1131000	29970	40.8	6.63	21620	1925	25570	3126	0.866	19.5	73.0	5576
	392	584	3.24	1246100	33430	40.9	6.70	23600	2130	28039	3475	0.869	17.9	81.2	7230
W40-40x16	199	296	3.48	618700	28850	40.5	8.75	12600	1443	14220	2235	0.878	38.0	65.9	762.6
(1016x406)	215	321	3.50	696400	33120	41.3	9.00	14070	1656	15800	2555	0.887	34.3	76.0	1021
	249	371	3.51	812100	38480	41.5	9.03	16240	1924	18330	2976	0.887	29.9	89.4	1575
	277	412	3.53	909800	43410	41.7	9.10	18050	2160	20440	3348	0.887	27.1	101.5	2134
	297	443	3.53	966510	45500	41.4	8.98	19101	2264	21777	3529	0.882	25.8	106.7	2545
	324	483	3.55	1067480	50710	41.7	9.08	20931	2510	23923	3919	0.884	23.7	119.9	3311
	362	539	3.58	1202540	57630	41.8	9.16	23350	2832	26824	4436	0.883	21.5	137.6	4546
	397	591	3.60	1331040	64010	42.1	9.22	25597	3130	29530	4916	0.883	19.8	154.3	5927
	431	642	3.62	1450590	70280	42.1	9.27	27683	3412	32097	5379	0.882	18.5	170.7	7440
	503	748	3.67	1731940	85110	42.6	9.45	32433	4082	37881	6459	0.882	16.1	210.7	11670
	593	883	3.74	2096420	104970	43.2	9.66	38396	4952	45265	7874	0.883	14.0	265.7	18750
W44-4x16	230	343	3.71	867400	33120	44.6	8.71	15920	1656	18060	2568	0.876	38.9	92.7	1037
(1118x406)	262	390	3.73	1005000	38480	45.0	8.80	18280	1924	20780	2988	0.878	33.9	108.7	1564
	290	433	3.75	1126000	43410	45.2	8.87	20320	2160	23160	3362	0.879	30.7	123.5	2130
	335	499	3.77	1294000	49980	45.1	8.87	23150	2468	26600	3870	0.876	27.3	143.4	3135

Cellular Beams



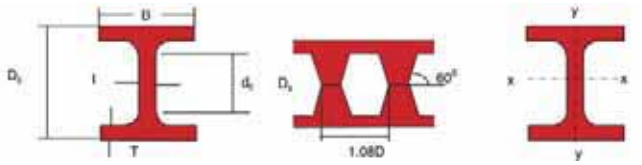
Section Size h x b	Unit Weight M		FLOOR BEAMS							ROOF BEAMS						
			H	D	S	Ixx	Zexx	Zplxx	Anet	H	D	S	Ixx	Zexx	Zplxx	Anet
in (mm)	lb/ft	kg/m	mm	mm	mm	cm^4	cm^3	cm^3	cm^2	mm	mm	mm	cm^4	cm^3	cm^3	cm^2
W6-6x6	15	22.32	217.4	150	225	2541	233.8	245.5	23.8	239.5	180	225	3080	257.1	267.9	23.4
(152x152)	20	29.76	222.6	150	225	3543	318.4	337.3	32.2	244.7	180	225	4291	350.7	368.6	31.7
	25	37.20	226.8	150	225	4456	393.1	420.2	39.8	248.9	180	225	5389	433.0	458.9	39.2
W8-8x5 1/4	17	25.1	289.8	200	300	4732	326.5	343.1	25.0	309.3	225	300	5384	348.2	364.0	24.7
(203x133)	20	30.0	293.4	200	300	5852	398.9	421.0	30.5	312.9	225	300	6656	425.5	446.8	30.1
W8-8x8	31	46.13	269.3	200	350	7906	587.1	616.7	48.2	322.0	245	305	11571	718.7	750.4	4.87
(203x203)	35	52.09	272.3	200	350	9098	668.1	705.4	54.8	325.0	245	305	13283	817.5	857.1	5.54
	40	59.53	275.7	200	350	10564	766.2	814.1	62.9	328.4	245	305	15394	937.6	988.5	6.36
	48	71.43	281.9	200	350	13116	930.4	997.9	76.1	334.6	245	305	19013	1136.6	1207.8	7.69
	58	86.31	288.3	200	350	16161	1120.9	1215.4	91.7	341.0	245	305	23342	1369.1	1468.8	9.37
W10-10x53/4	21	31.1	359.7	250	375	8971	498.8	523.2	30.7	383.7	275	350	10262	534.9	559.3	30.6
(254x146)	25	37.0	364.3	250	375	11254	617.9	650.1	37.7	388.3	275	350	12859	662.3	694.7	37.7
	29	43.0	367.9	250	375	13275	721.8	763.0	44.1	391.9	275	350	15160	773.7	815.0	44
W10-10x10	49	72.92	362.4	250	375	23472	1295.5	1364.1	79.5	399.3	300	375	28548	1429.8	1494.7	78.4
(254x254)	60	89.29	368.6	250	375	29231	1586.2	1683.7	97.3	405.5	300	375	35502	1750.9	1844.0	96
	72	107.00	375.0	250	375	35671	1902.7	2037.4	116.9	411.9	300	375	43247	2099.7	2229.0	115.2
	89	132.00	384.6	250	375	45888	2365.8	2562.5	145.1	421.5	300	375	55032	2611.0	2801.5	143.1
	112	166.67	397.4	250	375	59801	3009.9	3309.3	184.3	434.3	300	375	72131	3321.4	3613.4	181.8
W12-12x4	16.5	24.8	435.0	300	450	8816	405.3	430.9	21.2	463.2	325	400	10124	437.1	463.9	21.4
(305x102)	19	28.2	438.6	300	450	10657	485.9	515.9	25.2	466.8	325	400	12214	523.3	554.6	25.4
	22	32.8	442.6	300	450	12932	584.3	621.5	30.1	470.8	325	400	14801	628.7	667.4	30.3
W12-12x6 1/2	27	40.3	433.3	300	450	17237	795.6	832.8	40.4	461.5	325	400	19718	854.5	893.0	40.6
(305x165)	31	46.1	436.5	300	450	20061	919.2	965.2	46.7	464.7	325	400	22934	987.0	1034.6	46.9
	36	54.0	440.3	300	450	23670	1075.2	1134.4	54.7	468.5	325	400	27047	1154.6	1215.6	54.9
W12-12x12	65	96.73	437.8	300	450	45298	2069.3	2173.2	104.6	486.0	370	470	55687	2291.6	2386.7	102.5
(305x305)	79	117.56	444.4	300	450	56163	2527.6	2674.1	127.8	492.6	370	470	68954	2799.5	2935.2	125.2
	92	137.00	450.4	300	450	66358	2946.6	3137.4	149.0	498.6	370	470	81380	3264.3	3442.5	146
	106	157.74	457.0	300	450	78001	3413.6	3659.8	172.5	505.2	370	470	95538	3782.1	4013.8	169.1
W14-14x63/4	30	45.0	503.0	350	525	24287	965.8	1013.5	42.5	532.1	375	475	27436	1031.2	1081.0	42.8
(356x171)	34	51.0	506.6	350	525	28501	1125.3	1182.3	49.3	535.7	375	475	32162	1200.7	1260.0	49.6
	38	57.0	509.6	350	525	32342	1269.4	1337.0	55.6	538.7	375	475	36478	1354.3	1424.4	55.9
	45	67.1	515.0	350	525	39223	1523.4	1610.9	66.5	554.1	375	475	44196	1624.5	1715.0	66.9
W16-16x51/2	26	38.69	571.2	400	600	24957	8/73.8	921.2	34.2	604.5	425	525	28367	938.5	989.7	34.8
(406x140)	31	46.13	576.4	400	600	31451	1091.3	1149.9	42.3	609.7	425	525	35662	1169.8	1232.6	42.9
W16-16x7	36	53.57	575.8	400	600	37713	1309.9	1377.0	50.6	609.1	425	525	42739	1403.3	1475.1	51.2
(406x178)	40	59.53	579.6	400	600	43565	1503.3	1580.9	57.7	612.9	425	525	49297	1608.6	1691.1	58.4
	45	66.97	582.6	400	600	49074	1684.6	1776.3	64.7	615.9	425	525	55511	1802.5	1899.8	65.4
	50	74.41	586.0	400	600	55063	1879.3	1986.0	72.1	619.3	425	525	62247	2010.1	2123.1	72.9
W18-18x71/2	45	67.1	648.3	450	675	59376	1831.9	1926.9	62.9	682.5	475	600	66618	1952.1	2053.6	63.7
(457x191)	50	74.3	651.9	450	675	67373	2067.1	2176.9	70.8	686.1	475	600	75522	2201.4	2318.2	71.6
	55	82.0	654.9	450	675	74891	2287.3	2414.4	78.3	689.1	475	600	83924	2435.7	2570.6	79.2
	60	89.3	658.3	450	675	82871	2517.9	2662.5	86.1	692.5	475	600	92809	2680.3	2833.4	87.1
	66	98.3	662.1	450	675	92309	2788.6	2956.3	95.3	696.3	475	600	103329	2967.8	3144.9	96.3
W21-21x81/4	55	82.2	759.1	525	775	96581	2544.5	2682.9	75.1	796.1	550	675	107646	2704.3	2853.7	76.2
(533x210)	62	92.1	763.9	525	775	112366	2941.8	3103.0	86.3	800.9	550	675	125070	3123.2	3296.2	87.5
	68	101	767.5	525	775	125204	3262.5	3446.4	95.5	804.5	550	675	139274	3462.4	3658.9	96.8
	73	109	770.3	525	775	135978	3530.4	3736.0	103.4	807.3	550	675	151220	3746.3	3965.7	104.7
	82	122	775.3	525	775	154662	3989.3	4232.8	116.7	812.3	550	675	171888	4232.1	4490.7	118.2

Castellated Beams



Section Size D_c x B	Castellated Beam	Unit Weight M		Section Depth D_c	Section Width B	Thickness Web t	Thickness Flange T	Depth Between Fillet d_c	Root Radius r	Pitch of standard castellated $1.08D_s$
in (mm)	in(mm)	lb/ft	kg/m	mm	mm	mm	mm	mm	mm	mm
W4-4x4	**6x4**	13	19.35	156.7	103.1	7.11	8.76	126.38	6.4	110
(102x102)	**(153x102)**									
W5-5x5	**7 1/2 x 5**	18	23.81	190.8	127.0	6.10	9.14	157.32	7.6	137
(127x127)	**(191x127)**	19	28.28	194.3	127.8	6.86	10.92	157.26		137
W6-6x4	**9x4**	9	13.39	225.9	100.1	4.32	5.46	202.18	6.4	164
(152x102)	**(228x102)**	12	17.86	229.2	101.6	5.84	7.11	202.18		164
		16	23.81	235.5	102.4	6.60	10.29	202.12		164
W6-6x6	**9x6**	15	22.32	228.1	152.1	5.84	6.60	202.10	6.4	164
(152x152)	**(228x152)**	20	29.76	233.5	152.9	6.60	9.27	202.16		164
		25	37.20	238.1	154.4	8.13	11.56	202.18		164
W8-8x4	**12x4**	10	14.88	301.9	100.1	4.32	5.21	276.28	7.6	219
(203x102)	**(305x102)**	13	19.35	304.4	101.6	5.84	6.48	276.24		219
		15	22.32	307.5	102.0	6.22	8.00	276.30		219
W8-8x5 1/4	**12x5 1/4**	18	26.79	308.3	133.4	5.84	8.38	276.34	7.6	219
(203x133)	**(305x133)**	21	31.25	311.8	133.9	6.35	10.16	276.28		219
W8-8x6 1/2	**12x6 1/2**	24	35.72	302.9	165.0	6.22	10.16	262.18	10.2	219
(203x165)	**(305x165)**	28	41.67	306.2	166.0	7.24	11.81	262.18		219
W8-8x8	**12x8**	31	46.13	304.7	203.1	7.24	11.05	262.20	10.2	219
(203x203)	**(305x203)**	35	52.09	307.7	203.7	7.87	12.57	262.16		219
		40	59.53	311.1	205.0	9.14	14.22	262.26		219
		48	71.43	317.4	206.0	10.16	17.40	262.20		219
		58	86.31	323.7	208.8	12.95	20.57	262.16		219
		67	99.71	330.1	210.3	14.48	23.75	262.20		219
W10-10x4	**15x4**	12	17.86	377.7	100.6	4.83	5.33	351.84	7.6	274
(254x102)	**(381x102)**	15	22.32	380.7	101.6	5.84	6.86	351.78		274
		17	25.30	383.8	101.9	6.10	8.38	351.84		274
		19	28.28	387.1	102.1	6.35	10.03	351.84		274
W10-10x5 3/4	**15x5 3/4**	22	32.74	385.3	146.0	6.10	9.14	351.82	7.6	274
(254x146)	**(381x146)**	26	38.69	389.4	146.6	6.60	11.18	351.84		274
		30	44.64	392.9	147.6	7.62	12.95	351.80		274
W10-10x8	**15x8**	33	49.11	374.1	202.2	7.37	11.05	326.60	12.7	274
(254x203)	**(381x203)**	39	58.04	379.0	202.8	8.00	13.46	326.68		274
		45	66.97	383.5	203.7	8.89	15.75	326.60		274
W10-10x10	**15x10**	49	72.92	380.5	254.0	8.64	14.22	326.66	12.7	274
(254x254)	**(381x254)**	54	80.36	383.3	254.8	9.40	15.62	326.66		274
		60	89.29	386.6	256.0	10.67	17.27	326.66		274
		68	101.19	391.2	257.3	11.94	19.56	326.68		274
		77	114.58	396.2	258.8	13.46	22.10	326.60		274
		88	130.95	402.3	260.7	15.37	25.15	326.60		274
		100	148.81	408.9	262.6	17.27	28.45	326.60		274
		112	166.67	415.5	264.5	19.18	31.75	326.60		274
W12-12x4	**18x4**	14	20.83	455.0	100.0	5.08	5.72	428.36	7.6	329
(305x102)	**(458x102)**	16	23.81	457.0	101.3	5.59	6.73	428.34		329
		19	28.28	461.4	101.7	5.97	8.89	428.42		329
		22	32.74	465.2	102.4	6.60	10.80	428.40		329
W12-12x6 1/2	**18x6 1/2**	26	38.69	462.9	164.8	5.84	9.65	428.40	7.6	329
(305x165)	**(458x165)**	30	44.64	465.9	165.6	6.60	11.18	428.34		329
		35	52.09	470.0	166.6	7.62	13.21	428.38		329

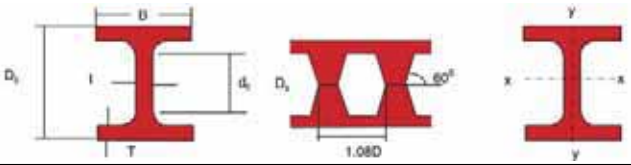
Castellated Beams



Section Size D_c x B	Castellated Beam	Unit Weight M		Section Depth D_c	Section Width B	Thickness Web t	Thickness Flange T	Depth Between Fillet d_c	Root Radius r	Pitch of standard castellated $1.08D_s$
in (mm)	in(mm)	lb/ft	kg/m	mm	mm	mm	mm	mm	mm	mm
W12-12x8	**18x8**	40	59.53	455.8	203.3	7.49	13.08	399.24	15.2	329
(305x203)	**(458x203)**	45	66.97	458.8	204.3	8.51	14.60	399.20		329
		50	74.41	462.1	205.2	9.40	16.26	399.18		329
W12-12x10	**18x10**	53	78.87	458.8	253.9	8.76	14.60	399.20	15.2	329
(305x254)	**(458x254)**	58	86.31	462.1	254.3	9.14	16.26	399.18		329
W12-12x12	**18x12**	65	96.73	460.3	304.8	9.91	15.37	399.16	15.2	329
(305x305)	**(458x305)**	72	107.14	463.7	305.8	10.92	17.02	399.26		329
		79	117.56	467.0	306.8	11.94	18.67	399.26		329
		87	129.46	470.8	308.0	13.08	20.57	399.26		329
		96	142.86	475.3	308.9	13.97	22.86	399.18		329
		106	157.74	479.9	310.4	15.49	25.15	399.20		329
		120	178.57	485.7	312.9	18.03	28.07	399.16		329
		136	202.38	493.1	315.0	20.07	31.75	399.20		329
		152	226.19	500.7	317.0	22.10	35.56	399.18		329
		170	253.98	508.9	319.3	24.38	39.62	399.26		329
		190	282.74	517.8	321.8	26.92	44.07	399.26		329
										329
W12*-12x12	**18x12**	210	312.50	526.1	324.9	29.97	48.26	399.18	15.2	329
(305x305)	**(458x305)**	230	342.26	534.8	327.5	32.64	52.58	399.24		329
		252	375.00	543.9	330.3	35.43	57.15	399.20		329
		279	415.18	555.1	333.8	38.86	62.74	399.22		329
		305	453.87	567.0	336.2	41.28	68.71	399.18		329
		336	500.00	579.7	340.0	45.08	75.06	399.18		329
W14-14x5	**21x5**	22	32.74	527.0	127.0	5.84	8.51	489.58	10.2	385
(356x127)	**(534x127)**	26	38.69	531.3	127.6	6.48	10.67	489.56		385
W14-14x6 3/4	**21x6 3/4**	30	44.64	529.5	170.9	6.86	9.78	489.54	10.2	385
(356x171)	**(534x171)**	34	50.60	533.1	171.3	7.24	11.56	489.58		385
		38	56.55	536.1	172.0	7.87	13.08	489.54		385
W14x8	**21x8**	43	63.99	525.0	203.1	7.75	13.46	467.68	15.2	385
(356x203)	**(534x203)**	48	71.43	528.3	204.0	8.64	15.11	467.68		385
		53	78.87	531.6	204.7	9.40	16.76	467.68		385
W14-14x10	**21x10**	61	90.78	530.8	253.9	9.52	16.38	467.64	15.2	385
(356x254)	**(534x254)**	68	101.19	534.6	254.9	10.54	18.29	467.62		385
		74	110.12	537.9	255.8	11.43	18.94	467.62		385
		82	122.02	541.5	257.3	12.95	21.72	467.66		385
W14-14x14 1/2	**21x14 1/2**	90	133.93	534.1	368.8	11.18	18.03	467.64	15.2	385
(356x368)	**(534x368)**	99	147.32	537.7	370.0	12.32	19.81	467.68		385
		109	162.20	541.7	371.0	13.34	21.84	467.62		385
		120	178.57	545.8	372.6	14.99	23.88	467.64		385
		132	196.43	550.4	374.0	16.38	26.16	467.68		385

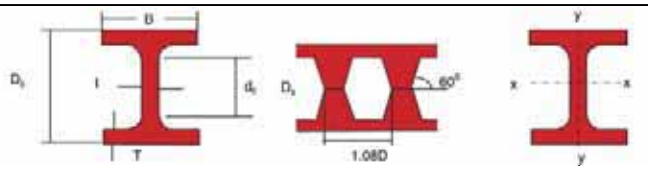
Note : * Not included in regular rolling schedule

Castellated Beams



Section Size D_c x B	Castellated Beam	Unit Weight M		Section Depth D_c	Section Width B	Thickness Web t	Thickness Flange T	Depth Between Fillet d_c	Root Radius r	Pitch of standard castellated $1.08D_s$
in (mm)	in(mm)	lb/ft	kg/m	mm	mm	mm	mm	mm	mm	mm
W16-16x51/2	**24x51/2**	26	38.69	601.5	139.7	6.35	8.76	563.58	10.2	438
(406x140)	**(609x140)**	31	46.13	606.4	140.3	6.98	11.18	563.64		438
W16-16x7	**24x7**	36	53.57	605.8	177.4	7.49	10.92	563.56	10.2	438
(406x178)	**(609x178)**	40	59.53	609.7	177.7	7.75	12.83	563.64		438
		45	66.97	612.7	178.7	8.76	14.35	563.64		438
		50	74.41	616.0	179.6	9.65	16.00	563.60		438
		57	84.83	620.3	180.8	10.92	18.16	563.58		438
W16-16x101/4	**24x101/4**	67	99.71	617.8	260.0	10.03	16.89	563.62	10.2	438
(406x260)	**(609x260)**	77	114.58	622.6	261.5	11.56	19.30	563.60		438
		89	132.44	628.4	263.3	13.33	22.22	563.56		438
		100	148.81	634.0	264.8	14.86	25.02	563.56		438
W18-18x6	**27x6**	35	52.09	678.1	152.4	7.62	10.80	636.10	10.2	494
(457x152)	**(686x152)**	40	59.53	683.2	152.8	8.00	13.34	636.12		494
		46	68.46	687.2	153.9	9.14	15.37	636.06		494
W18-18x71/2	**27x71/2**	50	74.41	685.4	190.4	9.02	14.48	636.04	10.2	494
(457x191)	**(686x191)**	55	81.85	688.5	191.3	9.91	16.00	636.10		494
		60	89.29	691.8	191.9	10.54	17.65	636.10		494
		65	96.73	694.6	192.8	11.43	19.05	636.10		494
		71	105.65	697.6	193.9	12.57	20.57	636.06		494
W18-18x11	**27x11**	76	113.10	691.0	280.3	10.80	17.27	636.06	10.2	494
(457x279)	**(686x279)**	86	127.98	695.6	281.7	12.19	19.56	636.08		494
		97	144.35	700.7	283.1	13.59	22.10	636.10		494
		106	157.74	704.2	284.5	14.99	23.88	636.04		494
		119	177.08	710.3	286.1	16.64	26.92	636.06		494
W21-21x61/2	**311/2x61/2**	44	65.48	791.3	165.1	8.89	11.43	743.04	12.7	576
(533x165)	**(800x165)**	50	74.41	795.6	165.9	9.65	13.58	743.02		576
		57	84.83	801.4	166.5	10.29	16.51	742.98		576
W21-21x81/4	**311/2x81/4**	62	92.26	799.6	209.3	10.16	15.62	742.96	12.7	576
(533x210)	**(800x210)**	68	101.19	803.2	210.1	10.92	17.40	743.00		576
		73	108.63	806.0	210.7	11.56	18.80	743.00		576
		83	123.51	810.8	212.2	13.08	21.21	742.98		576
		93	138.39	815.6	213.9	14.73	23.62	742.96		576
W21-21x121/4	**311/2x121/4**	101	150.30	809.0	312.2	12.70	20.32	742.96	12.7	576
(533x312)	**(800x312)**	111	165.18	812.9	313.4	13.97	22.22	743.06		576
		122	181.55	817.2	314.7	15.24	24.38	743.04		576
		132	196.43	821.0	316.0	16.51	26.29	743.02		576
		147	218.75	826.8	317.8	18.29	29.21	742.98		576
W24-24x7	**36x7**	55	81.85	903.7	177.9	10.03	12.83	852.64	12.7	659
(610x178)	**(915x178)**	62	92.27	908.0	178.8	10.92	14.99	852.62		659
W24-24x9	**36x9**	68	101.19	907.7	227.7	10.54	14.86	852.58	12.7	659
(610x229)	**(915x229)**	76	113.10	912.6	228.3	11.18	17.27	852.66		659
		84	125.00	917.1	229.1	11.94	19.56	852.58		659
		94	139.88	922.5	230.3	13.08	22.22	852.66		659
W24-24x123/4	**36x123/4**	104	154.76	916.1	323.8	12.70	19.05	852.60	12.7	659
(610x324)	**(915x324)**	117	174.11	921.1	325.1	13.97	21.59	852.62		659
		131	194.44	926.8	326.5	15.37	24.38	852.64		659
		146	217.27	933.4	327.7	16.51	27.69	852.62		659
		162	241.07	940.0	329.1	17.91	30.99	852.62		659
W27-27x10	**401/2x10**	84	125.00	1021.4	253.0	11.68	16.26	958.48	15.2	741
(686x254)	**(1029x254)**	94	139.88	1026.8	253.7	12.45	18.92	958.56		741
		102	151.78	1031.1	254.4	13.08	21.08	958.54		741
		114	169.64	1036.4	255.8	14.48	23.62	958.56		741

Castellated Beams



Section Size D_c x B	Castellated Beam	Unit Weight M		Section Depth D_c	Section Width B	Thickness Web t	Thickness Flange T	Depth Between Fillet d_c	Root Radius r	Pitch of standard castellated $1.08D_s$
in (mm)	in(mm)	lb/ft	kg/m	mm	mm	mm	mm	mm	mm	mm
W27*-27x14	**401/2x14**	146	217.26	1038.5	354.7	15.37	24.76	958.58	15.2	741
(686x356)	**(1029x366)**	161	239.58	1043.8	356.1	16.76	27.43	958.54		741
		178	264.88	1049.4	357.8	18.42	30.23	958.54		741
W30-30x101/2	**45x101/2**	99	147.32	1134.4	265.4	13.21	17.02	1067.06	16.5	823
(762x267)	**(1143x267)**	108	160.71	1138.7	266.1	13.84	19.30	1067.10		823
		116	172.62	1143.3	266.6	14.35	21.59	1067.12		823
		124	184.52	1147.3	267.1	14.86	23.62	1067.06		823
		132	196.43	1150.9	267.8	15.62	25.40	1067.10		823
W30*-30x15	**45x15**	173	257.44	1154.2	380.6	16.64	27.05	1067.10	16.5	823
(762x381)	**(1143x381)**	191	284.23	1160.2	382.0	18.03	30.10	1067.00		823
		211	313.99	1166.9	383.7	19.68	33.40	1067.10		823
W33-33x111/2	**491/2x111/2**	118	175.60	1253.6	291.6	13.97	18.80	1180.40	17.8	905
(838x292)	**(1257x292)**	130	193.45	1259.5	292.4	14.73	21.72	1180.46		905
		141	209.82	1264.8	293.0	15.37	24.38	1180.44		905
		152	226.19	1269.6	293.8	16.13	26.80	1180.40		905
W33*-33x151/4	**491/2x153/4**	201	299.11	1274.5	399.9	18.16	29.21	1180.48	17.8	905
(838x400)	**(1257x400)**	221	328.87	1280.8	401.4	19.68	32.38	1180.44		905
		241	358.63	1287.2	402.8	21.08	35.56	1180.48		905
W36-36x12	**54x12**	135	200.89	1360.0	303.5	15.24	20.07	1281.86	19.0	987
(914x305)	**(1371x305)**	150	223.21	1367.6	304.2	15.88	23.88	1281.84		987
		160	238.10	1371.7	304.8	16.51	25.91	1281.88		987
		170	253.98	1375.7	305.6	17.27	27.94	1281.82		987
		182	270.83	1379.8	306.7	18.42	29.97	1281.86		987
		194	288.69	1383.8	307.7	19.43	32.00	1281.80		987
		210	312.50	1388.9	309.4	21.08	34.54	1281.82		987
W36*-36x161/2	**54x161/2**	230	342.26	1368.9	418.3	19.30	32.00	1256.70	24.1	987
(914x419)	**(1371x419)**	245	364.58	1373.4	419.4	20.32	34.29	1256.62		987
		260	386.90	1378.0	420.4	21.34	36.58	1256.64		987
		280	416.67	1384.6	421.5	22.48	39.88	1256.64		987
		300	446.43	1390.2	423.0	24.00	42.67	1256.66		987

Note : * Not included in regular rolling schedule

Structural Tees

General

The section sizes for structural tees are given in the tables on the following pages. Structural tees are usually cut from universal beams and columns, but can also be rolled.

Cut from Heavy Column Sections. (H/HE)

Cut from Wide Flange Sections. Web height and flange width approximately equal. (H/HE)

Cut from Medium Flange Sections. (I/IPE)

Cut from Narrow Flange Sections. (I/IPE)

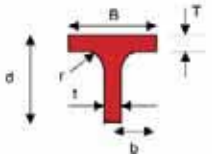
Figure 5 – Structural Tees: Section shapes

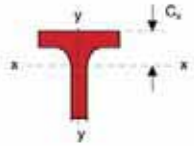
The standard specifications used for production of structural tees in this region are listed in this table.

Material	Yield strength N/mm²			Tensile strength N/mm²	Min. Elongation $L_0=5.65\sqrt{S_0}$	Min. Charpy V-notch. Temp. 20°C	Dimensions & Tolerances
AS 3679.1 (1996)	**≤12mm**	**12-40**	**≥40mm**				
Grade 250	260	250	230	min. 410	22 %	27J	***AS 3679.1 (1996)***
Grade 300	300	300	300	min. 430	22 %	27J	
Grade 350	360	340	330	min. 480	20 %	27J	
ASTM A36 (2001)	min. 250			400-550	20-21 %	-	
ASTM A572 (2001)							
Grade 42	min. 290			min. 415	20−24 %	-	
Grade 50	min. 345			min. 450	18-21 %	-	***ASTM A6 (1997)***
Grade 60	min. 415			min. 520	16-18 %	-	
Grade 65	min. 450			min. 550	15-17 %	-	
ASTM A913 (2001)							
Grade 50	min. 345			min. 450	18-21 %	-	
Grade 65	min. 450			min. 550	15-17 %	-	
BS 4360 (1986) **(superseded)**							***BS 4 Part 1 (1993) (superseded)***
Grade 43A	min. 275			430-580	22 %	-	
Grade 50B	min. 355			490-640	20 %	27J	
EN 10025 (2004)	**≤16mm**	**16-40**	**≥40mm**	**3-100mm**		**10<t≤150mm**	
S275JR	275	265	255	410-560	17-22 %	27J	***EN 10034 (1993)***
S355JR	355	345	335	490-630	17-22 %	27J	
S420N	420	400	390	500-660	19 %	27J	
S460N	460	440	430	530-720	17 %	27J	
JIS 3101 (1995)	**≤16mm**	**16-40**	**≥40mm**	**t<100mm**			
SS400	245	235	215	400-510	17-24 %	-	
SS490	285	275	255	490-610	15-21 %	-	
SS540	400	390	-	min 540	13-17 %	-	
JIS 3106 (1995)	**≤16mm**	**16-40**	**≥40mm**	**t<100mm**			***JIS 3192 (1994)***
SM400A, B	245	235	215	400-510	18-24 %	-	
SM490A, B	325	315	295	490-610	17-23 %	-	
SM490YA, YB	365	355	335	490-610	15-21 %	-	
SM520B	365	355	335	520-640	15-21 %	-	

Table 11 – Structural Tees: Standard specifications

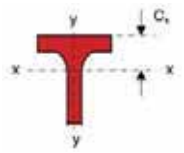
Structural Tees





Metric units

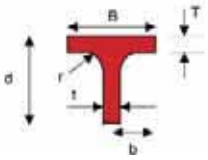
Designation Serial Size	Mass Per Metre	Cut from Serial Size	Mass Per Metre	Width Of Section B	Depth Of Section d	Thickness Web t	Thickness Flange T	Root Radius r	Ratio For Local Buckling d/t	Ratio For Local Buckling b/T	Dimension C_x
mm	kg/m		kg/m	mm	mm	mm	mm	mm			cm
50x100	8.5	100x100	17.2	100	50	6	8	8	8.33	6.25	1.00
62.5x125	11.8	125x125	23.6	125	62.5	6.5	9	8	9.62	6.94	1.19
75x75	7.0	150x75	14.0	75	75	5	7	8	15.0	5.36	1.79
75x100	10.3	150x100	20.7	100	74	6	9	8	12.3	5.56	1.56
75x150	15.6	150x150	31.1	150	75	7	10	8	10.7	7.50	1.37
87.5x90	9.0	175x90	18.0	90	87.5	5	8	8	17.5	5.63	1.93
87.5x175	20.2	175x175	40.4	175	87.5	7.5	11	13	11.7	7.95	1.55
100x100	9.1	200x100	18.2	99	99	4.5	7	11	22.0	7.07	2.15
	10.5	200x100	20.9	100	100	5.5	8	8	18.2	6.25	2.31
	10.7	200x100	21.3	100	100	5.5	8	11	18.2	6.25	2.29
100x150	15.0	200x150	29.9	150	97	6	9	8	16.2	8.33	1.80
	15.3	200x150	30.6	150	97	6	9	13	16.2	8.33	1.79
100x200	24.9	200x200	49.9	200	100	8	12	13	12.5	8.33	1.73
	28.1	200x200	57.8	204	100	12	12	13	8.3	8.50	2.09
	32.8	200x200	65.7	202	104	10	16	13	10.4	6.31	1.91
125x125	12.8	250x125	25.7	124	124	5	8	12	24.8	7.75	2.63
	14.5	250x125	29.0	125	125	6	9	8	20.8	6.94	2.81
	14.8	250x125	29.6	125	125	6	9	12	20.8	6.94	2.78
125x175	21.8	250x175	43.6	175	122	7	11	13	17.4	7.95	2.28
	22.1	250x175	44.1	175	122	7	11	16	17.4	7.95	2.27
125x250	32.2	250x250	64.4	252	122	11	11	16	11.1	11.5	2.39
	33.2	250x250	66.5	249	124	8	13	16	15.5	9.58	1.98
	35.9	250x250	71.8	250	125	9	14	13	13.9	8.93	2.08
	36.2	250x250	72.4	250	125	9	14	16	13.9	8.93	2.08
	41.1	250x250	82.2	255	125	14	14	16	8.93	9.11	2.58
150x150	16.0	300x150	32.0	149	149	5.5	8	13	27.1	9.31	3.26
	18.4	300x150	36.7	150	150	6.5	9	13	23.1	8.33	3.41
150x200	27.9	300x200	55.8	200	147	8	12	13	18.4	8.33	2.85
	28.4	300x200	56.8	200	147	8	12	18	18.4	8.33	2.83
	32.7	300x200	65.4	201	149	9	14	18	16.6	7.18	2.91
150x300	42.3	300x300	84.6	302	147	12	12	18	12.3	12.6	2.84
	43.5	300x300	87.0	299	149	9	14	18	16.6	10.7	2.36
	46.5	300x300	93.0	300	150	10	15	13	15.0	10.0	2.47
	47.0	300x300	94.0	300	150	10	15	18	15.0	10.0	2.47
	52.9	300x300	106	305	150	15	15	18	10.0	10.2	3.03
	52.9	300x300	106	301	152	11	17	18	13.8	8.85	2.55
175x175	20.7	350x175	41.4	174	173	6	9	14	28.8	9.67	3.71
	24.7	350x175	49.4	175	175	7	11	13	25.0	7.95	3.76
	24.8	350x175	49.6	175	175	7	11	14	25.0	7.95	3.75
175x250	34.6	350x250	69.2	249	168	8	12	20	21.0	10.4	3.02
	39.1	350x250	78.1	250	170	9	14	13	18.9	8.93	3.11
	39.8	350x250	79.7	250	170	9	14	20	18.9	8.93	3.09
175x350	53.1	350x350	106.2	351	169	13	13	20	13.0	13.5	3.21
	57.3	350x350	113	348	172	10	16	20	17.2	10.9	2.67
	65.4	350x350	130.8	354	172	16	16	20	10.8	11.1	3.40
	67.5	350x350	135	350	175	12	19	13	14.6	9.21	2.87
	68.2	350x350	137	350	175	12	19	20	14.6	9.21	2.86
	77.9	350x350	159	357	175	19	19	20	9.2	9.39	3.59
	79.3	350x350	181	352	178	14	22	20	12.7	8.00	3.05
200x200	28.3	400x200	56.1	199	198	7	11	16	28.3	9.05	4.17
	32.7	400x200	65.4	200	200	8	13	13	25.0	7.69	4.26
	33.0	400x200	66.0	200	200	8	13	16	25.0	7.69	4.23

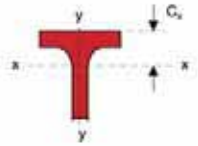


Metric units

Designation Serial Size	Mass Per Metre	Second Moment Of Area		Radius Of Gyration		Elastic Modulus		Plastic Modulus		Buckling Parameter	Torsional Index	Torsional Constant	Sectional Area
		Axis x-x	Axis y-y	Axis x-x	Axis y-y	Axis x-x	Axis y-y	Axis x-x	Axis y-y	u	x	J	A
mm	kg/m	cm^4	cm^4	cm	cm	cm^3	cm^3	cm^3	cm^3			cm^4	cm^2
50x100	8.5	16.2	66.8	1.22	2.49	4.04	13.4	7.86	20.5	-	5.58	2.35	10.8
62.5x125	11.8	35.1	147	1.53	3.13	6.92	23.5	13.3	35.9	-	6.41	3.93	15.0
75x75	7.0	42.4	24.7	2.18	1.66	7.44	6.59	13.4	10.4	0.520	10.2	1.40	8.92
75x100	10.3	51.7	75.2	1.98	2.39	8.84	15.0	16.2	23.2	-	7.90	3.27	13.2
75x150	15.6	66.4	282	1.83	3.77	10.8	37.5	20.6	57.2	-	7.08	6.22	19.8
87.5x90	9.0	70.4	48.7	2.48	2.06	10.3	10.8	18.5	16.8	0.463	10.9	2.15	11.4
87.5x175	20.2	115	492	2.11	4.37	16.0	56.2	30.4	85.8	-	7.27	10.5	25.7
100x100	9.1	93.3	56.8	2.84	2.21	12.0	11.5	21.5	17.9	0.493	13.3	1.92	11.6
	10.5	114	66.9	2.92	2.24	14.8	13.4	26.3	20.8	0.514	12.5	2.53	13.3
	10.7	114	66.9	2.90	2.22	14.8	13.4	26.5	21.0	0.511	11.8	2.87	13.6
100x150	15.0	124	253	2.55	3.65	15.7	33.8	28.3	51.5	-	10.6	4.65	19.1
	15.3	125	254	2.53	3.61	15.8	33.8	28.6	51.8	-	9.91	5.44	19.5
100x200	24.9	185	801	2.41	5.02	22.3	80.1	42.3	122	-	7.78	14.9	31.8
	28.1	256	851	2.68	4.88	32.4	83.4	59.2	129	-	7.19	19.6	35.8
	32.8	251	1100	2.45	5.13	29.6	109	58.4	166	-	6.09	33.3	41.8
125x125	12.8	207	127	3.56	2.79	21.2	20.5	37.5	31.8	0.487	15.0	3.36	16.3
	14.5	247	147	3.65	2.82	25.5	23.5	45.2	36.3	0.508	14.2	4.24	18.5
	14.8	247	147	3.62	2.79	25.4	23.5	45.3	36.6	0.505	13.5	4.83	18.8
125x175	21.8	288	492	3.22	4.21	29.1	56.2	52.3	86.0	-	10.7	10.6	27.7
	22.1	289	492	3.21	4.18	29.1	56.2	52.6	86.4	-	10.3	11.6	28.1
125x250	32.2	445	1469	3.29	5.98	45.3	117	81.3	179	-	9.54	19.6	41.0
	33.2	365	1674	2.93	6.29	35.0	134	65.7	204	-	8.96	23.3	42.3
	35.9	412	1824	3.00	6.32	39.6	146	74.3	222	-	8.56	27.9	45.7
	36.2	413	1824	2.99	6.29	39.6	146	74.6	222	-	8.38	29.3	46.1
	41.1	589	1938	3.36	6.09	59.4	152	108	234	-	7.73	39.1	52.3
150x150	16.0	391	221	4.38	3.29	33.5	29.7	59.5	45.9	0.515	17.8	4.32	20.4
	18.4	461	254	4.44	3.29	39.7	33.8	70.7	52.6	0.528	16.0	6.16	23.4
150x200	27.9	570	801	4.01	4.75	48.1	80.1	85.6	123	-	12.0	15.7	35.5
	28.4	571	801	3.97	4.71	48.1	80.1	86.1	123	-	11.4	17.9	36.2
	32.7	662	949	3.99	4.77	55.2	94.5	99.6	145	-	10.1	26.6	41.7
150x300	42.3	857	2758	3.99	7.16	72.3	183	129	280	-	10.6	30.5	53.8
	43.5	716	3120	3.59	7.51	57.1	209	105	317	-	10.0	35.6	55.4
	46.5	798	3377	3.67	7.55	63.7	225	117	341	-	9.70	40.9	59.2
	47.0	799	3377	3.65	7.51	63.8	225	118	342	-	9.41	44.0	59.9
	52.9	1108	3552	4.05	7.26	92.5	233	167	358	-	8.72	57.7	67.4
	52.9	904	3866	3.66	7.57	71.5	257	134	390	-	8.46	62.1	67.4
175x175	20.7	675	396	5.06	3.88	49.6	45.5	87.6	70.1	0.504	18.8	6.81	26.3
	24.7	811	492	5.08	3.96	59.0	56.2	104	86.7	0.495	16.1	11.2	31.5
	24.8	811	492	5.07	3.95	59.0	56.2	104	86.8	0.494	15.9	11.5	31.6
175x250	34.6	881	1546	4.47	5.92	63.9	124	114	190	-	12.9	22.3	44.1
	39.1	1015	1824	4.52	6.05	73.1	146	130	222	-	12.1	28.9	49.8
	39.8	1017	1825	4.48	6.00	73.1	146	131	223	-	11.4	33.1	50.8
175x350	53.1	1423	4690	4.59	8.33	104	267	185	409	-	11.3	44.8	67.6
	57.3	1232	5622	4.11	8.78	84.8	323	156	490	-	10.2	60.4	73.0
	65.4	1802	5923	4.65	8.43	131	335	234	513	-	9.41	81.1	83.3
	67.5	1519	6791	4.20	8.89	104	388	194	588	-	9.02	92.6	85.9
	68.2	1521	6793	4.18	8.84	104	388	195	589	-	8.77	99.3	86.9
	77.9	2203	7216	4.71	8.53	158	404	287	622	-	8.07	134	99.2
	79.3	1826	8002	4.25	8.90	124	455	236	691	-	7.70	152	101
200x200	28.3	1188	723	5.74	4.48	76.0	72.7	134	112	0.491	17.8	13.5	36.1
	32.7	1390	868	5.77	4.56	88.3	86.8	156	133	0.486	15.9	19.8	41.7
	33.0	1391	868	5.75	4.54	88.2	86.8	156	134	0.485	15.5	21.0	42.1

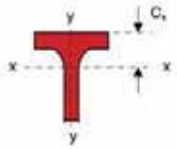
Structural Tees





Metric units

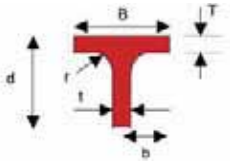
Designation		Cut from		Width	Depth	Thickness		Root	Ratio For		Dimension
Serial Size	Mass Per Metre	Serial Size	Mass Per Metre	Of Section	Of Section	Web	Flange	Radius	Local Buckling		
				B	d	t	T	r			C_x
mm	kg/m		kg/m	mm	mm	mm	mm	mm	d/t	b/T	cm
200x300	47.1	400x300	94.3	299	193	9	14	22	21.4	10.7	3.33
	52.3	400x300	105	300	195	10	16	13	19.5	9.38	3.43
	53.4	400x300	107	300	195	10	16	22	19.5	9.38	3.41
200x400	70.0	400x400	140	402	194	15	15	22	12.9	13.4	3.70
	73.3	400x400	147	398	197	11	18	22	17.9	11.1	3.01
	84.1	400x400	171.6	405	197	18	18	22	10.9	11.3	3.89
	85.8	400x400	172	400	200	13	21	22	15.4	9.52	3.21
	98.4	400x400	200	408	200	21	21	22	9.5	9.71	4.07
	116.0	400x400	232	405	207	18	28	22	11.5	7.23	3.68
	142.0	400x400	283	407	214	20	35	22	10.7	5.81	3.90
	207.0	400x400	415	417	229	30	50	22	7.6	4.17	4.85
	302.0	400x400	605	432	249	45	70	22	5.5	3.09	6.13
225x200	33.1	450x200	66.2	199	223	8	12	18	27.9	8.29	5.10
	37.5	450x200	74.9	200	225	9	14	13	25.0	7.14	5.19
	38.0	450x200	76.0	200	225	9	14	18	25.0	7.14	5.15
225x300	53.0	450x300	106	299	217	10	15	24	21.7	9.97	4.04
	60.4	450x300	121	300	220	11	18	13	20.0	8.33	4.09
	61.8	450x300	124	300	220	11	18	24	20.0	8.33	4.05
250x200	39.7	500x200	77.9	199	248	9	14	20	27.6	7.11	5.90
	44.1	500x200	88.2	200	250	10	16	13	25.0	6.25	6.03
	44.8	500x200	89.6	200	250	10	16	20	25.0	6.25	5.96
	51.5	500x200	102	201	253	11	19	20	23.0	5.29	5.95
250x300	57.1	500x300	114	300	241	11	15	26	21.9	10.0	4.92
	62.5	500x300	125	300	244	11	18	13	22.2	8.33	4.72
	64.2	500x300	128	300	244	11	18	26	22.2	8.33	4.66
300x200	47.3	600x200	92.5	199	298	10	15	22	29.8	6.63	7.79
	51.7	600x200	103	200	300	11	17	13	27.3	5.88	7.95
	52.8	600x200	106	200	300	11	17	22	27.3	5.88	7.84
	59.8	600x200	120	201	303	12	20	22	25.3	5.03	7.79
	67.0	600x200	134	202	306	13	23	22	23.5	4.39	7.79
300x300	68.5	600x300	137	300	291	12	17	28	24.3	8.82	6.39
	73.5	600x300	147	300	294	12	20	13	24.5	7.50	6.17
	75.6	600x300	151	300	294	12	20	28	24.5	7.50	6.08
	87.3	600x300	175	302	297	14	23	28	21.2	6.57	6.33
350x300	83.0	700x300	166	300	346	13	20	28	26.6	7.50	7.99
	90.9	700x300	182	300	350	13	24	18	26.9	6.25	7.63
	92.4	700x300	185	300	350	13	24	28	26.9	6.25	7.55
400x300	95.6	800x300	191	300	396	14	22	28	28.3	6.82	9.66
	103.0	800x300	207	300	400	14	26	18	28.6	5.77	9.27
	105.0	800x300	210	300	400	14	26	28	28.6	5.77	9.18
450x300	105.0	900x300	210	299	445	15	23	18	29.7	6.50	11.7
	120.0	900x300	240	300	450	16	28	18	28.1	5.36	11.4
	141.0	900x300	283	302	456	18	34	18	25.3	4.44	11.3
	152.0	900x300	304	303	459	19	37	18	24.2	4.09	11.4

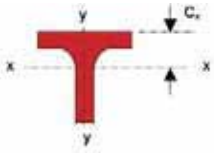


Metric units

Designation Serial Size	Mass Per Metre	Second Moment Of Area		Radius Of Gyration		Elastic Modulus		Plastic Modulus		Buckling Parameter	Torsional Index	Torsional Constant	Sectional Area
		Axis x-x	Axis y-y	Axis x-x	Axis y-y	Axis x-x	Axis y-y	Axis x-x	Axis y-y	u	x	J	A
mm	kg/m	cm^4	cm^4	cm	cm	cm^3	cm^3	cm^3	cm^3			cm^4	cm^2
200x300	47.1	1524	3122	5.04	7.21	95.5	209	170	318	-	12.9	39.9	60.0
	52.3	1728	3602	5.09	7.35	108	240	192	365	-	12.3	49.7	66.6
	53.4	1732	3604	5.05	7.28	108	240	193	367	-	11.6	56.7	68.0
200x400	70.0	2480	8129	5.27	9.54	158	404	280	619	-	11.3	77.7	89.2
	73.3	2047	9461	4.68	10.1	123	475	226	720	-	10.5	96.8	93.4
	84.1	3052	9977	5.34	9.65	193	493	346	755	-	9.62	131	107
	85.8	2478	11210	4.76	10.1	148	560	276	850	-	9.11	151	109
	98.4	3652	11900	5.40	9.8	229	584	414	897	-	8.38	205	125
	116.0	3626	15510	4.95	10.2	213	766	410	1166	-	7.04	356	148
	142.0	4380	19680	4.93	10.4	250	967	504	1470	-	5.83	657	180
	207.0	7470	30260	5.32	10.7	414	1451	863	2218	-	4.27	1934	264
	302.0	13250	47180	5.87	11.1	706	2184	1501	3362	-	3.21	5488	385
225x200	33.1	1861	790	6.65	4.33	108	79.4	193	123	0.565	18.2	19.1	42.1
	37.5	2142	935	6.70	4.43	124	93.5	219	145	0.563	16.8	25.7	47.7
	38.0	2144	936	6.66	4.40	124	93.6	220	145	0.559	16.1	28.4	48.4
225x300	53.0	2341	3346	5.89	7.04	133	224	235	343	-	13.5	51.9	67.5
	60.4	2676	4053	5.90	7.26	149	270	265	412	-	12.5	70.5	76.9
	61.8	2681	4055	5.84	7.18	149	270	267	414	-	11.7	81.6	78.7
250x200	39.7	2814	922	7.45	4.27	149	92.7	266	145	0.598	17.6	30.3	50.6
	44.1	3187	1069	7.54	4.36	168	107	299	166	0.599	16.7	37.9	56.1
	44.8	3190	1070	7.47	4.33	168	107	300	167	0.594	15.8	42.8	57.1
	51.5	3650	1290	7.46	4.43	189	128	337	201	0.582	13.8	65.7	65.6
250x300	57.1	3401	3381	6.84	6.82	177	225	314	348	0.167	14.7	58.8	72.8
	62.5	3607	4053	6.73	7.14	183	270	323	412	-	14.0	71.5	79.6
	64.2	3615	4056	6.65	7.04	183	270	325	415	-	13.0	85.8	81.8
300x200	47.3	5127	989	9.23	4.05	233	99.4	424	158	0.660	19.9	41.1	60.2
	51.7	5743	1137	9.34	4.16	261	114	470	179	0.662	19.2	48.5	65.9
	52.8	5749	1139	9.25	4.12	259	114	470	181	0.656	18.0	56.3	67.2
	59.8	6512	1360	9.24	4.22	289	135	522	214	0.644	15.9	83.2	76.2
	67.0	7288	1588	9.24	4.31	319	157	574	249	0.636	14.2	118	85.3
300x300	68.5	6315	3834	8.51	6.63	278	256	494	396	0.501	16.1	86.2	87.2
	73.5	6668	4505	8.44	6.94	287	300	505	461	0.465	15.6	99.3	93.6
	75.6	6679	4509	8.33	6.84	286	301	508	464	0.460	14.4	120	96.2
	87.3	7892	5291	8.43	6.90	338	350	601	542	0.466	12.8	178	111
350x300	83.0	11220	4511	10.3	6.53	422	301	751	468	0.572	17.2	130	106
	90.9	11960	5408	10.2	6.83	437	361	771	555	0.540	15.7	171	116
	92.4	11970	5411	10.1	6.78	436	361	774	558	0.536	15.0	191	118
400x300	95.6	17590	4964	12.0	6.39	588	331	1053	518	0.617	18.4	170	122
	103.0	18680	5860	11.9	6.67	608	391	1076	605	0.591	17.0	220	132
	105.0	18690	5864	11.8	6.62	607	391	1078	608	0.588	16.3	243	134
450x300	105.0	25750	5137	13.9	6.20	785	344	1415	539	0.662	21.1	180	133
	120.0	29030	6316	13.8	6.43	863	421	1541	659	0.639	17.9	289	153
	141.0	34070	7827	13.8	6.59	994	518	1773	811	0.627	15.1	488	180
	152.0	36650	8604	13.8	6.67	1061	568	1892	889	0.623	14.0	616	194

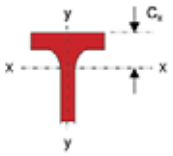
Structural Tees





Imperial units

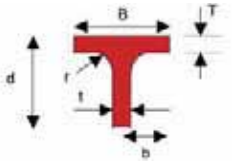
Designation Serial Size	Mass Per Metre	Cut from Serial Size	Mass Per Metre	Width Of Section	Depth Of Section	Thickness Web	Thickness Flange	Root Radius	Ratios For Local Buckling		Dimension
Bxd				B	d	t	T	r			C_x
mm	kg/m		kg/m	mm	mm	mm	mm	mm	d/t	b/T	cm
102x76	6.70	152x102	13.4	100.1	74.9	4.32	5.46	6.4	17.3	9.17	1.58
	8.93	152x102	17.9	101.6	76.6	5.84	7.11	6.4	13.1	7.14	1.72
	11.91	152x102	23.8	102.4	79.8	6.60	10.29	6.4	12.1	4.98	1.72
102x127	11.00	254x102	22.0	101.6	126.9	5.70	6.80	7.6	22.3	7.47	3.45
	12.60	254x102	25.0	101.9	128.5	6.00	8.40	7.6	21.4	6.07	3.32
	14.20	254x102	28.0	102.2	130.1	6.30	10.00	7.6	20.7	5.11	3.24
102x152	12.40	305x102	25.0	101.6	152.5	5.80	7.00	7.6	26.3	7.26	4.43
	14.10	305x102	28.0	101.8	154.3	6.00	8.80	7.6	25.7	5.78	4.20
	16.40	305x102	33.0	102.4	156.3	6.60	10.80	7.6	23.7	4.74	4.14
127x152	18.50	305x127	37.0	123.4	152.1	7.10	10.70	8.9	21.4	5.77	3.78
	21.00	305x127	42.0	124.3	153.5	8.00	12.10	8.9	19.2	5.14	3.87
	24.00	305x127	48.0	125.3	155.4	9.00	14.00	8.9	17.3	4.48	3.94
127x178	16.50	356x127	33.0	125.4	174.4	6.00	8.50	10.2	29.1	7.38	4.56
	19.50	356x127	39.0	126.0	176.6	6.60	10.70	10.2	26.8	5.89	4.44
133x102	12.50	203x133	25.0	133.2	101.5	5.70	7.80	7.6	17.8	8.54	2.10
	15.00	203x133	30.0	133.9	103.3	6.40	9.60	7.6	16.1	6.97	2.11
140x203	19.50	406x140	39.0	141.8	198.9	6.40	8.60	10.2	31.1	8.24	5.32
	23.00	406x140	46.0	142.2	201.5	6.80	11.20	10.2	29.6	6.35	5.02
146x127	15.60	254x146	31.0	146.1	125.6	6.00	8.60	7.6	20.9	8.49	2.66
	18.50	254x146	37.0	146.4	127.9	6.30	10.90	7.6	20.3	6.72	2.55
	21.50	254x146	43.0	147.3	129.7	7.20	12.70	7.6	18.0	5.80	2.64
152x76	11.50	152x152	23.0	152.2	76.1	5.80	6.80	7.6	13.1	11.2	1.39
	15.00	152x152	30.0	152.9	78.7	6.50	9.40	7.6	12.1	8.13	1.41
	18.50	152x152	37.0	154.4	80.8	8.00	11.50	7.6	10.1	6.71	1.53
152x229	26.20	457x152	52.0	152.4	224.8	7.60	10.90	10.2	29.6	6.99	6.04
	29.90	457x152	60.0	152.9	227.2	8.10	13.30	10.2	28.0	5.75	5.84
	33.60	457x152	67.0	153.8	228.9	9.00	15.00	10.2	25.4	5.13	5.91
	34.23	457x152	68.5	153.9	229.4	9.14	15.37	10.2	25.1	5.01	5.92
	37.10	457x152	74.0	154.4	230.9	9.60	17.00	10.2	24.1	4.54	5.88
	41.00	457x152	82.0	155.3	232.8	10.50	18.90	10.2	22.2	4.11	5.96
165x102	17.86	203x165	35.7	165.0	100.7	6.22	10.16	10.2	16.2	8.12	1.76
	20.83	203x165	41.7	166.0	102.4	7.24	11.81	10.2	14.1	7.03	1.87
165x152	19.35	305x165	38.7	164.8	155.2	5.84	9.65	7.6	26.6	8.54	3.16
	20.10	305x165	40.0	165.0	151.6	6.00	10.20	8.9	25.3	8.09	3.03
	22.32	305x165	44.6	165.6	156.7	6.60	11.18	7.6	23.7	7.41	3.22
	23.10	305x165	46.0	165.7	153.2	6.70	11.80	8.9	22.9	7.02	3.07
	26.04	305x165	52.1	166.6	158.8	7.62	13.21	7.6	20.8	6.31	3.31
	27.00	305x165	54.0	166.9	155.1	7.90	13.70	8.9	19.6	6.09	3.21
165x267	32.74	533x165	65.5	165.1	262.4	8.89	11.43	12.7	29.5	7.22	7.58
	37.20	533x165	74.4	165.9	264.5	9.65	13.59	12.7	27.4	6.10	7.44
	42.41	533x165	84.8	166.5	267.5	10.29	16.51	12.7	26.0	5.04	7.24
171x178	22.50	356x171	45.0	171.1	175.6	7.00	9.70	10.2	25.1	8.82	4.05
	25.50	356x171	51.0	171.5	177.4	7.40	11.50	10.2	24.0	7.46	3.94
	28.50	356x171	57.0	172.2	178.9	8.10	13.00	10.2	22.1	6.62	3.97
	33.50	356x171	67.0	173.2	181.6	9.10	15.70	10.2	20.0	5.52	4.00
178x203	27.10	406x178	54.0	177.7	201.2	7.70	10.90	10.2	26.1	8.15	4.83
	30.00	406x178	60.0	177.9	203.1	7.90	12.80	10.2	25.7	6.95	4.64
	33.60	406x178	67.0	178.8	204.6	8.80	14.30	10.2	23.3	6.25	4.73
	37.10	406x178	74.0	179.5	206.3	9.50	16.00	10.2	21.7	5.61	4.76
	42.41	406x178	84.8	180.8	208.7	10.92	18.16	10.2	19.1	4.98	4.93

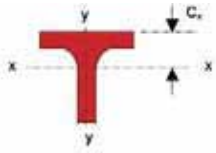


Imperial units

Designation Serial Size	Mass Per Metre	Second Moment Of Area		Radius Of Gyration		Elastic Modulus		Plastic Modulus		Buckling Parameter	Torsional Index	Torsional Constant	Sectional Area
		Axis x-x	Axis y-y	Axis x-x	Axis y-y	Axis x-x	Axis y-y	Axis x-x	Axis y-y	u	x	J	A
mm	kg/m	cm^4	cm^4	cm	cm	cm^3	cm^3	cm^3	cm^3			cm^4	cm^2
102x76	6.70	39.4	45.7	2.14	2.30	6.67	9.14	11.8	14.0	-	13.1	0.841	8.64
	8.93	54.8	62.3	2.19	2.33	9.22	12.3	16.5	18.9	-	10.2	1.87	11.5
	11.91	70.3	92.3	2.14	2.46	11.2	18.0	20.6	27.7	-	7.67	4.64	15.3
102x127	11.00	221	59.7	3.97	2.07	23.9	11.8	44.3	18.5	0.662	18.2	2.06	14.0
	12.60	249	74.4	3.94	2.16	26.1	14.6	46.9	22.9	0.628	15.7	3.20	16.0
	14.20	276	89.3	3.91	2.23	28.2	17.5	50.4	27.3	0.606	13.8	4.77	18.0
102x152	12.40	374	61.5	4.86	1.97	34.5	12.1	63.3	19.3	0.701	21.8	2.37	15.8
	14.10	418	77.7	4.83	2.08	37.2	15.3	69.1	24.1	0.681	18.7	3.69	17.9
	16.40	485	97.1	4.81	2.15	42.2	19.0	75.8	29.9	0.656	15.8	6.08	20.9
127x152	18.50	499	168	4.60	2.67	43.6	27.3	77.9	42.5	0.606	14.9	7.36	23.6
	21.00	571	194	4.62	2.70	49.7	31.3	88.9	49.0	0.606	13.3	10.5	26.7
	24.00	660	231	4.64	2.74	56.9	36.8	102	57.8	0.602	11.7	15.8	30.6
127x178	16.50	621	140	5.43	2.58	48.2	22.4	87.2	34.9	0.654	21.1	4.38	21.1
	19.50	724	179	5.39	2.68	54.7	28.4	98.1	44.3	0.632	17.6	7.53	24.9
133x102	12.50	131	154	2.86	3.10	16.2	23.1	28.7	35.4	-	12.8	2.97	16.0
	15.00	154	192	2.84	3.17	18.7	28.7	33.5	44.0	-	10.8	5.13	19.1
140x203	19.50	971	205	6.26	2.87	66.7	28.9	123	45.2	0.673	23.8	5.33	24.8
	23.00	1117	269	6.17	3.03	73.8	37.9	132	58.8	0.633	19.5	9.49	29.3
146x127	15.60	259	224	3.61	3.36	26.1	30.6	46.0	46.9	0.375	14.8	4.26	19.8
	18.50	292	285	3.52	3.48	28.5	39.0	50.7	59.6	0.230	12.2	7.65	23.6
	21.50	343	339	3.54	3.52	33.2	46.0	59.5	70.4	0.198	10.6	11.9	27.4
152x76	11.50	58.5	200	2.00	3.70	9.41	26.3	16.9	40.0	-	10.4	2.30	14.6
	15.00	72.3	280	1.94	3.83	11.2	36.7	20.9	55.7	-	8.00	5.24	19.1
	18.50	93.2	353	1.99	3.87	14.2	45.7	27.1	69.6	-	6.67	9.54	23.5
152x229	26.20	1660	323	7.06	3.11	101	42.3	187	66.4	0.678	22.0	10.7	33.3
	29.90	1871	397	7.01	3.23	111	52.0	199	81.2	0.648	18.8	16.9	38.1
	33.60	2113	456	7.03	3.27	124	59.4	223	93.0	0.646	16.8	23.8	42.8
	34.23	2161	469	7.03	3.28	127	60.9	227	95.5	0.645	16.5	25.4	43.7
	37.10	2325	523	7.02	3.33	135	67.8	242	106.2	0.636	15.1	32.9	47.2
	41.00	2589	592	7.04	3.37	149	76.3	267	119.9	0.634	13.7	44.5	52.3
165x102	17.86	147	381	2.54	4.08	17.7	46.2	32.4	70.0	-	9.63	7.22	22.8
	20.83	176	451	2.57	4.12	21.0	54.3	39.0	82.5	-	8.43	11.2	26.6
165x152	19.35	485	360	4.44	3.82	39.3	43.7	68.8	66.8	0.434	16.9	6.22	24.7
	20.10	467	382	4.27	3.86	38.5	46.3	67.7	70.7	0.392	15.5	7.35	25.7
	22.32	560	424	4.44	3.86	45.0	51.2	79.1	78.2	0.427	14.8	9.49	28.4
	23.10	535	448	4.27	3.91	43.7	54.1	77.2	82.6	0.379	13.6	11.1	29.4
	26.04	664	510	4.46	3.91	52.8	61.2	93.6	93.8	0.422	12.7	15.4	33.3
	27.00	641	532	4.32	3.93	52.1	63.7	92.8	97.6	0.388	11.8	17.3	34.4
165x267	32.74	2934	431	8.37	3.21	157	52.2	288	82.9	0.704	23.5	16.0	41.9
	37.20	3317	520	8.36	3.31	174	62.7	319	99.4	0.692	20.6	23.7	47.4
	42.41	3745	638	8.33	3.44	192	76.7	347	121	0.672	17.8	36.8	54.0
171x178	22.50	795	406	5.27	3.76	58.8	47.4	104	73.0	0.546	18.4	7.90	28.7
	25.50	879	484	5.21	3.86	63.7	56.5	113	86.8	0.521	16.1	11.9	32.4
	28.50	984	554	5.21	3.91	70.7	64.4	125	99.1	0.514	14.4	16.6	36.3
	33.50	1152	681	5.19	3.99	81.4	78.7	145	121	0.499	12.2	27.8	42.7
178x203	27.10	1289	511	6.11	3.85	84.3	57.5	150	89	0.587	19.2	11.5	34.5
	30.00	1391	602	6.03	3.97	88.8	67.6	157	104	0.561	16.9	16.6	38.3
	33.60	1569	683	6.06	4.00	99.8	76.4	177	118	0.561	15.2	23.0	42.8
	37.10	1733	773	6.06	4.04	109	86.1	194	133	0.555	13.8	31.3	47.2
	42.41	2026	897	6.12	4.07	127	99.2	226	154	0.559	12.3	46.0	54.1

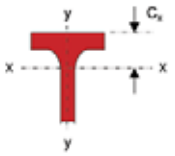
Structural Tees





Imperial units

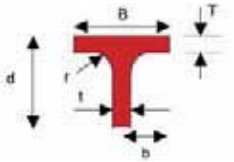
Designation Serial Size Bxd	Mass Per Metre	Cut from Serial Size	Mass Per Metre	Width Of Section B	Depth Of Section d	Thickness Web t	Thickness Flange T	Root Radius r	Ratios For Local Buckling d/t	Ratios For Local Buckling b/T	Dimension C_x
mm	kg/m		kg/m	mm	mm	mm	mm	mm			cm
178x305	40.92	610x178	81.8	177.9	299.3	10.03	12.83	12.7	29.8	6.93	8.88
	46.13	610x178	92.3	178.8	301.5	10.92	14.99	12.7	27.6	5.96	8.79
191x229	33.60	457x191	67.0	189.9	226.6	8.50	12.70	10.2	26.7	7.48	5.46
	37.10	457x191	74.0	190.4	228.4	9.00	14.50	10.2	25.4	6.57	5.38
	41.00	457x191	82.0	191.3	229.9	9.90	16.00	10.2	23.2	5.98	5.47
	44.60	457x191	89.0	191.9	231.6	10.50	17.70	10.2	22.1	5.42	5.47
	48.37	457x191	96.7	192.8	233.0	11.43	19.05	10.2	20.4	5.06	5.58
	49.20	457x191	98.0	192.8	233.5	11.40	19.60	10.2	20.5	4.92	5.53
	52.83	457x191	106	193.9	234.6	12.57	20.57	10.2	18.7	4.71	5.73
203x102	23.00	203x203	46.0	203.6	101.5	7.20	11.00	10.2	14.1	9.25	1.69
	26.00	203x203	52.0	204.3	103.0	7.90	12.50	10.2	13.0	8.17	1.75
	30.00	203x203	60.0	205.8	104.7	9.40	14.20	10.2	11.1	7.25	1.89
	35.50	203x203	71.0	206.4	107.8	10.00	17.30	10.2	10.8	5.97	1.95
	43.00	203x203	86.0	209.1	111.0	12.70	20.50	10.2	8.74	5.10	2.20
	49.85	203x203	99.7	210.3	114.3	14.48	23.75	10.2	7.89	4.43	2.38
203x127	24.55	254x203	49.1	202.2	123.6	7.37	11.05	12.7	16.8	9.15	2.21
	29.02	254x203	58.0	202.8	126.0	8.00	13.46	12.7	15.8	7.53	2.22
	33.48	254x203	67.0	203.7	128.3	8.89	15.75	12.7	14.4	6.47	2.31
203x152	29.76	305x203	59.5	203.3	151.6	7.49	13.08	15.2	20.2	7.77	2.75
	33.48	305x203	67.0	204.3	143.2	8.51	14.60	15.2	16.8	7.00	2.63
	37.20	305x203	74.4	205.2	154.8	9.40	16.26	15.2	16.5	6.31	2.96
210x267	41.10	533x210	82.0	208.8	264.1	9.60	13.20	12.7	27.5	7.91	6.75
	46.10	533x210	92.0	209.3	266.5	10.10	15.60	12.7	26.4	6.71	6.55
	50.50	533x210	101	210.0	268.3	10.80	17.40	12.7	24.8	6.03	6.53
	54.50	533x210	109	210.8	269.7	11.60	18.80	12.7	23.3	5.61	6.61
	61.00	533x210	122	211.9	272.2	12.70	21.30	12.7	21.4	4.97	6.66
	61.76	533x210	124	212.2	272.2	18.08	21.21	12.7	15.1	5.00	6.76
	69.20	533x210	138	213.9	274.6	14.73	23.62	12.7	18.6	4.53	6.95
229x305	50.60	610x229	101	227.6	301.2	10.50	14.80	12.7	28.7	7.69	7.78
	56.50	610x229	113	228.2	303.7	11.10	17.30	12.7	27.4	6.60	7.58
	62.50	610x229	125	229.0	306.0	11.90	19.60	12.7	25.7	5.84	7.54
	69.90	610x229	140	230.2	308.5	13.10	22.10	12.7	23.5	5.21	7.61
254x127	36.50	254x254	73	254.6	127.0	8.60	14.20	12.7	14.8	8.96	2.05
	40.18	254x254	80	254.8	128.1	9.40	15.62	12.7	13.6	8.16	2.12
	44.50	254x254	89	256.3	130.1	10.30	17.30	12.7	12.6	7.41	2.21
	50.60	254x254	101	257.3	132.1	11.94	19.56	12.7	11.1	6.58	2.37
	53.50	254x254	107	258.8	133.3	12.80	20.50	12.7	10.4	6.31	2.45
	57.29	254x254	115	258.8	134.6	13.46	22.10	12.7	10.0	5.86	2.51
	66.00	254x254	132	261.3	138.1	15.30	25.30	12.7	9.03	5.16	2.70
	74.41	254x254	149	262.6	139.7	17.27	28.45	12.7	8.09	4.62	2.85
	83.34	254x254	167	264.5	144.3	19.18	31.75	12.7	7.52	4.17	3.07
254x178	45.39	356x254	91	253.9	176.4	9.53	16.38	15.2	18.5	7.75	3.16
	50.60	356x254	101	254.9	178.3	10.54	18.29	15.2	16.9	6.97	3.27
	55.06	356x254	110	255.8	180.0	11.43	20.94	15.2	15.8	6.11	3.32
	61.01	356x254	122	257.3	181.7	12.95	21.72	15.2	14.0	5.92	3.53
254x343	62.60	686x254	125	253.0	338.9	11.70	16.20	15.2	29.0	7.81	8.85
	69.94	686x254	140	253.7	341.9	12.45	18.92	15.2	27.5	6.70	8.67
	75.90	686x254	152	254.4	344.0	13.08	21.08	15.2	26.3	6.03	8.57
	84.83	686x254	170	255.8	346.6	14.48	23.62	15.2	23.9	5.41	8.69
267x381	73.66	762x267	147	265.4	376.6	13.21	17.02	16.5	28.5	7.80	10.4
	80.36	762x267	161	266.1	378.8	13.84	19.30	16.5	27.4	6.89	10.2
	86.31	762x267	173	266.6	381.2	14.35	21.59	16.5	26.6	6.17	10.0
	92.27	762x267	185	267.1	383.2	14.86	23.62	16.5	25.8	5.65	9.90
	98.22	762x267	196	267.8	384.9	15.62	25.40	16.5	24.6	5.27	9.91

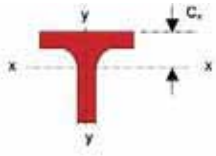


Imperial units

Designation Serial Size	Mass Per Metre	Second Moment Of Area		Radius Of Gyration		Elastic Modulus		Plastic Modulus		Buckling Parameter	Torsional Index	Torsional Constant	Sectional Area
		Axis x-x	Axis y-y	Axis x-x	Axis y-y	Axis x-x	Axis y-y	Axis x-x	Axis y-y	u	x	J	A
mm	kg/m	cm^4	cm^4	cm	cm	cm^3	cm^3	cm^3	cm^3			cm^4	cm^2
178x305	40.92	4818	605	9.60	3.40	229	68.0	419	109	0.716	24.2	24.5	52.2
	46.13	5427	718	9.61	3.50	254	80.3	465	128	0.708	21.5	35.4	58.8
191x229	33.60	2028	726	6.89	4.12	118	76.5	209	118	0.597	18.9	18.5	42.7
	37.10	2218	836	6.85	4.20	127	87.8	225	136	0.583	16.9	25.8	47.3
	41.00	2468	936	6.87	4.23	141	97.8	250	152	0.583	15.5	34.5	52.2
	44.60	2679	1045	6.86	4.29	151	109	269	169	0.576	14.1	45.2	56.9
	48.37	2937	1141	6.90	4.30	166	118	295	184	0.579	13.2	56.7	61.6
	49.20	2962	1174	6.88	4.33	166	122	296	189	0.573	12.9	60.5	62.6
	52.83	3252	1254	6.95	4.32	183	129	327	202	0.583	12.2	72.2	67.2
203x102	23.00	177	774	2.45	5.14	20.9	76.1	39.0	115	-	8.86	11.0	29.4
	26.00	200	889	2.46	5.18	23.4	87.0	44.5	132	-	7.92	15.8	33.1
	30.00	244	1032	2.53	5.20	28.4	100	54.4	152	-	7.04	23.5	38.2
	35.50	281	1269	2.49	5.30	31.8	123	63.6	187	-	5.96	40.0	45.2
	43.00	373	1564	2.61	5.34	41.9	150	84.6	228	-	5.11	68.1	54.8
	49.85	452	1844	2.67	5.39	50.0	175	103	267	-	4.51	105	63.5
203x127	24.55	321	762	3.20	4.93	31.7	75.4	57.0	114	-	10.7	12.1	31.3
	29.02	368	937	3.16	5.03	35.5	92.4	65.4	140	-	9.12	20.3	37.0
	33.48	427	1111	3.16	5.10	40.5	109	76.2	166	-	7.96	31.4	42.8
203x152	29.76	599	918	3.97	4.92	48.3	90.3	86.7	137	-	11.4	19.8	38.0
	33.48	568	1040	3.69	4.99	48.6	102	88.6	155	-	9.56	27.0	41.8
	37.20	778	1173	4.05	4.98	62.1	114	113	174	-	9.40	37.0	47.4
210x267	41.10	3510	1004	8.19	4.38	179	96.2	320	150	0.634	20.8	25.7	52.3
	46.10	3870	1195	8.12	4.51	193	114	343	177	0.613	18.3	37.7	58.7
	50.50	4232	1346	8.11	4.57	208	128	371	199	0.606	16.6	50.3	64.3
	54.50	4591	1472	8.13	4.60	225	140	401	217	0.605	15.5	63.0	69.4
	61.00	5149	1694	8.14	4.67	250	160	446	249	0.600	13.8	88.9	77.7
	61.76	5240	1690	8.18	4.65	193	159	449	259	0.599	13.8	90.8	78.7
	69.20	5989	1934	8.24	4.68	292	181	522	284	0.609	12.5	125	88.2
229x305	50.60	5666	1458	9.38	4.76	254	128	456	200	0.644	21.6	38.3	64.4
	56.50	6244	1717	9.32	4.89	274	151	489	234	0.626	19.0	55.5	72.0
	62.50	6880	1966	9.29	4.97	298	172	531	267	0.617	17.1	76.9	79.7
	69.90	7724	2253	9.31	5.03	332	196	592	305	0.613	15.3	108	89.1
254x127	36.50	418	1954	3.00	6.48	39.2	154	74.1	232	-	8.63	28.8	46.5
	40.18	463	2155	3.01	6.50	43.3	169	82.8	256	-	7.91	37.9	51.1
	44.50	524	2429	3.04	6.55	48.6	190	94.1	287	-	7.24	51.1	56.6
	50.60	621	2779	3.10	6.57	57.3	216	112	328	-	6.47	73.9	64.5
	53.50	676	2964	3.15	6.59	62.2	229	122	348	-	6.20	85.9	68.2
	57.29	726	3196	3.15	6.62	66.3	247	132	375	-	5.80	106	73.0
	66.00	871	3766	3.22	6.69	78.4	288	159	438	-	5.17	159	84.1
	74.41	995	4299	3.24	6.74	89.5	327	185	499	-	4.61	225	94.6
	83.34	1193	4904	3.35	6.79	105	371	219	566	-	4.24	312	106
254x178	45.39	1204	2237	4.56	6.22	83.2	176	150	268	-	10.7	45.6	57.8
	50.60	1358	2527	4.59	6.26	93.2	198	170	302	-	9.71	62.7	64.5
254x178x55	55.06	1503	2924	4.55	6.34	102	229	189	348	-	8.57	91.1	72.7
	61.01	1712	3088	4.70	6.31	117	240	215	366	-	8.30	105	77.6
254x343	62.60	8930	2192	10.6	5.24	357	173	643	270	0.651	22.0	57.9	79.7
	69.94	9906	2581	10.5	5.38	388	204	695	317	0.635	19.4	83.7	89.2
	75.90	10680	2900	10.5	5.47	414	228	738	355	0.624	17.7	110	96.9
	84.83	12010	3305	10.5	5.53	463	258	825	403	0.623	16.0	152	108
267x381	73.66	13340	2661	11.9	5.32	489	201	892	315	0.680	22.8	78.1	93.8
	80.36	14440	3041	11.9	5.45	522	229	944	359	0.667	20.8	103	102
	86.31	15470	3421	11.8	5.57	550	257	990	402	0.654	19.1	133	110
	92.27	16410	3763	11.8	5.65	577	282	1035	441	0.645	17.7	166	118
	98.22	17480	4079	11.8	5.70	612	305	1095	477	0.641	16.6	202	125

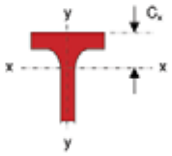
Structural Tees





Imperial units

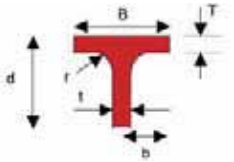
Designation Serial Size Bxd	Mass Per Metre	Cut from Serial Size	Mass Per Metre	Width Of Section B	Depth Of Section d	Thickness Web t	Thickness Flange T	Root Radius r	Ratios For Local Buckling d/t	Ratios For Local Buckling b/T	Dimension C_x
mm	kg/m		kg/m	mm	mm	mm	mm	mm			cm
279x229	56.55	457x279	113	280.3	231.3	10.80	17.27	10.2	21.4	8.12	4.58
	64.00	457x279	128	281.7	232.6	12.19	19.56	10.2	19.1	7.20	4.69
	72.18	457x279	144	283.1	236.1	13.59	22.10	10.2	17.4	6.40	4.84
	78.87	457x279	158	284.5	237.9	14.99	23.88	10.2	15.9	5.96	5.00
	88.55	457x279	177	286.1	240.9	16.64	26.92	10.2	14.5	5.31	5.15
292x419	87.80	838x292	176	291.6	417.3	13.97	18.80	17.8	29.9	7.76	11.3
	96.70	838x292	193	292.4	420.2	14.73	21.72	17.8	28.5	6.73	11.1
	104.9	838x292	210	293.0	422.9	15.37	24.38	17.8	27.5	6.01	10.9
	113.1	838x292	226	293.8	425.3	16.13	26.80	17.8	26.4	5.48	10.8
305x152	48.40	305x305	97	305.3	153.9	9.90	15.40	15.2	15.5	9.91	2.50
	53.57	305x305	107	305.8	155.6	10.92	17.02	15.2	14.2	8.98	2.60
	58.90	305x305	118	307.4	157.2	12.00	18.70	15.2	13.1	8.22	2.69
	64.73	305x305	129	308.0	159.1	13.08	20.57	15.2	12.2	7.49	2.79
	68.50	305x305	137	309.2	160.2	13.80	21.70	15.2	11.6	7.12	2.86
	71.43	305x305	143	308.9	161.4	13.97	22.86	15.2	11.6	6.76	2.88
	79.00	305x305	158	311.2	163.5	15.80	25.00	15.2	10.3	6.22	3.04
	89.29	305x305	179	312.9	166.6	18.03	28.07	15.2	9.24	5.57	3.25
	101.2	305x305	202	315.0	170.3	20.07	31.75	15.2	8.49	4.96	3.44
	113.1	305x305	226	317.0	174.1	22.10	35.56	15.2	7.88	4.46	3.64
	126.5	305x305	253	319.3	178.2	24.38	39.62	15.2	7.31	4.03	3.86
	141.4	305x305	283	321.8	182.6	26.92	44.07	15.2	6.78	3.65	4.11
305x305	74.60	610x305	149	304.8	306.1	11.80	19.70	16.5	25.9	7.74	6.45
	89.50	610x305	179	307.1	310.0	14.10	23.60	16.5	22.0	6.51	6.69
305x457	100.5	914x305	201	303.5	451.5	15.24	20.07	19.0	29.6	7.56	12.6
	111.6	914x305	223	304.2	455.3	15.88	23.88	19.0	28.7	6.37	12.1
	119.1	914x305	238	304.8	457.3	16.51	25.91	19.0	27.7	5.88	12.0
	126.5	914x305	253	305.6	459.4	17.27	27.94	19.0	26.6	5.47	12.0
	135.4	914x305	271	306.7	461.4	18.42	29.97	19.0	25.0	5.12	12.1
	144.4	914x305	289	307.7	463.4	19.43	32.00	19.0	23.8	4.81	12.2
	156.3	914x305	313	309.4	466.0	21.08	34.54	19.0	22.1	4.48	12.4
305x508	111.0	1016x305	222	300.0	485.0	16.00	21.10	29.0	30.3	7.11	13.9
	124.0	1016x305	248	300.0	490.0	16.50	26.00	29.0	29.7	5.77	13.2
	136.0	1016x305	272	300.0	495.0	16.50	31.00	29.0	30.0	4.84	12.5
	157.0	1016x305	314	300.0	500.0	19.10	35.90	29.0	26.2	4.18	12.9
	175.0	1016x305	350	302.0	504.0	21.10	40.00	29.0	23.9	3.78	13.1
312x267	75.15	533x312	150	312.2	271.3	12.70	20.32	12.7	21.4	7.68	5.53
	82.59	533x312	165	313.4	273.2	13.97	22.22	12.7	19.6	7.05	5.66
	90.78	533x312	182	314.7	275.3	15.24	24.38	12.7	18.1	6.45	5.78
	98.22	533x312	196	316.0	277.2	16.51	26.29	12.7	16.8	6.01	5.91
	109.4	533x312	219	317.8	280.2	18.29	29.21	12.7	15.3	5.44	6.08
324x305	77.38	610x324	155	323.9	305.6	12.70	19.05	12.7	24.1	8.50	6.59
	87.06	610x324	174	325.1	308.1	13.97	21.59	12.7	22.1	7.53	6.65
	97.47	610x324	195	326.5	310.9	15.37	24.38	12.7	20.2	6.70	6.73
	108.6	610x324	217	327.7	314.2	16.51	27.69	12.7	19.0	5.92	6.75
	120.5	610x324	241	329.1	317.5	17.91	30.99	12.7	17.7	5.31	6.85
356x343	109.0	686x356	218	355.0	348.0	15.40	24.80	15.0	22.6	7.16	7.49
	120.0	686x356	240	356.0	350.0	16.80	27.40	15.0	20.8	6.50	7.59
	132.0	686x356	264	358.0	353.0	18.40	30.20	15.0	19.2	5.93	7.74
368x178	66.97	356x368	134	368.8	178.1	11.28	18.03	15.2	15.8	10.2	2.80
	73.66	356x368	147	370.0	179.8	12.32	19.81	15.2	14.6	9.34	2.89
	81.10	356x368	162	371.0	181.9	13.34	21.84	15.2	13.6	8.49	2.98
	89.29	356x368	179	372.6	183.9	14.99	23.88	15.2	12.3	7.80	3.14
	98.22	356x368	196	374.0	186.2	16.38	26.16	15.2	11.4	7.15	3.27

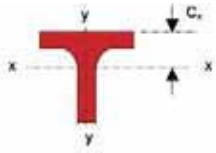


Imperial units

Designation Serial Size	Mass Per Metre	Second Moment Of Area		Radius Of Gyration		Elastic Modulus		Plastic Modulus		Buckling Parameter	Torsional Index	Torsional Constant	Sectional Area
		Axis x-x	Axis y-y	Axis x-x	Axis y-y	Axis x-x	Axis y-y	Axis x-x	Axis y-y	u	x	J	A
mm	kg/m	cm^4	cm^4	cm	cm	cm^3	cm^3	cm^3	cm^3			cm^4	cm^2
279x229	56.55	2987	3172	6.44	6.64	161	226	284	345	-	13.9	58.8	72.0
	64.00	3387	3647	6.45	6.69	182	259	323	396	-	12.4	85.0	81.5
	72.18	3902	4184	6.51	6.74	208	296	371	453	-	11.1	122	92.1
	78.87	4340	4589	6.57	6.76	231	323	414	495	-	10.3	155	100
	88.55	4938	5262	6.61	6.82	261	368	470	566	-	9.22	220	113
292x419	87.80	19410	3897	13.2	5.90	639	267	1163	419	0.675	23.3	110	112
	96.70	21260	4539	13.1	6.06	687	310	1239	486	0.659	20.8	153	124
	104.9	22890	5126	13.1	6.18	729	350	1307	547	0.647	19.0	201	134
	113.1	24560	5681	13.0	6.27	775	387	1385	604	0.639	17.5	256	144
305x152	48.40	858	3655	3.73	7.70	66.5	239	123	362	-	9.64	45.5	61.72
	53.57	965	4059	3.76	7.72	74.5	265	139	402	-	8.81	60.8	68.17
	58.90	1080	4530	3.79	7.77	82.9	295	156	447	-	8.09	80.3	75.09
	64.73	1205	5013	3.82	7.80	91.8	326	175	494	-	7.44	106	82.47
	68.50	1287	5351	3.84	7.83	97.8	346	188	525	-	7.09	124	87.20
	71.43	1330	5620	3.82	7.86	100	364	195	552	-	6.79	142	90.96
	79.00	1533	6285	3.90	7.90	115	404	225	614	-	6.25	188	101
	89.29	1807	7175	3.99	7.94	135	459	266	698	-	5.63	267	114
	101.2	2107	8282	4.04	8.02	155	526	311	802	-	5.06	384	129
	113.1	2434	9455	4.11	8.09	177	597	361	910	-	4.60	535	144
	126.5	2824	10770	4.18	8.17	202	674	419	1030	-	4.20	736	161
	141.4	3288	12260	4.27	8.25	232	762	488	1166	-	3.84	1010	180
305x305	74.60	7397	4655	8.82	7.00	306	305	538	468	0.483	16.4	99.8	95.0
	89.50	9026	5705	8.90	7.07	371	372	656	571	0.484	13.8	170	114
305x457	100.5	26340	4693	14.3	6.05	809	309	1477	487	0.688	23.5	145	128
	111.6	28940	5621	14.2	6.28	867	370	1565	580	0.666	20.7	210	143
	119.1	30670	6135	14.2	6.36	911	403	1639	631	0.659	19.3	257	152
	126.5	32610	6668	14.2	6.43	961	436	1727	685	0.654	18.1	312	161
	135.4	35080	7233	14.2	6.47	1031	472	1852	741	0.654	17.0	383	173
	144.4	37400	7800	14.3	6.51	1095	507	1965	798	0.652	16.0	460	184
	156.3	40900	8564	14.3	6.55	1195	554	2146	875	0.653	14.9	580	199
305x508	111.0	33450	4782	15.4	5.82	965	319	1778	504	0.701	23.1	191	141
	124.0	36990	5886	15.3	6.10	1033	392	1953	617	0.689	20.1	287	158
	136.0	39550	7011	15.1	6.36	1070	467	1921	729	0.648	17.6	412	173
	157.0	46440	8125	15.2	6.37	1252	542	2251	850	0.651	15.4	625	200
	175.0	52090	9239	15.3	6.45	1398	612	2512	964	0.651	14.0	851	222
312x267	75.15	5599	5158	7.64	7.33	259	330	457	505	0.320	13.9	108	96.0
	82.59	6221	5707	7.68	7.36	287	364	508	558	0.325	12.8	142	105
	90.78	6881	6341	7.71	7.40	316	403	562	618	0.322	11.7	186	116
	98.22	7532	6924	7.76	7.44	345	438	616	673	0.325	10.9	234	125
	109.4	8506	7827	7.81	7.49	388	493	695	759	0.326	9.92	320	139
324x305	77.38	7854	5400	8.92	7.39	328	333	576	511	0.469	16.8	98.0	98.8
	87.06	8815	6189	8.92	7.47	365	381	643	584	0.461	15.0	139	111
	97.47	9904	7081	8.93	7.55	407	434	719	667	0.455	13.4	197	124
	108.6	10970	8132	8.89	7.66	445	496	790	763	0.439	12.0	279	139
	120.5	12200	9220	8.90	7.74	490	560	874	862	0.431	10.8	384	154
356x343	109.0	14010	9258	10.0	8.17	513	522	904	801	0.475	14.8	227	139
	120.0	15430	10320	10.1	8.22	563	580	996	891	0.472	13.5	303	153
	132.0	17180	11570	10.1	8.29	624	646	1106	995	0.471	12.3	404	168
368x178	66.97	1530	7540	4.23	9.39	102	409	190	618	-	9.63	84.6	85.5
	73.66	1701	8366	4.25	9.43	113	452	212	684	-	8.83	111	94.0
	81.10	1887	9299	4.27	9.48	124	501	236	759	-	8.09	148	103
	89.29	2152	10300	4.35	9.51	141	553	271	838	-	7.45	195	114
	98.22	2408	11410	4.39	9.55	157	610	305	926	-	6.86	255	125

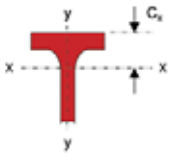
Structural Tees





Imperial units

Designation Serial Size Bxd	Mass Per Metre	Cut from Serial Size	Mass Per Metre	Width Of Section B	Depth Of Section d	Thickness Web t	Thickness Flange T	Root Radius r	Ratios For Local Buckling d/t	Ratios For Local Buckling b/T	Dimension C_x
mm	kg/m		kg/m	mm	mm	mm	mm	mm			cm
381x381	129.0	762x381	258	381.0	387.0	16.60	27.10	17.0	23.3	7.03	8.41
	142.0	762x381	284	382.0	390.0	18.00	30.10	17.0	21.7	6.35	8.50
	157.0	762x381	314	384.0	393.0	19.70	33.40	17.0	19.9	5.75	8.63
400x419	150.0	838x400	300	400.0	428.0	18.20	29.20	18.0	23.5	6.85	9.62
	165.0	838x400	330	401.0	431.0	19.70	32.40	18.0	21.9	6.19	9.70
	179.0	838x400	358	403.0	434.0	21.10	35.60	18.0	20.6	5.66	9.76
406x178	107.9	356x406	216	393.7	187.7	17.27	27.69	15.2	10.9	7.11	3.28
	118.3	356x406	237	395.4	190.2	18.92	30.23	15.2	10.1	6.54	3.43
	131.0	356x406	262	397.5	193.3	21.08	33.27	15.2	9.17	5.97	3.63
	143.6	356x406	287	399.0	188.7	22.61	36.58	15.2	8.35	5.45	3.63
	157.0	356x406	314	401.3	199.6	24.89	39.62	15.2	8.02	5.06	3.98
	173.4	356x406	347	403.6	203.7	27.18	43.69	15.2	7.49	4.62	4.20
	191.2	356x406	382	406.3	208.0	29.84	48.01	15.2	6.97	4.23	4.45
	211.0	356x406	422	409.0	213.0	32.80	52.60	15.0	6.49	3.89	4.73
	232.0	356x406	464	412.0	217.0	35.80	57.40	15.0	6.06	3.59	4.98
	255.0	356x406	510	416.0	223.0	39.10	62.70	15.0	5.70	3.32	5.30
	276.0	356x406	552	418.0	228.0	42.00	67.60	15.0	5.43	3.09	5.58
	296.0	356x406	592	421.0	232.0	45.00	72.30	15.0	5.16	2.91	5.84
	317.0	356x406	634	424.0	237.0	47.60	77.10	15.0	4.98	2.75	6.10
	339.0	356x406	678	428.0	242.0	51.20	81.50	15.0	4.73	2.63	6.39
	372.0	356x406	744	432.0	249.0	55.60	88.90	15.0	4.48	2.43	6.79
406x508	129.0	1016x406	258	400.0	485.0	16.50	21.10	29.0	29.4	9.48	12.4
	148.0	1016x406	296	400.0	491.0	16.50	27.10	29.0	29.8	7.38	11.4
	160.0	1016x406	320	400.0	495.0	16.50	31.00	29.0	30.0	6.45	10.9
	186.0	1016x406	372	400.0	500.0	19.10	36.10	29.0	26.2	5.54	11.2
	206.0	1016x406	412	402.0	504.0	21.10	40.00	29.0	23.9	5.03	11.4
419x457	171.0	914x419	342	418.0	456.0	19.30	32.00	24.0	23.6	6.53	10.2
	182.0	914x419	364	419.0	458.0	20.30	34.30	24.0	22.6	6.11	10.2
	194.0	914x419	388	420.0	461.0	21.30	36.60	24.0	21.6	5.74	10.3
	209.0	914x419	418	422.0	464.0	22.50	39.90	24.0	20.6	5.29	10.3
	224.0	914x419	448	423.0	467.0	24.00	42.70	24.0	19.5	4.95	10.5
457x508	143.0	1016x457	286	450.0	485.0	18.00	21.10	29.0	26.9	10.7	12.2
	164.0	1016x457	328	450.0	491.0	18.00	27.10	29.0	27.3	8.30	11.2
	182.0	1016x457	364	450.0	496.0	18.00	32.00	29.0	27.6	7.03	10.6
	199.0	1016x457	398	451.0	500.0	19.10	35.90	29.0	26.2	6.28	10.5
	222.0	1016x457	444	453.0	504.0	21.10	40.00	29.0	23.9	5.66	10.8
	244.0	1016x457	488	455.0	508.0	23.10	43.90	29.0	22.0	5.18	11.0



Imperial units

Designation Serial Size	Mass Per Metre	Second Moment Of Area		Radius Of Gyration		Elastic Modulus		Plastic Modulus		Buckling Parameter	Torsional Index	Torsional Constant	Sectional Area
		Axis x-x	Axis y-y	Axis x-x	Axis y-y	Axis x-x	Axis y-y	Axis x-x	Axis y-y	u	x	J	A
mm	kg/m	cm^4	cm^4	cm	cm	cm^3	cm^3	cm^3	cm^3			cm^4	cm^2
381x381	129.0	20680	12510	11.2	8.73	683	657	1204	1008	0.497	15.2	319	164
	142.0	22840	14000	11.2	8.80	749	733	1324	1127	0.493	13.8	429	181
	157.0	25380	15790	11.3	8.88	827	822	1468	1266	0.489	12.5	581	200
400x419	150.0	30210	15600	12.6	9.04	910	780	1607	1201	0.532	15.6	427	191
	165.0	33240	17440	12.6	9.12	995	870	1760	1341	0.528	14.2	572	210
	179.0	36230	19450	12.6	9.22	1077	965	1910	1490	0.522	13.0	747	229
406x178	107.9	2602	14090	4.35	10.1	168	716	331	1085	-	6.51	315	138
	118.3	2922	15580	4.40	10.2	187	788	374	1196	-	6.01	410	151
	131.0	3353	17430	4.48	10.2	214	877	430	1332	-	5.52	548	167
	143.6	3305	19380	4.27	10.3	217	971	452	1475	-	4.85	719	181
	157.0	4230	21360	4.60	10.3	265	1065	547	1620	-	4.73	923	200
	173.4	4828	23970	4.68	10.4	299	1188	626	1809	-	4.36	1233	221
	191.2	5542	26870	4.77	10.5	339	1323	719	2017	-	4.02	1638	244
	211.0	6419	30040	4.89	10.6	387	1469	829	2243	-	3.73	2157	269
	232.0	7280	33520	4.97	10.7	436	1627	942	2487	-	3.45	2806	295
	255.0	8480	37700	5.11	10.8	499	1813	1087	2774	-	3.22	3671	324
	276.0	9591	41250	5.23	10.8	557	1974	1221	3024	-	3.04	4593	351
	296.0	10680	45090	5.32	10.9	615	2142	1356	3284	-	2.87	5633	377
	317.0	11910	49130	5.43	11.0	677	2317	1501	3556	-	2.73	6825	404
	339.0	13430	53440	5.58	11.1	754	2497	1669	3838	-	2.62	8154	432
	372.0	15630	59970	5.74	11.2	863	2776	1920	4271	-	2.45	10580	474
406x508	129.0	37390	11290	15.1	8.28	1035	564	1867	876	0.632	22.7	230	165
	148.0	40850	14490	14.7	8.77	1082	724	1920	1116	0.585	19.1	377	189
	160.0	42850	16570	14.5	9.01	1109	828	1959	1272	0.560	17.1	512	204
	186.0	50380	19300	14.6	9.03	1299	965	2301	1486	0.563	14.9	790	237
	206.0	56440	21710	14.7	9.10	1449	1080	2573	1668	0.564	13.6	1064	262
419x457	171.0	38770	19510	13.3	9.46	1095	934	1936	1437	0.533	15.1	592	218
	182.0	41230	21070	13.3	9.53	1159	1006	2052	1549	0.529	14.2	718	232
	194.0	43990	22640	13.4	9.58	1229	1078	2179	1662	0.527	13.4	861	247
	209.0	47320	25040	13.3	9.70	1312	1187	2331	1830	0.520	12.4	1094	266
	224.0	51060	26990	13.4	9.73	1411	1276	2513	1971	0.521	11.7	1334	285
457x508	143.0	41160	16070	15.0	9.39	1134	714	2039	1106	0.607	22.1	269	182
	164.0	44940	20620	14.7	9.93	1186	916	2098	1410	0.556	18.7	435	209
	182.0	47640	24340	14.4	10.3	1221	1082	2152	1658	0.521	16.4	632	231
	199.0	51900	27490	14.3	10.4	1316	1219	2323	1868	0.510	14.8	858	254
	222.0	58190	31040	14.3	10.5	1468	1371	2601	2104	0.510	13.4	1173	283
	244.0	64590	34530	14.4	10.5	1623	1518	2885	2334	0.511	12.4	1540	311

Bearing Piles

General

The section sizes of bearing piles are given in the tables on the following pages. Bearing piles are different from universal beams and columns because the flange and the web thickness are approximately equal and the height and the width are almost the same.

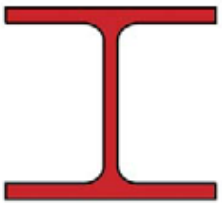


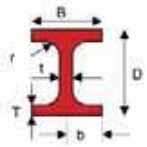
Figure 6 – Bearing Piles: Section shape

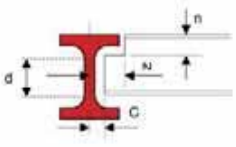
The standard specifications used for production of bearing piles in this region are listed in this table.

Material	Yield strength N/mm²			Tensile strength N/mm²	Min. Elongation $L_0=5.65\sqrt{S_0}$	Min. Charpy V-notch. Temp. 20°C	Dimensions & Tolerances
AS 3679.1 (1996)	**≤12mm**	**12-40**	**≥40mm**				
Grade 250	260	250	230	min. 410	22 %	27J	***AS 3679.1 (1996)***
Grade 300	300	300	300	min. 430	22 %	27J	
Grade 350	360	340	330	min. 480	20 %	27J	
ASTM A36 (2001)	min. 250			400-550	20-21 %	-	
ASTM A572 (2001)							
Grade 42	min. 290			min. 415	20~24 %	-	
Grade 50	min. 345			min. 450	18-21 %	-	***ASTM A6 (1997)***
Grade 60	min. 415			min. 520	16-18 %	-	
Grade 65	min. 450			min. 550	15-17 %	-	
ASTM A913 (2001)							
Grade 50	min. 345			min. 450	18-21 %	-	
Grade 65	min. 450			min. 550	15-17 %	-	
BS 4360 (1986) **(superseded)**							***BS 4 Part 1 (1993) (superseded)***
Grade 43A	min. 275			430-580	22 %	-	
Grade 50B	min. 355			490-640	20 %	27J	
EN 10025 (2004)	**≤16mm**	**16-40**	**≥40mm**	**3-100mm**		**10<t≤150mm**	
S275JR	275	265	255	410-560	17-22 %	27J	***EN 10034 (1993)***
S355JR	355	345	335	490-630	17-22 %	27J	
S420N	420	400	390	500-660	19 %	27J	
S460N	460	440	430	530-720	17 %	27J	
JIS 3101 (1995)	**≤16mm**	**16-40**	**≥40mm**	**t<100mm**			
SS400	245	235	215	400-510	17-24 %	-	
SS490	285	275	255	490-610	15-21 %	-	
SS540	400	390	-	min 540	13-17 %	-	
JIS 3106 (1995)	**≤16mm**	**16-40**	**≥40mm**	**t<100mm**			***JIS 3192 (1994)***
SM400A, B	245	235	215	400-510	18-24 %	-	
SM490A, B	325	315	295	490-610	17-23 %	-	
SM490YA, YB	365	355	335	490-610	15-21 %	-	
SM520B	365	355	335	520-640	15-21 %	-	

Table 12 – Bearing Piles: Standard specifications

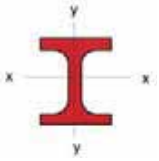
Bearing Piles





Metric units

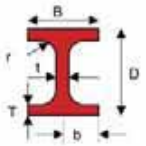
Designation Size DxD	Mass Per Metre	Depth Of Section	Width Of Section	Thickness Flange	Thickness Web	Root Radius	Depth Between Fillet	Area Of Section	Ratios For Local Buckling Flange	Ratios For Local Buckling Web	Dimensions For Detailing End Clearance	Dimensions For Detailing Notch	
		D	B	T	t	r	d	A	b/T	d/t	C	N	n
mm	kg/m	mm	mm	mm	mm	mm	mm	cm^2			mm	mm	mm
200x200	56.2	200	204	12	12	13	150	71.5	8.50	12.5	8	106	25
250x250	63.8	244	252	11	11	13	196	81.3	11.5	17.8	8	131	24
	64.4	244	252	11	11	16	190	82.1	11.5	17.3	8	131	27
	82.2	250	255	14	14	16	190	105	9.11	13.6	9	131	30
300x300	83.4	294	302	12	12	13	244	106	12.6	20.3	8	155	25
	84.5	294	302	12	12	18	234	108	12.6	19.5	8	155	30
	106	300	305	15	15	18	234	135	10.2	15.6	10	155	33
	142	310	310	20	20	18	234	181	7.75	11.7	12	155	38
350x350	105	338	351	13	13	13	286	133	13.5	22.0	9	179	26
	106	338	351	13	13	20	272	135	13.5	20.9	9	179	33
	129	344	354	16	16	13	286	165	11.1	17.9	10	179	29
	131	344	354	16	16	20	272	167	11.1	17.0	10	179	36
	154	350	357	19	19	13	286	196	9.39	15.1	12	179	32
	156	350	357	19	19	20	272	198	9.39	14.3	12	179	39
400x400	140	388	402	15	15	22	314	178	13.4	20.9	10	204	37
	168	394	405	18	18	22	314	214	11.3	17.4	11	204	40
	197	400	408	21	21	22	314	251	9.71	15.0	13	204	43
	235	408	412	25	25	22	314	300	8.24	12.6	15	204	47

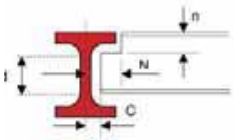


Metric units

Designation Size	Mass Per Metre	Surface Area Per Metre	Second Moment Of Area		Radius Of Gyration		Elastic Modulus		Plastic Modulus		Buckling Parameter	Torsional Index	Warping Constant	Torsional Constant
			Axis x-x	Axis y-y	Axis x-x	Axis y-y	Axis x-x	Axis y-y	Axis x-x	Axis y-y	u	x	H	J
mm	kg/m	m^2	cm^4	cm^4	cm	cm	cm^3	cm^3	cm^3	cm^3			dm^6	cm^4
200x200	56.2	1.17	4983	1702	8.35	4.88	498	167	565	257	0.826	14.3	0.150	39.6
250x250	63.8	1.45	8703	2938	10.3	6.01	713	233	797	357	0.828	19.5	0.399	37.1
	64.5	1.45	8787	2939	10.3	5.98	720	233	805	358	0.829	19.0	0.399	39.5
	82.2	1.46	11480	3877	10.5	6.09	919	304	1039	468	0.827	15.4	0.540	79.0
300x300	83.4	1.75	16640	5514	12.5	7.20	1132	365	1260	558	0.829	21.9	1.10	56.3
	84.5	1.74	16870	5517	12.5	7.16	1147	365	1277	560	0.831	21.1	1.10	61.4
	106	1.76	21540	7106	12.6	7.26	1436	466	1614	716	0.829	17.4	1.44	116
	142	1.79	29870	9955	12.9	7.42	1927	642	2199	992	0.828	13.4	2.09	271
350x350	105	2.03	27740	9377	14.4	8.39	1642	534	1822	815	0.827	23.5	2.48	81.4
	106	2.02	28190	9381	14.4	8.33	1668	535	1851	818	0.829	22.5	2.48	90.3
	129	2.05	34880	11840	14.6	8.48	2028	669	2269	1024	0.826	19.4	3.19	151
	131	2.04	35330	11850	14.6	8.43	2054	669	2299	1027	0.828	18.7	3.19	164
	154	2.07	42350	14430	14.7	8.57	2420	808	2730	1241	0.826	16.5	3.95	252
	156	2.06	42800	14430	14.7	8.53	2446	809	2760	1244	0.827	16.1	3.95	270
400x400	140	2.32	48970	16260	16.6	9.55	2524	809	2802	1237	0.830	22.5	5.66	156
	168	2.33	59720	19960	16.7	9.65	3031	986	3390	1511	0.828	19.2	7.05	264
	197	2.35	70890	23810	16.8	9.75	3545	1167	3992	1794	0.828	16.7	8.55	415
	235	2.38	86470	29200	17.0	9.87	4239	1418	4818	2185	0.827	14.2	10.7	694

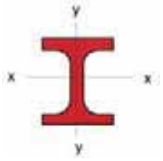
Bearing Piles





Imperial units

Designation Size	Mass Per Metre		Depth Of Section	Width Of Section	Thickness Flange	Thickness Web	Root Radius	Depth Between Fillet	Area Of Section	Ratios For Local Buckling Flange	Ratios For Local Buckling Web	Dimensions For Detailing End Clearance	Dimensions For Detailing Notch	
DxB			D	B	T	t	r	d	A	b/T	d/t	C	N	n
in (mm)	lb/ft	kg/m	mm	mm	mm	mm	mm	mm	cm^2			mm	mm	mm
8x8	30	44.9	200.2	205.9	9.5	9.5	10.2	160.8	57.2	10.8	16.9	7	108	20
(203x203)	36	53.9	204.0	207.7	11.4	11.3	10.2	160.8	68.7	9.11	14.2	8	108	22
10x10	42	63.0	247.1	256.6	10.7	10.6	12.7	200.3	80.2	12.0	18.9	7	133	23
(254x254)	48	71.0	249.7	258.0	12	12	12.7	200.3	90.4	10.8	16.7	8	133	25
	57	85.1	254.3	260.4	14.3	14.4	12.7	200.3	108	9.10	13.9	9	133	27
12x12	53	78.9	299.3	306.4	11.1	11	15.2	246.7	100	13.8	22.4	8	158	26
(305x305)	59	88.0	301.7	307.8	12.3	12.4	15.2	246.7	112	12.5	19.9	8	158	28
	63	93.0	303.3	308.0	13.1	13.1	15.2	246.7	119	11.8	18.8	9	157	28
	64	94.9	303.7	308.7	13.3	13.3	15.2	246.7	121	11.6	18.5	9	158	29
	74	110.0	307.9	310.7	15.4	15.3	15.2	246.7	140	10.1	16.1	10	158	31
	84	125.0	311.9	312.3	17.4	17.4	15.2	246.7	159	8.97	14.2	11	157	33
	85	126.1	312.3	312.9	17.6	17.5	15.2	246.7	161	8.89	14.1	11	158	33
	100	149.1	318.5	316.0	20.7	20.6	15.2	246.7	190	7.63	12.0	12	158	36
	121	180.0	326.7	319.7	24.8	24.8	15.2	246.7	229	6.45	9.95	14	157	40
	125	186.0	328.3	320.9	25.6	25.5	15.2	246.7	237	6.27	9.67	15	158	41
	149	222.9	337.9	325.7	30.4	30.3	15.2	246.7	284	5.36	8.14	17	158	46
13x13	60	89.3	318.5	327.7	11.68	11.68	15.2	264.7	113	14.0	22.7	8	168	27
(330x330)	73	108.6	323.8	330.3	14.35	14.35	15.2	264.7	139	11.5	18.4	9	168	30
	87	129.5	328.9	332.9	16.89	16.89	15.2	264.7	164	9.85	15.7	10	168	32
	100	148.8	334.0	335.4	19.43	19.43	15.2	264.7	190	8.63	13.6	12	168	35
14x14 1/2	73	108.9	346.4	371.0	12.9	12.8	15.2	290.2	139	14.4	22.7	8	189	28
(356x368)	89	133.0	352.0	373.8	15.7	15.6	15.2	290.2	169	11.9	18.6	10	189	31
	102	152.0	356.4	376.0	17.9	17.8	15.2	290.2	194	10.5	16.3	11	189	33
	117	173.9	361.4	378.5	20.4	20.3	15.2	290.2	221	9.28	14.3	12	189	36
	121	180.0	362.9	378.8	21.1	21.1	15.2	290.3	230	8.98	13.8	13	189	36



Imperial units

Designation Size	Mass Per Metre		Surface Area Per metre	Second Moment Of Area		Radius Of Gyration		Elastic Modulus		Plastic Modulus		Buckling Parameter	Torsional Index	Warping Constant	Torsional Constant
				Axis x-x	Axis y-y	Axis x-x	Axis y-y	Axis x-x	Axis y-y	Axis x-x	Axis y-y	u	x	H	J
in (mm)	lb/ft	kg/m	m^2	cm^4	cm^4	cm	cm	cm^3	cm^3	cm^3	cm^3			dm^6	cm^4
8x8	30	44.9	1.19	4100	1384	8.46	4.92	410	134	459	206	0.827	18.6	0.126	19.2
(203x203)	36	53.9	1.20	5027	1705	8.55	4.98	493	164	557	252	0.827	15.8	0.158	32.7
10x10	42	63.0	1.48	8861	3016	10.5	6.13	717	235	799	360	0.827	20.5	0.421	34.3
(254x254)	48	71.0	1.49	10070	3439	10.6	6.17	807	267	904	409	0.826	18.4	0.486	48.4
	57	85.1	1.50	12290	4216	10.6	6.24	966	324	1092	498	0.825	15.6	0.607	81.8
12x12	53	78.9	1.78	16450	5327	12.8	7.28	1099	348	1218	531	0.832	23.9	1.11	46.9
(305x305)	59	88.0	1.78	18430	5985	12.8	7.31	1221	389	1360	595	0.830	21.6	1.25	64.2
	63	93.0	1.79	19690	6387	12.9	7.33	1298	415	1449	635	0.831	20.5	1.34	76.4
	64	94.9	1.79	20050	6529	12.9	7.35	1320	423	1474	648	0.830	20.2	1.38	80.0
	74	110.0	1.80	23560	7710	13.0	7.42	1531	496	1720	762	0.830	17.7	1.65	122
	84	125.0	1.81	27040	8849	13.0	7.46	1734	567	1961	872	0.829	15.8	1.92	177
	85	126.1	1.82	27410	9002	13.1	7.49	1755	575	1986	885	0.829	15.7	1.95	182
	100	149.1	1.83	33070	10910	13.2	7.58	2076	691	2370	1066	0.828	13.5	2.42	295
	121	180.0	1.86	40970	13550	13.4	7.69	2508	847	2897	1313	0.827	11.5	3.09	510
	125	186.0	1.86	42610	14140	13.4	7.73	2596	881	3003	1366	0.827	11.1	3.24	560
	149	222.9	1.89	52700	17580	13.6	7.87	3119	1079	3653	1680	0.826	9.55	4.16	943
13x13	60	89.3	1.90	20940	6857	13.6	7.79	1315	418	1457	639	0.830	24.3	1.61	57.9
(330x330)	73	108.6	1.91	26200	8628	13.7	7.88	1618	522	1808	800	0.829	20.1	2.07	106
	87	129.5	1.93	31430	10400	13.8	7.96	1911	625	2151	959	0.828	17.3	2.53	171
	100	148.8	1.94	36860	12240	13.9	8.03	2207	730	2502	1123	0.828	15.2	3.03	260
14x14 1/2	73	108.9	2.13	30630	10990	14.9	8.90	1769	592	1956	903	0.823	24.2	3.06	84.6
(356x368)	89	133.0	2.14	37980	13680	15.0	8.99	2158	732	2406	1119	0.822	20.1	3.87	151
	102	152.0	2.16	43970	15880	15.1	9.05	2468	845	2767	1293	0.821	17.8	4.55	223
	117	173.9	2.17	51010	18460	15.2	9.13	2823	976	3186	1497	0.821	15.8	5.37	330
	121	180.0	2.17	53040	19140	15.2	9.13	2923	1011	3306	1552	0.821	15.3	5.59	367

Hot Finished Ellipcon Sections

General

Hot finished ellipcon sections are new and exciting section types. They come in two shapes, one is an ellipse (ellipcon sections) and the other is half of an ellipse with one flat side (semi ellipcon sections). Both shapes give the structures very outstanding architectural looks, and the sections have many structural advantages.

The new elliptical sections are good alternatives to traditional section types. They have all the properties of the hot finished structural tubes, which are already used in many construction works. In addition, the architects are given full vent to expressing the structure in creative and exciting architecture, and end up with something both practical and aesthetic.

For structures with limited space these new sections might provide smaller column footprints than other design solutions, increasing the open floor area. Their special shapes both serve the structural purpose and give continuity in the structure. For non-symmetric load situations the sections might be more cost efficient than circular or square hollow sections, because the designer can choose sections with different stiffness about the two axis, x and y.

As for other hollow sections such as square, rectangular and circular, the ellipcon sections have constant external dimension within the same serial size, only the thickness is increasing. In other words, the same column size can be maintained throughout the full height of the building, simplifying architectural details and ensuring economy in fabrication (See “Hot Finished Hollow Sections”).

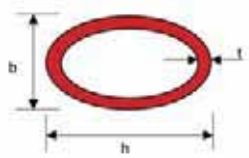
The tubes are produced according to EN 10210 Part 1 (1994): Technical delivery requirements for Hot finished hollow sections, and Part 2 (1997): Tolerances, dimensions and sectional properties. A few points are not included in EN 10210:

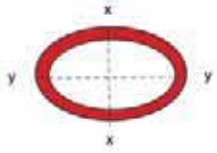
- The tolerance on the twist = 4mm +1mm/m length
- The tolerance on the straightness = 0.40% of total length
- Section properties for the hot ellipcon sections are not included in EN 10210.

The mechanical properties of the hollow sections, calculations of torsional inertia constants and torsional modulus constants are according to standards ISO/DIS 657-XIV.

Architect: S. Gresy

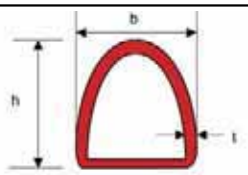
Ellipcon

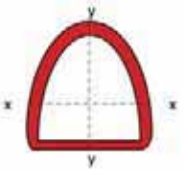




Designation Size	Thickness	Mass Per Metre	Area Of Section	Second Moment Of Inertia		Radius Of Gyration		Elastic Modulus		Plastic Modulus		Torsional Constant		Surface Area Per Metre
h x b	t		A	I_x	I_y	r_x	r_y	Z_x	Z_y	S_x	S_y	J	C	
mm	mm	kg/m	cm^2	cm^4	cm^4	cm	cm	cm^3	cm^3	cm^3	cm^3	cm^4	cm^3	m^2/m
117x60	3.2	6.92	8.58	116	40.5	3.67	2.17	19.8	13.5	27.6	17.2	120	30.0	0.298
	4	8.57	10.6	141	48.8	3.65	2.14	24.1	16.3	33.9	21.1	145	36.0	0.298
	5	10.60	13.1	171	58.4	3.61	2.11	29.2	19.5	41.5	25.6	175	42.7	0.298
	6	12.60	15.6	199	67.1	3.58	2.08	34.0	22.4	48.7	29.9	201	48.7	0.298
	8	16.40	20.2	249	81.8	3.51	2.01	42.6	27.3	62.1	37.6	248	58.8	0.298
149x70	4	10.80	13.3	284	85.9	4.62	2.55	38.1	24.5	53.6	31.3	264	55.3	0.367
	5	13.30	16.4	346	103	4.59	2.51	46.4	29.6	65.8	38.3	319	66.2	0.367
	6	15.90	19.5	405	120	4.55	2.48	54.3	34.2	77.6	44.9	370	76.1	0.367
	8	20.80	25.5	513	148	4.48	2.41	68.9	42.3	99.8	57.0	461	93.2	0.367
	10	25.50	31.3	610	172	4.42	2.34	81.8	49.1	120	67.9	539	107	0.367
178x90	6	19.50	24.1	740	250	5.54	3.22	83.2	55.6	117	72.0	749	123	0.451
	8	25.60	31.7	947	315	5.47	3.15	106	69.9	152	92.4	947	154	0.451
	10	31.50	39.0	1136	371	5.40	3.09	128	82.4	184	111	1123	179	0.451
220x106	6	24.00	29.6	1388	438	6.85	3.85	126	82.7	177	106	1334	185	0.546
	8	31.60	39.0	1790	556	6.78	3.78	163	105	231	137	1701	234	0.546
	10	39.00	48.1	2163	662	6.71	3.71	197	125	282	165	2033	276	0.546
248x109	6	26.60	32.5	1903	519	7.65	4.00	153	95.3	217	121	1635	217	0.596
	8	35.00	42.9	2461	661	7.58	3.93	198	121	283	157	2088	274	0.596
	10	43.30	52.9	2983	788	7.51	3.86	241	145	346	190	2501	324	0.596
	12	51.40	62.8	3472	901	7.44	3.79	280	165	406	221	2874	369	0.596
320x160	8	47.10	58.3	5877	1978	10.0	5.82	367	247	513	315	5928	553	0.807
	10	58.40	72.3	7181	2393	9.97	5.75	449	299	631	385	7192	665	0.807
	12	69.60	86.0	8422	2779	9.90	5.69	526	347	745	453	8375	769	0.807
	14	80.50	99.4	9604	3137	9.83	5.62	600	392	855	517	9483	863	0.807
400x200	8	59.30	73.4	11690	3966	12.6	7.35	584	397	811	500	11860	890	1.01
	10	73.60	91.1	14350	4829	12.5	7.28	717	483	1001	615	14470	1079	1.01
	12	87.80	109	16910	5646	12.5	7.21	845	565	1186	726	16960	1257	1.01
	14	102.00	126	19370	6416	12.4	7.14	968	642	1366	832	19320	1422	1.01
480x240	10	88.90	110	25170	8529	15.1	8.81	1049	711	1457	897	25510	1594	1.21
	12	106.00	131	29750	10014	15.1	8.74	1240	835	1730	1062	30010	1865	1.21
	14	123.00	152	34190	11432	15.0	8.67	1425	953	1997	1222	34320	2122	1.21

Semi Ellipcon





Designation Size	Thickness	Mass Per Metre	Area Of Section	Second Moment Of Inertia		Radius Of Gyration		Elastic Modulus		Plastic Modulus		Torsional Constant		Surface Area Per Metre
h x b	t		A	I_x	I_y	r_x	r_y	Z_x	Z_y	S_x	S_y	J	C	
mm	mm	kg/m	cm^2	cm^4	cm^4	cm	cm	cm^3	cm^3	cm^3	cm^3	cm^4	cm^3	m^2/m
60x60	3.5	5.15	6.56	29.9	26.9	2.14	2.03	8.57	8.97	12.9	12.0	48.5	15.9	39.0
	4	5.82	7.41	33.2	30.0	2.12	2.01	9.56	9.99	14.1	13.5	54.5	17.7	34.4
	5	7.12	9.07	39.2	35.5	2.08	1.98	11.4	11.8	16.2	16.2	65.7	20.8	28.0
	6	8.35	10.6	44.3	40.3	2.04	1.95	13.0	13.4	17.9	18.7	75.9	23.5	23.7
75x75	4	7.40	9.43	68.0	61.1	2.69	2.54	15.5	16.3	23.6	21.7	109	29.0	34.0
	5	9.09	11.6	81.1	73.1	2.65	2.51	18.7	19.5	27.6	26.3	133	34.5	27.5
	6	10.70	13.7	92.9	84.1	2.61	2.48	21.6	22.4	31.0	30.6	155	39.4	23.2
	8	13.80	17.6	113	103	2.53	2.42	26.6	27.4	35.9	38.3	195	47.7	17.9
90x90	4	8.98	11.4	121	109	3.25	3.08	22.9	24.1	35.4	31.9	193	43.1	33.7
	5	11.10	14.1	146	131	3.21	3.05	27.8	29.1	42.0	38.8	235	51.8	27.2
	6	13.10	16.7	168	152	3.18	3.02	32.3	33.7	47.7	45.4	276	59.6	22.9
	8	17.00	21.6	207	188	3.10	2.95	40.4	41.8	56.8	57.5	350	73.3	17.6
110x110	4	11.10	14.1	227	203	4.01	3.79	35.0	36.9	54.9	48.4	358	66.4	33.5
	5	13.70	17.5	275	247	3.97	3.76	42.7	44.9	65.8	59.3	439	80.3	27.0
	6	16.30	20.7	320	288	3.93	3.73	49.9	52.3	75.7	69.8	517	93.1	22.7
	8	21.20	27.0	401	362	3.86	3.66	63.2	65.8	92.2	89.2	663	116	17.3
125x125	5	15.70	20.0	412	369	4.54	4.30	55.9	59.0	87.2	77.6	651	106	26.9
	6	18.60	23.0	481	431	4.50	4.26	65.6	69.0	101	91.4	769	123	22.5
	8	24.30	31.0	607	546	4.42	4.20	83.6	87.4	124	118	991	155	17.2
	10	29.80	38.0	717	649	4.35	4.13	99.9	104	143	142	1197	183	13.9
160x160	5	20.30	25.8	890	794	5.87	5.54	93.9	99.3	149	130	1390	179	26.7
	6	24.20	30.8	1045	935	5.83	5.51	111	117	173	153	1647	210	22.3
	8	31.70	40.4	1335	1198	5.75	5.45	143	150	218	199	2140	267	16.9
	10	39.00	49.7	1598	1439	5.67	5.38	172	180	257	242	2606	319	13.7
180x180	6	27.30	34.8	1509	1348	6.59	6.22	142	150	224	196	2365	270	22.3
	8	35.90	45.8	1938	1736	6.51	6.16	183	193	283	255	3083	345	16.9
	10	44.30	56.4	2331	2095	6.43	6.09	222	233	336	311	3765	414	13.6
	12	52.40	66.7	2692	2427	6.35	6.03	258	270	382	363	4413	477	11.5
203x223	6	32.60	41.5	2354	2448	7.53	7.68	196	220	299	287	3981	385	22.0
	8	42.90	54.7	3037	3170	7.45	7.61	254	284	379	375	5220	497	16.7
	10	53.00	67.5	3671	3849	7.37	7.55	310	345	449	459	6413	600	13.4
	12	62.80	80.0	4258	4484	7.29	7.48	362	402	511	539	7559	697	11.3
225x259	6	37.20	47.4	3359	3759	8.41	8.90	251	290	383	380	5845	502	21.9
	8	49.10	62.6	4350	4888	8.34	8.84	327	377	487	497	7683	650	16.6
	10	60.80	77.4	5279	5957	8.26	8.77	400	460	582	611	9462	789	13.4
	12	72.10	91.9	6148	6968	8.18	8.71	469	538	666	719	11180	919	11.2

Hot Finished Hollow Sections

General

Structural hollow sections make beautiful, efficient structures with a nice continuity.
The hot finished hollow sections - square, rectangular and circular, have constant external dimension within the same serial size, and only the thickness is increasing. In other words, the same column size can be maintained throughout the full height of the building, only changing the thickness, simplifying architectural details and ensuring economy in fabrication.
When used in compression, as columns, hollow sections are more efficient than other column types. The resulting reduction in structural weight can be as much as 1 storey for every 9 storeys built.
Due to their high sectional properties hollow sections provide smaller column footprints than other design solutions, with increased floor area.
Added together these qualities give an efficient and economic structure.

It has long been the opinion among structural people that for low-rise buildings only concrete will be economical, but with multi-storey hollow sections steel structures can compete with concrete. Steel might be more expensive per metric ton, but with the fabrication and erection time, a lighter structure, labour cost, and easy maintenance taken into account, a steel structure might give the most economic design.

Comparable specifications

Specification	Grade	Min. Yield strength N/mm^2	Tensile strength N/mm^2	Charpy V-Notch Impact Joules	°C
JIS G 3444 (1994)	STK400	235	min. 400	-	-
ASTM A501 (1996)	Shapes	250	min. 400	-	-
BS 4360 (1986)	43C	275	430-580	27	0
EN 10210 (1994)	S275J0H	275	430-580	27	0
BS 4360 (1986)	43D	275	430-580	27	-20
EN 10210 (1994)	S275J2H	275	430-580	27	-20
BS 4360 (1986)	43EE	275	430-580	27	-50
ASTM A618 (1996)	Grade I & II	345	min. 485	-	-
JIS G 3444 (1994)	STK500	355	min. 500	-	-
BS 4360 (1986)	50C	355	490-640	27	0
EN 10210 (1994)	S355J0H	355	510-680	27	0
BS 4360 (1986)	50D	355	490-640	27	-20
EN 10210 (1994)	S355J2H	355	510-680	27	-20
BS 4360 (1986)	50EE	355	490-640	27	-50
NORSEC 360 (1991)	Eqv. 50EE	360	490-630	100	-20
				50	-60
JIS G 3444 (1994)	STK540	390	min. 540	-	-
BS 4360 (1986)	55C	450	550-700	27	0

Note: The values are for sections of thickness less than 16mm for BS 4360 and less than 3mm for EN 10025.
BS 4360 (1986): an old, but well known British Standard for weldable structural steels.
EN 10210-1 (1994): European Norms superseding parts of the old BS 4360, see Explanatory notes.
ASTM A501 (1996): standard from American Society for Testing of Materials for hot formed welded and seamless carbon steels structural tubing.
ASTM A618 (1996): standard from American Society for Testing of Materials for Hot-Formed welded and seamless high-strength low-alloy structural tubing.
JIS G 3444 (1994): Japanese Industrial Standard for Carbon steel tubes for general structural purposes.
NORSEC 360 (1991): a steel product from British Steel for marine structures in the arctic regions.

Table 13 – Hot Finished Hollow Sections: Comparable specifications

Product specifications

Production of hot finished Structural Hollow Sections has been standardised in EN 10210:1994: "Hot finished structural hollow sections of non-alloy and fine grain structural steels" Part 1, Grades S235, S275, S355, but other grades and sub-grades can be supplied, subject to minimum order quantities**. Our ex-stock material is mainly of grade S355J2H.** Dimensions, tolerances and sectional properties meet the requirements of EN 10210:1997: "Hot finished structural hollow sections of non-alloy and fine grain structural steels", Part 2.

Chemical composition

The chemical composition of hot finished hollow sections is given in EN 10210-1: 1994, Table A.1 and B.1.

When a carbon equivalent value (CEV) is required it shall be determined from the cast analysis using the formula: $CEV = C + \frac{Mn}{6} + \frac{(Cr + Mo + V)}{5} + \frac{(Ni + Cu)}{15}$

Mechanical properties

The mechanical properties for hot finished sections in accordance with EN 10210-1:1994, are summarised below.

Designation	Minimum Yield strength R_{eH} in N/mm^2			Tensile strength R_m in N/mm^2		Min. elongation in % $L_0=5.65(S_0)^{1/2}$				Test temp.	Impact KV
	Nominal thickness in mm					*Nominal thickness in mm*					
	t≤ 16 N/mm^2	*16<t≤40* N/mm^2	*40<t≤65* N/mm^2	*t<3* N/mm^2	*3<t≤65* N/mm^2	*t≤40* **Longitudinal**	*40<t≤65*	*t≤40* **Transverse**	*40<t≤65*	C	J
S235JRH	235	225	215	360-510	340-470	26	25	24	23	20	27
S275J0H	275	265	255	430-580	410-560	22	21	20	19	0	27
S275J2H										-20	27
S355J0H	355	345	335	510-680	490-630	22	21	20	19	0	27
S355J2H										-20	27

Table 14 – Hot Finished Hollow Sections: Mechanical properties

Tensile test

The tensile strength, yield strength and elongation are determined from standard test pieces, which may be the full section of the product or longitudinal or transverse strip specimen. The location of strip test pieces should be away from the weld, for circular hollow sections, and midway between corners on a side not affected by the weld, for square and rectangular hollow sections.

The requirements of EN 10002-1: "Metallic materials - Tensile testing - Method of test (at ambient temperature)", shall apply.

Charpy V-notch impact test

The test pieces for impact testing shall be taken longitudinally or transverse from the test object. The location of strip test pieces should be away from the weld, for circular hollow sections, and midway between corners on a side not affected by the weld, for square and rectangular hollow sections.

Where thickness permits, standard specimens 10x10mm in cross-section are cut longitudinally or transverse from the section and a 2mm deep V-notch accurately machined into one face. The specimens, in accordance with EN 10045-1: "Metallic

materials - Charpy impact test - Test method", are tested at the required temperature according to grade.
If the nominal product thickness is not sufficient for the preparation of standard test pieces (≤12mm), the test shall be carried out using test pieces of width less than 10mm, but not less than 5mm.

Manufacturing tolerances

Hot finished structural hollow sections are manufactured according to EN 10210: 1994, Part 2, and the rolling tolerances are as shown in Table 15 below.

Characteristic	Circular hollow sections	Square and rectangular hollow sections
Outside dimensions (D, B, H)	±1% with a minimum of ±0.5mm and a maximum of ±10mm	±1% with a minimum of ±0.5mm
Thickness (T)	-10% [1) 2)]	
Out-of-roundness (O)	2% for hollow sections having a diameter to thickness ratio not exceeding 100 [3)]	-
Concavity/convexity [4)]	-	1%
Squareness of side	-	90°±1°
External corner profile (C_1, C_2 or R) [5)]	-	Maximum 3T at each corner
Twist (V) (see drawing under)	-	2mm plus 0.5mm/m length
Straightness	0.2% of total length	
Mass (M)	±6% on individual lengths [6)]	

Type of length measure	Length	Tolerances
Random length	**4 000 to 16 000** with a range of 2000 per order item	10% of sections supplied may be below the minimum for the ordered range, but not less than 75% of the minimum of the range
Approximate length	**4 000 to 16 000**	500mm
Exact length	**≥ 2 000 to 6 000**	+10/-0 mm
	≥ 6 000	+15/-0 mm

Notes:
1) The positive deviation is limited by the tolerance on mass.
2) For seamless sections the tolerance for the thickness is: thickness less than 10% but not less than 12.5% of the nominal thickness may occur in the smooth transition areas, but not over more than 22.5% of the circumference.
3) Where the diameter to thickness ratio exceeds 100mm the tolerance on out-of-roundness shall be agreed.
4) The tolerance on concavity and convexity are independent of the tolerance on the outside dimensions.
5) The sides need not be tangential to the corner arcs.
6) The positive tolerance on the mass of seamless hollow sections shall be 8%.

Table 15 – Hot Finished Hollow Sections: Manufacturing tolerances

All external dimensions, including out-of-roundness, shall be measured at a distance from the end of the hollow section of not less than D for circular sections, B for square sections and H for rectangular sections, with a minimum of 100mm.
D= diameter
B= width
H= height
R= outer corner radius
C_1 and C_2= see drawing under.
V= see drawing under.

The thickness T of welded sections shall be measured at a position not less than 2T from the weld.

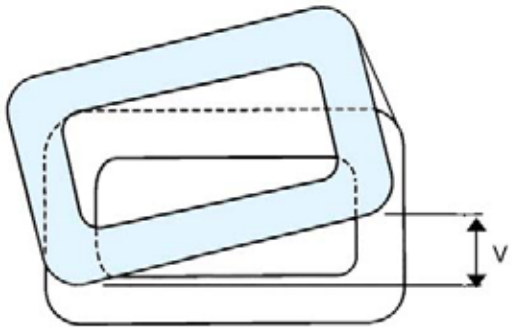


Figure 7 – Twist of square or rectangular hollow sections

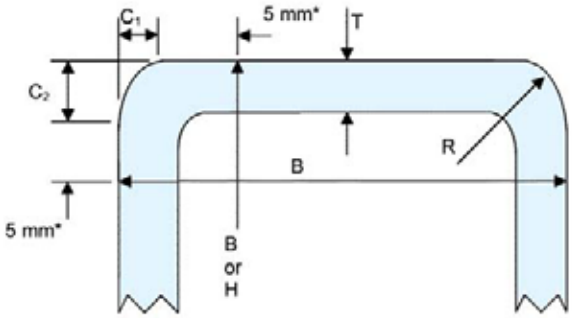
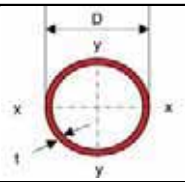


Figure 8 – How to measure cross-sectional dimensions of hollow sections

Other specifications

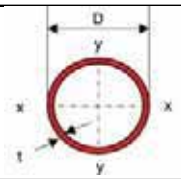
Hot finished structural hollow sections are also supplied to other international standards and National specifications, see Table 13 on first page of this chapter.

Circular



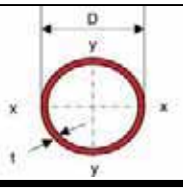
Designation Outside Diameter D	Thickness t	Mass Per Metre	Area Of Section A	Second Moment Of Inertia I	Radius Of Gyration r	Elastic Modulus Z	Plastic Modulus S	Torsional Constants J	Torsional Constants C	Surface Area Per Metre
mm	mm	kg/m	cm^2	cm^4	cm	cm^3	cm^3	cm^4	cm^3	m^2/m
21.3	2.3	1.08	1.37	0.629	0.677	0.590	0.834	1.26	1.18	0.0669
	3.2	1.43	1.82	0.768	0.650	0.722	1.06	1.54	1.44	0.0669
26.9	2.3	1.40	1.78	1.36	0.874	1.01	1.40	2.71	2.02	0.0845
	3.2	1.87	2.38	1.70	0.846	1.27	1.81	3.41	2.53	0.0845
33.7	2.6	1.99	2.54	3.09	1.10	1.84	2.52	6.19	3.67	0.106
	2.9	2.20	2.81	3.36	1.09	1.99	2.76	6.71	3.98	0.106
	3.0	2.27	2.89	3.44	1.09	2.04	2.84	6.88	4.08	0.106
	3.2	2.41	3.07	3.60	1.08	2.14	2.99	7.21	4.28	0.106
	4.0	2.93	3.73	4.19	1.06	2.49	3.55	8.38	4.97	0.106
	5.0	3.54	4.51	4.78	1.03	2.84	4.16	9.57	5.68	0.106
42.4	2.6	2.55	3.25	6.46	1.41	3.05	4.12	12.9	6.10	0.133
	2.9	2.82	3.60	7.06	1.40	3.33	4.53	14.1	6.66	0.133
	3.0	2.91	3.71	7.25	1.40	3.42	4.67	14.5	6.84	0.133
	3.2	3.09	3.94	7.62	1.39	3.59	4.93	15.2	7.19	0.133
	3.6	3.44	4.39	8.33	1.38	3.93	5.44	16.7	7.86	0.133
	4.0	3.79	4.83	8.99	1.36	4.24	5.92	18.0	8.48	0.133
	5.0	4.61	5.87	10.5	1.33	4.93	7.04	20.9	9.86	0.133
	6.3	5.61	7.14	12.0	1.30	5.66	8.29	24.0	11.3	0.133
	8.0	6.79	8.65	13.5	1.25	6.36	9.64	27.0	12.7	0.133
48.3	2.5	2.82	3.60	9.46	1.62	3.92	5.25	18.9	7.83	0.152
	2.6	2.93	3.73	9.78	1.62	4.05	5.44	19.6	8.10	0.152
	2.9	3.25	4.14	10.7	1.61	4.43	5.99	21.4	8.86	0.152
	3.0	3.35	4.27	11.0	1.61	4.55	6.17	22.0	9.11	0.152
	3.2	3.56	4.53	11.6	1.60	4.80	6.52	23.2	9.59	0.152
	4.0	4.37	5.57	13.8	1.57	5.70	7.87	27.5	11.4	0.152
	5.0	5.34	6.80	16.2	1.54	6.69	9.42	32.3	13.4	0.152
	6.3	6.53	8.31	18.7	1.50	7.76	11.2	37.5	15.5	0.152
	8.0	7.95	10.1	21.4	1.45	8.85	13.2	42.7	17.7	0.152
60.3	2.5	3.56	4.54	19.0	2.05	6.30	8.36	38.0	12.6	0.189
	2.6	3.70	4.71	19.7	2.04	6.52	8.66	39.3	13.0	0.189
	3.0	4.24	5.40	22.2	2.03	7.37	9.86	44.4	14.7	0.189
	3.2	4.51	5.74	23.5	2.02	7.78	10.4	46.9	15.6	0.189
	4.0	5.55	7.07	28.2	2.00	9.34	12.7	56.3	18.7	0.189
	5.0	6.82	8.69	33.5	1.96	11.1	15.3	67.0	22.2	0.189
	6.3	8.39	10.7	39.5	1.92	13.1	18.5	79.0	26.2	0.189
	8.0	10.32	13.1	46.0	1.87	15.3	22.1	92.0	30.5	0.189
	10.0	12.40	15.8	52.0	1.81	17.2	25.6	104	34.5	0.189
76.1	2.5	4.54	5.78	39.2	2.60	10.3	13.5	78.4	20.6	0.239
	2.6	4.71	6.00	40.6	2.60	10.7	14.1	81.2	21.3	0.239
	3.0	5.41	6.89	46.1	2.59	12.1	16.0	92.2	24.2	0.239
	3.2	5.75	7.33	48.8	2.58	12.8	17.0	97.6	25.6	0.239
	4.0	7.11	9.06	59.1	2.55	15.5	20.8	118	31.0	0.239
	5.0	8.77	11.2	70.9	2.52	18.6	25.3	142	37.3	0.239
	6.0	10.37	13.2	81.8	2.49	21.5	29.6	164	43.0	0.239
	6.3	10.84	13.8	84.8	2.48	22.3	30.8	170	44.6	0.239
	8.0	13.44	17.1	101	2.42	26.4	37.3	201	52.9	0.239
	10.0	16.30	20.8	116	2.36	30.5	44.0	232	61.0	0.239
	12.0	18.97	24.2	128	2.31	33.8	49.9	257	67.5	0.239

Circular



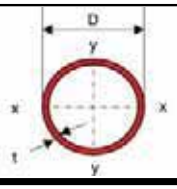
Designation Outside Diameter D	Thickness t	Mass Per Metre	Area Of Section A	Second Moment Of Inertia I	Radius Of Gyration r	Elastic Modulus Z	Plastic Modulus S	Torsional Constants J	Torsional Constants C	Surface Area Per Metre
mm	mm	kg/m	cm^2	cm^4	cm	cm^3	cm^3	cm^4	cm^3	m^2/m
88.9	2.5	5.33	6.79	63.4	3.06	14.3	18.7	127	28.5	0.279
	3.0	6.36	8.10	74.8	3.04	16.8	22.1	150	33.6	0.279
	3.2	6.76	8.62	79.2	3.03	17.8	23.5	158	35.6	0.279
	3.6	7.57	9.65	87.9	3.02	19.8	26.2	176	39.5	0.279
	4.0	8.38	10.7	96.3	3.00	21.7	28.9	193	43.3	0.279
	5.0	10.35	13.2	116	2.97	26.2	35.2	233	52.4	0.279
	6.0	12.27	15.6	135	2.94	30.4	41.3	270	60.7	0.279
	6.3	12.83	16.3	140	2.93	31.5	43.1	280	63.1	0.279
	8.0	15.96	20.3	168	2.87	37.8	52.5	336	75.6	0.279
	10.0	19.46	24.8	196	2.81	44.1	62.6	392	88.2	0.279
	12.0	22.76	29.0	220	2.75	49.4	71.5	439	98.8	0.279
	14.0	25.86	32.9	239	2.69	53.8	79.5	478	108	0.279
101.6	3.6	8.70	11.1	133	3.47	26.2	34.6	266	52.5	0.319
	5.0	11.91	15.2	177	3.42	34.9	46.7	355	69.9	0.319
	6.3	14.81	18.9	215	3.38	42.3	57.3	430	84.7	0.319
	8.0	18.47	23.5	260	3.32	51.1	70.3	519	102	0.319
	10.0	22.59	28.8	305	3.26	60.1	84.2	611	120	0.319
	12.0	26.52	33.8	345	3.20	67.9	96.9	690	136	0.319
	14.0	30.24	38.5	379	3.14	74.6	108	758	149	0.319
114.3	3.0	8.23	10.5	163	3.94	28.4	37.2	325	56.9	0.359
	3.2	8.77	11.2	172	3.93	30.2	39.5	345	60.4	0.359
	3.6	9.83	12.5	192	3.92	33.6	44.1	384	67.2	0.359
	4.0	10.88	13.9	211	3.90	36.9	48.7	422	73.9	0.359
	5.0	13.48	17.2	257	3.87	45.0	59.8	514	89.9	0.359
	6.0	16.03	20.4	300	3.83	52.5	70.4	600	105	0.359
	6.3	16.78	21.4	313	3.82	54.7	73.6	625	109	0.359
	8.0	20.97	26.7	379	3.77	66.4	90.6	759	133	0.359
	10.0	25.72	32.8	450	3.70	78.7	109	899	157	0.359
	12.0	30.27	38.6	511	3.64	89.5	126	1023	179	0.359
	14.0	34.63	44.1	566	3.58	99.0	142	1131	198	0.359
	16.0	38.79	49.4	613	3.52	107	156	1225	214	0.359
139.7	3.2	10.77	13.7	320	4.83	45.8	59.6	640	91.6	0.439
	3.6	12.08	15.4	357	4.81	51.1	66.7	713	102	0.439
	4.0	13.39	17.1	393	4.80	56.2	73.7	786	112	0.439
	5.0	16.61	21.2	481	4.77	68.8	90.8	961	138	0.439
	6.0	19.78	25.2	564	4.73	80.8	107	1129	162	0.439
	6.3	20.73	26.4	589	4.72	84.3	112	1177	169	0.439
	8.0	25.98	33.1	720	4.66	103	139	1441	206	0.439
	10.0	31.99	40.7	862	4.60	123	169	1724	247	0.439
	12.0	37.79	48.1	990	4.53	142	196	1980	283	0.439
	14.0	43.40	55.3	1105	4.47	158	222	2211	317	0.439

Circular



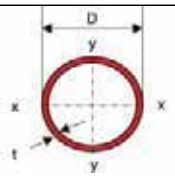
Designation Outside Diameter D	Thickness t	Mass Per Metre	Area Of Section A	Second Moment Of Inertia I	Radius Of Gyration r	Elastic Modulus Z	Plastic Modulus S	Torsional Constants J	Torsional Constants C	Surface Area Per Metre
mm	mm	kg/m	cm^2	cm^4	cm	cm^3	cm^3	cm^4	cm^3	m^2/m
168.3	3.2	13.03	16.6	566	5.84	67.2	87.2	1131	134	0.529
	3.6	14.62	18.6	632	5.82	75.1	97.7	1264	150	0.529
	4.0	16.21	20.6	697	5.81	82.8	108	1394	166	0.529
	4.5	18.18	23.2	777	5.79	92.4	121	1554	185	0.529
	5.0	20.14	25.7	856	5.78	102	133	1712	203	0.529
	6.0	24.02	30.6	1009	5.74	120	158	2017	240	0.529
	6.3	25.17	32.1	1053	5.73	125	165	2107	250	0.529
	8.0	31.63	40.3	1297	5.67	154	206	2595	308	0.529
	10.0	39.04	49.7	1564	5.61	186	251	3128	372	0.529
	12.0	46.26	58.9	1810	5.54	215	294	3620	430	0.529
	12.5	48.03	61.2	1868	5.53	222	304	3737	444	0.529
	14.0	53.27	67.9	2036	5.48	242	334	4073	484	0.529
177.8	4.5	19.23	24.5	920	6.13	104	135	1841	207	0.559
	5.0	21.31	27.1	1014	6.11	114	149	2028	228	0.559
	6.3	26.65	33.9	1250	6.07	141	185	2499	281	0.559
	8.0	33.50	42.7	1541	6.01	173	231	3083	347	0.559
	10.0	41.38	52.7	1862	5.94	209	282	3724	419	0.559
	12.0	49.07	62.5	2159	5.88	243	330	4318	486	0.559
	14.0	56.55	72.0	2434	5.81	274	377	4868	548	0.559
193.7	3.6	16.88	21.5	972	6.72	100	130	1943	201	0.609
	5.0	23.27	29.6	1320	6.67	136	178	2640	273	0.609
	6.0	27.77	35.4	1560	6.64	161	211	3119	322	0.609
	6.3	29.12	37.1	1630	6.63	168	221	3260	337	0.609
	8.0	36.64	46.7	2016	6.57	208	276	4031	416	0.609
	10.0	45.30	57.7	2442	6.50	252	338	4883	504	0.609
	12.0	53.77	68.5	2839	6.44	293	397	5678	586	0.609
	12.5	55.86	71.2	2934	6.42	303	411	5869	606	0.609
	14.0	62.04	79.0	3210	6.37	331	453	6419	663	0.609
	16.0	70.12	89.3	3554	6.31	367	507	7109	734	0.609
219.1	3.6	19.13	24.4	1415	7.62	129	167	2830	258	0.688
	5.0	26.40	33.6	1928	7.57	176	229	3856	352	0.688
	6.0	31.53	40.2	2282	7.54	208	273	4564	417	0.688
	6.3	33.06	42.1	2386	7.53	218	285	4772	436	0.688
	8.0	41.65	53.1	2960	7.47	270	357	5919	540	0.688
	10.0	51.57	65.7	3598	7.40	328	438	7197	657	0.688
	12.0	61.29	78.1	4200	7.33	383	515	8400	767	0.688
	12.5	63.69	81.1	4345	7.32	397	534	8689	793	0.688
	14.2	71.75	91.4	4820	7.26	440	597	9640	880	0.688
	16.0	80.14	102	5297	7.20	483	661	10590	967	0.688
	20.0	98.20	125	6261	7.07	572	795	12520	1143	0.688

Circular



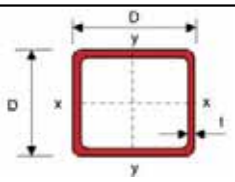
Designation Outside Diameter D	Thickness t	Mass Per Metre	Area Of Section A	Second Moment Of Inertia I	Radius Of Gyration r	Elastic Modulus Z	Plastic Modulus S	Torsional Constants J	Torsional Constants C	Surface Area Per Metre
mm	mm	kg/m	cm^2	cm^4	cm	cm^3	cm^3	cm^4	cm^3	m^2/m
244.5	5.0	29.53	37.6	2699	8.47	221	287	5397	441	0.768
	6.0	35.29	45.0	3199	8.43	262	341	6397	523	0.768
	6.3	37.01	47.1	3346	8.42	274	358	6692	547	0.768
	8.0	46.66	59.4	4160	8.37	340	448	8321	681	0.768
	10.0	57.83	73.7	5073	8.30	415	550	10150	830	0.768
	12.0	68.81	87.7	5938	8.23	486	649	11880	972	0.768
	12.5	71.52	91.1	6147	8.21	503	673	12300	1006	0.768
	14.0	79.58	101	6758	8.16	553	745	13520	1106	0.768
	14.2	80.65	103	6837	8.16	559	754	13670	1119	0.768
	16.0	90.16	115	7533	8.10	616	837	15070	1232	0.768
	20.0	110.73	141	8957	7.97	733	1011	17910	1465	0.768
273	5.0	33.05	42.1	3781	9.48	277	359	7562	554	0.858
	6.0	39.51	50.3	4487	9.44	329	428	8974	657	0.858
	6.3	41.44	52.8	4696	9.43	344	448	9392	688	0.858
	8.0	52.28	66.6	5852	9.37	429	562	11700	857	0.858
	10.0	64.86	82.6	7154	9.31	524	692	14310	1048	0.858
	12.0	77.24	98.4	8396	9.24	615	818	16790	1230	0.858
	12.5	80.30	102	8697	9.22	637	849	17400	1274	0.858
	14.0	89.42	114	9580	9.17	702	940	19160	1404	0.858
	14.2	90.63	115	9695	9.16	710	952	19390	1421	0.858
	16.0	101.41	129	10710	9.10	784	1058	21410	1569	0.858
	20.0	124.79	159	12800	8.97	938	1283	25600	1875	0.858
	25.0	152.90	195	15130	8.81	1108	1543	30250	2216	0.858
323.9	5.0	39.32	50.1	6369	11.3	393	509	12740	787	1.02
	6.0	47.04	59.9	7572	11.2	468	606	15150	935	1.02
	6.3	49.34	62.9	7929	11.2	490	636	15860	979	1.02
	8.0	62.32	79.4	9910	11.2	612	799	19820	1224	1.02
	10.0	77.41	98.6	12160	11.1	751	986	24320	1501	1.02
	12.0	92.30	118	14320	11.0	884	1168	28640	1768	1.02
	12.5	95.99	122	14850	11.0	917	1213	29690	1833	1.02
	14.0	107.00	136	16400	11.0	1012	1345	32790	2025	1.02
	14.2	108.45	138	16600	11.0	1025	1363	33200	2050	1.02
	16.0	121.49	155	18390	10.9	1136	1518	36780	2271	1.02
	20.0	149.89	191	22140	10.8	1367	1850	44280	2734	1.02
	25.0	184.28	235	26400	10.6	1630	2239	52800	3260	1.02
355.6	6.0	51.73	65.9	10070	12.4	566	733	20140	1133	1.12
	6.3	54.27	69.1	10550	12.4	593	769	21090	1186	1.12
	8.0	68.58	87.4	13200	12.3	742	967	26400	1485	1.12
	10.0	85.23	109	16220	12.2	912	1195	32450	1825	1.12
	12.0	101.68	130	19140	12.2	1076	1417	38280	2153	1.12
	12.5	105.77	135	19850	12.1	1117	1472	39700	2233	1.12
	14.0	117.94	150	21950	12.1	1235	1635	43900	2469	1.12
	14.2	119.56	152	22230	12.1	1250	1656	44460	2500	1.12
	16.0	134.00	171	24660	12.0	1387	1847	49330	2774	1.12
	20.0	165.53	211	29790	11.9	1676	2255	59580	3351	1.12
	25.0	203.83	260	35680	11.7	2007	2738	71350	4013	1.12

Circular



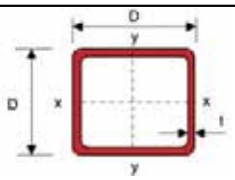
Designation Outside Diameter D	Thickness t	Mass Per Metre	Area Of Section A	Second Moment Of Inertia I	Radius Of Gyration r	Elastic Modulus Z	Plastic Modulus S	Torsional Constants J	Torsional Constants C	Surface Area Per Metre
mm	mm	kg/m	cm^2	cm^4	cm	cm^3	cm^3	cm^4	cm^3	m^2/m
406.4	6.0	59.25	75.5	15130	14.2	745	962	30260	1489	1.28
	6.3	62.16	79.2	15850	14.1	780	1009	31700	1560	1.28
	8.0	78.60	100	19870	14.1	978	1270	39750	1956	1.28
	10.0	97.76	125	24480	14.0	1205	1572	48950	2409	1.28
	12.0	116.72	149	28940	14.0	1424	1867	57870	2848	1.28
	12.5	121.43	155	30030	13.9	1478	1940	60060	2956	1.28
	14.0	135.48	173	33260	13.9	1637	2157	66520	3274	1.28
	14.2	137.35	175	33690	13.9	1658	2185	67370	3315	1.28
	16.0	154.05	196	37450	13.8	1843	2440	74900	3686	1.28
	20.0	190.58	243	45430	13.7	2236	2989	90860	4472	1.28
	25.0	235.15	300	54700	13.5	2692	3642	109400	5384	1.28
	32.0	295.46	376	66430	13.3	3269	4497	132900	6539	1.28
457	6.3	70.02	89.2	22650	15.9	991	1280	45310	1983	1.44
	8.0	88.58	113	28450	15.9	1245	1613	56890	2490	1.44
	10.0	110.24	140	35090	15.8	1536	1998	70180	3071	1.44
	12.0	131.69	168	41560	15.7	1819	2377	83110	3637	1.44
	12.5	137.03	175	43150	15.7	1888	2470	86290	3776	1.44
	14.2	155.07	198	48460	15.7	2121	2785	96930	4242	1.44
	16.0	174.01	222	53960	15.6	2361	3113	107900	4723	1.44
	20.0	215.54	275	65680	15.5	2874	3822	131400	5749	1.44
	25.0	266.34	339	79420	15.3	3475	4671	158800	6951	1.44
	32.0	335.40	427	97010	15.1	4246	5791	194000	8491	1.44
	40.0	411.35	524	114900	14.8	5031	6977	229900	10060	1.44
508	6.3	77.95	99.3	31250	17.7	1230	1586	62490	2460	1.60
	8.0	98.65	126	39280	17.7	1546	2000	78560	3093	1.60
	10.0	122.81	156	48520	17.6	1910	2480	97040	3820	1.60
	12.0	146.79	187	57540	17.5	2265	2953	115100	4530	1.60
	12.5	152.75	195	59760	17.5	2353	3070	119500	4705	1.60
	14.2	172.93	220	67200	17.5	2646	3463	134400	5291	1.60
	16.0	194.14	247	74910	17.4	2949	3874	149800	5898	1.60
	20.0	240.70	307	91430	17.3	3600	4766	182900	7199	1.60
	25.0	297.79	379	110900	17.1	4367	5837	221800	8734	1.60
	32.0	375.64	479	136100	16.9	5360	7261	272300	10720	1.60
	40.0	461.66	588	162200	16.6	6385	8782	324400	12770	1.60
	50.0	564.75	719	190900	16.3	7515	10530	381800	15030	1.60

Square



Designation Size DxD	Thickness t	Mass Per Metre	Area Of Section A	Second Moment Of Area I	Radius Of Gyration r	Elastic Modulus Z	Plastic Modulus S	Torsional Constants J	Torsional Constants C	Surface Area Per Metre
mm	mm	kg/m	cm^2	cm^4	cm	cm^3	cm^3	cm^4	cm^3	m^2/m
20x20	2	1.12	1.40	0.739	0.727	0.739	0.930	1.22	1.07	0.0748
	2.5	1.35	1.68	0.835	0.705	0.835	1.08	1.41	1.20	0.0736
25x25	2	1.41	1.80	1.56	0.932	1.25	1.53	2.52	1.81	0.0948
	2.5	1.74	2.18	1.81	0.909	1.44	1.82	2.97	2.08	0.0936
	3	2.00	2.54	2.00	0.886	1.60	2.06	3.35	2.30	0.0923
	3.2	2.15	2.68	2.06	0.877	1.65	2.15	3.48	2.37	0.0918
30x30	2.5	2.14	2.68	3.33	1.11	2.22	2.74	5.40	3.22	0.114
	3	2.47	3.14	3.74	1.09	2.50	3.14	6.16	3.60	0.112
	3.2	2.65	3.32	3.89	1.08	2.59	3.29	6.44	3.74	0.112
35x35	4	3.76	4.79	7.48	1.25	4.28	5.47	12.5	6.16	0.130
	6	5.16	6.57	8.81	1.16	5.03	6.91	15.4	7.19	0.125
40x40	2.5	2.92	3.68	8.54	1.52	4.27	5.14	13.6	6.22	0.154
	3	3.45	4.34	9.78	1.50	4.89	5.97	15.7	7.10	0.152
	3.2	3.66	4.60	10.2	1.49	5.11	6.28	16.5	7.42	0.152
	4	4.46	5.59	11.8	1.45	5.91	7.44	19.5	8.54	0.150
	5	5.40	6.73	13.4	1.41	6.68	8.66	22.5	9.60	0.147
45x45	4	5.01	6.39	17.6	1.66	7.82	9.71	28.7	11.3	0.170
	5	6.07	7.73	20.1	1.61	8.95	11.41	33.5	12.9	0.167
50x50	2.5	3.71	4.68	17.5	1.93	6.99	8.29	27.5	10.2	0.194
	3	4.39	5.54	20.2	1.91	8.08	9.70	32.1	11.8	0.192
	3.2	4.66	5.88	21.2	1.90	8.49	10.2	33.8	12.4	0.192
	4	5.72	7.19	25.0	1.86	9.99	12.3	40.4	14.5	0.190
	5	6.97	8.73	28.9	1.82	11.6	14.5	47.6	16.7	0.187
	6	8.15	10.2	32.0	1.77	12.8	16.5	53.6	18.4	0.185
	6.3	8.49	10.6	32.8	1.76	13.1	17.0	55.2	18.8	0.184
	8	10.31	12.7	35.2	1.7	14.1	19.2	60.9	20.1	0.179
	10	11.70	14.9	37.6	1.59	15.0	21.4	66.7	21.4	0.174
60x60	3	5.39	6.74	36.2	2.32	12.1	14.3	56.9	17.7	0.232
	3.2	5.67	7.16	38.2	2.31	12.7	15.2	60.2	18.6	0.232
	4	6.97	8.79	45.4	2.27	15.1	18.3	72.5	22.0	0.230
	5	8.54	10.7	53.3	2.23	17.8	21.9	86.4	25.7	0.227
	6	10.00	12.6	59.9	2.18	20.0	25.1	98.6	28.8	0.225
	6.3	10.50	13.1	61.6	2.17	20.5	26.0	102	29.6	0.224
	8	12.80	16.0	69.7	2.09	23.2	30.4	118	33.4	0.219
	10	14.90	18.9	75.5	2.00	25.2	34.4	131	36.0	0.214
70x70	3	6.28	7.94	59.0	2.73	16.9	19.9	92	24.8	0.272
	3.6	7.46	9.42	68.6	2.70	19.6	23.3	108	28.7	0.271
	5	10.10	12.7	88.5	2.64	25.3	30.8	142	36.8	0.267
	6	11.90	15.0	101	2.59	28.7	35.5	163	41.6	0.265
	6.3	12.50	15.6	104	2.58	29.7	36.9	169	42.9	0.264
	8	15.30	19.2	120	2.50	34.2	43.8	200	49.2	0.259
75x75	3.2	7.25	9.08	77.5	2.92	20.7	24.3	121	30.3	0.292
	4	8.93	11.2	93.2	2.89	24.8	29.6	147	36.3	0.290
	5	11.00	13.7	111	2.84	29.6	35.8	177	43.0	0.287
	6	12.90	16.2	126	2.80	33.7	41.4	204	48.9	0.285
	6.3	13.50	16.9	131	2.78	34.9	43.0	212	50.5	0.284
	8	16.60	20.8	152	2.71	40.5	51.3	252	58.4	0.279
	10	19.60	24.9	170	2.61	45.4	59.4	289	65.1	0.274

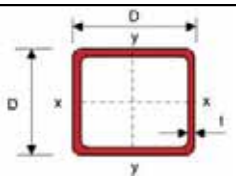
Square



Designation Size DxD	Thickness t	Mass Per Metre	Area Of Section A	Second Moment Of Area I	Radius Of Gyration r	Elastic Modulus Z	Plastic Modulus S	Torsional Constants J	Torsional Constants C	Surface Area Per Metre
mm	mm	kg/m	cm^2	cm^4	cm	cm^3	cm^3	cm^4	cm^3	m^2/m
80x80	3	7.18	9.14	89.8	3.13	22.5	26.3	140	33.0	0.312
	3.6	8.59	10.9	105	3.11	26.2	31.0	164	38.5	0.311
	5	11.70	14.7	137	3.05	34.2	41.1	217	49.8	0.307
	6	13.80	17.4	156	3.00	39.1	47.8	252	56.8	0.305
	6.3	14.40	18.1	162	2.99	40.5	49.7	262	58.7	0.304
	8	17.80	22.4	189	2.91	47.3	59.5	312	68.3	0.299
	10	21.10	26.9	214	2.82	53.5	69.3	360	76.8	0.294
90x90	3.6	9.72	12.3	152	3.52	33.8	39.7	237	49.7	0.351
	5	13.30	16.7	200	3.45	44.4	53.0	316	64.8	0.347
	6	15.70	19.8	230	3.41	51.1	61.8	367	74.3	0.345
	6.3	16.40	20.7	238	3.40	53.0	64.3	382	77.0	0.344
	8	20.40	25.6	281	3.32	62.6	77.6	459	90.5	0.339
	10	24.30	30.9	322	3.23	71.6	91.3	536	103.0	0.334
100x100	4	12.00	15.2	232	3.91	46.4	54.4	361	68.2	0.390
	5	14.80	18.7	279	3.86	55.9	66.4	439	81.8	0.387
	6	17.60	22.2	323	3.82	64.6	77.6	513	94.3	0.385
	6.3	18.40	23.2	336	3.80	67.1	80.9	534	97.8	0.384
	8	22.90	28.8	400	3.73	79.9	98.2	646	116	0.379
	10	27.90	34.9	462	3.64	92.4	116	761	133	0.374
	12	31.90	40.7	512	3.55	102.0	132	858	147	0.369
120x120	5	18.00	22.7	498	4.68	83.0	97.6	777	122	0.467
	6	21.30	27.0	579	4.63	96.6	115	911	141	0.465
	6.3	22.30	28.2	603	4.62	100	120	950	147	0.464
	8	27.90	35.2	726	4.55	121	146	1160	176	0.459
	10	34.20	42.9	852	4.46	142	175	1382	206	0.454
	12.5	41.60	52.1	982	4.34	164	207	1623	236	0.448
140x140	5	21.10	26.7	807	5.50	115	135	1253	170	0.547
	6	25.10	31.8	944	5.45	135	159	1475	198	0.545
	8	32.90	41.6	1195	5.36	171	204	1892	249	0.539
	10	40.40	50.9	1416	5.27	202	246	2272	294	0.534
	12.5	49.50	62.1	1653	5.16	236	293	2696	342	0.528
150x150	5	22.70	28.7	1002	5.90	134	156	1550	197	0.587
	6	27.00	34.2	1174	5.86	156	184	1828	230	0.585
	6.3	28.30	35.8	1223	5.85	163	192	1909	240	0.584
	8	35.40	44.8	1491	5.77	199	237	2351	291	0.579
	10	43.60	54.9	1773	5.68	236	286	2832	344	0.574
	12.5	52.40	67.1	2080	5.57	277	342	3375	402	0.568
	16 +	66.40	83.0	2430	5.41	324	411	4026	467	0.559
160x160	12.5	57.30	72.1	2576	5.98	322	395	4158	467	0.608
	16	70.20	89.4	3028	5.82	379	476	4988	546	0.599
180x180	6	32.60	41.4	2077	7.09	231	269	3215	340	0.705
	6.3	34.20	43.3	2168	7.07	241	281	3361	355	0.704
	8	43.00	54.4	2661	7.00	296	349	4162	434	0.699
	10	53.00	66.9	3193	6.91	355	424	5048	518	0.694
	12.5	65.20	82.1	3790	6.80	421	511	6070	613	0.688
	16	81.40	102	4504	6.64	500	621	7343	724	0.679

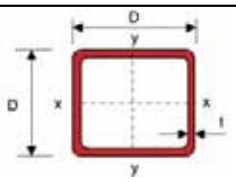
+ Seamless process

Square



Designation Size DxD	Thickness t	Mass Per Metre	Area Of Section A	Second Moment Of Area I	Radius Of Gyration r	Elastic Modulus Z	Plastic Modulus S	Torsional Constants J	Torsional Constants C	Surface Area Per Metre
mm	mm	kg/m	cm^2	cm^4	cm	cm^3	cm^3	cm^4	cm^3	m^2/m
200x200	5	30.50	38.7	2445	7.95	245	283	3756	362	0.787
	6	36.40	46.2	2883	7.90	288	335	4449	426	0.785
	6.3	38.20	48.4	3011	7.89	301	350	4653	444	0.784
	8	48.00	60.8	3709	7.81	371	436	5778	545	0.779
	10	59.30	74.9	4471	7.72	447	531	7031	655	0.774
	12.5	73.00	92.1	5336	7.61	534	643	8491	778	0.768
	16	91.50	115	6394	7.46	639	785	10340	927	0.759
220x220	5	33.50	42.7	3281	8.76	298	344	5028	442	0.867
	6	40.00	51.0	3875	8.72	352	408	5963	521	0.865
	8	52.70	67.2	5002	8.63	455	532	7765	669	0.859
	10	65.10	82.9	6050	8.54	550	650	9473	807	0.854
	12	77.20	98.3	7023	8.45	638	762	11090	933	0.849
	14	88.90	113	7922	8.36	720	868	12620	1049	0.844
250x250	6	45.80	58.2	5752	9.94	460	531	8825	681	0.985
	6.3	48.10	61.0	6014	9.93	481	556	9238	712	0.984
	8	60.50	76.8	7455	9.86	596	694	11530	880	0.979
	10	75.00	94.9	9055	9.77	724	851	14110	1065	0.974
	12.5	92.60	117	10920	9.66	873	1037	17160	1279	0.968
	16	117.00	147	13270	9.50	1061	1280	21140	1546	0.959
260x260	6	47.60	60.6	6491	10.4	499	576	9951	740	1.02
	6.3	49.90	63.5	6788	10.3	522	603	10420	773	1.02
	8	62.80	80.0	8423	10.3	648	753	13010	956	1.02
	10	77.70	98.9	10240	10.2	788	924	15930	1159	1.01
	12	92.20	117	11950	10.1	920	1087	18730	1348	1.01
	12.5	95.80	122	12370	10.1	951	1127	19410	1394	1.01
	14	106.00	136	13560	10.0	1043	1244	21400	1525	1.00
	14.2	108.00	137	13710	9.99	1055	1259	21660	1542	1.00
	16	120.00	153	15060	9.91	1159	1394	23940	1689	1.00
300x300	6	55.10	70	10080	12.0	672	772	15407	997	1.18
	6.3	57.95	73.6	10550	12.0	703	809	16140	1043	1.18
	8	73.10	92.8	13130	11.9	875	1013	20190	1294	1.18
	9	81.93	104	14600	11.9	973	1130	22520	1437	1.18
	10	90.70	115	16030	11.8	1068	1246	24810	1575	1.17
	12	107.97	137	18780	11.7	1252	1470	29250	1840	1.17
	12.5	112.00	142	19440	11.7	1296	1525	30330	1904	1.17
	16	142.00	179	23850	11.5	1590	1895	37620	2325	1.16
350x350	6	64.50	82.2	16170	14.0	924	1058	24650	1373	1.38
	8	85.70	109	21130	13.9	1207	1392	32380	1789	1.38
	10	106.00	135	25880	13.9	1479	1715	39890	2185	1.37
	12	127.00	161	30440	13.8	1739	2030	47150	2563	1.37
	12.5	132.00	167	31540	13.7	1802	2107	48930	2654	1.37
	14	146.00	186	34790	13.7	1988	2334	54190	2922	1.36
	14.2	148.00	189	35210	13.7	2012	2364	54880	2957	1.36
	16	167.00	211	38940	13.6	2225	2630	60990	3264	1.36
	19	190.00	248	44820	13.5	2561	3055	70760	3744	1.35
	22	217.00	283	50270	13.3	2873	3460	80010	4187	1.34
	25	242.00	318	55320	13.2	3161	3845	88750	4595	1.34

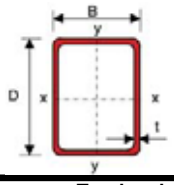
Square



Designation Size DxD	Thickness t		Mass Per Metre	Area Of Section A	Second Moment Of Area I	Radius Of Gyration r	Elastic Modulus Z	Plastic Modulus S	Torsional Constants J	Torsional Constants C	Surface Area Per Metre
mm	mm		kg/m	cm^2	cm^4	cm	cm^3	cm^3	cm^4	cm^3	m^2/m
400x400	8		97.90	125	31860	16.0	1593	1830	48700	2363	1.58
	10		122.00	155	39130	15.9	1956	2260	60090	2895	1.57
	12		145.00	185	46130	15.8	2306	2679	71180	3405	1.57
	12.5		152.00	192	47840	15.8	2392	2782	73910	3530	1.57
	14		168.00	214	52870	15.7	2643	3087	81960	3894	1.56
	14.2		170.00	217	53530	15.7	2676	3127	83030	3942	1.56
	16		192.00	243	59340	15.6	2967	3484	92440	4362	1.56
	20	#	237.00	300	71540	15.4	3577	4247	112500	5237	1.55
	22		251.00	327	77260	15.4	3863	4612	122100	5646	1.54
	25		282.00	368	85380	15.2	4269	5141	135900	6223	1.54
450x450	12		162.00	209	66460	17.8	2954	3419	102200	4368	1.77
	16		213.00	275	85860	17.7	3816	4459	133200	5620	1.76
	19		250.00	324	99540	17.5	4424	5208	155400	6497	1.75
	22		286.00	371	112500	17.4	5000	5929	176700	7324	1.74
	25		321.00	418	124700	17.3	5544	6624	197200	8101	1.74
	28	△	355.00	464	136300	17.1	6058	7292	216800	8832	1.73
	32	△	399.00	524	150700	17.0	6696	8143	241700	9735	1.72
500x500	12		181.00	233	92030	19.89	3681	4248	141200	5451	1.97
	16		238.00	307	119300	19.71	4771	5554	184400	7038	1.96
	19		280.00	362	138600	19.58	5545	6498	215500	8159	1.95
	22		320.00	415	157100	19.44	6283	7411	245600	9222	1.94
	25		360.00	468	174600	19.31	6986	8295	274600	10230	1.94
	28	△	399.00	520	191300	19.18	7653	9149	302600	11180	1.93
	32	△	450.00	588	212300	19.00	8491	10242	338200	12370	1.92
	36	△	498.00	654	231700	18.82	9269	11283	372000	13470	1.91
550x550	16		263.00	339	160400	21.75	5833	6769	247300	8616	2.16
	19		309.00	400	186800	21.62	6793	7930	289500	10010	2.15
	22		355.00	459	212100	21.49	7714	9058	330400	11340	2.14
	25		399.00	518	236300	21.35	8594	10150	370100	12610	2.14
	28	△	443.00	576	259500	21.22	9436	11220	408400	13810	2.13
	32	△	500.00	652	288700	21.04	10500	12580	457500	15330	2.12
	36	△	555.00	726	316100	20.86	11500	13890	504400	16740	2.11
	40	△	608.00	799	341800	20.68	12430	15140	549000	18060	2.10
600x600	25	△	439.00	568	311100	23.40	10370	12200	485300	15230	2.34
	28	△	487.00	632	342100	23.26	11410	13490	536300	16720	2.33
	32	△	550.00	716	381600	23.08	12720	15160	601900	18600	2.32
	36	△	611.00	798	418800	22.91	13960	16770	664900	20370	2.31
	40	△	671.00	879	453900	22.73	15130	18310	725100	22030	2.30
700x700	25	△	517.00	668	504700	27.48	14420	16850	782900	21240	2.74
	28	△	575.00	744	556600	27.35	15900	18670	867000	23380	2.73
	32	△	651.00	844	623100	27.17	17800	21040	975800	26110	2.72
	36	△	724.00	942	686500	26.99	19610	23330	1081000	28700	2.71
	40	△	797.00	1039	746900	26.81	21340	25540	1182000	31160	2.70

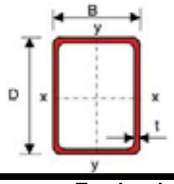
Grade S355J2H only
△S.A.W process

Rectangular



Designation Size	Thickness	Mass Per Metre	Area Of Section	Second Moment Of Area		Radius Of Gyration		Elastic Modulus		Plastic Modulus		Torsional Constants		Surface Area Per Metre
				Axis	Axis	Axis	Axis	Axis	Axis	Axis	Axis			
DxB	t		A	x-x	y-y	x-x	y-y	x-x	y-y	x-x	y-y	J	C	
mm	mm	kg/m	cm^2	cm^4	cm^4	cm	cm	cm^3	cm^3	cm^3	cm^3	cm^4	cm^3	m^2/m
50x25	2.5	2.72	3.43	10.4	3.39	1.74	0.994	4.16	2.71	5.33	3.22	8.42	4.61	0.144
	3	3.22	4.04	11.9	3.83	1.72	0.973	4.76	3.06	6.18	3.71	9.64	5.20	0.142
	3.2	3.41	4.28	12.5	3.98	1.71	0.964	4.98	3.18	6.50	3.89	10.1	5.41	0.142
	4	4.07	5.19	14.4	4.48	1.66	0.929	5.75	3.59	7.67	4.54	11.6	6.11	0.140
50x30	2.5	2.92	3.68	11.8	5.22	1.79	1.19	4.73	3.48	5.92	4.11	11.7	5.73	0.154
	3	3.45	4.34	13.6	5.94	1.77	1.17	5.43	3.96	6.88	4.76	13.5	6.51	0.152
	3.2	3.66	4.60	14.2	6.20	1.76	1.16	5.68	4.13	7.25	5.00	14.2	6.80	0.152
	4	4.46	5.59	16.5	7.08	1.72	1.13	6.60	4.72	8.59	5.88	16.6	7.77	0.150
	5	5.40	6.73	18.7	7.89	1.67	1.08	7.49	5.26	10.0	6.80	19.0	8.67	0.147
60x40	2.5	3.71	4.68	22.8	12.1	2.21	1.60	7.61	6.03	9.32	7.02	25.1	9.73	0.194
	3	4.39	5.54	26.5	13.9	2.18	1.58	8.82	6.95	10.9	8.19	29.2	11.2	0.192
	3.2	4.66	5.88	27.8	14.6	2.18	1.57	9.27	7.29	11.5	8.64	30.8	11.7	0.192
	4	5.72	7.19	32.8	17.0	2.14	1.54	10.9	8.52	13.8	10.3	36.7	13.7	0.190
	5	6.97	8.73	38.1	19.5	2.09	1.50	12.7	9.77	16.4	12.2	43.0	15.7	0.187
	6	8.15	10.2	42.3	21.4	2.04	1.45	14.1	10.7	18.6	13.7	48.2	17.3	0.185
	6.3	8.49	10.6	43.4	21.9	2.02	1.44	14.5	11.0	19.2	14.2	49.5	17.6	0.184
	8	10.00	12.8	47.9	23.7	1.94	1.36	16.0	11.9	22.1	16.1	55.4	19.2	0.179
80x40	3	5.34	6.74	54.2	18.0	2.84	1.63	13.6	9.00	17.1	10.4	43.8	15.3	0.232
	3.2	5.67	7.16	57.2	18.9	2.83	1.63	14.3	9.46	18.0	11.0	46.2	16.1	0.232
	4	6.97	8.79	68.2	22.2	2.79	1.59	17.1	11.1	21.8	13.2	55.2	18.9	0.230
	5	8.54	10.7	80.3	25.7	2.74	1.55	20.1	12.9	26.1	15.7	65.1	21.9	0.227
	6	10.00	12.6	90.5	28.5	2.68	1.50	22.6	14.2	30.0	17.8	73.4	24.2	0.225
	6.3	10.50	13.1	93.3	29.2	2.67	1.49	23.3	14.6	31.1	18.4	75.6	24.8	0.224
	8	12.80	16.0	106	32.1	2.58	1.42	26.5	16.1	36.5	21.2	85.8	27.4	0.219
	10	14.90	18.9	115	33.7	2.47	1.33	28.8	16.9	41.3	23.5	92.5	28.9	0.214
80x50	3	5.81	7.34	63.1	30.2	2.93	2.03	15.8	12.1	19.4	13.9	64.8	19.7	0.252
	4	7.53	9.59	79.8	37.7	2.88	1.98	19.9	15.1	24.9	17.8	82.6	24.6	0.250
	5	9.33	11.7	94.4	44.1	2.84	1.94	23.6	17.7	29.9	21.3	98.4	28.8	0.247
	6	11.00	13.8	107	49.5	2.79	1.90	26.8	19.8	34.4	24.4	112	32.3	0.245
	8	14.11	17.6	127	57.4	2.69	1.81	31.7	23.0	42.2	29.6	135	37.5	0.239
	10	16.40	20.9	140	62.1	2.59	1.72	35.0	24.8	48.3	33.4	150	40.6	0.234
90x50	3	6.28	7.94	84.4	33.5	3.26	2.05	18.8	13.4	23.2	15.3	76.5	22.4	0.272
	3.2	6.63	8.44	89.1	35.3	3.25	2.04	19.8	14.1	24.6	16.2	80.9	23.6	0.272
	3.6	7.46	9.42	98.3	38.7	3.23	2.03	21.8	15.5	27.2	18.0	89.4	25.9	0.271
	4	8.15	10.4	107	41.9	3.21	2.01	23.8	16.8	29.8	19.6	97.5	28.0	0.270
	5	10.10	12.7	127	49.2	3.16	1.97	28.3	19.7	36.0	23.5	116	32.9	0.267
	6	11.90	15.0	145	55.4	3.11	1.92	32.2	22.1	41.6	27.0	133	37.0	0.265
	6.3	12.50	15.6	150	57.0	3.10	1.91	33.3	22.8	43.2	28.0	138	38.1	0.264
	8	15.30	19.2	174	64.6	3.01	1.84	38.6	25.8	51.4	32.9	160	43.2	0.259
	10	18.00	22.9	194	70.2	2.91	1.75	43.0	28.1	59.3	37.4	179	47.1	0.254
100x50	3	6.75	8.54	110	36.8	3.58	2.08	21.9	14.7	27.3	16.8	88.4	25.0	0.292
	3.2	7.18	9.08	116	38.8	3.57	2.07	23.2	15.5	28.9	17.7	93.4	26.4	0.292
	4	8.86	11.2	140	46.2	3.53	2.03	27.9	18.5	35.2	21.5	113	31.4	0.290
	5	10.90	13.7	167	54.3	3.48	1.99	33.3	21.7	42.6	25.8	135	36.9	0.287
	6	12.90	16.2	190	61.2	3.43	1.95	38.1	24.5	49.4	29.7	154	41.6	0.285
	6.3	13.40	16.9	197	63.0	3.42	1.93	39.4	25.2	51.3	30.8	160	42.9	0.284
	8	16.60	20.8	230	71.7	3.33	1.86	46.0	28.7	61.4	36.3	186	48.9	0.279
	10	19.60	24.9	259	78.4	3.22	1.77	51.8	31.4	71.2	41.4	209	53.6	0.274

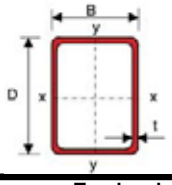
Rectangular



Designation Size DxB	Thickness t		Mass Per Metre	Area Of Section	Second Moment Of Area		Radius Of Gyration		Elastic Modulus		Plastic Modulus		Torsional Constants		Surface Area Per Metre
					Axis x-x	Axis y-y	Axis x-x	Axis y-y	Axis x-x	Axis y-y	Axis x-x	Axis y-y	J	C	
mm	mm		kg/m	cm^2	cm^4	cm^4	cm	cm	cm^3	cm^3	cm^3	cm^3	cm^4	cm^3	m^2/m
100x60	3		7.22	9.14	124	55.7	3.68	2.47	24.7	18.6	30.2	21.2	121	30.7	0.312
	3.6		8.59	10.9	145	64.8	3.65	2.44	28.9	21.6	35.6	24.9	142	35.6	0.311
	5		11.70	14.7	189	83.6	3.58	2.38	37.8	27.9	47.4	32.9	188	45.9	0.307
	6		13.80	17.4	217	95.0	3.53	2.34	43.4	31.7	55.1	38.1	216	52.1	0.305
	6.3		14.40	18.1	225	98.1	3.52	2.33	45.0	32.7	57.3	39.5	224	53.8	0.304
	8		17.80	22.4	264	113	3.44	2.25	52.8	37.8	68.7	47.1	265	62.2	0.299
120x60	3.6		9.72	12.3	227	76.3	4.30	2.49	37.9	25.4	47.2	28.9	183	43.3	0.351
	4		10.70	13.6	249	83.1	4.28	2.47	41.5	27.7	51.9	31.7	201	47.1	0.350
	5		13.30	16.7	299	98.8	4.23	2.43	49.9	32.9	63.1	38.4	242	56.0	0.347
	6		15.70	19.8	345	113	4.18	2.39	57.5	37.5	73.6	44.5	279	63.8	0.345
	6.3		16.40	20.7	358	116	4.16	2.37	59.7	38.8	76.7	46.3	290	65.9	0.344
	8		20.40	25.6	425	135	4.08	2.30	70.8	45.0	92.7	55.4	344	76.6	0.339
	10		24.30	30.9	488	152	3.97	2.21	81.4	50.5	109.2	64.4	396	86.1	0.334
120x80	5		14.80	18.7	365	193	4.42	3.21	60.9	48.2	74.6	56.1	401	77.9	0.387
	6		17.60	22.2	423	222	4.37	3.17	70.6	55.6	87.3	65.5	468	89.6	0.385
	6.3		18.40	23.2	440	230	4.36	3.15	73.3	57.6	91.0	68.2	487	92.9	0.384
	8		22.90	28.8	525	273	4.27	3.08	87.5	68.1	111	82.6	587	110	0.379
	10		27.90	34.9	609	313	4.18	2.99	102	78.1	131	97.3	688	126	0.374
150x100	5		18.70	23.7	739	392	5.58	4.07	98.5	78.5	119	90.1	807	127	0.487
	6		22.30	28.2	862	456	5.53	4.02	115	91.2	141	106	946	147	0.485
	6.3		23.30	29.5	898	474	5.52	4.01	120	94.8	147	110	986	153	0.484
	8		29.10	36.8	1087	569	5.44	3.94	145	114	180	135	1203	183	0.479
	10		35.70	44.9	1282	665	5.34	3.85	171	133	216	161	1432	214	0.474
	12		41.40	52.7	1450	745	5.25	3.76	193	149	249	185	1633	240	0.469
	12.5		42.80	54.6	1488	763	5.22	3.74	198	153	256	190	1679	246	0.468
160x80	4.5		16.24	20.6	679	229	5.75	3.33	84.9	57.1	106	64.8	547	97.2	0.468
	5		18.00	22.7	744	249	5.72	3.31	93.0	62.3	116	71.1	600	106	0.467
	6		21.30	27.0	868	288	5.67	3.27	108	72.0	136	83.3	701	122	0.465
	6.3		22.30	28.2	903	299	5.66	3.26	113	74.8	142	86.8	730	127	0.464
	8		27.90	35.2	1091	356	5.57	3.18	136	89.0	175	106	883	151	0.459
	10		34.20	42.9	1284	411	5.47	3.10	161	103	209	125	1041	175	0.454
	12		39.50	50.3	1449	455	5.37	3.01	181	114	240	142	1175	194	0.449
	12.5		41.60	52.1	1485	465	5.34	2.99	186	116	247	146	1204	198	0.448
200x100	5		22.70	28.7	1495	505	7.21	4.19	149	101	185	114	1204	172	0.587
	6		27.00	34.2	1754	589	7.16	4.15	175	118	218	134	1414	200	0.585
	6.3		28.30	35.8	1829	613	7.15	4.14	183	123	228	140	1475	208	0.584
	8		35.40	44.8	2234	739	7.06	4.06	223	148	282	172	1804	251	0.579
	10		43.60	54.9	2664	869	6.96	3.98	266	174	341	206	2156	295	0.574
	12		50.80	64.7	3047	979	6.86	3.89	305	196	395	237	2469	333	0.569
	12.5		53.40	67.1	3136	1004	6.84	3.87	314	201	408	245	2541	341	0.568
	16	+	66.40	83.0	3678	1147	6.66	3.72	368	229	491	290	2982	391	0.559
200x120	5		24.1	30.7	1690	762	7.40	4.98	168	127	205	144	1650	210	0.627
	6.3		30.1	38.3	2070	929	7.34	4.92	207	155	253	177	2030	255	0.624
	8		37.6	48.0	2530	1130	7.26	4.85	253	188	313	218	2490	310	0.619
	10		46.3	58.9	3030	1340	7.17	4.76	303	223	379	263	3000	367	0.614
	12.5		55.7	71.7	3468	1524	6.99	4.63	347	254	444	308	3568	426	0.608
	16		71.38	89.4	4221	1813	6.87	4.50	422	302	550	377	4247	497	0.599

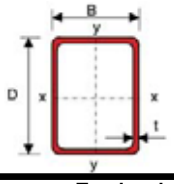
+ Seamless process

Rectangular



Designation Size	Thickness	Mass Per Metre	Area Of Section	Second Moment Of Area		Radius Of Gyration		Elastic Modulus		Plastic Modulus		Torsional Constants		Surface Area Per Metre
				Axis	Axis	Axis	Axis	Axis	Axis	Axis	Axis			
DxB	t		A	x-x	y-y	x-x	y-y	x-x	y-y	x-x	y-y	J	C	
mm	mm	kg/m	cm^2	cm^4	cm^4	cm	cm	cm^3	cm^3	cm^3	cm^3	cm^4	cm^3	m^2/m
200x150	6	31.70	40.2	2318	1485	7.60	6.08	232	198	277	227	2820	313	0.685
	6.3	33.22	42.1	2420	1549	7.58	6.07	242	207	289	237	2947	326	0.684
	8	41.70	52.8	2971	1894	7.50	5.99	297	253	359	294	3643	398	0.679
	9	46.60	58.9	3276	2084	7.46	5.95	328	278	398	325	4033	437	0.677
	10	51.40	64.9	3568	2264	7.41	5.91	357	302	436	356	4409	475	0.674
	12	60.90	76.7	4109	2596	7.32	5.82	411	346	508	414	5119	543	0.669
	12.5	63.20	79.6	4236	2673	7.30	5.80	424	356	525	428	5287	559	0.668
250x150	6	36.40	46.2	3965	1796	9.27	6.24	317	239	385	270	3877	396	0.785
	6.3	38.00	48.4	4143	1874	9.25	6.22	331	250	402	283	4054	413	0.784
	8	48.00	60.8	5111	2298	9.17	6.15	409	306	501	350	5021	506	0.779
	10	59.30	74.9	6174	2755	9.08	6.06	494	367	611	426	6090	605	0.774
	12.5	73.00	92.1	7387	3265	8.96	5.96	591	435	740	514	7326	717	0.768
	16	91.50	115	8879	3873	8.79	5.80	710	516	906	625	8868	849	0.759
300x100	5	30.52	38.7	4146	731	10.3	4.34	276	146	354	161	2040	262	0.787
	6	36.20	46.2	4893	854	10.3	4.30	326	171	419	190	2399	306	0.785
	6.3	38.00	48.4	5111	890	10.3	4.29	341	178	439	199	2504	319	0.784
	8	48.00	61.1	6386	1087	10.2	4.22	426	217	551	247	3066	387	0.780
	10	58.80	74.9	7613	1275	10.1	4.13	508	255	666	296	3676	458	0.774
	12	70.30	88.7	8818	1447	9.97	4.04	588	289	779	343	4223	520	0.769
	16	91.50	117	11240	1747	9.82	3.87	749	349	1008	431	5142	620	0.769
300x200	6	45.80	58.2	7486	4013	11.3	8.31	499	401	596	451	8100	651	0.985
	6.3	48.10	61.0	7829	4193	11.3	8.29	522	419	624	472	8476	681	0.984
	8	60.50	76.8	9717	5184	11.3	8.22	648	518	779	589	10560	840	0.979
	10	75.00	94.9	11820	6278	11.2	8.13	788	628	956	721	12910	1015	0.974
	12	89.15	113	13800	7294	11.1	8.05	920	729	1124	847	15140	1178	0.969
	12.5	92.60	117	14270	7537	11.0	8.02	952	754	1165	877	15680	1217	0.968
	16	117.00	147	17390	9109	10.9	7.87	1159	911	1441	1080	19250	1468	0.959
300x250	6.3	53.00	67.5	9239	6984	11.7	10.20	616	559	720	636	12140	862	1.082
	8	66.80	85.1	11500	8682	11.6	10.10	767	695	902	796	15170	1067	1.077
	10	82.80	106	14050	10580	11.5	10.00	937	847	1109	978	18600	1295	1.071
	12.5	102.00	130	17050	12810	11.4	9.91	1137	1025	1358	1196	22680	1561	1.065
	16	129.00	165	20930	15670	11.3	9.76	1395	1254	1689	1485	28020	1898	1.055
350x150	6.3	48.10	61	9551	2537	12.5	6.44	546	338	680	375	6383	587	0.974
	8	60.50	77	11880	3125	12.4	6.36	679	417	851	467	7917	721	0.974
	10	75.00	94.9	14320	3737	12.3	6.27	818	498	1035	566	9633	867	0.974
	12.5	92.60	117	17300	4450	12.2	6.17	988	593	1263	686	11620	1032	0.968
	16	117.00	149	21500	5386	12.0	6.02	1229	718	1586	850	14110	1235	0.968
350x250	8	73.10	93	16560	9854	13.3	10.30	946	788	1124	892	19010	1255	1.18
	10	90.70	116	20270	12020	13.2	10.20	1158	963	1385	1098	23330	1526	1.18
	12.5	112.00	143	24680	14580	13.1	10.10	1410	1166	1700	1345	28490	1843	1.18
	16	142.00	181	30440	17860	13.0	9.95	1739	1429	2121	1672	35280	2248	1.18
400x120	6.3	50.00	63.7	11880	1752	13.7	5.24	594	292	766	322	5035	527	1.03
	8	63.10	80.3	14790	2146	13.6	5.17	740	358	960	399	6212	645	1.02
	10	78.10	99.5	18050	2569	13.5	5.08	903	428	1180	486	7501	771	1.02
	12.5	96.60	123	21900	3040	13.3	4.97	1095	507	1444	588	8973	912	1.01
400x150	6.3	53.00	67.5	13350	2863	14.1	6.51	667	382	841	420	7588	673	1.09
	8	66.80	85.1	16630	3528	14.0	6.44	832	470	1054	524	9415	828	1.08
	10	82.80	106	20340	4257	13.9	6.35	1017	568	1297	640	11450	998	1.08
	12.5	102.00	130	24720	5087	13.8	6.24	1236	678	1589	778	13820	1191	1.07
	16	129.00	165	30400	6108	13.6	6.09	1520	814	1978	957	16810	1427	1.06

Rectangular



Designation Size	Thickness		Mass Per Metre	Area Of Section	Second Moment Of Area		Radius Of Gyration		Elastic Modulus		Plastic Modulus		Torsional Constants		Surface Area Per Metre
					Axis	Axis	Axis	Axis	Axis	Axis	Axis	Axis			
DxB	t			A	x-x	y-y	x-x	y-y	x-x	y-y	x-x	y-y	J	C	
mm	mm		kg/m	cm^2	cm^4	cm^4	cm	cm	cm^3	cm^3	cm^3	cm^3	cm^4	cm^3	m^2/m
400x200	6.3		57.90	73.6	15700	5376	14.6	8.55	785	538	960	594	12610	917	1.18
	8		73.10	92.8	19560	6660	14.5	8.47	978	666	1203	743	15740	1135	1.18
	10		90.70	115	23910	8084	14.4	8.39	1196	808	1480	911	19260	1376	1.17
	12.5		112.00	142	29060	9738	14.3	8.28	1453	974	1813	1111	23440	1656	1.17
	16		142.00	179	35740	11820	14.1	8.13	1787	1182	2256	1374	28870	2010	1.16
400x300	8		85.70	109	25860	16620	15.4	12.30	1293	1108	1524	1252	30980	1749	1.37
	10		106.00	136	31750	20360	15.3	12.30	1587	1357	1882	1544	38140	2136	1.37
	12.5		132.00	168	38800	24800	15.2	12.20	1940	1654	2316	1898	46750	2593	1.37
	16		167.00	213	48100	30620	15.0	12.00	2405	2041	2899	2371	58200	3186	1.37
450x250	8		85.40	109	30080	12140	16.6	10.6	1337	971	1622	1081	27080	1629	1.38
	10		106.00	135	36900	14820	16.5	10.5	1640	1185	2000	1331	33280	1986	1.37
	12.5		132.00	167	45030	17970	16.4	10.4	2001	1438	2458	1631	40720	2406	1.37
	16		167.00	211	55710	22040	16.2	10.2	2476	1763	3070	2029	50550	2947	1.36
500x200	8		85.70	109	34270	8170	17.7	8.7	1371	817	1716	900	21100	1430	1.37
	10		106.00	135	41760	9891	17.6	8.6	1670	989	2105	1101	25870	1737	1.37
	12.5		132.00	168	51510	12020	17.5	8.5	2060	1202	2609	1354	31480	2097	1.37
	16		167.00	213	63930	14670	17.3	8.31	2557	1467	3267	1683	38830	2554	1.37
500x300	10		122.00	155	53760	24440	18.6	12.6	2150	1629	2595	1826	52450	2696	1.57
	12.5		152.00	192	65810	29780	18.5	12.5	2633	1985	3196	2244	64390	3281	1.57
	16		192.00	243	81780	36770	18.3	12.3	3271	2451	4005	2804	80330	4044	1.56
	20	△	237.00	302	100100	44550	18.2	12.1	4006	2970	4942	3442	97310	4845	

△S.A.W process

Cold Formed Hollow Sections

General

Structural hollow sections make beautiful, efficient structures with a nice continuity.
The cold formed hollow sections, square, rectangular and circular, have constant external dimension within the same serial size only the thickness is increasing. In other words, the same column size can be maintained throughout the full height of the building, only changing the thickness, simplifying architectural details and ensuring economy in fabrication.
By using multi-storey columns the number of joints will be smaller and the number of welds affecting the capacity of cold formed sections will therefore be reduced (see "Comparison between hot finished and cold formed hollow sections").
Due to their high sectional properties hollow sections provide smaller column footprints than other design solutions, with increased floor area.
Added together these qualities give an efficient and economic structure.

It has long been the opinion amongst structural people that for low-rise buildings only concrete will be economical, but with multi-storey hollow sections steel structures can compete with concrete structures. Steel might be more expensive per metric ton, but with the fabrication and erection time, a lighter structure, labour cost, and easy maintenance taken into account, a steel structure might give the most economic design.

Comparable specifications

Specification	Grade	Min. Yield strength N/mm^2	Tensile strength N/mm^2	Charpy V-Notch Impact Joules	°C
EN 10219-1 (1997)	S235JRH	235	340-470	27	20
JIS G 3444 (1994)	STK400	235	min. 400	-	-
JIS G 3466 (1988)	STKR400	245	min. 400	-	-
AS 1163 (1991)	C250L0	250	min. 320	27	0
EN 10219-1 (1997)	S275J0H	275	410-560	27	0
EN 10219-1 (1997)	S275J2H	275	410-560	27	-20
ASTM A500 (1996)					
Round tubing	Grade A	228	min. 310	-	-
Shaped tubing	"	269	min. 310	-	-
Round tubing	Grade B	290	min. 400	-	-
Shaped tubing	"	317	min. 400	-	-
JIS G 3466 (1988)	STKR490	325	min. 490	-	-
AS 1163 (1991)	C350L0	350	min. 430	27	0
JIS G 3444 (1994)	STK500	355	min. 500	-	-
EN 10219-1 (1997)	S355J0H	355	490-630	27	0
EN 10219-1 (1997)	S355J2H	355	490-630	27	-20
JIS G 3444 (1994)	STK540	390	min. 540	-	-
AS 1163 (1991)	C450L0	450	min. 500	27	0

Note: For EN 10219-1 and ASTM A500 the values given are for section thickness above 3mm.
EN 10219-1 (1997): one of the new European Norms, see Explanatory notes.
ASTM A36 (1991): standard from American Society for Testing of Materials for carbon structural steel.
ASTM 500 (1996): standard from American Society for Testing of Materials for cold formed welded and seamless carbon steels structural tubing in rounds and shapes.
JIS G 3444 (1994): Japanese Industrial Standard for Carbon steel tubes for general structural purposes.
JIS G 3466 (1988): Japanese Industrial Standard for Carbon steel square pipes for general structural purposes.
AS 1163 (1991): Australian Standard for Structural steel hollow sections.

Table 16 – Cold Formed Hollow Sections: Comparable specifications

Product specifications

Productions of cold formed structural hollow sections have been standardised in EN 10219: 1997: "Cold formed structural hollow sections of non-alloy and fine grain steel" Part 1, Grades S235, S275, S355, but other grades and sub-grades can be supplied, subject to minimum order quantities. Dimensions, tolerances and sectional properties meet the requirements of EN 10219:1997: "Cold formed structural hollow sections of non-alloy and fine grain structural steels" Part 2.

The cold formed hollow sections, square, rectangular and circular have constant external dimension within the same serial size, only the thickness is increasing. In other words, the same column size can be maintained throughout the full height of the building, simplifying architectural details and ensuring economy in fabrication.

Chemical composition

The chemical compositions of hot finished hollow sections are given in EN 10219-1: 1997, Table A.1, B.1 and B.2.
When a carbon equivalent value (CEV) is required it shall be determined from the cast analysis using the formula: $CEV = C + \frac{Mn}{6} + \frac{(Cr + Mo + V)}{5} + \frac{(Ni + Cu)}{15}$

Mechanical properties

The mechanical properties for cold formed sections in accordance with EN 10219-1:1997 are summarised below.

Designation	Min. Yield strength R_{eH} in N/mm²		Tensile strength R_m in N/mm²		Min. elongation (%) $L_0=5.65(S_0)^{1/2}$	Test temp.	Impact KV
	Nominal thickness in mm						
	t≤ 16	*16>t≤40*	*t<3*	*3≥t≤40*	*t≤40*		
	N/mm²	N/mm²	N/mm²	N/mm²	%	C	J
S235JRH	235	225	360-510	340-470	24	20	27
S275J0H	275	265	430-580	410-560	20	0	27
S275J2H						-20	27
S355J0H	355	345	510-680	490-630	20	0	27
S355J2H						-20	27

Table 17 – Cold Formed Hollow Sections: Mechanical properties

Tensile test

The tensile test shall be carried out according with EN 10002-1: "Metallic materials - Tensile testing - Method of test (at ambient temperature)". See chapter “Hot finished Hollow Sections”.

Charpy V-notch impact test

The specimens, in accordance with EN 10045-1: "Metallic materials - Charpy impact test - Test method", are tested at the required temperature according to grade. See chapter “Hot finished Hollow Sections”.

Manufacturing tolerances

The tolerances for cold formed hollow sections are specified in EN 10219: 1997, Part 2. The tolerances are mostly similar to those specified in EN 10210: 1997, Part 2, for hot finished hollow sections. The tolerances are listed in Table 18 below.

Characteristic	Circular hollow sections		Square and rectangular hollow sections	
			Size in mm	*Tolerance*
Outside dimensions (D, B, H)	±1% with a minimum of ±0.5mm and a maximum of ±10mm		**H, B <100:**	±1% with a minimum of: ±0.5mm.
			100≤H, B≤200:	±0.8%
			H, B >200:	±0.6 %
Thickness (T)	**- For D≤406.4mm:**	**T≤5mm:** ±10% **T>5mm:** ±0.50mm	**For T>5mm:**	±0.50mm
			For T≤5mm:	±10%
	- For D>406.4mm:	±10% with a max. of 2mm		
Out-of-roundness (O)	2% for hollow sections having a diameter to thickness ratio not exceeding 100 [1]		-	
Concavity/convexity [2]	-		Max. 0.8% with a minimum of 0.5mm	
Squareness of side	-		90°±1°	
External corner profile (C_1, C_2 or R)	-		**For T≤6mm:**	1.6T to 2.4T
			For 6<T≤10mm:	2.0T to 3.0T
			For 10<T:	2.4T to 3.6T
Twist (V)	-		2mm plus 0.5mm/m length	
Straightness	0.20% of total length		0.15% of total length	
Mass (M)	±6% on individual lengths			

Type of length	Length	Tolerances
Random length	**4 000 to 16 000** with a range of 2000 per order item	10% of sections supplied may be below the minimum for the ordered range, but not less than 75% of the minimum of the range
Approximate length	**≥4 000**	+50/0 mm
Exact length	**< 6 000**	+5/0 mm
	≥ 6 000 to ≤ 10 000	+15/0 mm
	> 10 000	+5/0 mm +1mm/m

Notes: 1) Where diameter to thickness ratio exceeds 100mm the tolerance on out-of-roundness shall be agreed.
2) The tolerance on concavity and convexity is independent of the tolerance on the outside dimensions.

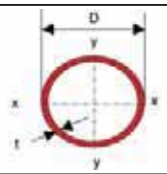
Table 18 – Cold Formed Hollow Sections: Manufacturing tolerances

All external dimensions including out-of-roundness shall be measured at a distance from the end of the hollow section of not less than D for circular sections, B for square sections and H for rectangular sections, with a minimum of 100mm.
D= diameter,
B= width,
H= height,
R= outer corner radius
V, C_1 and C_2= see drawings in chapter “Hot Finished Hollow Sections”.
The thickness T of welded sections shall be measured at a position not less than 2T from the weld.

Other specifications

Cold formed structural hollow sections are also supplied to other international standards and National specifications, see Table 16 the on first page of this chapter.

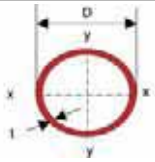
Circular



Designation Outside	Thickness		Mass Per Metre	Area Of Section	Ratio For Local Buckling	Second Moment Of Inertia	Radius Of Gyration	Elastic Modulus	Plastic Modulus	Torsional Constants		Surface Area Per Metre
D	t			A	D/t	I	r	Z	S	J	C	
mm	mm		kg/m	cm^2		cm^4	cm	cm^3	cm^3	cm^4	cm^3	m^2/m
26.9	2.5		1.50	1.92	10.8	1.44	0.867	1.07	1.49	2.88	2.14	0.0845
	3.2	*	1.87	2.38	8.41	1.70	0.846	1.27	1.81	3.41	2.53	0.0845
33.7	3.0		2.27	2.89	11.2	3.44	1.09	2.04	2.84	6.88	4.08	0.106
	3.2	*	2.41	3.07	10.5	3.60	1.08	2.14	2.99	7.21	4.28	0.106
	4.0	*	2.93	3.73	8.43	4.19	1.06	2.49	3.55	8.38	4.97	0.106
42.4	3.0		2.91	3.71	14.1	7.25	1.40	3.42	4.67	14.5	6.84	0.133
	3.2	*	3.09	3.94	13.3	7.62	1.39	3.59	4.93	15.2	7.19	0.133
	3.6	*	3.44	4.39	11.8	8.33	1.38	3.93	5.44	16.7	7.86	0.133
	4.0		3.79	4.83	10.6	8.99	1.36	4.24	5.92	18.0	8.48	0.133
48.3	3.0		3.35	4.27	16.1	11.0	1.61	4.55	6.17	22.0	9.11	0.152
	3.2	*	3.56	4.53	15.1	11.6	1.60	4.80	6.52	23.2	9.59	0.152
	3.6	*	3.97	5.06	13.4	12.7	1.59	5.26	7.21	25.4	10.5	0.152
	4.0		4.37	5.57	12.1	13.8	1.57	5.70	7.87	27.5	11.4	0.152
60.3	3.0		4.24	5.40	20.1	22.2	2.03	7.37	9.86	44.4	14.7	0.189
	3.2	*	4.51	5.74	18.8	23.5	2.02	7.78	10.4	46.9	15.6	0.189
	3.6	*	5.03	6.41	16.8	25.9	2.01	8.58	11.6	51.7	17.2	0.189
	4.0		5.55	7.07	15.1	28.2	2.00	9.34	12.7	56.3	18.7	0.189
	5.0		6.82	8.69	12.1	33.5	1.96	11.1	15.3	67	22.2	0.189
76.1	3.0		5.41	6.89	25.4	46.1	2.59	12.1	16.0	92.2	24.2	0.239
	3.2	*	5.75	7.33	23.8	48.8	2.58	12.8	17.0	97.6	25.6	0.239
	3.6	*	6.44	8.20	21.1	54.0	2.57	14.2	18.9	108	28.4	0.239
	4.0		7.11	9.06	19.0	59.1	2.55	15.5	20.8	118	31.0	0.239
	5.0		11.2	11.26	15.2	70.9	2.52	18.6	25.3	142	37.3	0.239
88.9	3.0		6.36	8.10	29.6	74.8	3.04	16.8	22.1	150	33.6	0.279
	3.2	*	6.76	8.62	27.8	79.2	3.03	17.8	23.5	158	35.6	0.279
	4.0		8.38	10.7	22.2	96.3	3.00	21.7	28.9	193	43.3	0.279
	5.0		10.35	13.2	17.8	116	2.97	26.2	35.2	233	52.4	0.279
101.6	4.0		9.63	12.3	25.4	146	3.45	28.8	38.1	293	57.6	0.319
	4.5		10.80	13.7	22.6	162	3.44	31.9	42.5	324	63.8	0.319
	5.0		11.90	15.2	20.3	177	3.42	34.9	46.7	355	69.9	0.319
	6.0		14.10	18.0	16.9	207	3.39	40.7	54.9	413	81	0.319
114.3	3.0		8.23	10.5	38.1	163	3.94	28.4	37.2	325	56.9	0.359
	3.2	*	8.77	11.2	35.7	172	3.93	30.2	39.5	345	60.4	0.359
	3.6	*	9.83	12.5	31.8	192	3.92	33.6	44.1	384	67.2	0.359
	5.0		13.48	17.2	22.9	257	3.87	45.0	59.8	514	89.9	0.359
	6.0		16.03	20.4	19.1	300	3.83	52.5	70.4	600	105	0.359
	6.3		16.78	21.4	18.1	313	3.82	54.7	73.6	625	109	0.359
139.7	5.0		16.61	21.2	27.9	481	4.77	68.8	90.8	961	138	0.439
	6.0		19.78	25.2	23.3	564	4.73	80.8	107	1130	162	0.439
	6.3		20.73	26.4	22.2	589	4.72	84.3	112	1177	169	0.439
	8.0		25.98	33.1	17.5	720	4.66	103	139	1441	206	0.439
	10.0		31.99	40.7	14.0	862	4.60	123	169	1724	247	0.439

* Sizes not included in BS EN 10219 Part 2 (1997)

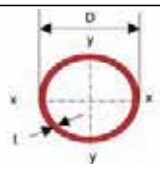
Circular



Designation Outside D	Thickness t		Mass Per Metre	Area Of Section A	Ratio For Local Buckling D/t	Second Moment Of Inertia I	Radius Of Gyration r	Elastic Modulus Z	Plastic Modulus S	Torsional Constants J	Torsional Constants C	Surface Area Per Metre
mm	mm		kg/m	cm^2		cm^4	cm	cm^3	cm^3	cm^4	cm^3	m^2/m
168.3	4.0		16.21	20.6	42.1	697	5.81	82.8	108	1394	166	0.529
	5.0		20.14	25.7	33.7	856	5.78	102	133	1712	203	0.529
	6.3		25.17	32.1	26.7	1053	5.73	125	165	2107	250	0.529
	8.0		31.63	40.3	21.0	1297	5.67	154	206	2595	308	0.529
	10.0		39.04	49.7	16.8	1564	5.61	186	251	3128	372	0.529
	12.5	*	48.03	61.2	13.5	1868	5.53	222	304	3737	444	0.529
193.7	4.0		18.71	23.8	48.4	1073	6.71	111	144	2146	222	0.609
	4.5	*	21.00	26.7	43.0	1198	6.69	124	161	2395	247	0.609
	5.0		23.27	29.6	38.7	1320	6.67	136	178	2640	273	0.609
	6.0		27.77	35.4	32.3	1560	6.64	161	211	3119	322	0.609
	6.3		29.12	37.1	30.7	1630	6.63	168	221	3260	337	0.609
	8.0		36.64	46.7	24.2	2016	6.57	208	276	4031	416	0.609
	10.0		45.30	57.7	19.4	2442	6.50	252	338	4883	504	0.609
	12.5		55.86	71.2	15.5	2934	6.42	303	411	5869	606	0.609
219.1	4.5	*	23.82	30.3	48.7	1747	7.59	159	207	3494	319	0.688
	5.0		26.40	33.6	43.8	1928	7.57	176	229	3856	352	0.688
	6.0		31.53	40.2	36.5	2282	7.54	208	273	4564	417	0.688
	6.3		33.06	42.1	34.8	2386	7.53	218	285	4772	436	0.688
	8.0		41.65	53.1	27.4	2960	7.47	270	357	5919	540	0.688
	10.0		51.57	65.7	21.9	3598	7.40	328	438	7197	657	0.688
	12.0		61.29	78.1	18.3	4200	7.33	383	515	8400	767	0.688
	12.5		63.69	81.1	17.5	4345	7.32	397	534	8689	793	0.688
	16.0	*	80.14	102	13.7	5297	7.20	483	661	10600	967	0.688
244.5	5.0		29.53	37.6	48.9	2699	8.47	221	287	5397	441	0.768
	6.0		35.29	45.0	40.8	3199	8.43	262	341	6397	523	0.768
	6.3		37.01	47.1	38.8	3346	8.42	274	358	6692	547	0.768
	8.0		46.66	59.4	30.6	4160	8.37	340	448	8321	681	0.768
	10.0		57.83	73.7	24.5	5073	8.30	415	550	10150	830	0.768
	12.0		68.81	87.7	20.4	5938	8.23	486	649	11880	972	0.768
	12.5		71.52	91.1	19.6	6147	8.21	503	673	12300	1006	0.768
	16.0	*	90.16	115	15.3	7533	8.10	616	837	15070	1232	0.768
273	5.0		33.05	42.1	54.6	3781	9.48	277	359	7562	554	0.858
	6.0		39.51	50.3	45.5	4487	9.44	329	428	8974	657	0.858
	6.3		41.44	52.8	43.3	4696	9.43	344	448	9392	688	0.858
	8.0		52.28	66.6	34.1	5852	9.37	429	562	11700	857	0.858
	10.0		64.86	82.6	27.3	7154	9.31	524	692	14310	1048	0.858
	12.0		77.24	98.4	22.8	8396	9.24	615	818	16790	1230	0.858
	12.5		80.30	102	21.8	8697	9.22	637	849	17400	1274	0.858
	16.0	*	101.41	129	17.1	10710	9.10	784	1058	21410	1569	0.858
323.9	5.0		39.32	50.1	64.8	6369	11.3	393	509	12740	787	1.02
	6.0		47.04	59.9	54.0	7572	11.2	468	606	15150	935	1.02
	6.3		49.34	62.9	51.4	7929	11.2	490	636	15860	979	1.02
	8.0		62.32	79.4	40.5	9910	11.2	612	799	19820	1224	1.02
	10.0		77.41	98.6	32.4	12160	11.1	751	986	24320	1501	1.02
	12.0		92.30	118	27.0	14320	11.0	884	1168	28640	1768	1.02
	12.5		95.99	122	25.9	14850	11.0	917	1213	29690	1833	1.02
	16.0	*	121.49	155	20.2	18390	10.9	1136	1518	36780	2271	1.02

* Sizes not included in BS EN 10219 Part 2 (1997)

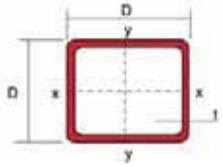
Circular



Designation Outside	Thickness	Mass Per Metre	Area Of Section	Ratio For Local Buckling	Second Moment Of Inertia	Radius Of Gyration	Elastic Modulus	Plastic Modulus	Torsional Constants		Surface Area Per Metre
D	t		A	D/t	I	r	Z	S	J	C	
mm	mm	kg/m	cm^2		cm^4	cm	cm^3	cm^3	cm^4	cm^3	m^2/m
355.6	5.0	43.23	55.1	71.1	8464	12.4	476	615	16930	952	1.12
	6.0	51.73	65.9	59.3	10070	12.4	566	733	20140	1133	1.12
	6.3	54.27	69.1	56.4	10550	12.4	593	769	21090	1186	1.12
	8.0	68.58	87.4	44.5	13200	12.3	742	967	26400	1485	1.12
	10.0	85.23	109	35.6	16220	12.2	912	1195	32450	1825	1.12
	12.0	101.68	130	29.6	19140	12.2	1076	1417	38280	2153	1.12
	12.5	105.77	135	28.4	19850	12.1	1117	1472	39700	2233	1.12
	16.0	134.00	171	22.2	24660	12.0	1387	1847	49330	2774	1.12
406.4	6.0	59.25	75.5	67.7	15130	14.2	745	962	30260	1489	1.28
	6.3	62.16	79.2	64.5	15850	14.1	780	1009	31700	1560	1.28
	8.0	78.60	100	50.8	19870	14.1	978	1270	39750	1956	1.28
	10.0	97.76	125	40.6	24480	14.0	1205	1572	48950	2409	1.28
	12.0	116.72	149	33.9	28940	14.0	1424	1867	57870	2848	1.28
	12.5	121.43	155	32.5	30030	13.9	1478	1940	60060	2956	1.28
	16.0	154.05	196	25.4	37450	13.8	1843	2440	74900	3686	1.28
457	6.0	66.73	85.0	76.2	21620	15.9	946	1220	43240	1892	1.44
	6.3	70.02	89.2	72.5	22650	15.9	991	1280	45310	1983	1.44
	8.0	88.58	113	57.1	28450	15.9	1245	1613	56890	2490	1.44
	10.0	110.24	140	45.7	35090	15.8	1536	1998	70180	3071	1.44
	12.0	131.69	168	38.1	41560	15.7	1819	2377	83110	3637	1.44
	12.5	137.03	175	36.6	43150	15.7	1888	2470	86290	3776	1.44
	16.0	174.01	222	28.6	53960	15.6	2361	3113	107900	4723	1.44
508	6.0	74.28	94.6	84.7	29810	17.7	1174	1512	59620	2347	1.60
	6.3	77.95	99.3	80.6	31250	17.7	1230	1586	62490	2460	1.60
	8.0	98.65	126	63.5	39280	17.7	1546	2000	78560	3093	1.60
	10.0	122.81	156	50.8	48520	17.6	1910	2480	97040	3820	1.60
	12.0	146.79	187	42.3	57540	17.5	2265	2953	115100	4530	1.60
	12.5	152.75	195	40.6	59760	17.5	2353	3070	119500	4705	1.60
	16.0	194.14	247	31.8	74910	17.4	2949	3874	149800	5898	1.60

* Sizes not included in BS EN 10219 Part 2 (1997)

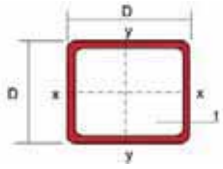
Square



Designation Size DxD	Thickness t		Mass Per Metre	Area Of Section A	Second Moment Of Area I	Radius Of Gyration r	Elastic Modulus Z	Plastic Modulus S	Torsional Constants J	Torsional Constants C	Surface Area Per Metre
mm	mm		kg/m	cm^2	cm^4	cm	cm^3	cm^3	cm^4	cm^3	m^2/m
12x12	1.0	*	0.357	0.414	0.0808	0.442	0.135	0.167	0.138	0.205	0.0446
	1.2	*	0.421	0.481	0.0897	0.432	0.150	0.189	0.157	0.229	0.0439
	1.6	*	0.540	0.600	0.102	0.412	0.169	0.224	0.187	0.263	0.0425
13x13	1.2	*	0.400	0.529	0.118	0.473	0.182	0.228	0.205	0.278	0.0479
	1.6	*	0.500	0.664	0.136	0.453	0.209	0.273	0.247	0.324	0.0465
16x16	1.0	*	0.456	0.574	0.210	0.605	0.263	0.318	0.349	0.397	0.0606
	1.2	*	0.540	0.673	0.239	0.595	0.298	0.366	0.403	0.453	0.0599
	1.6	*	0.699	0.856	0.284	0.576	0.354	0.449	0.498	0.543	0.0585
19x19	1.0	*	0.555	0.694	0.368	0.728	0.387	0.463	0.600	0.584	0.0726
	1.2	*	0.659	0.817	0.421	0.718	0.444	0.537	0.699	0.671	0.0719
	1.6	*	0.859	1.05	0.511	0.698	0.538	0.668	0.876	0.819	0.0705
20x20	2.0		1.05	1.34	0.692	0.720	0.692	0.877	1.21	1.06	0.0731
	2.5	*	1.25	1.59	0.766	0.694	0.766	1.00	1.39	1.19	0.0714
25x25	1.2	*	0.897	1.11	1.03	0.963	0.820	0.975	1.66	1.24	0.0959
	1.6	*	1.18	1.43	1.28	0.944	1.02	1.24	2.12	1.54	0.0945
	1.8	*	1.33	1.59	1.38	0.934	1.11	1.35	2.33	1.68	0.0938
	2.0		1.36	1.74	1.48	0.924	1.19	1.47	2.53	1.80	0.0931
	2.3	*	1.54	1.95	1.61	0.909	1.29	1.62	2.80	1.97	0.0921
	2.4	*	1.70	2.02	1.65	0.904	1.32	1.67	2.88	2.02	0.0918
	2.5		1.64	2.09	1.69	0.899	1.35	1.71	2.97	2.07	0.0914
	3.0		1.89	2.41	1.84	0.874	1.47	1.91	3.33	2.27	0.0897
30x30	1.2	*	1.08	1.35	1.83	1.17	1.22	1.44	2.93	1.84	0.116
	1.6	*	1.41	1.75	2.31	1.15	1.54	1.84	3.77	2.32	0.115
	1.8	*	1.57	1.95	2.52	1.14	1.68	2.03	4.16	2.54	0.114
	2.3	*	1.97	2.41	2.99	1.11	2.00	2.45	5.07	3.03	0.112
	3.0		2.48	3.01	3.50	1.08	2.34	2.96	6.15	3.58	0.110
	3.2	*	2.62	3.17	3.62	1.07	2.41	3.08	6.42	3.71	0.109
32x32	1.2	*	1.13	1.44	2.25	1.25	1.41	1.65	3.58	2.11	0.124
	1.6	*	1.50	1.88	2.84	1.23	1.78	2.12	4.62	2.68	0.123
	2.0	*	1.82	2.30	3.36	1.21	2.10	2.54	5.58	3.18	0.121
	2.3	*	2.02	2.60	3.71	1.20	2.32	2.84	6.24	3.52	0.120
	3.0	*	2.68	3.25	4.38	1.16	2.74	3.44	7.62	4.18	0.118
38x38	1.6	*	1.81	2.26	4.92	1.47	2.59	3.06	7.90	3.90	0.147
	2.0	*	2.22	2.78	5.88	1.46	3.10	3.70	9.60	4.67	0.145
	2.3	*	2.48	3.15	6.54	1.44	3.44	4.15	10.8	5.20	0.144
	3.0	*	3.29	3.97	7.85	1.41	4.13	5.10	13.3	6.28	0.142
40x40	2.0		2.31	2.94	6.94	1.54	3.47	4.13	11.3	5.23	0.153
	2.5		2.82	3.59	8.22	1.51	4.11	4.97	13.6	6.21	0.151
	3.0		3.30	4.21	9.32	1.49	4.66	5.72	15.8	7.07	0.150
	4.0		4.20	5.35	11.1	1.44	5.54	7.01	19.4	8.48	0.146
50x50	1.5		2.44	2.85	11.1	1.97	4.43	5.15	17.4	6.65	0.195
	1.6	*	2.45	3.03	11.7	1.96	4.68	5.46	18.5	7.03	0.195
	2.0		2.93	3.74	14.1	1.95	5.66	6.66	22.6	8.51	0.193
	2.3	*	3.40	4.25	15.9	1.93	6.34	7.52	25.6	9.55	0.192
	3.0		4.25	5.41	19.5	1.90	7.79	9.39	32.1	11.8	0.190
	3.2	*	4.54	5.73	20.4	1.89	8.16	9.89	33.9	12.3	0.189
	4.0		5.45	6.95	23.7	1.85	9.49	11.7	40.4	14.4	0.186
	4.5	*	6.11	7.67	25.5	1.82	10.2	12.8	44.1	15.6	0.185
	5.0		6.69	8.36	27.0	1.80	10.8	13.7	47.5	16.6	0.183
	6.0	*	7.71	9.63	29.5	1.75	11.8	15.3	53.2	18.2	0.179

* Sizes not included in EN 10219 Part 2 (1997)

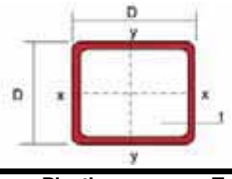
Square



Designation Size DxD	Thickness t		Mass Per Metre	Area Of Section A	Second Moment Of Area I	Radius Of Gyration r	Elastic Modulus Z	Plastic Modulus S	Torsional Constants J	Torsional Constants C	Surface Area Per Metre
mm	mm		kg/m	cm^2	cm^4	cm	cm^3	cm^3	cm^4	cm^3	m^2/m
60x60	1.6	*	2.88	3.67	20.7	2.37	6.89	8.0	32.4	10.4	0.235
	2.3	*	4.06	5.17	28.3	2.34	9.44	11.1	45.2	14.2	0.232
	3.0		5.19	6.61	35.1	2.31	11.7	14.0	57.1	17.7	0.230
	4.0		6.71	8.55	43.6	2.26	14.5	17.6	72.6	22.0	0.226
	4.5	*	7.43	9.47	47.2	2.23	15.7	19.3	79.8	23.9	0.225
	5.0		8.13	10.40	50.5	2.21	16.8	20.9	86.4	25.6	0.223
	6.0		9.44	12.0	56.1	2.16	18.7	23.7	98.4	28.6	0.219
63.5x63.5	2.3	*	4.31	5.49	33.9	2.48	10.7	12.5	53.8	16.0	0.246
	3.0	*	5.52	7.03	42.1	2.45	13.3	15.8	68.2	20.0	0.244
	4.5	*	8.04	10.1	57.0	2.38	18.0	21.9	95.7	27.2	0.239
	5.0	*	8.92	11.4	66.1	2.41	20.3	25.0	112	30.9	0.243
	6.0	*	10.57	12.9	68.2	2.30	21.5	27.0	119	32.8	0.233
65x65	1.6	*	3.06	3.99	26.5	2.58	8.16	9.4	41.4	12.2	0.255
	2.3	*	4.31	5.63	36.4	2.54	11.2	13.1	57.9	16.9	0.252
	3.0	*	5.59	7.21	45.4	2.51	14.0	16.6	73.3	21.0	0.250
	4.0	*	7.08	9.35	56.6	2.46	17.4	21.0	93.7	26.3	0.246
	4.5	*	7.88	10.4	61.6	2.44	18.9	23.1	103	28.7	0.245
	5.0	*	8.92	11.4	66.1	2.41	20.3	25.0	112	30.9	0.243
	6.0	*	10.40	13.2	73.9	2.36	22.7	28.5	128	34.7	0.239
70x70	2.5		5.17	6.59	49.4	2.74	14.1	16.5	78.5	21.2	0.271
	3.0		6.13	7.81	57.5	2.71	16.4	19.4	92.4	24.7	0.270
	3.6	*	7.24	9.23	66.5	2.69	19.0	22.7	108	28.7	0.268
	4.0		7.97	10.1	72.1	2.67	20.6	24.8	119	31.1	0.266
	5.0		9.70	12.4	84.6	2.62	24.2	29.6	142	36.7	0.263
75x75	2.3	*	5.23	6.55	57.1	2.95	15.2	17.7	90.0	22.9	0.292
	3.0	*	6.81	8.41	71.6	2.92	19.1	22.5	115	28.7	0.290
	4.0	*	8.66	10.9	90.2	2.87	24.1	28.8	147	36.3	0.286
	4.5	*	9.70	12.2	98.6	2.85	26.3	31.7	163	39.7	0.285
	5.0	*	10.76	13.4	106	2.82	28.4	34.5	177	42.9	0.283
	6.0	*	12.78	15.6	120	2.77	32.0	39.6	205	48.7	0.279
80x80	3.0		7.07	9.01	88	3.12	22.0	25.8	140	33.0	0.310
	3.6	*	8.37	10.7	102	3.09	25.5	30.2	165	38.4	0.308
	4.0		9.22	11.7	111	3.07	27.8	33.1	180	41.8	0.306
	5.0		11.30	14.4	131	3.03	32.9	39.7	218	49.7	0.303
	6.0		13.20	16.8	149	2.98	37.3	45.8	252	56.6	0.299
	6.3		13.50	17.2	149	2.94	37.1	46.1	261	57.9	0.293
90x90	2.3	*	6.23	7.93	101	3.56	22.4	25.9	158	33.6	0.352
	3.0		8.01	10.2	127	3.53	28.3	33.0	201	42.5	0.350
	3.2	*	8.33	10.8	135	3.52	29.9	35.0	214	44.9	0.349
	3.6	*	9.50	12.1	149	3.50	33.0	38.9	238	49.6	0.348
	4.0		10.50	13.3	162	3.48	36.0	42.6	261	54.2	0.346
	4.5	*	11.50	14.9	178	3.46	39.5	47.1	289	59.6	0.345
	5.0		12.80	16.4	193	3.43	42.9	51.4	316	64.7	0.343
	6.0		15.10	19.2	220	3.39	49.0	59.5	368	74.2	0.339

* Sizes not included in EN 10219 Part 2 (1997)

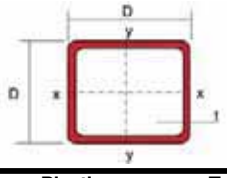
Square



Designation Size DxD	Thickness t		Mass Per Metre	Area Of Section A	Second Moment Of Area I	Radius Of Gyration r	Elastic Modulus Z	Plastic Modulus S	Torsional Constants J	Torsional Constants C	Surface Area Per Metre
mm	mm		kg/m	cm^2	cm^4	cm	cm^3	cm^3	cm^4	cm^3	m^2/m
100x100	2.3	*	6.95	8.85	140	3.97	27.9	32.3	217	41.9	0.392
	3.0		8.96	11.4	177	3.94	35.4	41.2	279	53.2	0.390
	3.2	*	9.60	12.1	187	3.93	37.5	43.7	296	56.3	0.389
	4.0		11.70	14.9	226	3.89	45.3	53.3	362	68.1	0.386
	4.5	*	13.30	16.7	249	3.87	49.9	59.0	402	75.1	0.385
	5.0		14.40	18.4	271	3.84	54.2	64.6	441	81.7	0.383
	6.0		17.00	21.6	311	3.79	62.3	75.1	514	94.1	0.379
	6.3		17.50	22.2	314	3.76	62.8	76.4	536	97.0	0.373
	8.0		21.40	27.2	366	3.67	73.2	91.1	645	114	0.366
	9.0	*	24.10	30.0	391	3.61	78.1	98.6	700	123	0.361
	10.0		25.60	32.6	411	3.55	82.2	105.0	750	130	0.357
120x120	4.0		14.20	18.1	402	4.71	67.0	78.3	637	101	0.466
	5.0		17.50	22.4	485	4.66	80.9	95.4	778	122	0.463
	6.0		20.70	26.4	562	4.61	93.7	112	913	141	0.459
	6.3		21.40	27.3	572	4.58	95.3	114	955	146	0.453
	8.0		26.40	33.6	677	4.49	113	138	1163	175	0.446
125x125	2.3	*	8.75	11.2	278	4.99	44.5	51.1	430	66.8	0.492
	3.0	*	11.30	14.4	355	4.96	56.7	65.6	553	85.1	0.490
	3.2	*	12.00	15.3	376	4.95	60.1	69.6	587	90.2	0.489
	4.5	*	16.90	21.2	506	4.89	80.9	94.8	804	122	0.485
	5.0	*	18.70	23.4	553	4.86	88.4	104	884	133	0.483
	6.0	*	22.10	27.6	641	4.82	103	122	1038	154	0.479
	6.4	*	23.20	29.0	660	4.78	106	126	1101	162	0.473
	9.0	*	31.38	39.0	838	4.64	134	165	1454	208	0.461
150x150	3.0	*	13.70	17.4	623	5.98	83.0	95.5	965	125	0.590
	4.0		18.00	22.9	808	5.93	108	125	1265	162	0.586
	4.5	*	20.50	25.7	896	5.91	120	139	1411	180	0.585
	5.0		22.30	28.4	982	5.89	131	153	1554	197	0.583
	6.0		26.40	33.6	1146	5.84	153	180	1833	230	0.579
	6.3		27.40	34.8	1174	5.80	156	185	1922	239	0.573
	8.0		33.90	43.2	1412	5.71	188	226	2364	289	0.566
	9.0	*	38.20	48.0	1537	5.66	205	248	2608	316	0.561
	10.0		41.30	52.6	1650	5.61	220	269	2840	341	0.557
	12.0		47.10	60.1	1780	5.44	237	298	3231	380	0.538
175x175	4.0	*	21.20	26.9	1303	6.95	149	172	2028	224	0.686
	4.5	*	23.70	30.2	1449	6.93	166	192	2265	249	0.685
	5.0	*	26.20	33.4	1591	6.91	182	211	2498	273	0.683
	6.0	*	31.10	39.6	1864	6.86	213	249	2954	320	0.679
	9.0	*	45.30	57.0	2546	6.68	291	348	4246	446	0.661
	12.7	*	62.50	75.5	3124	6.43	357	443	5585	568	0.635
180x180	5.0		27.00	34.4	1737	7.11	193	224	2724	290	0.703
	6.0		32.10	40.8	2037	7.06	226	264	3223	340	0.699
	6.3		33.30	42.4	2096	7.03	233	273	3383	354	0.693
	8.0		41.50	52.8	2546	6.94	283	336	4189	432	0.686
	10.0		50.70	64.6	3017	6.84	335	404	5074	515	0.677
	12.0		58.50	74.5	3322	6.68	369	454	5865	584	0.658
	12.5		60.50	77.0	3406	6.65	378	467	6050	600	0.656

* Sizes not included in EN 10219 Part 2 (1997)

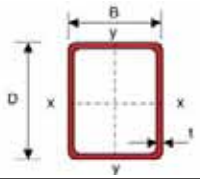
Square



Designation Size DxD	Thickness t		Mass Per Metre	Area Of Section A	Second Moment Of Area I	Radius Of Gyration r	Elastic Modulus Z	Plastic Modulus S	Torsional Constants J	Torsional Constants C	Surface Area Per Metre
mm	mm		kg/m	cm^2	cm^4	cm	cm^3	cm^3	cm^4	cm^3	m^2/m
200x200	5.0		30.10	38.4	2410	7.93	241	279	3763	362	0.783
	6.0		35.80	45.6	2833	7.88	283	330	4459	426	0.779
	6.3		37.20	47.4	2922	7.85	292	341	4682	444	0.773
	8.0		46.50	59.2	3566	7.76	357	421	5815	544	0.766
	9.0	*	52.30	66.0	3918	7.71	392	465	6454	599	0.761
	10.0		57.00	72.6	4251	7.65	425	508	7072	651	0.757
	12.0		66.00	84.1	4730	7.50	473	576	8230	743	0.738
	12.5		68.30	87.0	4859	7.47	486	594	8502	765	0.736
203x203	4.5	*	28.10	35.2	2295	8.07	226	261	3567	339	0.797
	6.4	*	38.40	48.9	3103	7.96	306	357	4973	464	0.785
	9.5	*	56.00	70.4	4288	7.80	422	503	7088	646	0.771
	12.7	*	72.60	89.7	5161	7.58	508	621	9030	801	0.747
250x250	6.0		45.20	57.6	5672	9.92	454	524	8843	681	0.979
	6.3		47.10	60.0	5873	9.89	470	544	9290	711	0.973
	8.0		59.10	75.2	7229	9.80	578	676	11600	878	0.966
	9.0	*	66.50	84.0	7984	9.75	639	750	12910	972	0.961
	10.0		72.70	92.6	8707	9.70	697	822	14200	1062	0.957
	12.0		84.80	108	9859	9.55	789	944	16690	1226	0.938
	12.5		88.00	112	10160	9.52	813	975	17280	1266	0.936
254x254	6.4	*	48.50	62.0	6257	10.0	493	571	9898	746	0.989
	9.5	*	71.20	89.8	8781	9.89	691	813	14240	1053	0.975
	12.7	*	92.90	116	10830	9.68	853	1023	18420	1328	0.951
300x300	6.0		54.70	69.6	9964	12.0	664	764	15430	997	1.18
	8.0		71.60	91.2	12800	11.8	853	991	20310	1293	1.17
	9.0	*	80.60	102	14180	11.8	946	1102	22660	1434	1.16
	10.0		88.40	113	15520	11.7	1035	1211	24970	1572	1.16
	12.0		104.00	132	17770	11.6	1184	1402	29510	1829	1.14
	12.5		108.00	137	18350	11.6	1223	1451	30600	1892	1.14
	16.0		138.00	171	22080	11.4	1472	1774	37840	2299	1.12
350x350	9.0	*	94.70	120	22970	13.8	1312	1522	36370	1987	1.36
	12.0		124.00	156	29050	13.6	1660	1949	47600	2552	1.34
	16.0		163.00	203	36510	13.4	2086	2488	61480	3238	1.32
400x400	9.0	*	109.00	138	34790	15.9	1739	2009	54720	2630	1.56
	12.0		143.00	180	44320	15.7	2216	2587	71840	3395	1.54
	16.0		188.00	235	56150	15.5	2808	3322	93280	4336	1.52

* Sizes not included in EN 10219 Part 2 (1997)

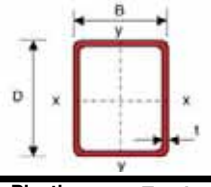
Rectangular



Designation Size DxB	Thickness t		Mass Per Metre	Area Of Section	Second Moment Of Area		Radius Of Gyration		Elastic Modulus		Plastic Modulus		Torsional Constants		Surface Area Per Metre
					Axis x-x	Axis y-y	Axis x-x	Axis y-y	Axis x-x	Axis y-y	Axis x-x	Axis y-y			
				A									J	C	
mm	mm		kg/m	cm^2	cm^4	cm^4	cm	cm	cm^3	cm^3	cm^3	cm^3	cm^4	cm^3	m^2/m
19x9	1.0	*	0.411	0.494	0.206	0.0621	0.645	0.354	0.216	0.138	0.283	0.165	0.165	0.244	0.0526
	1.2	*	0.421	0.577	0.231	0.0689	0.633	0.346	0.243	0.153	0.323	0.188	0.187	0.273	0.0519
	1.6	*	0.540	0.728	0.268	0.0783	0.607	0.328	0.282	0.174	0.390	0.224	0.222	0.315	0.0505
25x12	1.0	*	0.555	0.674	0.510	0.160	0.869	0.487	0.408	0.266	0.521	0.310	0.410	0.467	0.0706
	1.2	*	0.659	0.793	0.583	0.181	0.857	0.478	0.467	0.302	0.604	0.358	0.473	0.532	0.0699
	1.6	*	0.859	1.02	0.705	0.215	0.833	0.460	0.564	0.358	0.749	0.440	0.582	0.638	0.0685
25x13	1.2	*	0.670	0.817	0.617	0.219	0.869	0.517	0.494	0.337	0.632	0.398	0.549	0.586	0.0719
	1.6	*	0.860	1.05	0.749	0.262	0.845	0.500	0.599	0.402	0.786	0.492	0.679	0.707	0.0705
32x16	1.0	*	0.707	0.894	1.15	0.391	1.14	0.661	0.722	0.488	0.905	0.558	0.962	0.847	0.0926
	1.2	*	0.838	1.06	1.34	0.449	1.12	0.652	0.836	0.562	1.06	0.650	1.12	0.978	0.0919
	1.6	*	1.10	1.37	1.66	0.550	1.10	0.634	1.04	0.688	1.34	0.818	1.41	1.21	0.0905
38x19	1.0	*	0.858	1.07	1.99	0.676	1.36	0.793	1.05	0.711	1.30	0.805	1.65	1.23	0.111
	1.2	*	1.02	1.27	2.32	0.783	1.35	0.784	1.22	0.824	1.53	0.943	1.93	1.43	0.110
	1.6	*	1.34	1.66	2.91	0.973	1.33	0.766	1.53	1.02	1.95	1.20	2.46	1.79	0.109
38x25	1.0	*	0.949	1.19	2.40	1.26	1.42	1.03	1.26	1.01	1.52	1.14	2.63	1.66	0.123
	1.2	*	1.13	1.42	2.80	1.47	1.41	1.02	1.48	1.17	1.79	1.35	3.10	1.94	0.122
	1.6	*	1.50	1.85	3.55	1.85	1.39	1.00	1.87	1.48	2.30	1.72	3.99	2.45	0.121
50x25	1.0	*	1.15	1.43	4.69	1.60	1.81	1.06	1.87	1.28	2.31	1.43	3.85	2.22	0.147
	1.2	*	1.37	1.71	5.50	1.88	1.80	1.05	2.20	1.50	2.73	1.69	4.54	2.59	0.146
	1.6	*	1.81	2.23	7.02	2.37	1.77	1.03	2.81	1.90	3.53	2.17	5.85	3.29	0.145
	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
	2.3	*	2.48	3.10	9.31	3.10	1.73	1.00	3.72	2.48	4.78	2.92	7.90	4.34	0.142
	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
	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
	3.2	*	3.41	4.13	11.6	3.80	1.68	0.960	4.65	3.04	6.14	3.73	10.1	5.38	0.139
50x30	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
	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
	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
	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
60x40	1.6	*	2.37	3.03	15.2	8.16	2.24	1.64	5.07	4.08	6.12	4.64	16.9	6.72	0.195
	2.3	*	3.33	4.25	20.7	11.0	2.20	1.61	6.88	5.50	8.44	6.38	23.4	9.10	0.192
	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
	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
	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
	4.5	*	6.01	7.67	33.3	17.4	2.08	1.51	11.1	8.72	14.3	10.7	39.9	14.7	0.185
65x38	1.6	*	2.45	3.13	17.8	7.79	2.39	1.58	5.49	4.10	6.70	4.63	17.4	6.91	0.201
	2.3	*	3.40	4.39	24.2	10.5	2.35	1.55	7.46	5.53	9.24	6.37	24.0	9.36	0.198
	3.0		4.38	5.59	29.8	12.8	2.31	1.51	9.18	6.75	11.5	7.93	30.0	11.5	0.196
	3.2		4.54	5.92	31.3	13.4	2.30	1.51	9.63	7.06	12.2	8.35	31.6	12.1	0.195
	4.0	*	5.64	7.19	36.5	15.5	2.25	1.47	11.2	8.17	14.5	9.89	37.5	14.0	0.192
75x38	1.6	*	2.70	3.45	25.3	8.85	2.71	1.60	6.76	4.66	8.3	5.21	21.2	8.03	0.221
	1.9	*	3.22	4.06	29.4	10.2	2.69	1.59	7.85	5.39	9.7	6.08	24.7	9.30	0.219
	2.3	*	3.86	4.85	34.6	12.0	2.67	1.57	9.23	6.30	11.5	7.19	29.2	10.9	0.218
	3.0	*	4.99	6.19	42.8	14.7	2.63	1.54	11.4	7.72	14.5	8.98	36.6	13.4	0.216
	3.2	*	5.17	6.56	45.0	15.4	2.62	1.53	12.0	8.09	15.3	9.46	38.6	14.1	0.215
	4.0	*	6.27	7.99	52.8	17.9	2.57	1.50	14.1	9.40	18.3	11.2	45.9	16.5	0.212
	4.5	*	6.94	8.84	57.1	19.2	2.54	1.47	15.2	10.1	19.9	12.3	50.0	17.8	0.211

* Sizes not included in BS EN 10219 Part 2 (1997)

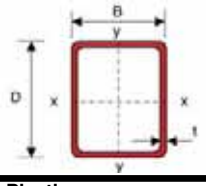
Rectangular



Designation Size DxB	Thickness t		Mass Per Metre	Area Of Section	Second Moment Of Area		Radius Of Gyration		Elastic Modulus		Plastic Modulus		Torsional Constants		Surface Area Per Metre
					Axis x-x	Axis y-y	Axis x-x	Axis y-y	Axis x-x	Axis y-y	Axis x-x	Axis y-y	J	C	
mm	mm		kg/m	cm^2	cm^4	cm^4	cm	cm	cm^3	cm^3	cm^3	cm^3	cm^4	cm^3	m^2/m
75x50	1.9	*	3.60	4.51	35.5	19.1	2.81	2.05	9.48	7.62	11.4	8.65	39.5	12.5	0.243
	2.3	*	4.31	5.40	41.9	22.4	2.79	2.04	11.2	8.96	13.6	10.3	46.9	14.8	0.242
	3.0	*	5.59	6.91	52.2	27.8	2.75	2.00	13.9	11.1	17.1	12.9	59.3	18.4	0.240
	3.2	*	5.80	7.33	54.9	29.2	2.74	2.00	14.6	11.7	18.0	13.6	62.6	19.3	0.239
	4.0	*	7.08	8.95	65.0	34.3	2.69	1.96	17.3	13.7	21.7	16.3	75.3	22.9	0.236
	4.5	*	7.88	9.92	70.6	37.2	2.67	1.94	18.8	14.9	23.8	17.9	82.7	24.9	0.235
	4.6	*	8.04	10.1	71.6	37.7	2.66	1.93	19.1	15.1	24.2	18.2	84.1	25.2	0.234
	4.8	*	8.33	10.5	73.7	38.8	2.65	1.92	19.6	15.5	24.9	18.8	86.8	26.0	0.234
	5.0	*	8.53	10.9	75.6	39.7	2.64	1.91	20.2	15.9	25.7	19.3	89.5	26.7	0.233
	6.0	*	9.92	12.6	84.4	44.1	2.58	1.87	22.5	17.6	29.2	21.9	102	29.8	0.229
80x40	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
	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
90x50	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
	3.6	*	7.24	9.23	94.7	37.7	3.20	2.02	21.1	15.1	26.4	17.5	89.6	25.8	0.268
	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
	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
100x50	1.9	*	4.36	5.46	71.6	24.5	3.62	2.12	14.3	9.82	17.6	10.9	58.7	16.9	0.293
	2.3	*	5.23	6.55	84.8	29.0	3.60	2.10	17.0	11.6	21.0	13.0	69.9	20.0	0.292
	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
	3.2	*	7.07	8.93	112	38.0	3.55	2.06	22.5	15.2	28.2	17.4	93.7	26.4	0.289
	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
	4.5	*	9.70	12.2	147	48.9	3.47	2.00	29.3	19.5	37.6	23.0	124	34.2	0.285
	5.0		10.50	13.4	158	52.5	3.44	1.98	31.6	21.0	40.8	25.0	135	36.8	0.283
	6.0		12.30	15.6	179	58.7	3.38	1.94	35.8	23.5	46.9	28.5	154	41.4	0.279
	6.3		12.50	15.9	176	58.2	3.32	1.91	35.1	23.3	46.9	28.6	158	42.1	0.273
100x60	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
	3.6	*	8.37	10.7	140	63.3	3.63	2.44	28.0	21.1	34.7	24.3	143	35.6	0.308
	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
	5.0		11.30	14.4	181	80.8	3.55	2.37	36.2	26.9	45.6	31.9	188	45.8	0.303
	6.0		13.20	16.8	205	91.2	3.49	2.33	41.1	30.4	52.5	36.6	216	51.9	0.299
	6.3		13.50	17.2	203	90.9	3.44	2.30	40.7	30.3	52.8	36.9	223	53.0	0.293
100x75	2.3	*	6.04	7.70	112	72.3	3.82	3.06	22.5	19.3	26.6	21.9	138	31.0	0.342
	3.0	*	8.02	9.91	142	91.1	3.78	3.03	28.4	24.3	33.9	27.9	177	39.1	0.340
	3.2	*	8.33	10.5	150	96.2	3.77	3.02	30.0	25.6	35.9	29.5	187	41.3	0.339
	4.0	*	10.20	12.9	180	115	3.73	2.99	36.0	30.8	43.7	35.9	228	49.7	0.336
	4.5	*	11.50	14.4	198	127	3.71	2.96	39.6	33.7	48.3	39.6	253	54.6	0.335
	4.6	*	11.70	14.7	201	129	3.70	2.96	40.3	34.3	49.2	40.3	257	55.5	0.334
	4.8	*	12.10	15.3	208	133	3.69	2.95	41.6	35.4	51.0	41.8	267	57.4	0.334
	5.0	*	12.80	15.9	215	137	3.68	2.94	42.9	36.5	52.7	43.2	276	59.2	0.333
	6.0	*	15.10	18.6	245	156	3.63	2.89	49.0	41.6	61.0	49.9	320	67.7	0.329
120x60	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
	3.6	*	9.50	12.1	221	74.8	4.27	2.48	36.8	24.9	46.1	28.4	184	43.2	0.348
	4.0		10.50	13.3	241	81.2	4.25	2.47	40.1	27.1	50.5	31.1	201	47.0	0.346
	5.0		12.80	16.4	287	96.0	4.19	2.42	47.8	32.0	60.9	37.4	242	55.8	0.343
	6.0		15.10	19.2	328	109	4.13	2.38	54.7	36.3	70.6	43.1	280	63.6	0.339
	6.3		15.50	19.7	327	109	4.07	2.35	54.5	36.4	71.2	43.7	289	65.1	0.333
120x80	4.0		11.70	14.9	295	157	4.44	3.24	49.1	39.3	59.8	45.2	331	64.9	0.386
	5.0		14.40	18.4	353	188	4.39	3.20	58.9	46.9	72.4	54.7	402	77.8	0.383
	6.0		17.00	21.6	406	215	4.33	3.15	67.7	53.8	84.3	63.5	469	89.4	0.379
	6.3		17.50	22.2	408	217	4.28	3.12	68.1	54.3	85.6	64.7	488	92.1	0.373
	8.0		21.40	27.2	476	252	4.18	3.04	79.3	62.9	102.0	76.9	584	108.0	0.366

* Sizes not included in BS EN 10219 Part 2 (1997)

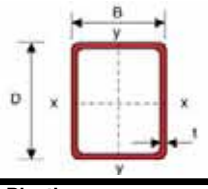
Rectangular



Designation Size DxB	Thickness t		Mass Per Metre	Area Of Section	Second Moment Of Area		Radius Of Gyration		Elastic Modulus		Plastic Modulus		Torsional Constants		Surface Area Per Metre
					Axis x-x	Axis y-y	Axis x-x	Axis y-y	Axis x-x	Axis y-y	Axis x-x	Axis y-y			
				A									J	C	
mm	mm		kg/m	cm^2	cm^4	cm^4	cm	cm	cm^3	cm^3	cm^3	cm^3	cm^4	cm^3	m^2/m
125x50	2.3	*	6.04	7.70	148	35.5	4.39	2.15	23.7	14.2	29.9	15.7	93.9	25.3	0.342
	3.0	*	8.02	9.91	187	44.4	4.34	2.12	29.9	17.7	38.1	20.0	119	31.6	0.340
	3.2	*	8.33	10.5	198	46.7	4.33	2.11	31.6	18.7	40.4	21.1	126	33.4	0.339
	4.0	*	10.20	12.9	238	55.6	4.28	2.07	38.0	22.2	49.0	25.5	152	39.8	0.336
	4.5	*	11.50	14.4	261	60.6	4.25	2.05	41.7	24.2	54.2	28.1	167	43.5	0.335
	4.6	*	11.70	14.7	265	61.5	4.25	2.04	42.4	24.6	55.2	28.6	170	44.2	0.334
	4.8	*	12.10	15.3	274	63.4	4.23	2.04	43.8	25.3	57.2	29.6	176	45.6	0.334
	5.0	*	12.80	15.9	282	65.2	4.22	2.03	45.2	26.1	59.1	30.6	182	47.0	0.333
	6.0	*	15.10	18.6	322	73.3	4.16	1.98	51.5	29.3	68.3	35.1	209	53.1	0.329
	6.4	*	15.60	19.4	322	74.0	4.08	1.95	51.6	29.6	69.6	35.9	217	54.7	0.323
125x75	2.3	*	6.95	8.85	192	87.5	4.65	3.14	30.6	23.3	37.0	26.1	190	39.1	0.392
	3.0	*	9.23	11.4	243	111	4.61	3.11	38.9	29.5	47.3	33.3	243	49.5	0.390
	3.2	*	9.60	12.1	257	117	4.60	3.10	41.1	31.1	50.1	35.3	258	52.3	0.389
	4.0	*	11.80	14.9	311	141	4.56	3.07	49.7	37.5	61.1	43.0	315	63.1	0.386
	4.5	*	13.30	16.7	342	155	4.53	3.04	54.8	41.2	67.7	47.5	349	69.5	0.385
	5.0	*	14.70	18.4	373	168	4.50	3.02	59.6	44.7	74.1	52.0	382	75.6	0.383
	6.0	*	17.20	21.6	428	192	4.45	2.98	68.5	51.1	86.2	60.3	444	86.7	0.379
	6.4	*	18.20	22.6	435	196	4.39	2.94	69.6	52.2	88.5	62.1	467	90.3	0.373
150x50	3.0	*	9.23	11.4	299	52.6	5.12	2.15	39.8	21.1	51.4	23.5	150	38.3	0.390
	3.2	*	9.60	12.1	316	55.5	5.10	2.14	42.1	22.2	54.5	24.9	159	40.4	0.389
	4.0	*	11.80	14.9	381	66.2	5.05	2.10	50.9	26.5	66.5	30.1	192	48.3	0.386
	4.5	*	13.30	16.7	420	72.2	5.02	2.08	56.0	28.9	73.6	33.2	212	52.9	0.385
	4.6	*	13.50	17.0	427	73.4	5.01	2.08	57.0	29.4	75.0	33.8	215	53.7	0.384
	4.8	*	14.00	17.7	442	75.7	5.00	2.07	58.9	30.3	77.8	35.0	223	55.4	0.384
	5.0	*	14.70	18.4	456	77.9	4.99	2.06	60.8	31.1	80.5	36.2	230	57.1	0.383
	6.0	*	17.30	21.6	523	87.9	4.92	2.02	69.8	35.2	93.5	41.7	264	64.8	0.379
	6.4	*	18.20	22.6	528	89.3	4.84	1.99	70.4	35.7	95.7	42.9	275	66.9	0.373
150x75	3.0	*	10.10	12.9	380	130	5.42	3.17	50.6	34.7	62.5	38.7	312	59.8	0.440
	3.2	*	10.90	13.7	402	137	5.41	3.16	53.6	36.6	66.3	41.0	331	63.3	0.439
	4.0	*	13.40	16.9	488	166	5.37	3.13	65.1	44.2	81.1	50.1	404	76.6	0.436
	4.5	*	15.10	18.9	539	183	5.34	3.11	71.9	48.7	90.0	55.5	448	84.4	0.435
	4.6	*	15.30	19.3	549	186	5.33	3.10	73.2	49.5	91.7	56.5	457	85.9	0.434
	4.8	*	14.00	20.1	568	192	5.32	3.09	75.8	51.2	95.2	58.6	474	88.9	0.434
	5.0	*	16.70	20.9	588	198	5.31	3.08	78.4	52.9	98.6	60.7	491	91.9	0.433
	6.0	*	19.70	24.6	679	228	5.25	3.04	90.5	60.7	115	70.6	572	105.8	0.429
	6.4	*	20.70	25.8	693	233	5.19	3.01	92.4	62.2	119	73.1	603	110.4	0.423
	9.0	*	27.60	34.5	865	287	5.01	2.89	115	76.6	153	93.6	775	138.1	0.411
150x100	3.0	*	11.58	14.4	461	248	5.65	4.15	61.4	49.5	73.5	55.8	507	81.4	0.490
	3.2	*	12.00	15.3	488	262	5.64	4.14	65.1	52.5	78.0	59.2	539	86.2	0.489
	4.0		14.90	18.9	595	319	5.60	4.10	79.3	63.7	95.7	72.5	662	105	0.486
	4.5	*	16.90	21.2	658	352	5.58	4.08	87.7	70.4	106	80.5	736	116	0.485
	4.6	*	17.10	21.6	670	358	5.57	4.07	89.4	71.7	108	82.1	751	118	0.484
	4.8	*	17.80	22.5	695	371	5.56	4.06	92.7	74.3	113	85.2	780	123	0.484
	5.0		18.30	23.4	719	384	5.55	4.05	95.9	76.8	117	88.3	809	127	0.483
	6.0		21.70	27.6	835	444	5.50	4.01	111	88.8	137	103	948	147	0.479
	6.3		22.40	28.5	848	453	5.45	3.98	113	90.5	140	106	992	152	0.473
	6.4	*	23.20	29.0	858	458	5.44	3.98	114	91.6	142	107	1005	154	0.473
	8.0		27.70	35.2	1008	536	5.35	3.90	134	107	169	128	1206	182	0.466
	9.0	*	31.40	39.0	1089	577	5.29	3.85	145	115	185	140	1320	197	0.461
	9.5	*	33.30	40.8	1127	597	5.26	3.82	150	119	192	145	1374	204	0.459
	12.7	*	42.30	50.1	1232	655	4.96	3.61	164	131	221	167	1619	234	0.435

* Sizes not included in BS EN 10219 Part 2 (1997)

Rectangular



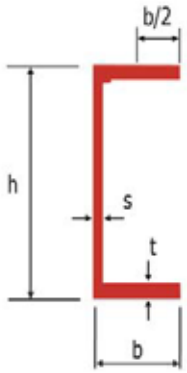
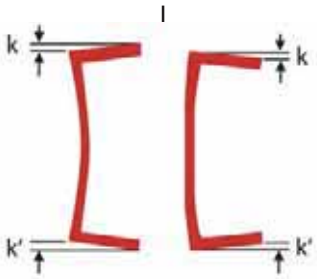
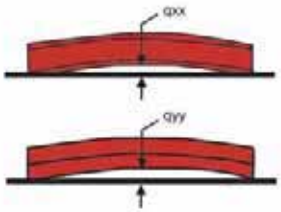
Designation Size DxB	Thickness t		Mass Per Metre	Area Of Section	Second Moment Of Area		Radius Of Gyration		Elastic Modulus		Plastic Modulus		Torsional Constants		Surface Area Per Metre
					Axis x-x	Axis y-y	Axis x-x	Axis y-y	Axis x-x	Axis y-y	Axis x-x	Axis y-y			
				A									J	C	
mm	mm		kg/m	cm^2	cm^4	cm^4	cm	cm	cm^3	cm^3	cm^3	cm^3	cm^4	cm^3	m^2/m
160x80	5.0		17.50	22.4	722	244	5.68	3.30	90.2	61.0	113	69.7	601	106	0.463
	6.0		20.70	26.4	836	281	5.62	3.26	105	70.2	132	81.3	702	122	0.459
	8.0		26.40	33.6	1001	335	5.46	3.16	125	83.7	163	100	882	150	0.446
175x100	4.8	*	19.70	24.9	1013	426	6.38	4.14	116	85.2	142	96.7	969	144	0.534
	6.4	*	25.70	32.2	1260	528	6.26	4.05	144	106	180	122	1251	182	0.523
	9.5	*	37.10	45.5	1673	694	6.06	3.90	191	139	246	166	1719	243	0.509
	12.7	*	47.30	56.5	1867	777	5.75	3.71	213	155	288	195	2052	283	0.485
175x125	4.8	*	21.60	27.3	1187	708	6.60	5.09	136	113	163	129	1410	184	0.584
	6.4	*	28.30	35.4	1487	886	6.49	5.01	170	142	207	164	1832	234	0.573
	9.5	*	40.90	50.3	1999	1184	6.30	4.85	228	189	285	226	2554	317	0.559
	12.7	*	52.40	62.8	2286	1356	6.03	4.65	261	217	340	270	3129	377	0.535
200x100	4.0		18.00	22.9	1200	411	7.23	4.23	120	82.2	148	91.7	985	142	0.586
	4.5	*	20.50	25.7	1331	455	7.20	4.21	133	90.9	165	102	1097	157	0.585
	5.0		22.30	28.4	1459	497	7.17	4.19	146	99.4	181	112	1206	172	0.583
	6.0		26.40	33.6	1703	577	7.12	4.14	170	115	213	132	1417	200	0.579
	6.3		27.40	34.8	1739	591	7.06	4.12	174	118	219	135	1483	208	0.573
	8.0		33.90	43.2	2091	705	6.95	4.04	209	141	267	165	1811	250	0.566
	9.0	*	40.52	48.0	2276	764	6.89	3.99	228	153	293	180	1988	272	0.561
	9.5	*	40.90	50.3	2362	792	6.85	3.97	236	158	306	188	2073	282	0.559
	12.0		49.10	60.1	2607	876	6.59	3.82	261	175	350	215	2414	322	0.538
	12.7	*	52.40	62.8	2679	898	6.53	3.78	268	180	363	223	2496	331	0.535
200x150	4.5	*	25.40	30.2	1761	1135	7.64	6.13	176	151	209	172	2169	243	0.685
	6.0	*	31.10	39.6	2268	1457	7.56	6.06	227	194	271	223	2826	313	0.679
	6.3	*	33.30	41.1	2330	1499	7.53	6.04	233	200	280	230	2965	325	0.673
	9.0	*	45.30	57.0	3097	1985	7.37	5.90	310	265	379	312	4055	435	0.661
	9.5	*	48.40	59.8	3225	2066	7.34	5.88	322	275	396	326	4244	454	0.659
	12.0	*	58.50	72.1	3668	2353	7.14	5.71	367	314	463	380	5099	532	0.638
	12.7	*	62.50	75.5	3794	2432	7.09	5.67	379	324	482	396	5316	552	0.635
250x150	5.0		30.10	38.4	3304	1508	9.28	6.27	264	201	320	225	3285	337	0.783
	6.0		35.80	45.6	3886	1768	9.23	6.23	311	236	378	266	3886	396	0.779
	6.3		37.20	47.4	4001	1825	9.18	6.20	320	243	391	276	4078	412	0.773
	8.0		46.50	59.2	4886	2219	9.08	6.12	391	296	482	340	5050	504	0.766
	9.0	*	52.30	66.0	5369	2433	9.02	6.07	430	324	533	375	5596	554	0.761
	10.0		57.00	72.6	5825	2634	8.96	6.02	466	351	582	409	6121	602	0.757
	12.0		66.00	84.1	6458	2925	8.77	5.90	517	390	658	463	7088	684	0.738
	12.5		68.30	87.0	6633	3002	8.73	5.87	531	400	678	477	7315	704	0.736
300x100	6.0		35.8	45.6	4777	842	10	4.30	318	168	411	188	2403	306	0.779
	6.3		37.2	47.4	4907	868	10	4.28	327	174	425	194	2515	318	0.773
	10.0		57.0	72.6	7106	1224	10	4.11	474	245	631	285	3681	455	0.757
300x200	6.0		45.20	57.6	7370	3962	11.3	8.29	491	396	588	446	8115	651	0.979
	6.3		47.10	60.0	7624	4104	11.3	8.27	508	410	610	463	8524	680	0.973
	8.0		59.10	75.2	9389	5042	11.2	8.19	626	504	757	574	10630	838	0.966
	9.0	*	66.50	84.0	10370	5561	11.1	8.14	691	556	840	637	11820	927	0.961
	10.0		72.70	92.6	11310	6058	11.1	8.09	754	606	921	698	12990	1012	0.957
	12.0		84.80	108	12790	6854	10.9	7.96	853	685	1056	801	15240	1167	0.938
	12.5		88.00	112	13180	7060	10.8	7.94	879	706	1091	828	15770	1204	0.936
400x200	6.0	*	54.70	69.6	14790	5092	14.6	8.55	739	509	906	562	12070	877	1.18
	8.0		71.60	91.2	18970	6517	14.4	8.45	949	652	1173	728	15820	1133	1.17
	9.0	*	80.60	102	21020	7204	14.4	8.40	1051	720	1305	809	17620	1255	1.16
	10.0	*	88.40	113	23000	7864	14.3	8.36	1150	786	1434	888	19370	1373	1.16
	12.0	*	104.00	132	26250	8977	14.1	8.24	1312	898	1656	1027	22780	1591	1.14
	12.5		108.00	137	27100	9260	14.1	8.22	1355	926	1714	1062	23590	1644	1.14

* Sizes not included in BS EN 10219 Part 2 (1997)

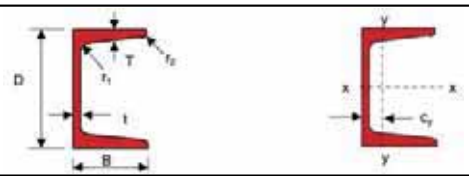
Channels

Rolling tolerances – EN 10279 : 2000

This European standard specifies requirements for the tolerances on dimensions, shape and mass on hot rolled steel channels with parallel flanges.

Designation	Property	Range mm	Tolerance mm	
	Height **h**	h ≤ 65 65< h ≤ 200 200< h ≤ 400 400 < h	± 1.5 ± 2.0 ± 3.0 ± 4.0	
	Flange width **b**	b ≤ 50 50 < b ≤ 100 100 < b ≤ 125 125 < b	± 1.5 ± 2.0 ± 2.5 ± 3.0	
	Web thickness **s**	s ≤ 10 10 s ≤ 15 15 s	± 0.5 ± 0.7 ± 1.0	
	Flange thickness **t**	t ≤ 10 10 t ≤ 15 15 t	Tolerance limited by weight	-0.5 -1 -1.5
	Heel radius r_3	All Sizes	< 0.3 * t	
	Out of squareness K + K'	b ≤ 100 100 < b	2 2% of b	
	Web flatness f	h ≤ 100 100< h ≤ 200 200< h ≤ 400 400 < h	± 0.5 ± 1.0 ± 1.5 ± 1.5	
	Straightness (x direction)	h ≤ 150 150< h ≤300 300 < h	0.30% L 0.20% L 0.15% L	
	Straightness (y direction)	h ≤ 150 150< h ≤300 300 < h	0.50% L 0.30% L 0.20% L	
Mass per unit length	kg/m	h ≤ 125 125 < h	± 6.0% ± 4.0%	
Standard	Length L	All	100	0
Alternative Standard (by agreement)		All	50	-50

Tapered Flange

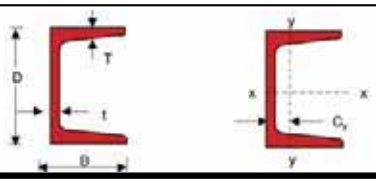


Metric

Designation Size DxBxt	Mass Per Metre	Thickness Web t	Thickness Flange T	Root Radius r_1	Toe Radius r_2	Area Of Section A	Centre Of Gravity C_y	Second Moment Of Area I_x	Second Moment Of Area I_y	Radius Of Gyration r_x	Radius Of Gyration r_y	Elastic Modulus Z_x	Elastic Modulus Z_y
mm	kg/m	mm	mm	mm	mm	cm^2	cm	cm^4	cm^4	cm	cm	cm^3	cm^4
50x25x5	3.86	5.0	6.0	6	3	4.92	0.81	16.8	2.49	1.85	0.71	6.73	1.48
75x40x5	6.92	5.0	7.0	8	4	8.82	1.27	75.9	12.4	2.93	1.19	20.2	4.54
100x50x5	9.36	5.0	7.5	8	4	11.9	1.55	189	26.9	3.99	1.50	37.8	7.82
125x65x6	13.40	6.0	8.0	8	4	17.1	1.94	425	65.5	4.99	1.96	68.0	14.4
150x75x6.5	18.60	6.5	10.0	10	5	23.7	2.31	864	122	6.04	2.27	115	23.6
150x75x9	24.00	9.0	12.5	15	7.5	30.5	2.31	1060	151	5.90	2.22	141	29.1
180x75x7	21.40	7.0	10.5	11	5.5	27.2	2.15	1380	137	7.12	2.24	154	25.5
200x80x7.5	24.60	7.5	11.0	12	6	31.3	2.24	1950	177	7.89	2.38	195	30.8
200x90x8	30.30	8.0	13.5	14	7	38.7	2.77	2490	286	8.02	2.72	249	45.9
230x80x8	28.40	8.0	12.0	13	6.5	36.1	2.15	2900	200	8.96	2.35	252	34.2
250x90x9	34.60	9.0	13.0	14	7	44.1	2.42	4180	306	9.74	2.63	335	46.5
250x90x11	40.20	11.0	14.5	17	8.5	51.2	2.39	4690	342	9.47	2.58	375	51.7
300x90x9	38.10	9.0	12.0	14	7	48.6	2.23	6440	325	11.5	2.59	429	48.0
300x90x10	43.80	10.0	15.5	19	9.5	55.7	2.33	7400	373	11.5	2.59	494	56.0
300x90x12	48.60	12.0	16.0	19	9.5	61.9	2.28	7870	379	11.3	2.48	525	56.4
380x100x10.5	54.50	10.5	16.0	18	9	69.4	2.41	14500	557	14.5	2.83	762	73.3
380x100x13	62.00	13.0	16.5	18	9	79.0	2.29	15600	584	14.1	2.72	822	75.8
380x100x13	67.30	13.0	20.0	24	12	85.7	2.25	17600	655	14.3	2.76	926	87.8

Note : The flange thickness is measured at the centre of the flange

Tapered Flange



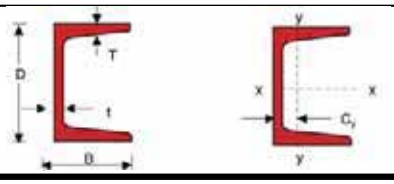
Imperial

Designation Size		Mass Per Metre	Depth Of Section	Width Of Section	Thickness Web	Thickness Flange	Area Of Section	Centre Of Gravity	Second moment Of Area		Radius Of Gyration		Elastic Modulus		Plastic Modulus	
			D	B	t	T	A	C_y	I_x	I_y	r_x	r_y	Z_x	Z_y	S_x	S_y
in x in	lb/ft	kg/m	mm	mm	mm	mm	cm^2	cm	cm^4	cm^4	cm	cm	cm^3	cm^3	cm^3	cm^3
3x1 1/2	4.5	6.7	76.2	38.1	5.1	6.8	8.62	1.12	75.1	10.1	2.95	1.08	19.71	3.78	23.7	7.5
4x2	7	10.42	101.6	50.8	6.1	7.6	13.16	1.41	206	27.7	3.95	1.48	40.51	7.64	48.7	14.9
5x2 1/2	10	14.90	127.0	63.5	6.4	9.2	18.79	1.82	477	64.7	5.04	1.88	75.1	14.5	89.1	27.7
6x3	12	17.88	152.4	76.2	6.4	9.0	22.48	2.04	838	109	6.11	2.24	110	20	129	38.3
6x3 1/2	16	23.84	152.4	88.9	7.1	11.6	30.02	2.67	1154	210	6.20	2.66	151.4	34.5	177	63.7
7x3	14	20.84	177.8	76.2	6.6	10.3	26.39	2.05	1329	129	7.10	2.25	149.5	23.6	176	45.3

(British Channels)

Note : The flange thickness is measured at the centre of the flange

Tapered Flange

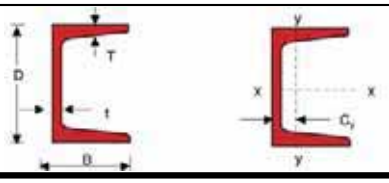


Imperial

Designation Size		Mass Per Metre	Depth Of Section	Width Of Section	Thickness Web	Thickness Flange	Area Of Section	Centre Of Gravity	Second moment Of Area		Radius Of Gyration		Elastic Modulus		Plastic Modulus	
			D	B	t	T	A	C_y	I_x	I_y	r_x	r_y	Z_x	Z_y	S_x	S_y
in x in	lb/ft	kg/m	mm	mm	mm	mm	cm^2	cm	cm^4	cm^4	cm	cm	cm^3	cm^3	cm^3	cm^3
3x1 3/8	4.1	6.1	76.2	35.0	4.3	6.9	7.81	1.06	69.11	8.0	2.98	1.01	18.14	3.27	21.7	6.4
3x1 1/2	5	7.4	76.2	37.0	6.6	6.9	9.48	1.06	76.58	9.6	2.85	1.01	20.1	3.65	24.9	7.36
3x1 5/8	6	8.90	76.2	40.0	9	6.9	11.30	1.13	86.37	12.1	2.76	1.03	22.67	4.2	28.7	8.8
4x1 5/8	5.4	8.00	101.6	40.0	4.7	7.5	10.30	1.15	160.3	13.8	3.97	1.16	31.56	4.89	37.8	9.4
4x1 3/4	7.2	10.80	101.6	43.0	8.2	7.5	13.70	1.13	190.8	17.4	3.72	1.12	37.56	5.48	47	11.3
5x1 3/4	6.7	10.40	127.0	47.0	4.8	8.1	12.70	1.29	332.4	24.3	5.01	1.36	52.34	7.19	61.8	14.1
5x1 7/8	9	13.00	127.0	48.0	8.3	8.1	17.00	1.21	371.3	27.4	4.66	1.27	58.47	7.65	73.1	15.3
6x1 7/8	8.2	12.20	152.4	48.0	5.1	8.7	15.50	1.26	548.4	29.2	5.94	1.37	72	8.3	85.6	16.1
6x2	10.5	15.60	152.4	51.0	8	8.7	19.90	1.24	630	36	5.63	1.35	82.68	9.36	103	18.7
6X2 1/8	13	19.30	152.4	54.0	11.1	8.7	24.70	1.28	720.8	42.4	5.41	1.31	94.59	10.3	121	22.1
7x2 1/8	9.8	14.60	177.8	53.0	5.3	9.3	18.50	1.36	895.5	42.7	6.94	1.52	100.7	10.9	120	21.1
7x2 1/4	12.25	18.20	177.8	55.0	8	9.3	23.20	1.31	1007	49.2	6.59	1.46	113.3	11.8	140	23.4
7x2 1/4	14.75	22.00	177.8	58.0	10.6	9.3	27.90	1.33	1143	56.8	6.39	1.42	128.6	12.7	163	27
8x2 1/4	11.5	17.10	203.0	57.0	5.6	9.9	21.80	1.44	1340	53.8	7.86	1.57	132	12.6	156	27.6
8x2 3/8	13.7	20.50	203.0	59.0	7.7	9.9	26.10	1.39	1490	62	7.57	1.54	147	13.7	177	30
8x2 1/2	18.5	27.90	203.0	64.0	12.4	9.9	35.50	1.43	1820	81.7	7.15	1.51	179	16.4	226	35.9
9x2 3/8	13.4	19.90	228.6	61.0	5.9	10.5	25.40	1.50	1991	76.1	8.86	1.73	174.2	16.7	208	31.9
9x2 1/2	15	22.00	228.6	63.0	7.2	10.5	28.10	1.49	2132	85.3	8.66	1.73	186.5	17.8	226	34.3
9x2 5/8	20	30.00	228.6	67.0	11.4	10.5	37.90	1.47	2544	103	8.19	1.65	222.5	19.8	282	41
10x2 5/8	15.3	22.80	254.0	65.0	6.1	11.1	29.00	1.58	2770	91.2	9.81	1.78	218	18.5	257	40.3
10x2 3/4	20	30.00	254.0	69.0	9.6	11.1	37.90	1.53	3260	114	9.29	1.74	257	21.2	315	46.5
10x2 7/8	25	37.00	254.0	73.0	13.4	11.1	47.40	1.56	3790	138	8.93	1.70	298	24	377	52.6
10x3	30	45.00	254.0	76.0	17.1	11.1	56.90	1.63	4270	158	8.68	1.67	336	26.5	434	57.4
12x3	20.7	30.80	305.0	74.0	7.2	12.7	39.30	1.74	5340	157	11.70	2.00	350	27.7	415	60.2
12x3	25	37.00	305.0	77.0	9.8	12.7	47.40	1.70	5970	183	11.20	1.97	391	30.5	477	66
12x3 1/8	30	45.00	305.0	80.0	13	12.7	56.90	1.70	6720	209	10.90	1.92	441	33.2	551	72.1
15x3 3/8	33.9	50.40	381.0	86.0	10.2	16.5	64.30	1.99	13100	334	14.30	2.28	688	50.5	825	107
15x3 1/2	40	60.00	381.0	89.0	13.2	16.5	76.10	1.97	14400	379	13.80	2.24	756	54.7	934	115
15x3 3/4	50	74.00	381.0	94.0	18.2	16.5	94.80	2.02	16700	454	13.30	2.19	877	61.5	1120	130

(American Standard Channels)

Tapered Flange

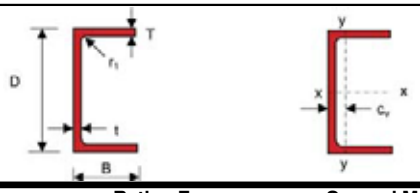


Imperial

Designation Size		Mass Per Metre	Depth Of Section	Width Of Section	Thickness Web	Thickness Flange	Area Of Section	Centre Of Gravity	Second moment Of Area		Radius Of Gyration		Elastic Modulus		Plastic Modulus	
			D	B	t	T	A	C_y	I_x	I_y	r_x	r_y	Z_x	Z_y	S_x	S_y
in x in	lb/ft	kg/m	mm	mm	mm	mm	cm^2	cm	cm^4	cm^4	cm	cm	cm^3	cm^3	cm^3	cm^3
6x2 1/2	12	17.90	152.0	63.0	7.9	9.5	22.80	1.63	773	69.8	5.83	1.75	101.7	15.1	123	29.6
6x3	15.1	22.50	152.0	74.0	8	12.1	28.60	2.18	1033	134	6.01	2.16	135.9	25.8	162	49.7
6x3 1/2	15.3	22.80	152.0	88.0	8.6	9.8	29.00	2.31	1050	178	6.01	2.48	138.2	27.9	164	55.2
6x3	16.3	24.30	152.0	76.0	9.5	12.1	30.90	2.17	1081	147	5.91	2.17	142.2	27.2	171	53.3
6x3 1/2	18	26.80	152.0	88.0	9.6	12.1	34.10	2.53	1223	219	5.99	2.54	160.9	35.4	192	68.7
7x3 1/2	19.1	28.40	178.0	87.0	8.9	127.0	36.20	2.46	1797	230	7.05	2.52	201.9	37.4	239	72.2
7x3 5/8	22.7	33.80	178.0	91.0	12.8	12.7	43.00	2.42	1973	271	6.77	2.51	221.7	40.8	271	80.9
8x1 7/8	8.5	12.60	203.0	47.0	4.5	7.9	16.10	1.07	971.2	27.1	7.77	1.30	95.69	7.53	115	14.5
8x3	18.7	27.80	203.0	75.0	9	12.7	35.50	1.99	2171	160	7.83	2.13	213.9	29.3	258	56.8
8x3	20	29.80	203.0	76.0	10.2	12.7	37.90	1.97	2261	167	7.72	2.10	222.7	29.8	271	58.7
8x3 1/2	21.4	31.80	203.0	87.0	9.5	13.3	40.50	2.36	2555	251	7.94	2.49	251.7	40	300	78
8x3 1/2	22.8	33.90	203.0	88.0	10.8	13.3	43.2	2.33	2645	262	7.83	2.46	260.6	40.7	314	80.3
9x3 1/2	23.9	35.60	229.0	87.0	10.2	14.0	45.30	2.29	3547	275	8.84	2.46	309.8	43.2	373	83.8
9x31/2	25.4	37.80	229.0	88.0	11.4	14.0	48.20	2.26	3670	286	8.73	2.44	320.5	43.9	389	86.3
10x11/2	8.4	12.50	254.0	38.0	4.3	7.1	15.90	0.71	1354	14.1	9.20	0.94	106.6	4.59	132	9.14
10x33/8	22	33.00	254.0	84.0	7.4	14.6	41.60	2.30	4310	255	10.13	2.46	339.4	42.2	397	81.3
10x33/8	25	37.00	254.0	86.0	9.7	14.0	47.40	2.25	4543	285	9.81	2.46	357.7	45.3	430	86.5
10x4	28.5	42.40	254.0	100.0	10.8	.614.6	54.00	2.58	5257	433	9.87	2.83	414	59	496	114
10x41/8	33.6	50.00	254.0	104.0	145	14.6	63.70	2.55	5750	498	9.52	2.80	452.8	63.8	558	126
10x43/8	41.1	61.20	254.0	110.0	20.2	14.6	78.10	2.59	6550	582	9.17	2.73	515.8	69.2	654	146
12x11/2	10.6	15.80	305.0	38.0	4.8	7.8	20.00	0.69	2338	15.9	10.78	0.89	153.3	5.08	196	10.8
12X35/8	31	46.00	305.0	93.0	9.4	17.8	58.90	2.61	8292	436	12.00	2.74	543.7	65	661	129
12x33/4	35	52.00	305.0	96.0	11.8	17.8	66.20	2.55	8998	487	11.67	2.71	590.1	68.7	726	138
12x37/8	40	60.00	305.0	98.0	15	17.8	76.10	2.48	9732	526	11.33	2.63	638.2	71.5	798	146
12x4	45	67.00	305.0	102.0	18	17.8	85.02	2.53	10510	597	11.10	2.65	689	77.5	873	161
12x41/8	50	74.00	305.0	105.0	21.2	17.8	94.80	2.59	11140	664	10.87	2.65	730.7	83.5	939	175
13x4	31.8	47.30	330.0	102.0	9.5	15.5	60.30	2.58	9986	500	12.87	2.88	605.2	65.1	739	136
13x41/8	35	52.00	330.0	103.0	11.4	15.5	66.40	2.50	10500	526	12.58	2.82	636.1	67	786	140
13x41/8	40	60.00	330.0	106.0	14.2	15.5	76.01	2.45	11470	576	12.27	2.75	694.9	70.2	870	150
13x43/8	50	74.00	330.0	112.0	20	15.5	94.80	2.52	12990	708	11.74	2.74	787.4	81	1016	175
18x4	42.7	63.50	457.0	100.0	11.4	15.9	81.30	2.11	23040	535	16.88	2.57	1008	67.4	1263	141
18x4	45.8	68.20	457.0	102.0	12.7	15.9	87.10	2.12	24010	576	16.64	2.58	1051	70.9	1330	149
18x41/8	51.9	77.20	457.0	104.0	15.2	15.9	98.70	2.10	26090	611	16.29	2.49	1142	73.2	1463	159
18x41/8	58	86.00	457.0	107.0	17.8	15.9	110.00	2.14	27850	682	16.00	2.50	1219	79.3	1587	173

(American Standard Channels)

Parallel Flange



Designation Size DxB	Mass Per Metre	Thickness Web t	Thickness Flange T	Root Radius r_1	Depth Between Fillets d	Area Of Section A	Centre Of Gravity C_y	Ratios For Local Buckling Flange	Ratios For Local Buckling Web	Second Moment Of Area Axis x-x	Second Moment Of Area Axis y-y
	kg/m	mm	mm	mm	mm	cm^2	cm	B/T	d/t	cm^4	cm^4
100x50	10.2	5.0	8.5	9	65.0	13.0	1.73	5.88	13.0	208	32.3
125x65	14.8	5.5	9.5	12	82.0	18.8	2.25	6.84	14.9	483	80.0
150x75	17.9	5.5	10.0	12	106	22.8	2.58	7.50	19.3	861	131
150x90	23.9	6.5	12.0	12	102	30.4	3.30	7.50	15.7	1162	253
180x75	20.3	6.0	10.5	12	135	25.9	2.41	7.14	22.5	1370	146
180x90	26.1	6.5	12.5	12	131	33.2	3.17	7.20	20.2	1817	277
200x75	23.4	6.0	12.5	12	151	29.9	2.48	6.00	25.2	1963	170
200x90	29.7	7.0	14.0	12	148	37.9	3.12	6.43	21.1	2523	314
230x75	25.7	6.5	12.5	12	181	32.7	2.30	6.00	27.8	2748	181
230x90	32.2	7.5	14.0	12	178	41.0	2.92	6.43	23.7	3518	334
250x90	35.5	8.0	15.0	12	220	45.2	2.86	6.00	27.5	4510	364
260x75	27.6	7.0	12.0	12	212	35.1	2.10	6.25	30.3	3619	185
260x90	34.8	8.0	14.0	12	208	44.4	2.74	6.43	26.0	4728	353
300x90	41.4	9.0	15.5	12	245	52.7	2.60	5.81	27.2	7218	404
300x100	45.5	9.0	16.5	15	237	58.0	3.05	6.06	26.3	8229	568
380x100	54.0	9.5	17.5	15	315	68.7	2.79	5.71	33.2	15030	643
430x100	64.4	11.0	19.0	15	362	82.1	2.62	5.26	32.9	21940	722

Designation Size DxB	Mass Per Metre	Radius Of Gyration Axis x-x	Radius Of Gyration Axis y-y	Elastic Modulus Axis x-x	Elastic Modulus Axis y-y	Plastic Modulus Axis x-x	Plastic Modulus Axis y-y	Buckling Parameter u	Torsional Index x	Warping Constant H	Torsional Constant J
	kg/m	cm	cm	cm^3	cm^3	cm^3	cm^3			dm^6	cm^4
100x50	10.2	4.00	1.58	41.5	9.89	48.9	17.5	0.942	10.0	0.000491	2.53
125x65	14.8	5.07	2.06	77.3	18.8	89.9	33.2	0.942	11.1	0.00194	4.72
150x75	17.9	6.15	2.40	115	26.6	132	47.2	0.946	13.1	0.00467	6.10
150x90	23.9	6.18	2.89	155	44.4	179	76.9	0.936	10.8	0.00890	11.8
180x75	20.3	7.27	2.38	152	28.8	176	51.8	0.946	15.3	0.00754	7.34
180x90	26.1	7.40	2.89	202	47.4	232	83.5	0.949	12.8	0.0141	13.3
200x75	23.4	8.11	2.39	196	33.8	227	60.6	0.956	14.8	0.0107	11.1
200x90	29.7	8.16	2.89	252	53.4	291	94.5	0.954	12.9	0.0197	18.3
230x75	25.7	9.17	2.35	239	34.8	278	63.2	0.947	17.3	0.0153	11.8
230x90	32.2	9.27	2.86	306	55.0	355	98.9	0.950	15.1	0.0279	19.3
250x90	35.5	9.99	2.84	361	59.3	421	107	0.948	15.5	0.0359	23.8
260x75	27.6	10.1	2.30	278	34.4	328	62.0	0.932	20.5	0.0203	11.7
260x90	34.8	10.3	2.82	364	56.3	425	102	0.942	17.2	0.0379	20.6
300x90	41.4	11.7	2.77	481	63.1	568	114	0.934	18.4	0.0581	28.8
300x100	45.5	11.9	3.13	549	81.7	641	148	0.944	17.0	0.0813	36.8
380x100	54.0	14.8	3.06	791	89.2	933	161	0.932	21.2	0.150	45.7
430x100	64.4	16.3	2.97	1020	97.9	1222	176	0.917	22.5	0.219	63.0

Purlins

General

Introduction

Light-gauge plain and lipped channels are cold roll-formed from hot-rolled steel strips/coils of material according to JIS 3101 Grade SS400 (1995), or EN 10025 (1993). The sections are cold roll-formed according to JIS 3350 Grade SSC400 (1987), SPIM C100, SS104 (1996), or BS 5950 Part 7 (1992). The cold roll-forming of channels produces sections with excellent mechanical properties and yet light in weight. They are specially designed to ensure the ability to resist forces applied onto them.

High-tensile galvanised C and Z purlins (sections) are cold roll-formed from high tensile Zinc coated steel sheets according to ASTM A446 (replaced by ASTM A653 (1997) and A924 (1997). Due to the lightweight, the high strength of the steel and the Zinc-coated surface, high-tensile galvanised C and Z purlins are versatile and economic in use. They require minimal maintenance throughout the life span of the buildings.
The light-gauge channels and high-tensile galvanised purlins are suitable for roofing and wall cladding supports and for structural frames of buildings. Because of the lightweight of the sections, no heavy equipment is needed to move them from one place to another, or for the fabrication of the structure.

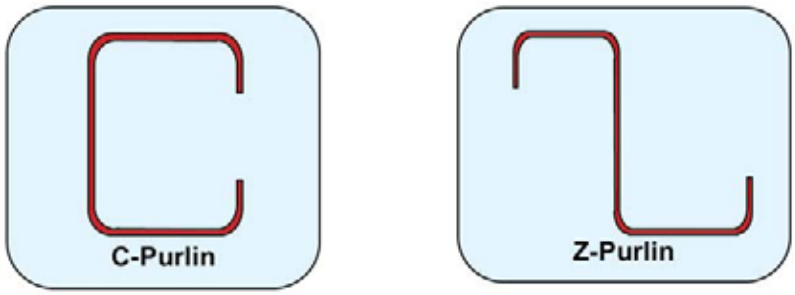


Figure 9 – C and Z Purlins

Material specifications

Light-Gauge Plain and Lipped Channels

Specification	Strength		Tolerances					
	Yield	Tensile	Height			Side	Lip	Corner
	N/mm^2	N/mm^2	H<150	150-300	H>300			Angle
JIS 3350 SSC400	min. 245	400-540	±1.5mm	±2.0mm	±3.0mm	±1.5mm	±2.0mm	±1.5°
SPIM C100	-	min. 295	±1.5mm	±2.0mm	±3.0mm	±1.5mm	±2.0mm	-
SS 104	250/450	430/480	±1.5mm	±2.0mm	±3.0mm	±1.5mm	±2.0mm	±1.0°
BS5950 Part7*	min. 235	340-470	±1.0mm	±1.25mm	±2.0mm	As for Height	±2.0/±3.0	±1.0°

Notes: *For BS5950 Part 7: The yield and tensile strengths are given by EN 10025 (1993) and are the smallest strengths from this standard. The intervals between heights are: H<50mm, 50-100, 100-200, H>200mm (first interval excluded here). The tolerance for the side length is split in two t<3mm/ 3≤ t <8mm.

Table 19 – Purlins: Material specifications and tolerances

Specification	Length		Thickness					
	L≤7m *L≤6m	L>7m *L>6m	1.6mm	2.0mm -2.3mm	2.8mm	3.0mm -3.2mm	4.0mm -4.5mm	6.0mm
JIS 3350 SSC400	+40mm -0mm	7m+Xm: X*5mm +40mm	±0.22mm	±0.25mm	±0.28mm	±0.30mm	±0.45mm	±0.60mm
SPIM C100	+40mm -0mm	7m+Xm: X*5mm +40mm	±0.22mm	±0.25mm	±0.28mm	±0.30mm	±0.45mm	±0.60mm
SS104*	+30mm -5.0mm	6m+Xm: X*5mm +40mm	+0.20mm -0.10mm	+0.20mm -0.12mm	+0.25mm -0.15mm	+0.30mm -0.17mm	+0.35mm -0.20mm	+0.40mm -0.22mm
BS5950 P7**	±3.0mm		±0.17mm	±0.18mm	±0.20mm	±0.22mm	±0.24mm	±0.26mm

Notes: *For SS104 the tolerance for the length has a change at 6 metres, and the intervals between the thickness are: t<2.0mm, 2.0-2.5, 2.5-3.0, 3.0-3.5, 3.5-4.0, 4.0-4.5, 4.5-5.0, 5.0-6.0mm (the two last intervals excluded from the table).

**For BS5950 Part 7 the intervals between thickness are: t<2.0mm, 2.0-2.5, 2.5-3.0, 3.0-4.0, 4.0-5.0, 5.0-6.0, 6.0-7.0, 8.0-10.0, 10.0-12.5, 12.5-15.0, 15.0-25.0mm, (the five last intervals excluded from the table).

Table 20 – Purlins: Tolerances on length and thickness

High-Tensile Galvanised C and Z Purlins

Steel grade	Base steel	Mechanical properties			Chemical properties			
	Thickness	Yield strength	Tensile strength	Minimum elongation	C	P	Mn	S
	mm	N/mm^2	N/mm^2	%	Max (%)	Max (%)	Max (%)	Max (%)
AS 1397 G450	1.5, 1.9, 2.4, 3.0	450	490	9	0.2	0.04	1.2	0.03
AS 1397 G500	1.2	500	520	7	0.2	0.04	1.2	0.03
AS 1397 G550	1.0	550	550	2	0.2	0.04	1.2	0.03

Table 21 – High-Tensile Galvanised Purlins: Mechanical properties/Tolerances

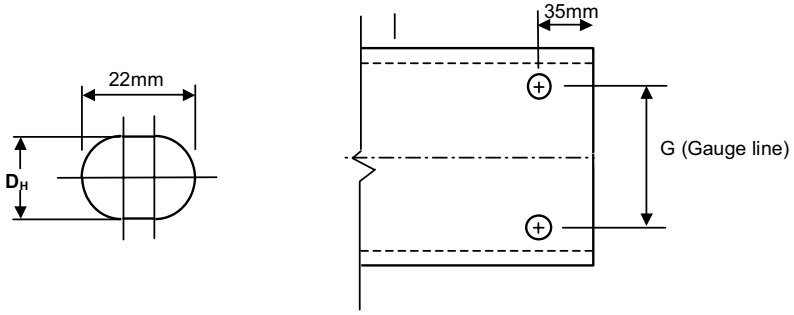
Storage and handling

C and Z Purlins should be kept dry during storage before use. They should be stacked clear of the ground with timber sleepers and covered to prevent bundles from getting wet. If bundles become wet during transportation or storage, the purlins must be separated and wiped dry with clean cloth as soon as possible.

Care must be taken to prevent bundles or loose pieces from dropping to the ground or banging against the building during loading and unloading, or when lifting onto the top of the building.

Holing and cleating for C Purlins

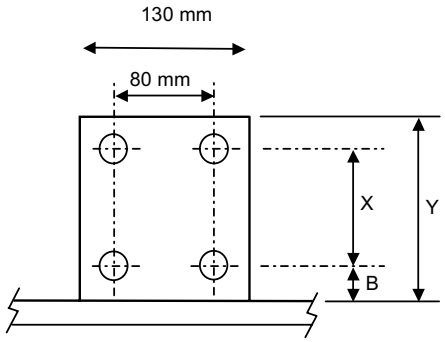
The figures under show the positioning of the holes on both the purlins. Z and C sections are normally supplied with holes punched to the Australian institute Steel Construction (AISC) gauge lines, except, in Victoria where the 150 series sections are punched to the structural Steel Fabricators Association, Victoria recommended gauge lines.



Nominal section size (mm)	G (mm)	D_H (mm)
100	40	18
150-Victoria only	70	18
150-other states	60	18
200	110	18
250	160	18
300	210	22
350	210	22

Figure 10 – Holing and cleats for C purlins

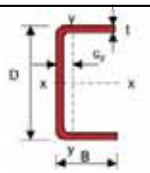
The holes are required at cleat supports at ends of laps and at bridging points. For the webs of 300 and 350 sections, centreline holes are also available on request, and may be combined with cleat holes to provide 3-bolt fastening to the cleats. For the 100, 150, 200, and 250 deep sections the holes are elongated with dimensions of 18mm x 22mm suitable for M12 bolts. For the 300 and 350 deep sections the holes are 22mm diameter suitable for M16 bolts. Sections are also available unpunched if required.



Nominal section size (mm)	X	B	Y	t (thickness)	Gap	D_H
100	40	40	105	8	10	18
150-Victoria only	70	50	145	8	6010	18
150-other states	60	55	145	8	10	18
200	110	55	195	8	10	18
250	160	55	245	8	10	18
300	210	65	305	12	20	22
350	260	65	355	12	20	22

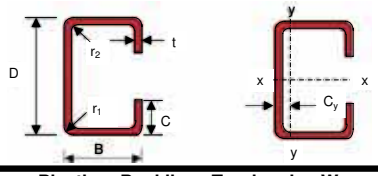
Table 22 – High-Tensile Galvanised Purlins: Cleat holes position

Plain Channels



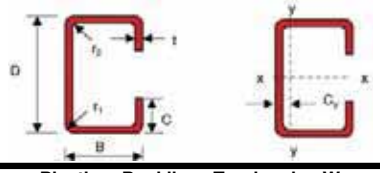
Designation Size DxB	Mass Per Metre	Thickness	Area Of Section	Centre Of Gravity	Second Moment Of Area		Radius Of Gyration		Elastic Modulus case b		Plastic Modulus		Buckling Constant	Torsional Index	Warping Constant	Torsional Constant
		t	A	C_y	I_x	I_y	r_x	r_y	Z_x	Z_y	S_x	S_y	u	x	H	J
mm	kg/m	mm	cm^2	cm	cm^4	cm^4	cm	cm	cm^3	cm^3	cm^3	mm^3			$dm^6 \times 10^{-3}$	cm^4
60x30	1.44	1.6	1.84	0.823	10.3	1.63	2.37	0.944	3.45	0.75	4.00	1.37	0.897	29.7	0.0101	0.0165
	2.03	2.3	2.59	0.856	14.2	2.25	2.34	0.932	4.72	1.05	5.54	1.94	0.891	20.4	0.0138	0.0490
75x45	2.00	1.6	2.56	1.30	23.9	5.37	3.06	1.45	6.37	1.68	7.22	5.85	0.891	37.7	0.0528	0.0226
	2.84	2.3	3.62	1.34	33.1	7.49	3.02	1.44	8.83	2.37	10.1	7.83	0.885	26.1	0.0739	0.0673
	3.65	3.0	4.65	1.37	41.7	9.46	2.99	1.43	11.1	3.02	12.9	9.51	0.878	19.9	0.0939	0.150
100x50	2.44	1.6	3.12	1.32	50.0	7.87	4.01	1.59	10.0	2.14	11.5	3.88	0.901	50.1	0.136	0.0274
	3.47	2.3	4.43	1.36	69.9	11.0	3.97	1.58	14.0	3.03	16.1	5.52	0.898	34.6	0.189	0.0815
	4.47	3.0	5.70	1.39	88.6	14.0	3.94	1.57	17.7	3.88	20.6	7.12	0.895	26.3	0.240	0.181
	5.87	4.0	7.47	1.43	113.3	18.0	3.89	1.55	22.7	5.05	26.6	9.37	0.890	19.5	0.307	0.430
125x50	3.92	2.3	5.00	1.21	117	11.8	4.85	1.54	18.8	3.12	22.0	5.72	0.900	43.2	0.315	0.0916
	5.06	3.0	6.45	1.24	149	15.1	4.81	1.53	23.9	4.01	28.2	7.46	0.898	32.7	0.397	0.204
	6.65	4.0	8.47	1.29	192	19.4	4.76	1.51	30.7	5.22	36.6	9.97	0.896	24.2	0.505	0.483
	7.42	4.5	9.46	1.31	212	21.4	4.74	1.51	34.0	5.81	40.6	11.2	0.895	21.3	0.555	0.689
150x65	4.91	2.3	6.27	1.61	218	25.8	5.90	2.03	29.1	5.29	33.7	9.56	0.902	52.2	1.00	0.114
	6.36	3.0	8.10	1.64	279	33.1	5.87	2.02	37.2	6.81	43.4	12.4	0.900	39.7	1.27	0.253
	8.38	4.0	10.67	1.69	361	42.9	5.82	2.00	48.2	8.91	56.6	16.5	0.898	29.4	1.63	0.601
	9.36	4.5	11.9	1.71	401	47.6	5.79	2.00	53.4	9.94	63.0	18.5	0.897	26.0	1.81	0.856
175x75	5.73	2.3	7.30	1.83	347	40.2	6.89	2.35	39.7	7.09	45.9	12.8	0.902	61.1	2.12	0.132
	7.42	3.0	9.45	1.86	445	51.5	6.86	2.33	50.8	9.14	59.1	16.6	0.901	46.5	2.70	0.294
	9.79	4.0	12.47	1.91	579	67.1	6.81	2.32	66.1	12.0	77.4	22.1	0.899	34.6	3.49	0.697
	10.95	4.5	14.0	1.93	643	74.6	6.79	2.31	73.5	13.4	86.3	24.8	0.898	30.6	3.87	0.992
200x75	6.18	2.3	7.88	1.71	473	41.7	7.75	2.30	47.3	7.21	55.4	13.0	0.899	70.0	2.88	0.142
	8.01	3.0	10.2	1.74	608	53.6	7.72	2.29	60.8	9.30	71.4	16.9	0.898	53.3	3.67	0.316
	10.60	4.0	13.5	1.78	792	69.8	7.67	2.28	79.2	12.2	94	22.7	0.897	39.5	4.74	0.75
	11.84	4.5	15.1	1.80	881	77.7	7.64	2.27	88.1	13.6	104	25.6	0.897	35.0	5.24	1.07
225x75	6.63	2.3	8.45	1.60	624	43.1	8.60	2.26	55.5	7.30	65.6	13.2	0.894	79.0	3.79	0.152
	8.59	3.0	11.0	1.63	803	55.4	8.56	2.25	71.3	9.43	84.6	17.3	0.894	60.1	4.83	0.339
	11.40	4.0	14.5	1.67	1048	72.2	8.51	2.23	93	12.4	111	23.3	0.893	44.6	6.22	0.80
	12.72	4.5	16.2	1.70	1166	80.4	8.48	2.23	104	13.8	124	26.3	0.893	39.4	6.88	1.14
250x75	7.08	2.3	9.03	1.50	802	44.3	9.43	2.22	64.2	7.39	76.5	13.4	0.888	88.2	4.84	0.163
	9.18	3.0	11.7	1.54	1032	56.9	9.39	2.21	82.5	9.54	98.8	17.6	0.888	67.1	6.17	0.361
	12.10	4.0	15.5	1.58	1349	74.3	9.34	2.19	108	12.5	130	23.9	0.888	49.8	7.95	0.86
	13.60	4.5	17.3	1.60	1502	82.7	9.31	2.18	120	14.0	145	27.1	0.888	44.0	8.79	1.22

Lipped Channels



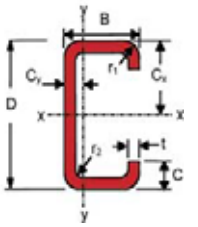
Designation Size DxBxC	Mass Per Metre	Thickness t	Inside Outside Radius r_1	r_2	Area Of Section A	Centre Of Gravity C_y	Second Moment Of Area I_x	I_y	Radius Of Gyration r_x	r_y	Elastic Modulus Z_x	Z_y	Plastic Modulus S_x	S_y	Buckling Constant u	Torsional Index x	Warp Constant H	Torsion Constant J
mm	kg/m	mm	mm	mm	cm^2	cm	cm^4	cm^4	cm	cm	cm^3	cm^3	cm^3	cm^3			$dm^6 \times 10^{-3}$	cm^4
60x30x10	1.62	1.6	4.0	2.4	2.05	1.06	11.4	2.50	2.36	1.10	3.81	1.29	4.48	2.12	0.808	35.5	0.0219	0.0182
	1.99	2.0	5.0	3.0	2.50	1.05	13.7	2.93	2.34	1.08	4.56	1.50	5.41	2.54	0.804	28.3	0.0257	0.0352
	2.25	2.3	5.8	3.5	2.83	1.05	15.2	3.20	2.32	1.06	5.06	1.64	6.05	2.57	0.801	24.5	0.0281	0.0530
75x45x15	2.31	1.6	4.0	2.4	2.93	1.72	26.8	8.59	3.03	1.71	7.15	3.09	8.27	4.62	0.776	46.7	0.129	0.0258
	2.86	2.0	5.0	3.0	3.60	1.71	32.5	10.3	3.00	1.69	8.66	3.69	10.1	5.61	0.774	37.2	0.154	0.0499
	3.24	2.3	5.8	3.5	4.09	1.71	36.5	11.5	2.99	1.67	9.73	4.11	11.4	6.31	0.772	32.2	0.171	0.0754
	4.12	3.0	7.5	4.5	5.18	1.70	44.9	13.8	2.94	1.63	12.0	4.94	14.2	7.79	0.769	24.5	0.206	0.165
	4.37	3.2	8.0	4.8	5.48	1.70	47.1	14.4	2.93	1.62	12.6	5.15	14.9	8.18	0.767	22.9	0.215	0.199
100x50x20	2.88	1.6	4.0	2.4	3.65	1.86	57.9	13.8	3.98	1.95	11.6	4.41	13.5	6.73	0.788	62.9	0.373	0.032
	3.60	2.0	5.0	3.0	4.50	1.86	70.5	16.7	3.96	1.93	14.1	5.32	16.5	8.22	0.786	50.1	0.450	0.062
	4.06	2.3	5.8	3.5	5.13	1.86	79.6	18.7	3.94	1.91	15.9	5.95	18.7	9.28	0.785	43.5	0.503	0.094
	5.18	3.0	7.5	4.5	6.53	1.85	99	22.9	3.90	1.87	19.8	7.27	23.6	11.6	0.781	33.1	0.616	0.205
	5.50	3.2	8.0	4.8	6.92	1.85	104	24.0	3.88	1.86	20.9	7.60	24.9	12.2	0.780	31.0	0.645	0.248
	6.71	4.0	10.0	6.0	8.41	1.84	123	27.7	3.83	1.82	24.7	8.79	29.8	14.5	0.775	24.7	0.747	0.478
	7.43	4.5	11.3	6.8	9.29	1.84	134	29.7	3.80	1.79	26.8	9.40	32.6	14.4	0.772	21.8	0.802	0.674
125x50x20	3.95	2.0	5.0	3.0	5.00	1.68	119	18.1	4.88	1.90	19.1	5.46	22.5	7.90	0.820	59.5	0.684	0.069
	4.51	2.3	5.8	3.5	5.70	1.68	135	20.3	4.86	1.89	21.5	6.11	25.5	8.91	0.819	51.6	0.767	0.104
	5.77	3.0	7.5	4.5	7.28	1.68	169	24.8	4.81	1.85	27.0	7.47	32.2	11.2	0.814	39.4	0.942	0.228
	6.13	3.2	8.0	4.8	7.72	1.68	178	26.0	4.80	1.84	28.4	7.82	34.0	11.8	0.813	36.9	0.987	0.275
	7.50	4.0	10.0	6.0	9.41	1.67	212	30.2	4.74	1.79	33.9	9.05	40.9	14.1	0.808	29.4	1.15	0.531
	8.31	4.5	11.3	6.8	10.4	1.66	231	32.3	4.71	1.76	36.9	9.7	45.0	15.4	0.804	26.1	1.24	0.750
150x65x20	5.50	2.3	5.8	3.5	6.97	2.11	245	40.5	5.93	2.41	32.7	9.23	38.1	13.8	0.840	59.6	2.03	0.126
	7.07	3.0	7.5	4.5	8.93	2.10	310	50.2	5.89	2.37	41.3	11.4	48.4	17.4	0.836	45.6	2.53	0.277
	7.51	3.2	8.0	4.8	9.48	2.10	327	52.7	5.87	2.36	43.6	12.0	51.2	18.4	0.835	42.7	2.66	0.336
	9.22	4.0	10.0	6.0	11.6	2.09	393	62.0	5.82	2.31	52.4	14.1	62.1	22.1	0.831	34.1	3.14	0.649
	10.25	4.5	11.3	6.8	12.9	2.09	432	67.1	5.78	2.28	57.5	15.2	68.5	24.2	0.828	30.3	3.41	0.917
175x75x20	6.31	2.3	5.8	3.5	8.00	2.34	386	60.3	6.95	2.75	44.1	11.7	51.1	17.8	0.853	68.0	3.92	0.144
	8.13	3.0	7.5	4.5	10.3	2.33	489	75.1	6.90	2.70	55.9	14.5	65.2	22.5	0.850	52.0	4.90	0.318
	8.63	3.2	8.0	4.8	10.9	2.33	518	79.1	6.88	2.69	59.1	15.3	69.1	23.7	0.849	48.7	5.17	0.385
	10.63	4.0	10.0	6.0	13.4	2.32	626	93.6	6.83	2.64	71.5	18.1	84.1	28.7	0.845	38.9	6.15	0.745
	11.84	4.5	11.3	6.8	14.9	2.31	689	102	6.80	2.61	78.7	19.6	93.0	31.6	0.842	34.6	6.71	1.05
200x75x20	6.76	2.3	5.8	3.5	8.58	2.19	527	63.0	7.84	2.71	52.7	11.9	61.5	18.0	0.860	76.8	5.22	0.154
	8.71	3.0	7.5	4.5	11.0	2.18	669	78.5	7.79	2.67	66.9	14.8	78.5	22.9	0.856	58.8	6.53	0.340
	9.27	3.2	8.0	4.8	11.7	2.18	708	82.6	7.77	2.65	70.8	15.5	83.2	24.3	0.855	55.1	6.89	0.412
	11.40	4.0	10.0	6.0	14.4	2.17	857	98	7.71	2.61	85.7	18.4	101	29.5	0.850	44.1	8.22	0.798
	12.73	4.5	11.3	6.8	16.0	2.17	945	106	7.68	2.57	94.5	19.9	112	32.6	0.847	39.2	8.98	1.13

Lipped Channels



Designation Size DxBxC	Mass Per Metre	Thickness t	Inside Outside Radius r_1	r_2	Area Of Section A	Centre Of Gravity C_y	Second Moment Of Area I_x	I_y	Radius Of Gyration r_x	r_y	Elastic Modulus Z_x	Z_y	Plastic Modulus S_x	S_y	Buckling Constant u	Torsional Index x	Warp Constant H	Torsion Constant J
mm	kg/m	mm	mm	mm	cm^2	cm	cm^4	cm^4	cm	cm	cm^3	cm^3	cm^3	cm^3			$dm^6 \times 10^{-3}$	cm^4
200x75x25	6.95	2.3	5.8	3.5	8.81	2.33	540	69.0	7.83	2.80	54.0	13.3	63.3	19.6	0.846	79.2	6.07	0.158
	8.93	3.0	7.5	4.5	11.3	2.32	687	86.3	7.78	2.76	68.7	16.7	80.8	24.9	0.843	60.6	7.62	0.349
	9.52	3.2	8.0	4.8	12.0	2.32	727	90.9	7.77	2.75	72.7	17.5	85.7	26.4	0.842	56.8	8.03	0.423
	11.70	4.0	10.0	6.0	14.8	2.31	881	108	7.71	2.70	88.1	20.8	105	32.0	0.838	45.3	9.59	0.819
	13.10	4.5	11.3	6.8	16.5	2.31	972	118	7.68	2.67	97.2	22.7	116	35.4	0.835	40.3	10.5	1.16
225x75x20	7.21	2.3	5.8	3.5	9.15	2.06	694	65.3	8.71	2.67	61.7	12.0	72.6	18.3	0.862	85.8	6.74	0.165
	9.30	3.0	7.5	4.5	11.8	2.05	883	81.4	8.66	2.63	78.4	14.9	92.8	23.4	0.858	65.8	8.46	0.363
	9.89	3.2	8.0	4.8	12.5	2.05	934	85.7	8.64	2.62	83.1	15.7	98.4	24.8	0.857	61.7	8.92	0.439
	12.20	4.0	10.0	6.0	15.4	2.05	1134	101	8.58	2.57	101	18.6	120	30.3	0.852	49.4	10.7	0.851
	13.61	4.5	11.3	6.8	17.2	2.04	1252	110	8.54	2.53	111	20.2	133	33.6	0.849	43.9	11.6	1.206
225x75x25	7.40	2.3	5.8	3.5	9.38	2.19	713	71.6	8.72	2.76	63.3	13.5	74.6	19.9	0.851	87.9	7.77	0.169
	9.54	3.0	7.5	4.5	12.1	2.19	907	89.6	8.66	2.72	80.6	16.9	95.5	25.3	0.848	67.4	9.76	0.372
	10.10	3.2	8.0	4.8	12.8	2.18	960	94.4	8.65	2.71	85.4	17.8	101	26.9	0.847	63.1	10.3	0.450
	12.50	4.0	10.0	6.0	15.8	2.18	1166	112	8.59	2.66	104	21.1	124	32.8	0.843	50.5	12.3	0.873
	14.00	4.5	11.3	6.8	17.6	2.17	1288	122	8.55	2.64	115	23.0	137	36.4	0.840	44.9	13.5	1.24
250x75x20	7.67	2.3	5.8	3.5	9.73	1.94	890	67.3	9.57	2.63	71.2	12.1	84.4	18.6	0.861	94.9	8.50	0.175
	9.89	3.0	7.5	4.5	12.5	1.94	1133	83.9	9.51	2.59	90.7	15.1	108	23.8	0.857	72.8	10.7	0.385
	10.52	3.2	8.0	4.8	13.3	1.94	1200	88.4	9.49	2.58	96.0	15.9	115	25.3	0.856	68.3	11.3	0.467
	12.99	4.0	10.0	6.0	16.4	1.93	1459	105	9.43	2.53	117	18.8	140	31.1	0.851	54.7	13.5	0.905
	14.49	4.5	11.3	6.8	18.3	1.93	1612	114	9.39	2.49	129	20.4	155	34.6	0.848	48.7	14.7	1.28
250x75x25	7.85	2.3	5.8	3.5	10	2.07	914	74.0	9.58	2.73	73.1	13.6	86.7	20.1	0.853	96.9	9.73	0.179
	10.13	3.0	7.5	4.5	12.8	2.07	1165	92.5	9.53	2.69	93.2	17.0	111	25.8	0.850	74.3	12.2	0.394
	10.80	3.2	8.0	4.8	13.6	2.07	1234	97.5	9.51	2.67	98.7	17.9	118	27.4	0.849	69.6	12.9	0.478
	13.30	4.0	10.0	6.0	16.8	2.06	1501	116	9.45	2.63	120	21.3	144	33.6	0.844	55.7	15.5	0.926
	14.85	4.5	11.3	6.8	18.7	2.06	1659	126	9.41	2.60	133	23.2	160	37.4	0.842	49.5	16.9	1.31

High-Tensile Galvanised C Purlins

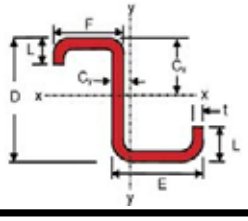


Designation Size Number	Mass Per Metre	Thickness t	Web D	Flange B	Lip C	Area Of Section A	Moment Of Inertia I_x	Moment Of Inertia I_y	Radius Of Gyration r_x	Radius Of Gyration r_y
mm	kg/m	mm	mm	mm	mm	cm^2	cm^4	cm^4	cm	cm
C10010	1.78	1.0	102	51	12.5	2.16	36.4	7.55	4.11	1.87
C10012	2.10	1.2	102	51	12.5	2.58	43.2	8.92	4.10	1.86
C10015	2.62	1.5	102	51	13.5	3.23	53.7	11.2	4.08	1.87
C10019	3.29	1.9	102	51	14.5	4.09	67.3	14.2	4.06	1.87
C15012	2.89	1.2	152	64	14.5	3.54	129	18.8	6.04	2.31
C15015	3.59	1.5	152	64	15.5	4.43	161	23.7	6.02	2.31
C15019	4.51	1.9	152	64	16.5	5.61	202	30.0	6.00	2.31
C15024	5.70	2.4	152	64	18.5	7.12	254	38.6	5.98	2.33
C20015	4.49	1.5	203	76	15.5	5.55	353	39.6	7.97	2.67
C20019	5.74	1.9	203	76	19.0	7.13	451	53.1	7.96	2.73
C20024	7.24	2.4	203	76	21.0	9.04	569	68.1	7.93	2.74
C25019	6.50	1.9	254	76	18.5	8.08	762	56.1	9.71	2.64
C25024	8.16	2.4	254	76	20.5	10.20	962	72.1	9.69	2.65
C30024	10.09	2.4	300	96	27.5	12.60	1700	151	11.6	3.46
C30030	12.76	3.0	300	96	31.5	16.00	2130	196	11.6	3.50
C35030	15.23	3.0	350	125	30.0	19.10	3580	382	13.7	4.47

Designation Size Number	Mass Per Metre	Section Modulus Z_x	Section Modulus Z_y	Centroid $\bar{x}$	Shear Centre x_o	Torsion constant J	Warping constant Iw	Mono-symmetry Section constant $ß_y$	Section modulus in bending Zxe	Area in compression Ae
mm	kg/m	cm^3	cm^3	mm	mm	mm^4	cm^6	mm	cm^3	Cm^2
C10010	1.78	7.13	2.19	16.1	39.9	71.9	160	123	5.37	113
C10012	2.10	8.48	2.59	16.0	39.7	124	188	123	6.74	153
C10015	2.62	10.5	3.29	161	40.11	242	241	122	8.73	217
C10019	3.29	13.2	4.21	16.2	40.4	492	311	122	12.3	329
C15012	2.89	17.0	4.17	18.3	46.5	170	842	171	11.8	165
C15015	3.59	21.1	5.29	18.4	46.9	332	1070	171	17.1	244
C15019	4.51	26.6	6.74	18.5	47.1	675	1370	170	21.8	340
C15024	5.70	33.5	8.79	18.9	48.0	1370	1810	169	30.9	527
C20015	4.49	34.7	7.17	19.9	51.6	416	3060	223	24.1	251
C20019	5.74	44.4	9.77	20.8	53.6	858	4240	221	36.6	381
C20024	7.24	56.0	12.7	21.1	54.4	1740	5540	219	47.5	541
C25019	6.50	60.0	9.86	18.1	48.5	972	6860	276	46.2	381
C25024	8.16	75.7	12.8	18.4	49.3	1970	8920	274	64.9	543
C30024	10.09	113	21.7	25.0	66.0	2430	26800	320	91.1	632
C30030	12.76	142	28.5	25.8	67.9	4790	35700	316	124	897
C35030	15.23	205	42.3	33.2	86.3	5730	90000	378	159	940

Table 23 – High-Tensile Galvanised C-Purlins: Section sizes

High-Tensile Galvanised Z Purlins



Designation Size Number	Mass Per Metre	Thickness t	Web D	Flange 1 E	Flange 2 F	Lip L	Area Of Section A	Moment Of Inertia I_x	Moment Of Inertia I_y	Section Modulus Z_y	Radius Of Gyration	α
mm	kg/m	mm	mm	mm	mm	mm	cm^2	cm^4	cm^4	cm^3	mm	(°)
Z10010	1.78	1.0	102	53	49	12.5	2.16	45.1	4.37	1.55	14.2	27.6
Z10012	2.10	1.2	102	53	49	12.5	2.58	53.6	5.16	1.84	14.2	27.5
Z10015	2.62	1.5	102	53	49	13.5	3.23	66.8	6.52	2.32	14.2	27.8
Z10019	3.29	1.9	102	53	49	14.5	4.09	84.0	8.29	2.94	14.2	28.1
Z15012	2.89	1.2	152	65	61	15.5	3.54	147	1.15	3.14	18.1	21.8
Z15015	3.59	1.5	152	65	61	16.5	4.43	184	1.45	3.96	18.1	22.0
Z15019	4.51	1.9	152	65	61	17.5	5.61	232	1.84	5.02	18.1	22.1
Z15024	5.70	2.4	152	66	60	19.5	7.12	292	2.38	6.38	18.3	22.5
Z20015	4.49	1.5	203	79	74	15.5	5.55	389	2.55	5.53	21.4	18.5
Z20019	5.74	1.9	203	79	74	18.5	7.13	502	3.42	7.45	21.9	19.1
Z20024	7.24	2.4	203	79	73	21.5	9.07	636	4.43	9.64	22.1	19.4
Z25019	6.50	1.9	254	79	74	18.0	8.08	808	3.81	7.82	21.7	14.0
Z25024	8.16	2.4	254	79	73	21.0	10.30	1020	4.93	10.2	21.9	14.3
Z30024	10.09	2.4	300	100	93	27.0	12.60	1830	1.01	16.8	28.3	16.0
Z30030	12.76	3.0	300	100	93	31.0	16.00	2310	1.32	21.9	28.7	16..3
Z35030	15.23	3.0	350	129	121	30.0	19.10	3920	2.49	32.8	36.1	17.8

Designation Size Number	Mass Per Metre	Moment of inertia I_x'	Moment of inertia I_y'	Product of moment inertia $I_x' I_y'$	Section modulus Z_x'	Section modulus Z_y'	Radius of gyration r_x'	Radius of gyration r_y'	Torsion constant J	Warping constant Iw	Section modulus in bending Zx'e	Area in compression constant Ae
mm	kg/m	cm^4	cm^4	cm^4	cm^3	cm^3	mm	mm	mm^4	cm^6	cm^3	mm^2
Z10010	1.78	36.4	13.1	16.8	7.00	2.56	41.1	24.7	71.9	215	5.33	113
Z10012	2.10	43.2	15.5	19.8	8.32	3.02	41.0	24.5	124	253	6.73	153
Z10015	2.62	53.7	19.7	24.9	10.3	3.84	40.8	24.7	242	321	8.82	217
Z10019	3.29	67.3	25.0	31.4	13.0	4.92	40.6	24.7	492	409	12.4	329
Z15012	2.89	128	30.3	46.9	16.7	4.78	60.3	29.3	170	1160	11.9	169
Z15015	3.59	160	38.3	58.8	20.8	6.06	60.1	29.4	332	1460	17.2	248
Z15019	4.51	201	48.7	74.4	26.1	7.73	59.9	29.5	675	1860	22.4	347
Z15024	5.70	253	63.2	95.0	32.6	10.0	59.6	29.8	1370	2410	31.4	535
Z20015	4.49	353	62.1	109	34.3	8.05	79.7	33.4	416	4260	23.8	248
Z20019	5.74	452	84.3	145	43.9	11.0	79.6	34.4	858	5830	36.4	378
Z20024	7.24	570	110	186	55.3	14.4	79.3	34.8	1740	7630	48.4	546
Z25019	6.50	762	83.3	181	59.3	10.8	97.1	32.1	972	9480	45.7	379
Z25024	8.16	964	108	233	74.9	14.2	96.9	32.5	1970	12400	66.0	547
Z30024	10.09	1700	232	457	112	23.8	116	42.8	2430	36600	89.9	628
Z30030	12.76	2130	304	588	140	31.4	116	43.6	4790	48200	125	908
Z35030	15.23	3580	593	1070	202	47.2	137	55.7	5730	124000	159	940

Table 24 – High-Tensile Galvanised Z-Purlins: Section sizes

Angles

Rolling tolerances – EN 10056-2 : 1993

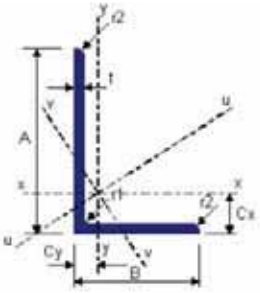
This European specifies tolerances on shapes dimensions and mass of hot rolled structural steel equal and unequal leg angles.

Tolerances on shapes and dimensions

Leg length (a or b)

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

Leg length a (mm)	Tolerance (mm)	
Up to and including 50	+1.0	-1.0
Greater than 50 up to and including 100	+2.0	-2.0
Greater than 100 up to and including 150	+3.0	-3.0
Greater than 150 up to and including 200	+4.0	-4.0
Greater than 200	+6.0	-4.0



Section thickness (t)

The deviation from nominal on thickness shall be within the tolerance given in the following table.

Leg length a (mm)	Tolerance (mm)	
Up to and including 5	+0.5	-0.5
Greater than 5 up to and including 10	+0.75	-0.75
Greater than 10 up to and including 15	+1.0	-1.0
Greater than 15	+1.20	-1.20

Out of square (k)

Out-of-squareness of the section shall not exceed the maximum following table. For unequal leg angles, the longer leg length (a) shall be used to determine the tolerance band.

Out of square – leg length (mm)	Tolerance (mm)
Up to and including 100	1.0
Greater than 100 up to and including 150	1.5
Greater than 150 up to and including 200	2.0
Greater than 200	3.0

Straightness (q)

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

Leg length a (mm)	Over full bar length	Tolerance over any part bar length (mm)	
	Deviation q (mm)	Length considered	Deviation (q)
Up to and including 150	0.4% L	1,500	-0.5
Up to and including 200	0.2% L	2,000	-0.75
Greater than 200	0.1% L	+1.20	-1.20

Tolerance on mass

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

a. ±6% for thickness for t ≤ 4mm or
b. ±4% for thickness for t > 4mm

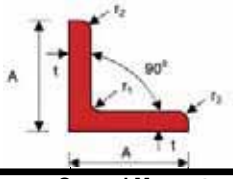
The deviation from the nominal mass is the difference between the actual mass of the piece and the calculated mass. The calculated mass shall be determined using a density of 7850 kg/m^3.

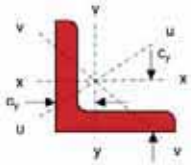
Tolerance on length

The tolerance on ordered length shall be either:

a. ±50mm; or
b. -0 / +100mm where minimum lengths are requested

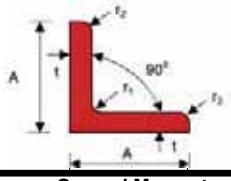
Equal

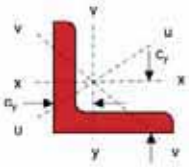




Designation Size AxA	Thickness t	Mass Per Metre	Radius Root r_1	Radius Toe r_2	Area Of Section	Distance Centre Of Gravity C_x and C_y	Second Moment Of Area Axis x-x , y-y	Second Moment Of Area Axis u-u	Second Moment Of Area Axis v-v	Radius Of Gyration Axis x-x , y-y	Radius Of Gyration Axis u-u	Radius Of Gyration Axis v-v	Elastic Modulus Axis x-x , y-y
mm	mm	kg/m	mm	mm	cm^2	cm	cm^4	cm^4	cm^4	cm	cm	cm	cm^3
20x20	3	0.885	3.5	2.4	1.11	0.593	0.381	0.601	0.160	0.585	0.735	0.380	0.271
25x25	3	1.12	3.5	2.4	1.41	0.718	0.784	1.24	0.326	0.745	0.938	0.481	0.440
	4	1.45	3.5	2.4	1.84	0.758	1.00	1.58	0.422	0.737	0.926	0.479	0.574
	5	1.70	3.5	2.4	2.25	0.796	1.19	1.87	0.516	0.728	0.912	0.479	0.701
30x30	3	1.36	5	2.4	1.74	0.836	1.41	2.23	0.590	0.901	1.13	0.582	0.652
	4	1.76	5	2.4	2.27	0.879	1.81	2.86	0.758	0.893	1.12	0.578	0.853
	5	2.16	5	2.4	2.78	0.919	2.17	3.42	0.921	0.884	1.11	0.576	1.04
35X35	6	1.65	5	2.4	3.87	1.08	4.13	6.51	1.76	1.03	1.30	0.674	1.71
38x38	3	1.72	6	2.4	2.24	1.03	2.99	4.72	1.25	1.15	1.45	0.748	1.08
	4	2.36	6	2.4	2.93	1.07	3.85	6.10	1.61	1.15	1.44	0.741	1.41
	5	2.79	6	2.4	3.60	1.12	4.66	7.36	1.95	1.14	1.43	0.736	1.73
	6	3.33	6	2.4	4.25	1.15	5.40	8.51	2.29	1.13	1.41	0.733	2.04
40x40	3	1.83	6	2.4	2.36	1.08	3.51	5.55	1.47	1.22	1.53	0.789	1.20
	4	2.42	6	2.4	3.09	1.12	4.53	7.18	1.89	1.21	1.52	0.782	1.58
	5	2.95	6	2.4	3.80	1.17	5.48	8.68	2.29	1.20	1.51	0.776	1.94
	6	3.52	6	2.4	4.49	1.20	6.37	10.1	2.69	1.19	1.50	0.773	2.28
45x45	4	2.74	7	2.4	3.52	1.24	6.59	10.4	2.75	1.37	1.72	0.884	2.02
	5	3.38	7	2.4	4.33	1.29	7.99	12.6	3.34	1.36	1.71	0.878	2.49
	6	3.99	7	2.4	5.12	1.33	9.31	14.7	3.90	1.35	1.69	0.873	2.93
50x50	3	2.33	7	2.4	2.99	1.32	7.06	11.1	2.97	1.54	1.93	0.997	1.92
	4	3.06	7	2.4	3.92	1.37	9.17	14.5	3.82	1.53	1.92	0.987	2.52
	4.5	3.40	7	2.4	4.38	1.39	10.2	16.1	4.23	1.52	1.92	0.984	2.82
	5	3.77	7	2.4	4.83	1.41	11.2	17.7	4.64	1.52	1.91	0.980	3.11
	6	4.43	7	2.4	5.72	1.45	13.0	20.6	5.43	1.51	1.90	0.974	3.67
	8	5.78	7	2.4	7.44	1.53	16.5	25.9	6.97	1.49	1.87	0.968	4.74
60x60	5	4.55	8	2.4	5.86	1.65	19.8	31.4	8.24	1.84	2.31	1.19	4.56
	6	5.42	8	2.4	6.95	1.70	23.2	36.8	9.65	1.83	2.30	1.18	5.40
63X63	5	4.75	8	2.4	6.16	1.73	23.1	36.6	9.58	1.93	2.44	1.25	5.05
	6	5.71	8	2.4	7.31	1.77	27.1	42.9	11.2	1.92	2.42	1.24	5.98
	8	7.42	8	2.4	9.55	1.85	34.5	54.6	14.4	1.90	2.39	1.23	7.76
65x65	5	5.00	9	2.4	6.40	1.77	25.5	40.3	10.6	2.00	2.51	1.29	5.39
	6	5.91	9	2.4	7.59	1.82	29.9	47.4	12.4	1.98	2.50	1.28	6.38
	8	7.66	9	2.4	9.91	1.90	38.2	60.4	15.9	1.96	2.47	1.27	8.29
	9	8.55	9	2.4	11.0	1.94	42.0	66.4	17.6	1.95	2.45	1.26	9.21
70x70	6	6.38	9	2.4	8.19	1.94	37.7	59.8	15.7	2.15	2.70	1.38	7.46
	7	7.38	9	2.4	9.46	1.98	43.1	68.3	17.9	2.13	2.69	1.38	8.59
	8	8.43	9	2.4	10.71	2.02	48.3	76.5	20.1	2.12	2.67	1.37	9.70
75x75	5	5.69	10	4.8	7.37	2.00	38.7	61.2	16.2	2.29	2.88	1.48	7.02
	6	6.85	10	4.8	8.76	2.04	45.7	72.4	19.0	2.28	2.88	1.47	8.38
	8	9.03	10	4.8	11.5	2.13	59.0	93.5	24.5	2.27	2.85	1.46	11.0
	9	9.96	10	4.8	12.8	2.17	65.3	103	27.2	2.26	2.84	1.46	12.3
	10	10.99	10	4.8	14.1	2.21	71.3	113	29.8	2.25	2.83	1.45	13.5
	12	13.00	10	4.8	16.7	2.29	82.7	130	35.0	2.23	2.80	1.45	15.9
80x80	6	7.34	10	4.8	9.36	2.17	56.0	88.7	23.2	2.45	3.08	1.58	9.6
	8	9.66	10	4.8	12.3	2.26	72.4	115	30.0	2.43	3.06	1.56	12.6
	10	11.8	10	4.8	15.1	2.34	87.7	139	36.5	2.41	3.03	1.55	15.5
90x90	6	8.30	11	4.8	10.6	2.41	81.0	128	33.7	2.76	3.48	1.78	12.3
	7	9.61	11	4.8	12.3	2.46	93.2	148	38.7	2.76	3.47	1.77	14.3
	8	10.90	11	4.8	13.9	2.50	105	167	43.5	2.75	3.46	1.77	16.2
	9	12.20	11	4.8	15.6	2.54	117	185	48.2	2.74	3.45	1.76	18.0
	10	13.40	11	4.8	17.2	2.58	128	202	52.9	2.73	3.43	1.76	19.9
	12	15.90	11	4.8	20.3	2.66	149	235	62.1	2.70	3.40	1.75	23.5
	13	17.00	11	4.8	21.9	2.70	159	251	66.6	2.69	3.39	1.74	25.2

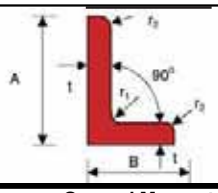
Equal

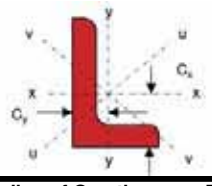




Designation Size AxA	Thickness t	Mass Per Metre	Radius Root r_1	Radius Toe r_2	Area Of Section	Distance Centre Of Gravity C_x and C_y	Second Moment Of Area Axis x-x , y-y	Second Moment Of Area Axis u-u	Second Moment Of Area Axis v-v	Radius Of Gyration Axis x-x , y-y	Radius Of Gyration Axis u-u	Radius Of Gyration Axis v-v	Elastic Modulus Axis x-x , y-y
mm	mm	kg/m	mm	mm	cm^2	cm	cm^4	cm^4	cm^4	cm	cm	cm	cm^3
100x100	6	9.20	12	4.8	11.9	2.65	113	178	47.0	3.08	3.88	1.99	15.3
	7	10.70	12	4.8	13.7	2.70	130	206	53.9	3.08	3.87	1.98	17.8
	8	12.20	12	4.8	15.6	2.75	146	232	60.6	3.07	3.86	1.97	20.2
	10	15.00	12	4.8	19.2	2.83	178	283	73.8	3.05	3.84	1.96	24.8
	12	17.80	12	4.8	22.8	2.91	208	330	86.5	3.02	3.81	1.95	29.4
	13	19.10	12	4.8	24.5	2.95	222	352	92.8	3.01	3.79	1.95	31.5
	15	21.90	12	4.8	28.0	3.02	250	395	105	2.99	3.76	1.94	35.8
120x120	8	14.70	13	4.8	18.8	3.24	259	411	107	3.71	4.67	2.38	29.5
	10	18.20	13	4.8	23.3	3.32	316	502	130	3.69	4.64	2.37	36.4
	12	21.60	13	4.8	27.6	3.41	371	588	153	3.66	4.62	2.36	43.1
	15	26.60	13	4.8	34.0	3.52	448	710	186	3.63	4.57	2.34	52.8
125x125	8	14.90	14	4.8	19.7	3.36	294	466	122	3.87	4.87	2.49	32.2
	10	19.09	14	4.8	24.3	3.44	360	570	149	3.84	4.84	2.47	39.7
	12	22.67	14	4.8	28.9	3.53	422	669	174	3.82	4.81	2.46	47.0
130x130	8	15.90	14	4.8	20.5	3.48	332	527	138	4.03	5.07	2.59	34.9
	9	17.90	14	4.8	22.9	3.53	370	586	153	4.02	5.06	2.58	39.0
	10	19.70	14	4.8	25.3	3.57	406	645	168	4.01	5.05	2.57	43.1
	12	23.50	14	4.8	30.1	3.65	477	758	197	3.98	5.02	2.56	51.1
	15	28.80	14	4.8	37.1	3.77	578	916	240	3.95	4.97	2.54	62.6
	16	30.70	14	4.8	39.4	3.81	610	966	253	3.94	4.95	2.54	66.3
150x150	8	18.00	16	4.8	23.8	3.97	518	820	215	4.66	5.87	3.01	46.9
	10	23.00	16	4.8	29.5	4.06	635	1008	263	4.64	5.85	2.99	58.0
	12	27.30	16	4.8	35.0	4.14	748	1187	309	4.62	5.82	2.97	68.9
	15	33.80	16	4.8	43.2	4.26	909	1442	375	4.59	5.78	2.95	84.6
	16	35.70	16	4.8	45.9	4.30	960	1523	397	4.57	5.76	2.94	89.8
	18	40.10	16	4.8	51.2	4.38	1060	1680	440	4.55	5.73	2.93	99.8
	19	41.90	16	4.8	53.8	4.42	1109	1756	462	4.54	5.71	2.93	105
175x175	12	31.80	16	4.8	41.0	4.77	1208	1920	497	5.43	6.84	3.48	94.9
	15	39.40	16	4.8	50.7	4.89	1474	2342	606	5.39	6.80	3.46	117
200x200	12	36.55	18	4.8	47.2	5.38	1829	2906	753	6.23	7.85	4.00	125
	13	39.49	18	4.8	50.9	5.42	1967	3126	809	6.22	7.84	3.99	135
	15	45.30	18	4.8	58.3	5.50	2237	3555	919	6.19	7.81	3.97	154
	16	48.50	18	4.8	62.0	5.54	2369	3765	973	6.18	7.79	3.96	164
	18	54.20	18	4.8	69.4	5.62	2627	4174	1080	6.15	7.76	3.95	183
	20	59.90	18	4.8	76.6	5.70	2877	4569	1185	6.13	7.72	3.93	201
	24	71.10	18	4.8	90.8	5.85	3357	5322	1391	6.08	7.65	3.91	237
	25	73.60	18	4.8	94.3	5.89	3472	5502	1442	6.07	7.64	3.91	246
	26	76.80	18	4.8	97.8	5.93	3586	5680	1492	6.05	7.62	3.91	255
250x250	25	93.70	20	4.8	120	7.14	7030	11170	2891	7.67	9.67	4.92	394
	28	104.00	20	4.8	133	7.25	7741	12290	3195	7.63	9.61	4.90	436
	32	118.00	20	4.8	151	7.40	8650	13710	3593	7.58	9.54	4.89	491
	35	128.00	20	4.8	164	7.51	9305	14720	3887	7.54	9.49	4.88	532
300x300	35	155.00	24	18	197	8.71	16300	25900	6690	9.09	11.50	5.82	766
350x350	35	182.00	24	18	232	9.96	26600	42300	10800	10.70	13.50	6.83	1060

Unequal





Designation Size AxB	Thickness t	Mass Per Metre	Radius Root r_1	Radius Toe r_2	Area Of Section	Distance Centre Of Gravity C_x	Distance Centre Of Gravity C_y	Second Moment Of Area Axis x-x	Second Moment Of Area Axis y-y	Second Moment Of Area Axis u-u	Second Moment Of Area Axis v-v	Radius of Gyration Axis x-x	Radius of Gyration Axis y-y	Radius of Gyration Axis u-u	Radius of Gyration Axis v-v	Elastic Modulus Axis x-x	Elastic Modulus Axis y-y	Angle x-x Axis to u-u Axis
mm	mm	kg/m	mm	mm	cm^2	cm	cm	cm^4	cm^4	cm^4	cm^4	cm	cm	cm	cm	cm^3	cm^3	
63x38	4.5	3.45	6	2.4	4.4	2.10	0.870	18.0	4.90	20.0	3.00	2.01	1.06	2.12	0.820	4.20	1.68	0.362
	6	4.43	6	2.4	5.75	2.17	0.930	23.0	6.30	25.0	3.80	1.99	1.04	2.10	0.820	5.50	2.18	0.358
75x50	6	5.65	7	2.4	7.22	2.45	1.21	40.9	14.6	47.1	8.48	2.38	1.42	2.55	1.08	8.10	3.87	0.436
	8	7.39	7	2.4	9.44	2.53	1.29	52.4	18.6	60.1	10.9	2.36	1.40	2.52	1.07	10.5	5.01	0.430
100x65	7	8.8	10	4.8	11.2	3.23	1.52	113	37.7	128	22.1	3.18	1.84	3.39	1.41	16.7	7.56	0.415
	8	9.4	10	4.8	12.7	3.28	1.56	127	42.3	144	24.9	3.17	1.83	3.38	1.40	18.9	8.57	0.414
	9	11.0	10	7.0	14.0	3.31	1.58	138	45.5	157	26.8	3.14	1.80	3.34	1.38	20.6	9.26	0.410
	10	12.3	10	4.8	15.6	3.36	1.64	154	51.1	175	30.2	3.14	1.81	3.35	1.39	23.2	10.5	0.410
	12	14.4	10	7.0	18.4	3.43	1.70	177	58.0	201	34.7	3.11	1.78	3.30	1.37	27.0	12.1	0.404
100x75	7	9.3	10	5.0	11.9	3.06	1.84	118	56.9	144	30.7	3.15	2.19	3.49	1.61	17.0	10.1	0.548
	8	10.6	10	4.8	13.5	3.11	1.88	133	64.2	163	34.6	3.14	2.18	3.48	1.60	19.3	11.4	0.548
	9	11.8	10	4.8	15.1	3.15	1.92	148	71.1	181	38.4	3.13	2.17	3.46	1.60	21.6	12.7	0.546
	10	13.0	10	4.8	16.6	3.19	1.96	162	77.7	198	42.2	3.12	2.16	3.45	1.59	23.8	14.0	0.545
	12	15.4	10	4.8	19.7	3.27	2.03	189	90.3	230	49.5	3.10	2.14	3.42	1.59	28.1	16.5	0.541
	13	16.5	10	4.8	21.2	3.31	2.07	202	96.3	245	53.1	3.09	2.13	3.40	1.58	30.2	17.7	0.539
125x75	6.5	10.0	11	4.8	12.7	4.07	1.62	206	56.6	228	34.4	4.02	2.11	4.23	1.64	24.4	9.63	0.360
	7	10.7	11	4.8	13.7	4.10	1.64	220	60.5	244	36.7	4.01	2.10	4.22	1.64	26.2	10.3	0.360
	8	12.2	11	4.8	15.5	4.14	1.69	249	68.1	275	41.3	4.00	2.10	4.21	1.63	29.7	11.7	0.360
	9	13.5	11	4.8	17.4	4.19	1.73	276	75.5	306	45.8	3.99	2.09	4.20	1.62	33.2	13.1	0.359
	10	15.0	11	4.8	19.2	4.23	1.77	303	82.6	336	50.2	3.98	2.08	4.18	1.62	36.7	14.4	0.358
	12	17.8	11	4.8	22.7	4.32	1.84	355	96.0	392	58.8	3.95	2.06	4.16	1.61	43.4	17.0	0.354
	13	19.1	10	7.0	24.3	4.35	1.87	376	101	414	61.9	3.93	2.04	4.13	1.60	46.1	17.9	0.352
150x75	7	12.1	12	5.0	15.5	5.17	1.50	364	63.1	386	40.8	4.85	2.02	5.00	1.62	37.0	10.5	0.263
	8	13.8	11	4.8	17.5	5.23	1.54	411	71.2	436	45.8	4.84	2.02	4.99	1.62	42.1	11.9	0.263
	9	15.3	12	8.5	19.4	5.25	1.55	447	75.3	473	48.7	4.79	1.97	4.93	1.58	45.8	12.7	0.259
	10	17.0	11	4.8	21.7	5.32	1.62	503	86.3	533	55.8	4.82	2.00	4.96	1.60	52.0	14.7	0.261
	12	20.2	11	4.8	25.7	5.41	1.70	591	100	626	65.3	4.79	1.98	4.93	1.59	61.6	17.3	0.259
	15	24.8	11	4.8	31.7	5.53	1.81	715	120	756	79.2	4.75	1.95	4.89	1.58	75.5	21.1	0.254
150x90	8	14.3	10	5.0	18.7	4.93	1.97	436	121	484	72.7	4.83	2.54	5.09	1.97	43.3	17.2	0.364
	9	16.4	12	6.0	20.9	4.95	2.00	485	133	537	80.5	4.81	2.52	5.06	1.96	48.2	19.0	0.361
	10	18.2	12	4.8	23.2	5.00	2.04	536	147	595	89.2	4.81	2.52	5.06	1.96	53.7	21.2	0.361
	12	21.6	12	4.8	27.6	5.09	2.12	630	172	698	105	4.78	2.50	5.03	1.95	63.6	25.0	0.359
	15	26.6	12	4.8	34.0	5.21	2.24	764	207	844	127	4.74	2.47	4.99	1.93	78.1	30.6	0.354
150x100	8	15.2	12	8.5	19.4	4.70	2.24	441	158	508	90.9	4.77	2.86	5.12	2.17	42.8	20.3	0.437
	9	17.1	12	6.0	21.8	4.77	2.30	502	181	579	104	4.79	2.88	5.15	2.18	49.1	23.5	0.439
	10	19.0	13	6.5	24.2	4.80	2.34	552	198	635	114	4.78	2.86	5.13	2.17	54.1	25.8	0.437
	12	22.4	12	8.5	28.6	4.88	2.41	642	228	738	132	4.74	2.83	5.08	2.15	63.4	30.1	0.435
	14	26.1	12	6.0	33.2	4.98	2.50	744	265	856	153	4.74	2.82	5.08	2.15	74.3	35.3	0.434
	15	27.7	12	8.5	35.2	5.01	2.53	781	276	897	161	4.71	2.80	5.04	2.14	78.2	37.0	0.431
200x100	10	23.0	15	4.8	29.4	6.95	2.03	1233	215	1309	138	6.48	2.70	6.68	2.17	94.5	27.0	0.264
	12	27.3	15	4.8	34.9	7.04	2.11	1454	252	1544	162	6.45	2.68	6.65	2.16	112	31.9	0.263
	14	31.6	15	7.5	40.3	7.12	2.18	1654	282	1755	182	6.41	2.65	6.60	2.12	128	36.1	0.261
	15	33.7	15	4.8	43.1	7.17	2.23	1772	303	1879	197	6.41	2.65	6.60	2.14	138	39.0	0.260
200x150	12	32.0	15	4.8	40.9	6.10	3.63	1667	813	2046	434	6.38	4.45	7.07	3.26	120	71.5	0.554
	15	39.6	15	4.8	50.6	6.22	3.75	2037	989	2496	530	6.34	4.42	7.02	3.23	148	87.9	0.552
	18	47.4	15	4.8	60.1	6.34	3.86	2390	1155	2923	622	6.30	4.38	6.97	3.22	175	104	0.549

Flat

Section Size		Unit Weight	Section Area
Thickness	Width	M	A
mm	mm	kg/m	cm^2
3	12	0.283	0.360
3	16	0.377	0.480
3	19	0.447	0.570
3	25	0.589	0.750
3	32	0.754	0.960
3	38	0.895	1.14
3	50	1.18	1.50
3	65	1.53	1.95
3	75	1.77	2.25
3	100	2.36	3.00
4.5	25	0.883	1.13
4.5	32	1.13	1.44
4.5	35	1.24	1.58
4.5	38	1.34	1.71
4.5	44	1.55	1.98
4.5	50	1.77	2.25
4.5	65	2.30	2.93
4.5	75	2.65	3.38
4.5	100	3.53	4.50
6	25	1.18	1.50
6	32	1.51	1.92
6	35	1.65	2.10
6	38	1.79	2.28
6	40	1.88	2.40
6	44	2.07	2.64
6	50	2.36	3.00
6	65	3.06	3.90
6	75	3.53	4.50
6	90	4.24	5.40
6	100	4.71	6.00
6	125	5.89	7.50
6	150	7.07	9.00
6	175	8.24	10.5
6	200	9.42	12.0
8	25	1.57	2.00
8	32	2.01	2.56
8	38	2.39	3.04
8	44	2.76	3.52
8	50	3.14	4.00
8	65	4.08	5.20
8	75	4.71	6.00
8	90	5.65	7.20
8	100	6.28	8.00

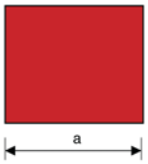
Section Size		Unit Weight	Section Area
Thickness	Width	M	A
mm	mm	kg/m	cm^2
8	125	7.85	10.0
8	150	9.42	12.0
8	200	12.56	16.0
9	19	1.34	1.71
9	25	1.77	2.25
9	32	2.26	2.88
9	38	2.68	3.42
9	44	3.11	3.96
9	50	3.53	4.50
9	65	4.59	5.85
9	75	5.30	6.75
9	90	6.36	8.10
9	100	7.07	9.00
9	125	8.83	11.3
9	150	10.60	13.5
9	180	12.72	16.2
9	200	14.13	18.0
9	250	17.66	22.5
9	300	21.20	27.0
12	25	2.36	3.00
12	32	3.01	3.84
12	38	3.58	4.56
12	40	3.77	4.80
12	44	4.14	5.28
12	50	4.71	6.00
12	65	6.12	7.80
12	75	7.07	9.00
12	90	8.48	10.8
12	100	9.42	12.0
12	125	11.78	15.0
12	150	14.13	18.0
12	180	16.96	21.6
12	200	18.84	24.0
12	250	23.55	30.0
12	300	28.26	36.0
16	25	3.14	4.00
16	32	4.02	5.12
16	38	4.77	6.08
16	50	6.28	8.00
16	65	8.16	10.4
16	75	9.42	12.0
16	90	11.30	14.4
16	100	12.56	16.0

Flat

Section Size		Unit Weight	Section Area
Thickness	**Width**	**M**	**A**
mm	mm	kg/m	cm^2
16	125	15.70	20.0
16	150	18.84	24.0
16	200	25.12	32.0
19	38	5.67	7.2
19	50	7.46	9.5
19	65	9.69	12.4
19	75	11.19	14.3
19	90	13.42	17.1
19	100	14.92	19.0
19	125	18.64	23.8
19	150	22.37	28.5
19	200	29.83	38.0
19	250	37.29	47.5
19	300	44.75	57.0
25	50	9.81	12.5
25	65	12.76	16.3
25	75	14.72	18.8
25	90	17.66	22.5

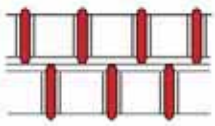
Section Size		Unit Weight	Section Area
Thickness	**Width**	**M**	**A**
mm	mm	kg/m	cm^2
25	100	19.63	25.0
25	125	24.53	31.3
25	150	29.44	37.5
32	100	25.12	32.0
32	125	31.40	40.0
32	150	37.68	48.0
32	180	45.22	57.6
32	200	50.24	64.0
32	230	57.78	73.6
32	250	62.80	80.0
32	280	70.34	89.6
32	300	75.36	96.0
36	100	28.26	36.0
36	125	35.33	45.0
36	150	42.39	54.0
36	180	50.87	64.8
36	200	56.52	72.0

Square



Size a	Designation Mass Per Metre		Area Of Section	Second Moment Of Inertia	Radius Of Gyration	Elastic Modulus	Plastic Modulus
mm	kg/m	lb/ft	mm^2	mm^4	mm	mm^3	mm^3
9	0.64	0.43	81.0	547	2.60	121	182
10	0.79	0.53	100	833	2.89	167	250
12	1.13	0.76	144	1728	3.46	288	432
13	1.33	0.89	169	2380	3.75	366	549
16	2.01	1.35	256	5461	4.62	683	1024
18	2.54	1.71	324	8748	5.20	972	1458
19	2.83	1.90	361	10860	5.48	1143	1715
22	3.80	2.55	484	19520	6.35	1775	2662
25	4.91	3.30	625	32550	7.22	2604	3906
28	6.15	4.14	784	51220	8.08	3659	5488
30	7.07	4.75	900	67500	8.66	4500	6750
32	8.04	5.40	1024	87380	9.24	5461	8192
36	10.17	6.84	1296	140000	10.4	7776	11660
38	11.34	7.62	1444	173800	11.0	9145	13720
40	12.56	8.44	1600	213300	11.5	10670	16000
44	15.20	10.21	1936	312300	12.7	14200	21300
45	15.90	10.68	2025	341700	13.0	15190	22780
50	19.63	13.19	2500	520800	14.4	20830	31250
55	23.75	15.96	3025	762600	15.9	27730	41590
60	28.26	18.99	3600	1080000	17.3	36000	54000
65	33.17	22.29	4225	1488000	18.8	45770	68660
75	44.16	29.67	5625	2637000	21.7	70310	105500
80	50.24	33.76	6400	3413000	23.1	85330	128000
85	56.72	38.11	7225	4350000	24.5	102400	153500
90	63.59	42.73	8100	5468000	26.0	121500	182300
95	70.85	47.61	9025	6788000	27.4	142900	214300
100	78.50	52.75	10000	8333000	28.9	166700	250000

Deformed and Round



Deformed

Section Size	Unit Weight M	Section Area A
mm	kg/m	cm^2
6	0.222	0.283
8	0.395	0.503
10	0.617	0.785
12	0.888	1.13
13	1.04	1.33
16	1.58	2.01
18	2.00	2.54
19	2.23	2.84
20	2.47	3.14
22	2.98	3.80
25	3.85	4.91
28	4.83	6.16
30	5.55	7.07
32	6.31	8.04
38	8.90	11.3
40	9.86	12.6
50	15.4	19.6

Round

Section Size	Unit Weight M	Section Area A
mm	kg/m	cm^2
6	0.222	0.283
8	0.395	0.503
9	0.499	0.636
10	0.617	0.785
12	0.888	1.13
13	1.04	1.33
14	1.21	1.54
16	1.58	2.01
18	2.00	2.54
19	2.23	2.84
20	2.47	3.14
21	2.72	3.46
22	2.98	3.80
24	3.55	4.52
25	3.85	4.91
26	4.17	5.31
28	4.83	6.16
29	5.19	6.61
30	5.55	7.07
31	5.92	7.55
32	6.31	8.04
35	7.55	9.62
38	8.90	11.3
40	9.86	12.6
42	10.88	13.9
44	11.9	15.2
45	12.5	15.9
50	15.4	19.6

Round

Section Size	Unit Weight M	Section Area A
mm	kg/m	cm^2
55	18.7	23.8
60	22.2	28.3
65	26.0	33.2
70	30.2	38.5
75	34.7	44.2
80	39.5	50.3
85	44.5	56.7
90	49.9	63.6
95	55.6	70.9
100	61.7	78.5
105	68.0	86.6
110	74.6	95.0
115	81.5	103.9
120	88.8	113.1
125	96.3	122.7
130	104.2	132.7
135	112.4	143.1
140	120.8	153.9
145	129.6	165.1
150	138.7	176.7
160	157.8	201.1
170	178.2	227.0
180	199.8	254.5
190	222.6	283.5
200	246.6	314.2
210	271.9	346.4
220	298.4	380.1
230	326.1	415.5
240	355.1	452
250	385	491
260	417	531
270	449	573
280	483	616
290	519	661
300	555	707
320	631	804

Plates

Product specifications

Main specifications

ABS Specifications (American Bureau of Shipping Rules)

ABS (1998):	Rules Requirements for Materials and Welding, Part 2. Ordinary strength hull **structural steel** plates. Higher strength hull **structural steel** plates.

ASTM Specifications (American Society for Testing of Materials)

A36 (1996):	Standard specification for Carbon **Structural Steel**.
A283 (1993):	Standard specification for Low and Intermediate Tensile Strength Carbon Steel Plates
A285 (1990):	Standard specification for **Pressure Vessel** Plates, Carbon Steel, Low- and Intermediate Tensile Strength.
A516 (1990):	Standard specification for **Pressure Vessel** Plates, Carbon Steel, for Moderate- and Lower-Temperature Service.
A572 (1997):	Standard specification for High-Strength, Low Alloy, Columbium-Vanadium **Structural Steel.**

BSI Specifications (British Standards Institute)

BS 7191 (1989):	Specification for **Weldable structural steels** for fixed offshore structures.
EN 10028 (1993):	Specification for Flat products made of steels for **pressure purposes**.
EN 10113 (1993):	Standard specification for Hot rolled products in weldable fine grain **structural steels**.
EN 10137 (1996):	Plates and wide flats made of high yield strength **structural steels** in the quenched and tempered or precipitation hardened conditions.
EN 10149 (1996):	Specification for Hot-rolled flat products made of high yield strength steels for **cold forming**.
EN 10207 (1992):	Steels for simple **pressure vessels** - Technical delivery requirements for plates, strips and bars.

JIS Specifications (Japanese Industrial Standards)

G 3101 (1991):	Rolled steels for **general structures**.
G 3106 (1995):	Rolled steels for **welded structure**.

LRS Specifications (Lloyd's Register of Shipping Rules)

LR (1998):	Manufacture, Testing and Certification of Materials.

List of standard specifications

Specifications	Yield strength N/mm²			Tensile strength N/mm²	Elongation min. %	Charpy V-notch Temp. (°C) Energy (J)				
	t<16mm	16<t<40	t>40mm		$L_0=5.65\sqrt{S_0}$	20	0	-20	-40	-50
GENERAL STRUCTURES										
ASTM A36					**50mm-200mm**					
	min. 250			400-550	23-20	-	-	-	-	-
ASTM A283					**50mm-200mm**					
Grade A	min. 165			310-415	30-27	-	-	-	-	-
Grade B	min. 185			345-450	28-25	-	-	-	-	-
Grade C	min. 205			380-515	25-22	-	-	-	-	-
Grade D	min. 230			415-550	23-20	-	-	-	-	-
ASTM A572					**50mm-200mm**					
Grade 42	min. 290			415	24-20	-	-	-	-	-
Grade 50	min. 345			450	21-18	-	-	-	-	-
Grade 60	min. 415			520	18-16	-	-	-	-	-
Grade 65	min. 450			550	17-15	-	-	-	-	-
EN 10025-3&4 : 2004										
S275N	min. 275			370-510		-	-	40	-	27
S355N	min. 355			470-630		-	-	40	-	27
S420N	min. 420			520-680		-	-	40	-	27
S460N	min. 460			550-720		-	-	40	-	27
S275M	min. 275			360-510		-	-	40	-	27
S355M	min. 355			450-610		-	-	40	-	27
S420M	min. 420			500-660		-	-	40	-	27
S460M	min. 460			530-720		-	-	40	-	27
EN 10149-2										
S315MC	min. 315			390-510	24	-	-	40	-	-
S355MC	min. 355			430-550	23	-	-	40	-	-
S420MC	min. 420			480-620	19	-	-	40	-	-
S460MC	min. 460			520-670	17	-	-	40	-	-
S500MC	min. 500			550-700	14	-	-	40	-	-
S550MC	min. 550			600-760	14	-	-	40	-	-
S600MC	min. 600			650-820	13	-	-	40	-	-
S650MC	650 (t≤8mm)		620	700-880	12	-	-	40	-	-
S700MC	700 (t≤8mm)		680	750-950	12	-	-	40	-	-
EN 10149-3										
S260NC	min. 260			370-490	30	-	-	40	-	-
S315NC	min. 315			430-550	27	-	-	40	-	-
S355NC	min. 355			470-610	25	-	-	40	-	-
S420NC	min. 420			530-670	23	-	-	40	-	-
JIS G 3101										
SS330	205	195	175	330-430	28-21	-	-	-	-	-
SS400	245	235	215	400-510	17-23	-	-	-	-	-
SS490	285	275	255	490-610	15-21	-	-	-	-	-
SS540	400	390	-	min. 540	13-17	-	-	-	-	-
JIS G 3106						**0 °C**				
SM400A, B, C	245	235	215	400-510	18-24	B/C 27/47		-	-	-
SM490A, B, C	325	315	295	490-610	17-23	B/C 27/47		-	-	-

Specifications	Yield strength N/mm²			Tensile strength	Elongation min. %	Charpy V-notch Temp. (°C) Energy (J)				
	t<16mm	16<t<40	t>40mm	N/mm²	$L_0=5.65S_0$	20	0	-20	-40	-50
Contd. GENERAL STRUCTURES										
Contd. JIS G 3106						**0°C**		**-5°C**		
SM490YA, YB	365	355	335	490-610	15-21	YB 27		-	-	-
SM520B, C	365	355	335	520-640	15-21	B/C 27/47		-	-	-
SM570	460	450	430	570-720	19-26	-	-	47	-	-
BRIDGES, FLOOD GATES, STORAGE TANKS, WATER TANKS, BUILDINGS, CRANE STRUCTURES										
EN 10025-6						**0**		**-20**		**-40**
S460Q, QL, QL1	[1] 460	[1)*] 440	[1)**] 400	[1)***] 550-720	17	40/50/60		30/40/50		-/30/40
S500Q, QL, QL1	[1] 500	[1)*] 480	[1)**] 440	[1)***] 590-770	17	40/50/60		30/40/50		-/30/40
S550Q, QL, QL1	[1] 550	[1)*] 530	[1)**] 490	[1)***] 640-820	16	40/50/60		30/40/50		-/30/40
S620Q, QL, QL1	[1] 620	[1)*] 580	[1)**] 560	[1)***] 700-890	15	40/50/60		30/40/50		-/30/40
S690Q, QL, QL1	[1] 690	[1)*] 650	[1)**] 630	[1)***] 760-940	14	40/50/60		30/40/50		-/30/40
S890Q, QL, QL1	[1] 890	[1)*] 830	-	[1)***] 880-1100	11	40/50/60		30/40/50		-/30/40
S960Q, QL, QL1	[1] 960	-	-	[1)***] 980-1150	10	40/50/60		30/40/50		-/30/40
EN 10137-3	**3mm<t≤50mm**	**50mm<t≤70mm**				**0**		**-20**		**-40**
S500A, AL	[2] 500	[2)*] 480		600-700	17	55/65		40/50		-/40
S550A, AL	[2] 550	[2)*] 530		650-820	16	55/65		40/50		-/40
S620A, AL	[2] 620	[2)*] 580		710-880	15	55/65		40/50		-/40
S690A, AL	[2] 690	[2)*] 650		760-930	14	55/65		40/50		-/40
SPECIAL STEEL										
BS 7191										
275D	275	265	-	430-580	22	-	-	40	-	-
275E	275	265	265	430-580	22	-	-	-	40	-
275EZ	275	265	265	430-580	22	-	-	-	40	-
355D	355	345	-	490-640	20	-	-	50	-	-
355E	355	345	-	490-640	20	-	-	-	50	-
355EM	355	345	340	460-620	20	-	-	-	50	-
355EMZ	355	345	340	460-620	20	-	-	-	50	-
450EM	450	415	-	550-700	19	-	-	-	60	-
450EMZ	450	415	-	550-700	19	-	-	-	60	-
HULL STRUCTURES										
ABS [3]						**For thickness t ≤ 50mm**				
Grade A, B, D, E	min. 235			400-550	22	-	27	27	27	**-60**
Gr. AH, DH, EH, FH 32	min. 315			440-590	22	-	34	34	34	34
Gr. AH, DH, EH, FH 36	min. 355			490-620	21	-	34	34	34	34
Gr. AH, DH, EH, FH 40	min. 390			510-650	20	-	41	41	41	41
LR [3]										
Grade A, B, D, E	min. 235			400-520	22	27	27	27	27	**-60**
Gr. AH, DH, EH, FH 32	min. 315			440-590	22	-	31	31	31	31
Gr. AH, DH, EH, FH 36	min. 355			490-620	21	-	34	34	34	34
Gr. AH, DH, EH, FH 40	min. 390			510-650	20	-	41	41	41	41
PRESSURE VESSELS, GENERAL										
ASTM A285					**50mm-200mm**					
Grade A	min. 165			310-450	30-27	-	-	-	-	-
Grade B	min. 185			345-485	28-25	-	-	-	-	-
Grade C	min. 205			380-515	27-23	-	-	-	-	-

Specifications	Yield strength N/mm²			Tensile Strength	Elongation min. %		Charpy V-notch Temp. (°C) Energy (J)				
	t<16mm	16<t<40	t>40mm	N/mm²			20	0	-20	-40	-50
Contd. PRESSURE VESSELS, GENERAL											
ASTM A516					50mm-200mm						
Grade 55	min. 205			380-515	27-23		-	-	-	-	-
Grade 60	min. 220			415-550	25-21		-	-	-	-	-
Grade 65	min. 240			450-585	23-19		-	-	-	-	-
Grade 70	min. 260			485-620	21-17		-	-	-	-	-
EN 10028-2											
P235GH	235	225	[4] 215	[4] 360-480	25		-	27	-	-	-
P265GH	265	255	[4] 245	[4] 410-530	23		-	27	-	-	-
P295GH	295	290	[4] 285	[4] 460-580	22		-	27	-	-	-
P355GH	355	345	[4] 335	[4] 510-650	21		-	27	-	-	-
16 Mo 3	275	270	[4] 260	[4] 440-590	24-23		31	-	-	-	-
13 CrMo 4-5	300	[4] 295		[4] 450-600	20		31	-	-	-	-
10 CrMo 9-10	310	300	[4] 290	[4] 480-630	18		31	-	-	-	-
11 CrMo 9-10	min. 310			520-670	18		31	-	-	-	-
EN 10028-3					≤70mm	70-150					
P275 N, NH							55	47	40	-	-
NL1	275	275	[5] 265	[5]* 390-510	24	23	63	55	47	34	27
NL2							100	90	65	40	30
P355 N, NH							55	47	40	-	-
NL1	355	355	[5] 345	[5]* 490-630	22	21	63	55	47	34	27
NL2							100	90	65	40	30
P460 N, NH							55	47	40	-	-
NL1	460	450	[5] 440	[5]* 570-720	17	16	63	55	47	34	27
NL2							100	90	65	40	30
EN 10028-4	t<30mm		30mm<t≤50mm		t<50mm						
11 MnNi 5-3	[6] 285		[6]* 275	420-530	24		70	60	55	50	45
13 MnNi 6-3	[6] 355		[6]* 345	490-610	22		70	60	55	50	45
15 MnNi 6	[6] 355		[6]* 345	490-640	22		65	65	65	60	50
12 Ni 14	[6] 355		[6]* 345	490-640	22		65	60	55	55	50
12 Ni 19	[6] 390		[6]* 380	530-710	20		70	70	70	65	65
X8 Ni9 HT 640	[6] 490		[6]* 480	640-840	18		70	70	70	70	70
X8 Ni9 HT 680	[6] 585		[6]* 575	680-820	18		120	120	120	120	120
X7 Ni 9	[6] 585		[6]* 575	680-820	18		120	120	120	120	120
EN 10028-5											
P355 M							60	40	27	-	-
ML1	355	355	[7] 345	450-610	22		-	60	40	27	-
ML2							-	80	60	40	27
P420 M							60	40	27	-	-
ML1	420	400	[7] 390	500-660	19		-	60	40	27	-
ML2							-	80	60	40	27
P460 M							60	40	27	-	-
ML1	460	440	[7] 430	530-720	17		-	60	40	27	-
ML2							-	80	60	40	27
EN 10028-6											**-60**
P355 Q, QH							60	40	27	-	-
QL1	[8] 355	[8]* 335	[8]** 315	[8]*** 490-630	22		-	60	40	27	-
QL2							-	80	60	40	27

Specifications		Yield strength N/mm²			Tensile strength	Elongation min. %	Charpy V-notch Temp. (°C) Energy (J)				
		t<16mm	16<t<40	t>40mm	N/mm²		20	0	-20	-40	-50
Contd.											
PRESSURE VESSELS, GENERAL											
Contd. EN 10028-6											**-60**
P460	Q, QH						60	40	27	-	-
	QL1	[8)] 460	[8)*] 440	[8)**] 400	[8)***] 500-720	19	-	60	40	27	-
	QL2						-	80	60	40	27
P500	Q, QH						60	40	27	-	-
	QL1	[8)] 500	[8)*] 480	[8)**] 440	[8)***] 590-770	17	-	60	40	27	-
	QL2						-	80	60	40	27
P690	Q, QH						60	40	27	-	-
	QL1	[8)] 690	[8)*] 670	[8)**] 630	[8)***] 770-940	14	-	60	40	27	-
	QL2						-	80	60	40	27
PRESSURE VESSELS, LOW TEMPERATURE SERVICE											
EN 10207						**3-40mm**	**40-60**				
P235S		235	225	215	360-480	26	25	-	-	28	-	-
P265S		265	255	245	410-530	22	22	-	-	28	-	-
P275SL		275	265	255	390-510	24	24	-	-	-	-	28

Table 25 – Plates: List of standards specifications

[1)] For t≤50mm.

[1)*] For 50<t≤100mm

[1)**] For 100<t≤150mm. For t>150mm, see EN 10137-2.

[1)***] For t≤100mm. For t>100mm, see EN 10137-2.

[2)] For t≤50mm.

[2)*] For 50<t≤70mm.

[3)] For LR and ABS plates the difference between A, B, D, E, F grades are the impact tests. They are made at the following temperatures:

A grade	+20 °C	E/EH grade	-40 °C
B/AH grade	0 °C	FH grade	-60 °C
D/DH grade	-20 °C		

[4)] For plates thicker than 60mm, see EN 10028-2:1992.

[5)] For plates thicker than 50mm, see EN 10028-3:1992.

[5)*] For plates thicker than 70mm, see EN 10028-3:1992.

[6)] For t≤30mm.

[6)*] For 30<t≤50mm

[7)] Maximum thickness 63mm.

[8)] For t≤50mm

[8)*] For 50<t≤100mm

[8)**] For 100<t<150mm

[8)***] For t≤100mm. For 100<t≤150mm, see EN 10028-6.

Mild Steel Plates

Metric units 7.85kg/mm m^2 - 0.7293 kg/mm ft^2

Width x Length (ft)		4 x 8	4 x 16	5 x 10	5 x 20	6 x 20	8 x 20	10 x 30
Thickness	Weight	Weight / pc						
mm	kg/ft^2	kg	kg	kg	kg	kg	kg	kg
1.2	0.875	28.0	-	43.8	-	-	-	-
1.5	1.094	35.0	-	54.7	-	-	-	-
1.6	1.167	37.3	-	58.3	-	-	-	-
1.9	1.386	44.3	-	69.3	-	-	-	-
2.3	1.677	53.7	-	83.9	-	-	-	-
2.6	1.896	60.7	-	94.8	-	-	-	-
3	2.188	70.0	-	109	219	-	-	-
3.2	2.334	74.7	-	117	-	-	-	-
4.0	2.917	93.3	187	146	292	350	-	-
4.5	3.282	105	210	164	328	394	-	-
5	3.647	117	233	182	365	438	-	-
6	4.376	140	280	219	438	525	700	1313
6.35	4.631	148	296	232	463	556	741	1389
7.5	5.470	175	350	273	547	656	875	1641
8	5.834	187	373	292	583	700	934	1750
9	6.564	210	420	328	656	788	1050	1969
9.53	6.950	222	445	348	695	834	1112	2085
10	7.293	233	467	365	729	875	1167	2188
12	8.752	280	560	438	875	1050	1400	2625
12.7	9.262	296	593	463	926	1111	1482	2779
13	9.481	303	607	474	948	1138	1517	2844
14	10.21	327	653	511	1021	1225	1634	3063
15	10.94	350	700	547	1094	1313	1750	3282
16	11.67	373	747	583	1167	1400	1867	3501
18	13.13	420	840	656	1313	1575	2100	3938
19	13.86	443	887	693	1386	1663	2217	4157
20	14.59	467	934	729	1459	1750	2334	4376
21	15.32	490	980	766	1532	1838	2450	4595
22	16.04	513	1027	802	1604	1925	2567	4813
24	17.50	560	1120	875	1750	2100	2801	5251
25	18.23	583	1167	912	1823	2188	2917	5470
25.4	18.52	593	1186	926	1852	2223	2964	5557
28	20.42	653	1307	1021	2042	2450	3267	6126
29	21.15	677	1354	1057	2115	2538	3384	6345
30	21.88	700	1400	1094	2188	2625	3501	6564
32	23.34	747	1494	1167	2334	2801	3734	7001
35	25.53	817	1634	1277	2553	3064	4085	7659
36	26.25	840	1680	1313	2625	3151	4201	7876
38	27.71	887	1774	1386	2771	3326	4434	8314
40	29.17	934	1867	1459	2917	3501	4668	8752
44	32.09	1027	2054	1605	3209	3851	5134	9627
45	32.82	1050	2100	1641	3282	3938	5251	9846
50	36.47	1167	2334	1823	3647	4376	5834	10940
55	40.11	1284	2567	2006	4011	4813	6418	12033
57	41.57	1330	2660	2079	4157	4988	6651	12471
60	43.76	1400	2801	2188	4376	5251	7001	13127
63.5	46.31	1482	2964	2316	4631	5557	7410	13893
65	47.40	1517	3034	2370	4740	5689	7585	14221
70	51.05	1634	3267	2553	5105	6126	8168	15315
75	54.70	1750	3501	2735	5470	6564	8752	16409

Contd. from previous page

Metric units 7.85kg/mm m^2 - 0.7293 kg/mm ft^2

Width x Length (ft)		4 x 8	4 x 16	5 x 10	5 x 20	6 x 20	8 x 20	10 x 30
Thickness	Weight	Weight / pc						
mm	kg/ft^2	kg	kg	kg	kg	kg	kg	kg
80	58.34	1867	3734	2917	5834	7001	9335	17503
90	65.64	2100	4201	3282	6564	7876	10502	19691
100	72.93	2334	4668	3647	7293	8752	11669	21879
110	80.22	2567	5134	4011	8022	9627	12836	24067
120	87.52	2801	5601	4376	8752	10502	14003	26255
125	91.16	2917	5834	4558	9116	10940	14586	27349
130	94.81	3034	6068	4740	9481	11377	15169	28443
140	102.1	3267	6535	5105	10210	12252	16336	30631
150	109.4	3501	7001	5470	10940	13127	17503	32819

Table 26 – Plates: Sizes of Mild Steel Plates

Chequered Plates

Metric units 8.08kg/mm m^2 - 0.7507 kg/mm ft^2

Width x Length (ft)		4x 8	4 x 10	4 x 16	4 x 20	5 x 10	5 x 20
Thickness	Weight	Weight / pc					
mm	kg/ft^2	kg	kg	kg	kg	kg	Kg
2.3	1.73	55.2	69.1	111	138	86.3	-
3	2.25	72.0	90.1	144	180	113	-
3.2	2.40	76.8	96.1	154	192	120	-
4	3.00	96.1	120	192	240	150	-
4.3	3.23	103	129	207	258	161	-
4.5	3.38	108	135	216	270	169	-
5	3.75	120	150	240	300	188	-
5.8	4.35	139	174	279	348	218	435
6	4.50	144	180	288	360	225	450
7.5	5.63	180	225	360	450	282	563
8	6.01	192	240	384	480	300	601
9	6.76	216	270	432	541	338	676
12	9.01	288	360	576	721	450	901

Table 27 – Plates: Sizes of Chequered Plates

Plates

Metric units 7.85kg/mm m^2 - 0.7293 kg/mm ft^2

Thickness	Unit Weight	Width x Length (ft) 4 x 8	4 x 16	5 x 10	5 x 20	6 x 20	8 x 20	10 x 30
t	M	Weight / pc						
mm	kg/ft^2	kg	kg	kg	kg	kg	kg	kg
1.2	0.875	28.0	-	43.8	-	-	-	-
1.5	1.094	35.0	-	54.7	-	-	-	-
1.6	1.167	37.3	-	58.3	-	-	-	-
1.9	1.386	44.3	-	69.3	-	-	-	-
2.3	1.677	53.7	-	83.9	-	-	-	-
2.6	1.896	60.7	-	94.8	-	-	-	-
3	2.188	70.0	-	109	219	-	-	-
3.2	2.334	74.7	-	117	-	-	-	-
4.5	3.282	105	210	164	328	394	-	-
5	3.647	117	233	182	365	438	-	-
6	4.376	140	280	219	438	525	700	1313
7	5.105	163	327	255	511	613	817	1532
8	5.834	187	373	292	583	700	934	1750
9	6.564	210	420	328	656	788	1050	1969
10	7.293	233	467	365	729	875	1167	2188
11	8.022	257	513	401	802	963	1284	2407
12	8.752	280	560	438	875	1050	1400	2625
12.7	9.262	296	593	463	926	1111	1482	2779
13	9.481	303	607	474	948	1138	1517	2844
14	10.21	327	653	511	1021	1225	1634	3063
15	10.94	350	700	547	1094	1313	1750	3282
16	11.67	373	747	583	1167	1400	1867	3501
17	12.40	397	793	620	1240	1488	1984	3719
18	13.13	420	840	656	1313	1575	2100	3938
19	13.86	443	887	693	1386	1663	2217	4157
20	14.59	467	934	729	1459	1750	2334	4376
21	15.32	490	980	766	1532	1838	2450	4595
22	16.04	513	1027	802	1604	1925	2567	4813
23	16.77	537	1074	839	1677	2013	2684	5032
24	17.50	560	1120	875	1750	2100	2801	5251
25	18.23	583	1167	912	1823	2188	2917	5470

Plates

Metric units 7.85kg/mm m^2 - 0.7293 kg/mm ft^2

Thickness	Unit Weight	Width x Length (ft) 4 x 8	4 x 16	5 x 10	5 x 20	6 x 20	8 x 20	10 x 30
t	M	Weight / pc						
mm	kg/ft^2	kg	kg	kg	kg	kg	kg	kg
25.4	18.52	593	1186	926	1852	2223	2964	5557
26	18.96	607	1214	948	1896	2275	3034	5689
27	19.69	630	1260	985	1969	2363	3151	5907
28	20.42	653	1307	1021	2042	2450	3267	6126
29	21.15	677	1354	1057	2115	2538	3384	6345
30	21.88	700	1400	1094	2188	2625	3501	6564
32	23.34	747	1494	1167	2334	2801	3734	7001
34	24.80	793	1587	1240	2480	2976	3967	7439
36	26.25	840	1680	1313	2625	3151	4201	7876
38	27.71	887	1774	1386	2771	3326	4434	8314
40	29.17	934	1867	1459	2917	3501	4668	8752
45	32.82	1050	2100	1641	3282	3938	5251	9846
50	36.47	1167	2334	1823	3647	4376	5834	10940
55	40.11	1284	2567	2006	4011	4813	6418	12033
60	43.76	1400	2801	2188	4376	5251	7001	13127
65	47.40	1517	3034	2370	4740	5689	7585	14221
70	51.05	1634	3267	2553	5105	6126	8168	15315
75	54.70	1750	3501	2735	5470	6564	8752	16409
80	58.34	1867	3734	2917	5834	7001	9335	17503
90	65.64	2100	4201	3282	6564	7876	10502	19691
100	72.93	2334	4668	3647	7293	8752	11669	21879
110	80.22	2567	5134	4011	8022	9627	12836	24067
120	87.52	2801	5601	4376	8752	10502	14003	26255
125	91.16	2917	5834	4558	9116	10940	14586	27349
130	94.81	3034	6068	4740	9481	11377	15169	28443
140	102.1	3267	6535	5105	10210	12252	16336	30631
150	109.4	3501	7001	5470	10940	13127	17503	32819

JIS G 3452-1988 (SGP)

Nominal size		Outside Diameter		Thickness		Unit Weight (plain end)	
A	B	mm	in	mm	in	lb/ft	kg/m
6	**1/8**	10.5	0.413	2.0	0.079	0.282	0.419
8	**1/4**	13.8	0.543	2.3	0.090	0.438	0.652
10	**3/8**	17.3	0.681	2.3	0.090	0.572	0.851
15	**1/2**	21.7	0.854	2.8	0.110	0.880	1.31
20	**3/4**	27.2	1.07	2.8	0.110	1.13	1.68
25	**1**	34.0	1.34	3.2	0.126	1.63	2.43
32	**1 1/4**	42.7	1.68	3.5	0.138	2.27	3.38
40	**1 1/2**	48.6	1.91	3.5	0.138	2.61	3.89
50	**2**	60.5	2.38	3.8	0.150	3.57	5.31
65	**2 1/2**	76.3	3.00	4.2	0.165	5.02	7.47
80	**3**	89.1	3.51	4.2	0.165	5.91	8.79
90	**3 1/2**	102	4.00	4.2	0.165	6.79	10.1
100	**4**	114	4.50	4.5	0.177	8.20	12.2
125	**5**	140	5.50	4.5	0.177	10.1	15.0
150	**6**	165	6.50	5.0	0.197	13.3	19.8
175	**7**	191	7.51	5.3	0.209	16.3	24.2
200	**8**	216	8.52	5.8	0.228	20.2	30.1
225	**9**	242	9.52	6.2	0.244	24.2	36.0
250	**10**	267	10.5	6.6	0.260	28.5	42.4
300	**12**	319	12.5	6.9	0.272	35.6	53.0
350	**14**	356	14.0	7.9	0.311	45.5	67.7
400	**16**	406	16.0	7.9	0.311	52.1	77.6
450	**18**	457	18.0	7.9	0.311	58.7	87.5
500	**20**	508	20.0	7.9	0.311	65.4	97.4

Tensile Strength : 290N/mm^2

Welded steel Pipes Class Extra Light (AA)

Designation of thread	Nominal bore	Outside diameter of black pipe max.		Outside diameter of black pipe min		Thickness		Plain end	
in.	mm	in.	mm	in.	mm	in.	mm	lb/ft	kg/m
1/2	15	0.84	21.4	0.83	21	0.063	1.6	0.52	0.773
3/4	20	1.06	26.9	1.04	26.4	0.063	1.6	0.666	0.99
1	25	1.33	33.8	1.31	33.2	0.075	1.9	0.994	1.48
1 1/4	32	1.67	42.5	1.65	41.9	0.075	1.9	1.27	1.89
1 1/2	40	1.9	48.4	1.88	47.8	0.075	1.9	1.45	2.16
2	50	2.3	60.2	2.35	59.6	0.075	1.9	1.83	2.72
2 1/2	65	2.99	76	2.96	75.2	0.075	1.9	2.31	3.45
3	80	3.49	88.7	3.46	87.9	0.083	2.1	3	4.46
3 1/2	90	3.98	102	3.95	101.1	0.083	2.1	3.46	5.15
4	100	4.48	113.9	4.45	113	0.091	2.3	4.23	6.31
5	125	5.53	140.6	5.46	138.7	0.157	4.0	8.99	13.4
6	150	6.54	166.1	6.46	164.1	0.157	4.0	10.7	15.9

BS 1387-1985

Steel tubes and tubulars suitable for screwing to BS 21 pipe threads

Tube	Designation of thread	Nominal bore	Outside diameter of black pipe max.		min		Thickness	
	in.	mm	in.	mm	in.	mm	in.	mm
Light (A)	1/8	6	0.383	10.1	0.369	9.7	0.072	1.8
	1/4	8	0.532	13.6	0.518	13.2	0.072	1.8
	3/8	10	0.671	17.1	0.656	16.7	0.072	1.8
	1/2	15	0.841	21.4	0.825	21.0	0.080	2.0
	3/4	20	1.059	26.9	1.041	26.4	0.092	2.3
	1	25	1.328	33.8	1.309	33.2	0.104	2.6
	1 1/4	32	1.670	42.5	1.650	41.9	1.104	2.6
	1 1/2	40	1.903	48.4	1.882	47.8	0.116	2.9
	2	50	2.347	60.2	2.307	59.6	0.116	2.9
	2 1/2	65	2.991	76.0	2.960	75.2	0.128	3.2
	3	80	3.491	88.7	3.460	87.9	0.128	3.2
	4	100	4.481	113.9	4.450	113.0	0.144	3.6
Medium (B)	1/8	6	0.411	10.4	0.386	9.8	0.080	2.0
	1/4	8	0.547	13.9	0.522	13.3	0.092	2.3
	3/8	10	0.685	17.4	0.660	16.8	0.092	2.3
	1/2	15	0.856	21.7	0.831	21.1	0.104	2.6
	3/4	20	1.072	27.2	1.047	26.6	0.104	2.6
	1	25	1.346	34.2	1.316	33.4	0.128	3.2
	1 1/4	32	1.687	42.9	1.657	42.1	0.128	3.2
	1 1/2	40	1.919	48.8	1.889	48.0	0.128	3.2
	2	50	2.394	60.8	2.354	59.8	0.144	3.6
	2 1/2	65	3.014	76.6	2.969	75.4	0.144	3.6
	3	80	3.524	89.5	3.469	88.1	0.160	4.0
	4	100	4.524	114.9	4.459	113.3	0.176	4.5
	5	125	5.534	140.6	5.459	138.7	0.192	5.0
	6	150	6.539	166.1	6.459	164.1	0.192	5.0
Heavy (C)	1/8	6	0.411	10.4	0.386	9.8	0.104	2.7
	1/4	8	0.547	13.9	0.522	13.3	0.116	2.9
	3/8	10	0.685	17.4	0.660	16.8	0.116	2.9
	1/2	15	0.856	21.7	0.831	21.1	0.128	3.2
	3/4	20	1.072	27.2	1.047	26.6	0.128	3.2
	1	25	1.346	34.2	1.316	33.4	0.160	4.0
	1 1/4	32	1.687	42.9	1.657	42.1	0.160	4.0
	1 1/2	40	1.919	48.8	1.889	48.0	0.160	4.0
	2	50	2.394	60.8	2.354	59.8	0.176	4.5
	2 1/2	65	3.014	76.6	2.969	75.4	0.176	4.5
	3	80	3.524	89.5	3.469	88.1	0.192	5.0
	4	100	4.524	114.9	4.459	113.3	0.212	5.4
	5	125	5.534	140.6	5.459	138.7	0.212	5.4
	6	150	6.539	166.1	6.459	164.1	0.212	5.4

Yield Strength : 195 N/mm^2

Tensile Strength : 320 to 460 N/mm^2

Steel tubes and tubulars suitable for screwing to BS 21 pipe threads

Tube	Weight of black pipe				Ordinary sockets			
	Plain end		Screwed and socketed		Min. outside dia.		Min. length	
	lb/ft	kg/m	lb/ft	kg/m	in.	mm	in.	mm
Light (A)	0.243	0.361	0.245	0.364	19/32	15.0	3/4	19
	0.347	0.517	0.350	0.521	23/32	18.5	1 1/16	27
	0.453	0.674	0.457	0.680	7/8	22.0	1 1/8	28
	0.640	0.952	0.646	0.961	1 1/16	27.0	1 7/16	37
	0.944	1.410	0.954	1.420	1 9/32	32.5	1 9/16	39
	1.350	2.010	1.360	2.030	1 9/16	39.5	1 13/16	46
	1.730	2.580	1.750	2.610	1 15/16	49.0	2	51
	2.190	3.250	2.220	3.290	2 3/16	56.0	2	51
	2.760	4.110	2.810	4.180	2 11/16	68.0	2 3/8	60
	3.900	5.800	3.980	5.920	3 5/16	84.0	2 11/16	69
	4.580	6.810	4.690	6.980	3 7/8	98.0	2 15/16	75
	6.640	9.890	6.840	10.200	4 7/8	124.0	3 7/16	87
Medium (B)	0.273	0.407	0.275	0.410	19/32	15.0	3/4	19
	0.437	0.650	0.440	0.654	23/32	18.5	1 1/16	27
	0.573	0.852	0.577	0.858	7/8	22.0	1 1/8	28
	0.822	1.220	0.828	1.230	1 1/16	27.0	1 7/16	37
	1.060	1.580	1.070	1.590	1 9/32	32.5	1 9/16	39
	1.640	2.440	1.650	2.460	1 9/16	39.5	1 13/16	46
	2.110	3.140	2.130	3.170	1 15/16	49.0	2	51
	2.430	3.610	2.460	3.650	2 3/16	56.0	2	51
	3.420	5.100	3.470	5.170	2 11/16	68.0	2 3/8	60
	4.380	6.510	4.460	6.630	3 5/16	84.0	2 11/16	69
	5.690	8.470	5.800	8.640	3 7/8	98.0	2 15/16	75
	8.140	12.100	8.340	12.400	4 7/8	124.0	3 7/16	87
	10.900	16.200	11.200	16.700	5 15/16	151.0	3 3/4	96
	12.900	19.200	13.300	19.800	7	178.0	3 3/4	96
Heavy (C)	0.331	0.493	0.333	0.496	19/32	15.0	3/4	19
	0.517	0.769	0.520	0.773	23/32	18.5	1 1/16	27
	0.686	1.020	0.690	1.030	7/8	22.0	1 1/8	28
	0.977	1.450	0.983	1.460	1 1/16	27.0	1 7/16	37
	1.270	1.900	1.280	1.910	1 9/32	32.5	1 9/16	39
	2.000	2.970	2.010	2.990	1 9/16	39.5	1 13/16	46
	2.580	3.840	2.600	3.870	1 15/16	49.0	2	51
	2.980	4.430	3.010	4.470	2 3/16	56.0	2	51
	4.140	6.170	4.190	6.240	2 11/16	68.0	2 3/8	60
	5.310	7.900	5.390	8.020	3 5/16	84.0	2 11/16	69
	6.760	10.100	6.870	10.300	3 7/8	98.0	2 15/16	75
	9.710	14.400	9.910	14.700	4 7/8	124.0	3 7/16	87
	12.000	17.800	12.300	18.300	5 15/16	151.0	3 3/4	96
	14.300	21.200	14.700	21.800	7	178.0	3 3/4	96

Yield Strength : 195 N/mm^2

Tensile Strength : 320 to 460 N/mm^2

API 5L (1991) and ASTM A53 (1997)

API Specification 5L line pipes (1991 edition); seamless and welded line pipes for conveying water, gaseous and liquid hydrocarbons and for the construction of chemical and industrial plants, oil refineries etc.
ASTM A53 (1997 edition) Steel pipes, black and hot-dipped, zinc-coated, welded and seamless, with nominal (average) diameter from 1/8" - 26".
Please note that API 5L pipes might be heat-treated, ASTM A53 pipes are all cold formed.

Chemical composition

The chemical composition of the API 5L and ASTM A53 pipes are shown below.

Delivery condition	Grade	C max. %	Mn max. %	P max. %	S max. %
API 5L					
S - W	A	0.22	0.90	0.04	0.05
S - W	B	0.27	1.15	0.04	0.05
S - W	X42	0.29	1.25	0.04	0.05
S - W	X46	0.31	1.35	0.04	0.05
S - W	X52	0.31	1.35	0.04	0.05
S - W	X56	0.26	1.35	0.04	0.05
S - W	X60	0.26	1.35	0.04	0.05
W	X65	0.26	1.40	0.04	0.05
W	X70	0.23	1.60	0.04	0.05
W	X80	0.18	1.80	0.03	0.018
ASTM A53					
S - W	A	0.25	0.95	0.05	0.06
S - W	B	0.30	1.20	0.05	0.06
F		-	-	0.08	0.06

Notes: S = Seamless, W = electric-resistance Welded, F = Furnace-welded

Table 28 – API 5L and ASTM A53 Pipes: Chemical composition

Mechanical properties

The mechanical properties for the API 5L and ASTM A53 pipes are shown in Table 29 below.

Delivery condition	Grade	Min. Yield strength N/mm^2	Min. Tensile strength N/mm^2
API 5L			
S - W	A	207	331
S - W	B	241	413
S - W	X42	289	413
S - W	X46	317	434
S - W	X52	358	455
S - W	X56	386	489
S - W	X60	413	517
W	X65	448	530
W	X70	482	565
W	X80	551	620-827
ASTM A53			
S - W	A	205	330
S - W	B	240	415
F		170	310

Table 29 – API 5L and ASTM A53 Pipes: Mechanical properties

The tables on the following pages show the available sizes with outside diameter, plain end weight, wall thickness, designation, and hydrostatic test pressure.

Section sizes

OD = outer diameter, ID = inner diameter
Δ = Sizes only from ASTM A53 (1997). Schedule Nos. are taken from ASTM A53.
ASTM sizes do not have an alternative size or grades X42 to X80.

Size OD	Wall thickness		Unit weight	ID	Butt weld	Hydrostatic test pressure Values given in (psi). 1psi = 6.895MPa.									
inch	Sch. No	t													
mm	(Class)	mm	kg/m	mm		A	B	X42	X46	X52	X56	X60	X65	X70	X80
1/8	Δ40(Std)	1.7	0.36	6.9	700	700	700	-	-	-	-	-	-	-	-
10.3	Δ80(XS)	2.4	0.47	5.5	850	850	850	-	-	-	-	-	-	-	-
1/4	Δ40(Std)	2.2	0.62	9.3	700	700	700	-	-	-	-	-	-	-	-
13.7	Δ80(XS)	3.0	0.79	7.7	850	850	850	-	-	-	-	-	-	-	-
3/8	Δ40(Std)	2.3	0.84	12.5	700	700	700	-	-	-	-	-	-	-	-
17.2	Δ80(XS)	3.2	1.10	10.1	850	850	850	-	-	-	-	-	-	-	-
1/2	Δ40(Std)	2.8	1.28	15.7	700	700	700	-	-	-	-	-	-	-	-
21.3	Δ80(XS)	3.7	1.61	13.9	850	850	850	-	-	-	-	-	-	-	-
	Δ160	4.8	1.95	11.7	900	900	900	-	-	-	-	-	-	-	-
	Δ(XXS)	7.5	2.55	6.3	1000	1000	1000	-	-	-	-	-	-	-	-
3/4	Δ40(Std)	2.9	1.70	20.9	700	700	700	-	-	-	-	-	-	-	-
26.7	Δ80(XS)	3.9	2.19	18.9	850	850	850	-	-	-	-	-	-	-	-
	Δ160	5.6	2.89	15.5	950	950	950	-	-	-	-	-	-	-	-
	Δ(XXS)	7.8	3.64	11.1	1000	1000	1000	-	-	-	-	-	-	-	-
1	40 (Std)	3.4	2.52	26.6	700	700	700	-	-	-	-	-	-	-	-
33.4	80 (XS)	4.5	3.21	24.4	850	850	850	-	-	-	-	-	-	-	-
	Δ160	6.4	4.23	20.7	1000	950	950	-	-	-	-	-	-	-	-
	(XXS)	9.1	5.45	15.2	-	1000	1000	-	-	-	-	-	-	-	-
1 1/4	40 (Std)	3.6	3.43	35.0	1000	1200	1300	-	-	-	-	-	-	-	-
42.2	80 (XS)	4.9	4.51	32.4	1300	1800	1900	-	-	-	-	-	-	-	-
	Δ160	6.4	5.60	29.5	1400	1900	2000	-	-	-	-	-	-	-	-
	(XXS)	9.7	7.77	22.8	-	2200	2300	-	-	-	-	-	-	-	-
1 1/2	40 (Std)	3.7	4.07	40.9	-	1200	1300	-	-	-	-	-	-	-	-
48.3	80 (XS)	5.1	5.43	38.1	-	1800	1900	-	-	-	-	-	-	-	-
	Δ160	7.1	7.23	34.0	-	1950	2050	-	-	-	-	-	-	-	-
	(XXS)	10.2	9.58	27.9	-	2200	2300	-	-	-	-	-	-	-	-
2 3/8		2.1	3.01	56.1	Std.	1260	1470	1760	1930	2180	2350	2520	2730	2940	3000
60.3					Alt.	1570	1830	2200	2410	2730	2940	3000	3000	3000	3000
	(Std)	2.8	3.97	54.6	Std.	1650	1930	2310	2530	2860	3000	3000	3000	3000	3000
					Alt.	2070	2410	2890	3000	3000	3000	3000	3000	3000	3000
		3.2	4.51	53.9	Std.	1890	2210	2650	2910	3000	3000	3000	3000	3000	3000
					Alt.	2370	2500	3000	3000	3000	3000	3000	3000	3000	3000
		3.6	5.03	53.1	Std.	2140	2490	2990	3000	3000	3000	3000	3000	3000	3000
					Alt.	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
	40 (Std)	3.9	5.42	52.5	Std.	2330	2500	3000	3000	3000	3000	3000	3000	3000	3000
					Alt.	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
		4.4	6.07	51.5	Std.	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
					Alt.	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
		4.8	6.57	50.7	Std.	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
					Alt.	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
	80 (XS)	5.5	7.43	49.3	Std.	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
					Alt.	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
		6.4	8.51	47.5	Std.	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
					Alt.	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
		7.1	9.31	46.1	Std.	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
					Alt.	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000

Size OD	Wall thickness		Unit weight	ID		Hydrostatic test pressure Values given in (psi). 1psi = 6.895MPa.									
inch	Sch. no	t													
mm	(Class)	mm	kg/m	mm		A	B	X42	X46	X52	X56	X60	X65	X70	X80
2 3/8	Δ160	8.7	11.10	42.8	Std.	2500	2500	-	-	-	-	-	-	-	-
60.3					Alt.	-	-	-	-	-	-	-	-	-	-
	(XXS)	11.1	13.47	38.1	Std.	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
					Alt.	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
2 7/8		2.1	3.67	68.8	Std.	1040	1210	1460	1590	1800	1940	2030	2250	2430	2770
73.0					Alt.	1300	1520	1820	1990	2250	2430	2600	2810	3000	3000
		2.8	4.85	67.4	Std.	1360	1590	1910	2090	2370	2550	2730	2960	3000	3000
					Alt.	1710	1990	2390	2620	2960	3000	3000	3000	3000	3000
		3.2	5.51	66.6	Std.	1570	1830	2190	2400	2710	2920	3000	3000	3000	3000
					Alt.	1960	2280	2740	3000	3000	3000	3000	3000	3000	3000
		3.6	6.16	65.8	Std.	1770	2060	2470	2710	3000	3000	3000	3000	3000	3000
					Alt.	2210	2500	3000	3000	3000	3000	3000	3000	3000	3000
		4.0	6.81	65.0	Std.	1950	2280	2730	3000	3000	3000	3000	3000	3000	3000
					Alt.	2440	2500	3000	3000	3000	3000	3000	3000	3000	3000
		4.4	7.44	64.2	Std.	2150	2500	3000	3000	3000	3000	3000	3000	3000	3000
					Alt.	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
		4.8	8.07	63.4	Std.	2350	2500	3000	3000	3000	3000	3000	3000	3000	3000
					Alt.	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
	40 (Std)	5.2	8.69	62.6	Std.	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
					Alt.	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
		5.5	9.16	62.0	Std.	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
					Alt.	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
		6.4	10.51	60.2	Std.	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
					Alt.	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
	80 (XS)	7.0	11.39	59.0	Std.	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
					Alt.	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
	Δ160	9.5	14.89	54.0	Std.	2500	2500	-	-	-	-	-	-	-	-
					Alt.	-	-	-	-	-	-	-	-	-	-
	(XXS)	14.0	20.37	45.0	Std.	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
					Alt.	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
3 ½		2.1	4.50	84.7	Std.	850	1000	1200	1310	1480	1590	1710	1850	1990	2270
88.9					Alt.	1070	1250	1490	1640	1850	1990	2130	2310	2490	2840
		2.8	5.95	83.3	Std.	1120	1310	1570	1720	1940	2090	2240	2430	2620	2990
					Alt.	1400	1640	1960	2150	2430	2620	2800	3000	3000	3000
		3.2	6.76	82.5	Std.	1290	1500	1800	1970	2230	2400	2570	2790	3000	3000
					Alt.	1610	1880	2250	2460	2790	3000	3000	3000	3000	3000
		3.6	7.57	81.7	Std.	1450	1690	2030	2220	2510	2710	2900	3000	3000	3000
					Alt.	1810	2120	2540	2780	3000	3000	3000	3000	3000	3000
		4.0	8.37	80.9	Std.	1600	1870	2250	2460	2780	3000	3000	3000	3000	3000
					Alt.	2010	2340	2810	3000	3000	3000	3000	3000	3000	3000
		4.4	9.17	80.1	Std.	1770	2060	2480	2710	3000	3000	3000	3000	3000	3000
					Alt.	2210	2500	3000	3000	3000	3000	3000	3000	3000	3000
		4.8	9.95	79.3	Std.	1930	2260	2710	2970	3000	3000	3000	3000	3000	3000
					Alt.	2420	2500	3000	3000	3000	3000	3000	3000	3000	3000
	40 (Std)	5.5	11.31	77.9	Std.	2220	2500	3000	3000	3000	3000	3000	3000	3000	3000
					Alt.	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
		6.4	13.02	76.1	Std.	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
					Alt.	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
		7.1	14.32	74.7	Std.	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
					Alt.	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
	80 (XS)	7.6	15.24	73.7	Std.	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
					Alt.	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000

Size OD	Wall thickness		Unit weight	ID		Hydrostatic test pressure Values given in (psi). 1psi = 6.895MPa.									
inch	Sch. no	t													
mm	(Class)	mm	kg/m	mm		A	B	X42	X46	X52	X56	X60	X65	X70	X80
3 ½	∆160	11.1	21.30	66.6	Std.	2500	2500	-	-	-	-	-	-	-	-
88.9					Alt.	-	-	-	-	-	-	-	-	-	-
	(XXS)	15.2	27.63	58.5	Std.	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
					Alt.	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
4		2.1	5.15	97.4	Std.	750	870	1050	1150	1290	1390	1490	1620	1740	1990
101.6					Alt.	930	1090	1310	1430	1620	1740	1870	2020	2180	2460
		2.8	6.82	96.0	Std.	980	1140	1370	1500	1700	1830	1960	2130	2290	2620
					Alt.	1230	1430	1720	1880	2130	2290	2450	2660	2860	3000
		3.2	7.76	95.2	Std.	1130	1310	1580	1730	1950	2100	2250	2440	2630	3000
					Alt.	1410	1640	1970	2160	2440	2630	2810	3000	3000	3000
		3.6	8.70	94.4	Std.	1270	1480	1780	1950	2200	2370	2540	2750	2960	3000
					Alt.	1590	1850	2220	2430	2750	2960	3000	3000	3000	3000
		4.0	9.63	93.6	Std.	1400	1640	1970	2150	2430	2620	2810	3000	3000	3000
					Alt.	1760	2050	2460	2690	3000	3000	3000	3000	3000	3000
		4.4	10.55	92.8	Std.	1550	1810	2170	2370	2680	2890	3000	3000	3000	3000
					Alt.	1940	2260	2710	2970	3000	3000	3000	3000	3000	3000
		4.8	11.46	92.0	Std.	1690	1970	2370	2590	2930	3000	3000	3000	3000	3000
					Alt.	2120	2470	2960	3000	3000	3000	3000	3000	3000	3000
	40 (Std)	5.7	13.48	90.2	Std.	2930	2370	2850	3000	3000	3000	3000	3000	3000	3000
					Alt.	2540	2800	3000	3000	3000	3000	3000	3000	3000	3000
		6.4	15.02	88.8	Std.	2250	2630	3000	3000	3000	3000	3000	3000	3000	3000
					Alt.	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
		7.1	16.55	87.4	Std.	2530	2800	3000	3000	3000	3000	3000	3000	3000	3000
					Alt.	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
	80 (XS)	8.1	18.68	85.4	Std.	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
					Alt.	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
4 ½		2.1	5.81	110.1	Std.	660	770	930	1020	1150	1240	1330	1440	1550	1770
114.30					Alt.	830	970	1160	1270	1440	1550	1660	1800	1940	2210
		3.2	8.77	107.9	Std.	1000	1170	1400	1530	1730	1870	2000	2170	2330	2670
					Alt.	1250	1460	1750	1920	2170	2330	2500	2710	2920	3000
		3.6	9.83	107.1	Std.	1130	1320	1580	1730	1960	2110	2260	2440	2630	3000
					Alt.	1410	1650	1970	2160	2440	2630	2820	3000	3000	3000
		4.0	10.88	106.3	Std.	1250	1460	1750	1910	2160	2330	2500	2700	2910	3000
					Alt.	1560	1820	2180	2390	2700	2910	3000	3000	3000	3000
		4.4	11.92	105.5	Std.	1380	1610	1930	2110	2390	2570	2750	2980	3000	3000
					Alt.	1720	2010	2410	2640	2980	3000	3000	3000	3000	3000
		4.8	12.96	104.7	Std.	1500	1750	2110	2310	2610	2810	3000	3000	3000	3000
					Alt.	1880	2190	2630	2880	3000	3000	3000	3000	3000	3000
		5.2	13.99	103.9	Std.	1620	1890	2270	2490	2810	3000	3000	3000	3000	3000
					Alt.	2030	2370	2840	3000	3000	3000	3000	3000	3000	3000
		5.6	15.01	103.1	Std.	1750	2040	2450	2690	3000	3000	3000	3000	3000	3000
					Alt.	2190	2560	3000	3000	3000	3000	3000	3000	3000	3000
	40 (Std)	6.0	16.02	102.3	Std.	1900	2210	2650	2910	3000	3000	3000	3000	3000	3000
					Alt.	2370	2770	3000	3000	3000	3000	3000	3000	3000	3000
		6.4	17.03	101.5	Std.	2000	2330	2800	3000	3000	3000	3000	3000	3000	3000
					Alt.	2500	2800	3000	3000	3000	3000	3000	3000	3000	3000
		7.1	18.77	100.1	Std.	2250	2620	3000	3000	3000	3000	3000	3000	3000	3000
					Alt.	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
		7.9	20.73	98.5	Std.	2500	2800	3000	3000	3000	3000	3000	3000	3000	3000
					Alt.	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
	80 (XS)	8.6	22.42	97.1	Std.	2700	2800	3000	3000	3000	3000	3000	3000	3000	3000
					Alt.	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000

Size OD	Wall thickness		Unit weight	ID		Hydrostatic test pressure Values given in (psi). 1psi = 6.895MPa.									
inch	Sch. no	t													
mm	(Class)	mm	kg/m	mm		A	B	X42	X46	X52	X56	X60	X65	X70	X80
4 ½	120	11.1	28.25	92.1	Std.	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
114.30					Alt.	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
	160	13.5	33.56	87.3	Std.	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
					Alt.	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
	(XXS)	17.1	40.99	80.1	Std.	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
					Alt.	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
5 9/16		2.1	7.21	137.1	Std.	540	630	750	820	930	1000	1040	1160	1250	1430
141.3		3.2	10.90	134.9	Std.	810	940	1130	1240	1400	1500	1630	1750	1890	2160
		4.0	13.54	133.3	Std.	1010	1180	1410	1550	1750	1910	2020	2120	2360	2690
		4.8	16.16	131.7	Std.	1220	1420	1700	1870	2110	2270	2430	2640	2840	3000
		5.6	18.74	130.1	Std.	1420	1650	1990	2170	2460	2650	2830	3000	3000	3000
	40	6.6	21.92	128.1	Std.	1670	1950	2340	2560	2890	3000	3000	3000	3000	3000
		7.1	23.50	127.1	Std.	1820	2120	2550	2790	3000	3000	3000	3000	3000	3000
		7.9	25.99	125.5	Std.	2020	2360	3000	3000	3000	3000	3000	3000	3000	3000
		8.7	28.45	123.9	Std.	2230	2600	3000	3000	3000	3000	3000	3000	3000	3000
	80 (XS)	9.5	30.88	122.3	Std.	2430	2800	3000	3000	3000	3000	3000	3000	3000	3000
	120	12.7	40.28	115.9	Std.	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
	160	15.9	49.17	109.5	Std.	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
	(XXS)	19.1	57.56	103.1	Std.	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000

Size OD	Wall thickness		Unit weight	ID	Hydrostatic test pressure Values given in (psi). 1psi = 6.895MPa.											
inch	Sch. No.				A		B									
mm	(Class)	mm	kg/m	mm	Std.	Alt.	Std.	Alt.	X42	X46	X52	X56	X60	X65	X70	X80
6 5/8		2.1	8.61	164.1	450	560	530	660	790	860	980	1050	1130	1220	1320	1500
168.3		2.8	11.43	162.7	590	740	690	860	1040	1140	1280	1380	1480	1600	1730	1970
		3.2	13.03	161.9	680	850	790	990	1190	1300	1470	1580	1700	1840	1980	2260
		3.6	14.62	161.1	770	960	890	1120	1340	1470	1660	1790	1920	2080	2230	2550
		4.0	16.21	160.3	850	1060	990	1240	1480	1620	1840	1980	2120	2300	2470	2830
		4.4	17.78	159.5	930	1170	1090	1360	1640	1790	2030	2180	2340	2530	2730	3000
		4.8	19.35	158.7	1020	1280	1190	1490	1790	1960	2210	2380	2550	2770	2980	3000
		5.2	20.91	157.9	1100	1380	1290	1610	1930	2110	2390	2570	2760	2990	3000	3000
		5.6	22.47	157.1	1190	1490	1390	1740	2080	2280	2580	2780	2980	3000	3000	3000
		6.4	25.55	155.5	1360	1700	1580	1980	2380	2600	2940	3000	3000	3000	3000	3000
	40	7.1	28.22	154.1	1520	1900	1780	2220	2660	2920	3000	3000	3000	3000	3000	3000
		7.9	31.25	152.5	1700	2120	1980	2470	2970	3000	3000	3000	3000	3000	3000	3000
		8.7	34.24	150.9	1870	2340	2180	2500	3000	3000	3000	3000	3000	3000	3000	3000
		9.5	37.20	149.3	2040	2550	2380	2800	3000	3000	3000	3000	3000	3000	3000	3000
	80 (XS)	11.0	42.67	146.3	2350	2800	2740	2800	3000	3000	3000	3000	3000	3000	3000	3000
		12.7	48.73	142.9	2720	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
	120	14.3	54.31	139.7	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
		15.9	59.76	136.5	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
	160	18.3	67.69	131.7	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
		19.1	70.27	130.1	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
	Δ	21.9	79.10	124.4	2800	-	2800	-	-	-	-	-	-	-	-	-
	(XXS)	22.2	79.98	123.9	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
8 5/8		3.2	17.04	212.7	520	650	610	760	910	1000	1130	1220	1300	1410	1520	1740
219.1		4.0	21.22	211.1	650	810	760	950	1140	1250	1410	1520	1630	1760	1900	2170
		4.8	25.37	209.5	780	980	920	1140	1370	1500	1700	1830	1960	2130	2290	2620
		5.2	27.43	208.7	850	1060	990	1240	1480	1620	1840	2000	2120	2290	2470	2820

Size OD	Wall thickness		Unit weight	ID	Hydrostatic test pressure Values given in (psi). 1psi = 6.895MPa.											
inch	Sch. No.	t			A		B									
mm	(Class)	mm	kg/m	mm	Std.	Alt.	Std.	Alt.	X42	X46	X52	X56	X60	X65	X70	X80
8 5/8		5.6	29.48	207.9	910	1140	1070	1330	1600	1750	1980	2130	2290	2480	2670	3000
219.1	20	6.4	33.57	206.3	1040	1300	1220	1520	1830	2000	2260	2430	2610	2830	3000	3000
	30	7.0	36.61	205.1	1160	1450	1350	1690	2020	2220	2510	2700	2890	3000	3000	3000
		7.9	41.14	203.3	1300	1630	1520	1900	2280	2500	2820	3000	3000	3000	3000	3000
	40	8.2	42.65	202.7	1340	1680	1570	1960	2350	2580	2910	3000	3000	3000	3000	3000
		8.7	45.14	201.7	1440	1790	1680	2090	2510	2750	3000	3000	3000	3000	3000	3000
		9.5	49.10	200.1	1570	1960	1830	2280	2740	3000	3000	3000	3000	3000	3000	3000
	Δ60	10.3	53.03	198.5	1700	-	2000	-	-	-	-	-	-	-	-	-
		11.1	56.94	196.9	1830	2290	2130	2670	3000	3000	3000	3000	3000	3000	3000	3000
	80 (XS)	12.7	64.64	193.7	2090	2610	2430	2800	3000	3000	3000	3000	3000	3000	3000	3000
		14.3	72.22	190.5	2350	2800	2740	2800	3000	3000	3000	3000	3000	3000	3000	3000
	Δ100	15.1	75.81	188.9	2500	-	2800	-	-	-	-	-	-	-	-	-
		15.9	79.67	187.3	2610	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
	120	18.3	90.62	182.5	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
		19.1	94.20	180.9	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
	140	20.6	100.84	177.9	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
	(XXS)	22.2	107.79	174.7	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
	Δ160	23.0	111.14	173.1	2800	-	2800	-	-	-	-	-	-	-	-	-
		25.4	121.32	168.3	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
10 3/4		4.0	26.54	265.1	520	650	610	760	1040	1130	1280	1380	1480	1600	1730	1970
273.1		4.8	31.76	263.5	630	790	730	920	1250	1370	1550	1660	1780	1930	2080	2380
		5.2	34.35	262.7	680	850	790	990	1350	1480	1670	1800	1930	2090	2250	2570
		5.6	36.94	261.9	730	920	860	1070	1450	1590	1800	1940	2080	2250	2420	2770
	20	6.4	42.09	260.3	840	1050	980	1220	1660	1820	2060	2210	2370	2570	2770	3000
		7.1	46.57	258.9	930	1170	1090	1360	1850	2030	2290	2470	2650	2870	3000	3000
	30	7.8	51.03	257.5	1030	1290	1200	1500	2040	2230	2520	2720	2910	3000	3000	3000
		8.7	56.72	255.7	1150	1440	1340	1680	2280	2500	2830	3000	3000	3000	3000	3000
	40	9.3	60.50	254.5	1220	1530	1430	1780	2420	2660	3000	3000	3000	3000	3000	3000
		11.1	71.72	250.9	1470	1830	1710	2140	2910	3000	3000	3000	3000	3000	3000	3000
10 3/4	60 (XS)	12.7	81.55	247.7	1670	2090	1950	2440	3000	3000	3000	3000	3000	3000	3000	3000
273.1		14.3	91.26	244.5	1880	2350	2200	2740	3000	3000	3000	3000	3000	3000	3000	3000
	Δ80	15.1	95.87	242.9	1990	-	2320	-	-	-	-	-	-	-	-	-
		15.9	100.85	241.3	2090	2620	2440	2800	3000	3000	3000	3000	3000	3000	3000	3000
	100	18.3	114.99	236.5	2410	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
		20.6	128.27	231.9	2720	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
	Δ120	21.4	132.86	230.2	2800	-	2800	-	-	-	-	-	-	-	-	-
		22.2	137.36	228.7	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
		23.8	146.30	225.5	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
	140	25.4	155.10	222.3	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
	Δ160	28.6	172.25	172.1	2800	-	2800	-	-	-	-	-	-	-	-	-
		31.8	188.75	209.5	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
12 3/4		4.4	34.67	315.1	490	610	570	710	960	1050	1190	1280	1380	1490	1610	1830
323.9		4.8	37.77	314.3	530	660	620	770	1050	1150	1300	1400	1500	1630	1750	2010
		5.2	40.87	313.5	570	720	670	840	1140	1250	1410	1520	1620	1760	1890	2170
		5.6	43.59	312.7	620	770	720	900	1230	1340	1520	1640	1750	1900	2040	2340
	20	6.4	50.11	311.1	710	880	820	1030	1400	1530	1730	1870	2000	2170	2330	2670
		7.1	55.47	309.7	790	990	930	1160	1570	1720	1950	2100	2250	2440	2620	3000
		7.9	61.56	308.1	880	1100	1030	1280	1750	1910	2160	2330	2500	2700	2910	3000
	30	8.4	65.35	307.1	930	1160	1090	1360	1850	2020	2290	2460	2640	2860	3000	3000
		8.7	67.62	306.5	970	1210	1130	1420	1930	2110	2390	2570	2750	2980	3000	3000
	(Std)	9.5	73.65	304.9	1060	1320	1240	1540	2100	2300	2600	2800	3000	3000	3000	3000
	40	10.3	79.65	303.3	1150	1430	1340	1670	2270	2490	2810	3000	3000	3000	3000	3000

Size OD	Wall thickness		Unit Weight	ID	Hydrostatic test pressure Values given in (psi). 1psi = 6.895MPa.											
inch	Sch. No.	t			A		B									
mm	(Class)	mm	kg/m	mm	Std.	Alt.	Std.	Alt.	X42	X46	X52	X56	X60	X65	X70	X80
12 3/4		11.1	85.62	301.7	1240	1550	1440	1800	2450	2690	3000	3000	3000	3000	3000	3000
323.9	(XS)	12.7	97.46	298.5	1410	1760	1650	2060	2800	3000	3000	3000	3000	3000	3000	3000
	60	14.3	109.18	295.3	1590	1980	1850	2310	3000	3000	3000	3000	3000	3000	3000	3000
		15.9	120.76	292.1	1760	2210	2060	2570	3000	3000	3000	3000	3000	3000	3000	3000
	80	17.5	132.23	288.9	1940	2430	2270	2800	3000	3000	3000	3000	3000	3000	3000	3000
		19.1	143.56	285.7	2120	2650	2470	2800	3000	3000	3000	3000	3000	3000	3000	3000
		20.6	154.08	282.7	2290	2800	2670	2800	3000	3000	3000	3000	3000	3000	3000	3000
	Δ100	21.4	159.69	281.0	2390	-	2780	-	-	-	-	-	-	-	-	-
		22.2	165.17	279.5	2470	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
		23.8	176.13	276.3	2650	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
	120(XXS)	25.4	186.91	273.1	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
		27.0	197.68	269.9	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
	140	28.6	208.27	266.7	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
		31.8	229.06	260.3	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
	Δ160	33.3	238.48	257.2	2800	-	2800	-	-	-	-	-	-	-	-	-
14		4.8	41.52	346.0	480	600	560	700	960	1050	1190	1280	1370	1480	1600	1830
355.6		5.2	44.93	345.2	520	650	610	760	1040	1140	1290	1390	1480	1600	1730	1970
	10	5.3	45.78	345.0	540	680	630	790	1070	1170	1330	1430	1530	1660	1790	2040
		5.6	48.33	344.4	560	700	660	820	1120	1220	1380	1490	1600	1730	1860	2130
		6.4	55.11	342.8	640	800	750	940	1280	1400	1580	1700	1820	1970	2130	2430
		7.1	61.02	341.4	720	900	840	1050	1430	1570	1770	1910	2050	2220	2390	2730
	20	7.9	67.74	339.8	800	1000	940	1170	1590	1740	1970	2120	2270	2460	2650	3000
		8.7	74.42	338.2	880	1110	1030	1290	1750	1920	2170	2340	2510	2720	2920	3000
	30(Std)	9.5	81.08	336.6	960	1210	1120	1410	1910	2090	2370	2550	2730	2960	3000	3000
		10.3	87.71	335.0	1040	1310	1220	1520	2070	2270	2560	2760	2960	3000	3000	3000
	40	11.1	94.30	333.4	1130	1410	1310	1640	2230	2450	2770	2980	3000	3000	3000	3000
		11.9	100.86	331.8	1210	1510	1410	1760	2390	2620	2960	3000	3000	3000	3000	3000
	(XS)	12.7	107.39	330.2	1290	1610	1500	1880	2550	2790	3000	3000	3000	3000	3000	3000
		14.3	120.36	327.0	1450	1810	1690	2110	2870	3000	3000	3000	3000	3000	3000	3000
	Δ60	15.1	126.55	325.4	1530	-	1780	-	-	-	-	-	-	-	-	-
		15.9	133.19	323.8	1610	2010	1880	2340	3000	3000	3000	3000	3000	3000	3000	3000
		17.5	145.91	320.6	1770	2210	2060	2580	3000	3000	3000	3000	3000	3000	3000	3000
	80	19.1	158.49	317.4	1930	2410	2250	2800	3000	3000	3000	3000	3000	3000	3000	3000
		20.6	170.18	314.4	2090	2610	2440	2800	3000	3000	3000	3000	3000	3000	3000	3000
		22.2	182.52	311.2	2250	2800	2620	2800	3000	3000	3000	3000	3000	3000	3000	3000
	100	23.8	194.74	308.0	2410	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
		25.4	206.83	304.8	2570	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
		27.0	218.79	301.6	2730	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
	Δ120	27.8	224.64	300.0	2740	-	2800	-	-	-	-	-	-	-	-	-
		28.6	230.63	298.4	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
	140	31.8	253.31	292.1	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
	Δ160	35.7	281.40	284.2	2800	-	2800	-	-	-	-	-	-	-	-	-
	Δ	50.8	381.40	254.0	2800	-	2800	-	-	-	-	-	-	-	-	-
	Δ	54.0	401.03	247.7	2800	-	2800	-	-	-	-	-	-	-	-	-
	Δ	55.9	412.56	243.8	2800	-	2800	-	-	-	-	-	-	-	-	-
	Δ	63.5	456.89	228.6	2800	-	2800	-	-	-	-	-	-	-	-	-
16		4.8	47.54	396.8	420	530	490	620	840	920	1040	1120	1200	1300	1400	1600
406.4		5.2	51.45	396.0	460	570	530	670	910	990	1120	1210	1290	1400	1510	1730
		5.6	55.35	395.2	490	620	570	720	980	1070	1210	1300	1400	1510	1630	1860
	10	6.4	63.13	393.6	560	700	660	820	1120	1220	1380	1490	1590	1730	1860	2130
		7.1	69.91	392.2	630	790	740	920	1250	1370	1550	1670	1790	1940	2090	2390
	20	7.9	77.63	390.6	700	880	820	1020	1390	1520	1720	1860	1990	2150	2320	2650

Size OD	Wall thickness		Unit weight	ID	Hydrostatic test pressure Values given in (psi). 1psi = 6.895MPa.											
inch	Sch. No.	t			A		B									
mm	(Class)	mm	kg/m	mm	Std.	Alt.	Std.	Alt.	X42	X46	X52	X56	X60	X65	X70	X80
16		8.7	85.32	389.0	770	970	900	1130	1540	1680	1900	2050	2190	2380	2560	2920
406.4	30(Std)	9.5	92.98	387.4	840	1050	980	1230	1670	1830	2070	2230	2390	2590	2790	3000
		10.3	100.61	385.8	910	1110	1070	1330	1810	1980	2240	2420	2590	2800	3000	3000
		11.1	108.20	384.2	990	1230	1150	1440	1950	2140	2420	2610	2790	3000	3000	3000
		11.9	115.77	382.6	1060	1320	1230	1540	2090	2290	2590	2790	2990	3000	3000	3000
	40(XS)	12.7	123.30	381.0	1120	1410	1310	1640	2230	2440	2760	2980	3000	3000	3000	3000
		14.3	138.27	377.8	1260	1580	1480	1840	2510	2750	3000	3000	3000	3000	3000	3000
		15.9	153.14	374.6	1410	1760	1640	2050	2790	3000	3000	3000	3000	3000	3000	3000
	Δ60	16.7	159.96	373.1	1480	-	1720	-	-	-	-	-	-	-	-	-
		17.5	167.83	371.4	1550	1940	1810	2260	3000	3000	3000	3000	3000	3000	3000	3000
		19.1	182.42	368.2	1690	2110	1970	2460	3000	3000	3000	3000	3000	3000	3000	3000
		20.6	195.98	365.2	1830	2280	2130	2660	3000	3000	3000	3000	3000	3000	3000	3000
	Δ80	21.4	203.29	363.5	1900	-	2220	-	-	-	-	-	-	-	-	-
		22.2	210.33	362.0	1970	2460	2300	2800	3000	3000	3000	3000	3000	3000	3000	3000
		23.8	224.55	358.8	2110	2640	2460	2800	3000	3000	3000	3000	3000	3000	3000	3000
		25.4	238.64	355.6	2250	2800	2620	2800	3000	3000	3000	3000	3000	3000	3000	3000
	Δ100	26.2	245.25	354.0	2320	-	2710	-	-	-	-	-	-	-	-	-
		27.0	252.61	352.4	2390	2800	2790	2800	3000	3000	3000	3000	3000	3000	3000	3000
		28.6	266.45	349.2	2530	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
		30.2	280.17	346.0	2670	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
	Δ120	31.0	286.33	344.5	2740	-	2800	-	-	-	-	-	-	-	-	-
		31.8	293.76	342.8	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
	Δ140	36.5	333.35	332.8	2800	-	2800	-	-	-	-	-	-	-	-	-
	Δ160	40.5	364.93	325.4	2800	-	2800	-	-	-	-	-	-	-	-	-
18		4.8	53.53	447.4	380	470	440	550	750	820	920	990	1070	1150	1240	1420
457.2		5.6	62.34	445.8	440	550	510	640	870	950	1080	1160	1240	1340	1450	1650
	10	6.4	71.12	444.2	500	620	580	730	990	1090	1230	1320	1420	1530	1650	1890
		7.1	78.77	442.8	560	700	660	820	1110	1220	1380	1490	1590	1730	1860	2120
	20	7.9	87.49	441.2	620	780	730	910	1240	1360	1530	1650	1770	1920	2060	2350
		8.7	96.18	439.6	690	860	800	1000	1360	1490	1690	1820	1950	2110	2270	2600
	(Std)	9.5	104.84	438.0	750	940	880	1090	1490	1630	1840	1980	2120	2300	2480	2830
		10.3	113.46	436.4	810	1020	950	1180	1610	1760	1990	2150	2300	2490	2680	3000
	30	11.1	122.05	434.8	880	1100	1020	1280	1740	1900	2150	2320	2480	2690	2900	3000
		11.9	130.62	433.2	940	1170	1090	1370	1860	2040	2300	2480	2660	2880	3000	3000
	(XS)	12.7	139.15	431.6	1000	1250	1170	1460	1980	2170	2460	2640	2830	3000	3000	3000
	40	14.3	156.11	428.4	1120	1400	1310	1640	2230	2440	2760	2970	3000	3000	3000	3000
		15.9	172.95	425.2	1250	1560	1460	1820	2480	2720	3000	3000	3000	3000	3000	3000
		17.5	189.67	422.0	1380	1720	1610	2010	2730	2990	3000	3000	3000	3000	3000	3000
	60	19.1	206.25	418.8	1500	1880	1750	2190	2980	3000	3000	3000	3000	3000	3000	3000
		20.6	221.69	415.8	1620	2030	1890	2370	3000	3000	3000	3000	3000	3000	3000	3000
		22.2	238.03	412.6	1750	2190	2040	2550	3000	3000	3000	3000	3000	3000	3000	3000
	80	23.8	254.25	409.4	1880	2340	2190	2740	3000	3000	3000	3000	3000	3000	3000	3000
		25.4	270.34	406.2	2000	2500	2330	2800	3000	3000	3000	3000	3000	3000	3000	3000
		27.0	286.30	40.30	2120	2660	2480	2800	3000	3000	3000	3000	3000	3000	3000	3000
		28.6	302.14	399.8	2250	2800	2620	2800	3000	3000	3000	3000	3000	3000	3000	3000
	Δ100	29.4	309.41	398.5	2310	-	2700	-	-	-	-	-	-	-	-	-
		30.2	317.85	396.6	2370	2800	2770	2800	3000	3000	3000	3000	3000	3000	3000	3000
		31.8	333.44	393.4	2500	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
	Δ120	34.9	363.28	387.4	2750	-	2800	-	-	-	-	-	-	-	-	-
	Δ140	39.7	408.04	377.9	2800	-	2800	-	-	-	-	-	-	-	-	-
	Δ160	45.2	459.05	366.7	2800	-	2800	-	-	-	-	-	-	-	-	-

Size OD	Wall thickness		Unit weight	ID	Hydrostatic test pressure Values given in (psi). 1psi = 6.895MPa.											
inch	Sch. No.	t			A		B									
mm	(Class)	mm	kg/m	mm	Std.	Alt.	Std.	Alt.	X42	X46	X52	X56	X60	X65	X70	X80
20		5.6	69.38	496.8	390	490	460	570	830	910	1020	1100	1180	1280	1380	1580
508.0	10	6.4	79.16	495.2	450	560	520	660	950	1040	1170	1260	1350	1460	1580	1800
		7.1	87.70	493.8	510	630	590	740	1060	1160	1320	1420	1520	1640	1770	2020
		7.9	97.43	492.2	560	700	660	820	1180	1290	1460	1570	1680	1830	1970	2250
		8.7	107.12	490.6	620	770	720	900	1300	1420	1610	1730	1860	2010	2170	2480
	20(Std)	9.5	116.78	489.0	680	840	790	980	1420	1550	1760	1890	2030	2190	2360	2700
		10.3	126.41	487.4	730	910	850	1070	1530	1680	1900	2050	2190	2380	2560	2920
		11.1	136.01	485.8	790	990	920	1150	1660	1810	2050	2210	2370	2560	2760	3000
		11.9	145.58	484.2	840	1060	980	1230	1770	1940	2190	2360	2530	2740	2950	3000
	30(XS)	12.7	155.12	482.6	900	1120	1050	1310	1890	2070	2340	2520	2700	2930	3000	3000
		14.3	174.10	479.4	1010	1260	1180	1480	2120	2330	2630	2830	3000	3000	3000	3000
	Δ40	15.1	183.19	477.8	1170	-	1250	-	-	-	-	-	-	-	-	-
		15.9	192.95	476.2	1120	1410	1310	1640	2360	2590	2930	3000	3000	3000	3000	3000
		17.5	211.68	473.0	1240	1550	1440	1810	2600	2850	3000	3000	3000	3000	3000	3000
		19.1	230.27	469.8	1350	1690	1580	1970	2840	3000	3000	3000	3000	3000	3000	3000
	60	20.6	247.60	466.8	1460	1830	1710	2130	3000	3000	3000	3000	3000	3000	3000	3000
		22.2	265.95	463.6	1580	1970	1840	2300	3000	3000	3000	3000	3000	3000	3000	3000
		23.8	284.18	460.4	1690	2110	1970	2460	3000	3000	3000	3000	3000	3000	3000	3000
		25.4	302.28	457.2	1800	2250	2100	2620	3000	3000	3000	3000	3000	3000	3000	3000
	Δ80	26.2	310.80	455.6	1860	-	2170	-	-	-	-	-	-	-	-	-
		27.0	320.26	454.0	1910	2390	2230	2750	3000	3000	3000	3000	3000	3000	3000	3000
		28.6	338.11	450.8	2020	2530	2360	2750	3000	3000	3000	3000	3000	3000	3000	3000
		30.2	355.83	447.6	2140	2670	2490	2750	3000	3000	3000	3000	3000	3000	3000	3000
		31.8	373.43	444.4	2250	2750	2620	2750	3000	3000	3000	3000	3000	3000	3000	3000
	Δ100	32.5	381.07	442.9	2310	-	2690	-	-	-	-	-	-	-	-	-
		33.3	389.81	441.4	2360	2750	2750	2750	3000	3000	3000	3000	3000	3000	3000	3000
		34.9	407.17	438.2	2480	2750	2750	2750	3000	3000	3000	3000	3000	3000	3000	3000
	Δ120	38.1	440.99	431.8	2700	-	2800	-	-	-	-	-	-	-	-	-
	Δ140	44.5	507.56	419.1	2800	-	2800	-	-	-	-	-	-	-	-	-
	Δ160	50.0	564.10	408.0	2800	-	2800	-	-	-	-	-	-	-	-	-
22		5.6	76.42	547.8	360	450	420	520	750	820	930	1000	1080	1160	1250	1430
558.8	10	6.4	87.21	546.2	410	510	480	600	860	940	1060	1150	1230	1330	1430	1640
		7.1	96.63	544.8	460	570	540	670	970	1060	1200	1290	1380	1490	1610	1840
		7.9	107.36	543.2	510	640	600	740	1070	1170	1330	1430	1530	1660	1790	2040
		8.7	118.06	541.6	560	700	660	820	1180	1290	1460	1580	1690	1830	1970	2250
	20	9.5	128.73	540.0	610	770	720	890	1290	1410	1600	1720	1840	1990	2150	2450
		10.3	139.37	538.4	660	830	780	970	1400	1530	1730	1860	1990	2160	2330	2660
		11.1	149.97	536.8	720	900	840	1050	1510	1650	1860	2010	2150	2330	2510	2870
		11.9	160.55	535.2	770	960	900	1120	1610	1770	2000	2150	2300	2490	2690	3000
	30	12.7	171.09	533.6	820	1020	950	1190	1720	1880	2130	2290	2450	2660	2860	3000
		14.3	192.08	530.4	920	1150	1070	1340	1930	2120	2390	2570	2760	2990	3000	3000
	40	15.9	212.95	527.2	1020	1280	1190	1490	2150	2350	2660	2860	3000	3000	3000	3000
		17.5	233.68	524.0	1130	1410	1310	1640	2360	2590	2930	3000	3000	3000	3000	3000
		19.1	254.30	520.8	1230	1530	1430	1790	2580	2820	3000	3000	3000	3000	3000	3000
		20.6	273.51	517.8	1330	1660	1550	1940	2790	3000	3000	3000	3000	3000	3000	3000
		22.2	293.87	514.6	1430	1790	1670	2090	3000	3000	3000	3000	3000	3000	3000	3000
		23.8	314.11	511.4	1530	1920	1790	2240	3000	3000	3000	3000	3000	3000	3000	3000
		25.4	334.23	508.2	1640	2050	1910	2390	3000	3000	3000	3000	3000	3000	3000	3000
		27.0	354.22	505.0	1740	2170	2030	2500	3000	3000	3000	3000	3000	3000	3000	3000
		28.6	374.08	501.8	1840	2300	2150	2500	3000	3000	3000	3000	3000	3000	3000	3000
		30.2	393.81	498.6	1940	2430	2270	2500	3000	3000	3000	3000	3000	3000	3000	3000
		31.8	413.42	495.4	2050	2500	2390	2500	3000	3000	3000	3000	3000	3000	3000	3000

Size OD	Wall thickness		Unit weight	ID	Hydrostatic test pressure Values given in (psi). 1psi = 6.895MPa.											
inch	Sch. No.	t			A		B									
mm	(Class)	mm	kg/m	mm	Std.	Alt.	Std.	Alt.	X42	X46	X52	X56	X60	X65	X70	X80
22		33.3	431.69	492.4	2150	2500	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
558.8		34.9	451.06	489.2	2250	2500	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
		36.5	470.30	486.0	2350	2500	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
		38.1	489.41	482.8	2450	2500	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
24	10	6.4	95.26	597.2	380	470	440	550	790	860	980	1050	1130	1220	1310	1500
609.6		7.1	105.56	595.8	420	530	490	610	890	970	1100	1180	1260	1370	1480	1690
		7.9	117.30	594.2	470	580	550	680	980	1080	1220	1310	1400	1520	1640	1870
		8.7	129.00	592.6	520	640	600	750	1080	1190	1340	1440	1550	1680	1810	2060
	20(Std)	9.5	140.68	591.0	560	700	660	820	1180	1290	1460	1580	1690	1830	1970	2250
		10.3	152.32	589.4	610	760	710	890	1280	1400	1580	1710	1830	1980	2130	2440
		11.1	163.93	587.8	660	820	770	960	1380	1510	1710	1840	1970	2140	2300	2630
		11.9	175.51	586.2	700	880	820	1030	1480	1620	1830	1970	2110	2290	2460	2810
	(XS)	12.7	187.06	584.6	750	940	880	1090	1580	1730	1950	2100	2250	2440	2630	3000
	30	14.3	210.07	581.4	840	1050	980	1230	1770	1940	2190	2360	2530	2740	2950	3000
		15.9	232.94	578.2	940	1170	1090	1370	1970	2160	2440	2630	2810	3000	3000	3000
	40	17.5	255.69	575.0	1030	1290	1200	1500	2170	2370	2680	2890	3000	3000	3000	3000
		19.1	278.32	571.8	1120	1410	1310	1640	2360	2590	2930	3000	3000	3000	3000	3000
		20.6	299.41	568.8	1220	1520	1420	1780	2560	2800	3000	3000	3000	3000	3000	3000
		22.2	321.79	565.6	1310	1640	1530	1910	2760	3000	3000	3000	3000	3000	3000	3000
		23.8	344.05	562.4	1410	1760	1640	2050	2950	3000	3000	3000	3000	3000	3000	3000
	Δ60	24.6	355.41	560.4	1450	-	1700	-	-	-	-	-	-	-	-	-
		25.4	366.17	559.2	1500	1880	1750	2190	3000	3000	3000	3000	3000	3000	3000	3000
		27.0	388.17	556.0	1590	1990	1860	2300	3000	3000	3000	3000	3000	3000	3000	3000
		28.6	410.05	552.8	1690	2110	1970	2300	3000	3000	3000	3000	3000	3000	3000	3000
		30.2	431.80	549.6	1780	2230	2080	2300	3000	3000	3000	3000	3000	3000	3000	3000
	Δ80	31.0	441.31	547.7	1830	-	2130	-	-	-	-	-	-	-	-	-
		31.8	453.42	546.4	1880	2300	2190	2300	3000	3000	3000	3000	3000	3000	3000	3000
		33.3	473.57	543.4	1970	2300	2300	2300	3000	3000	3000	3000	3000	3000	3000	3000
		34.9	494.95	540.2	2060	2300	2300	2300	3000	3000	3000	3000	3000	3000	3000	3000
		36.5	516.20	537.0	2160	2300	2300	2300	3000	3000	3000	3000	3000	3000	3000	3000
		38.1	537.33	533.8	2250	2300	2300	2300	3000	3000	3000	3000	3000	3000	3000	3000
	Δ100	38.9	546.68	531.8	2300	-	2680	-	-	-	-	-	-	-	-	-
		39.7	558.32	530.6	2300	2300	2300	2300	3000	3000	3000	3000	3000	3000	3000	3000
	Δ120	46.0	638.93	517.6	2720	-	2800	-	-	-	-	-	-	-	-	-
	Δ140	52.4	718.88	504.9	2800	-	2800	-	-	-	-	-	-	-	-	-
	Δ160	59.5	806.75	490.5	2800	-	2800	-	-	-	-	-	-	-	-	-
26		6.4	103.15	647.2	350	430	400	500	730	800	900	970	1040	1130	1210	1380
660.0		7.1	114.31	645.8	390	490	450	570	820	890	1010	1090	1170	1260	1360	1560
	10	7.9	127.04	644.2	430	540	500	630	910	990	1120	1210	1300	1400	1510	1730
		8.7	139.73	642.6	480	600	560	690	1000	1100	1240	1330	1430	1550	1670	1910
	(Std)	9.5	152.39	641.0	520	650	610	760	1090	1190	1350	1450	1560	1690	1820	2080
		10.3	165.02	639.4	560	700	660	820	1180	1290	1460	1570	1690	1830	1970	2250
		11.1	177.62	637.8	610	760	710	880	1270	1390	1580	1700	1820	1970	2120	2430
		11.9	190.19	636.2	650	810	760	950	1360	1490	1690	1820	1950	2110	2270	2600
	20(XS)	12.7	202.72	634.6	690	870	810	1010	1450	1590	1800	1940	2080	2250	2420	2770
		14.3	227.70	631.4	780	970	910	1130	1630	1790	2020	2180	2330	2530	2720	3000
		15.9	252.55	628.2	870	1080	1010	1260	1820	1990	2250	2420	2600	2810	3000	3000
		17.5	277.27	625.0	950	1190	1110	1390	2000	2190	2480	2670	2860	3000	3000	3000
		19.1	301.87	621.8	1040	1300	1210	1510	2180	2390	2700	2910	3000	3000	3000	3000
		20.6	324.81	618.8	1120	1410	1310	1640	2360	2590	2920	3000	3000	3000	3000	3000
		22.2	349.16	615.6	1210	1510	1410	1770	2540	2790	3000	3000	3000	3000	3000	3000
		23.8	373.39	612.4	1300	1620	1520	1890	2730	2990	3000	3000	3000	3000	3000	3000
		25.4	397.49	609.2	1380	1730	1620	2000	2910	3000	3000	3000	3000	3000	3000	3000

Size OD	Wall thickness		Unit weight	ID	Hydrostatic test pressure Values given in (psi). 1psi = 6.895MPa.											
inch	Sch. No.	t			A		B									
mm	(Class)	mm	kg/m	mm	Std.	Alt.	Std.	Alt.	X42	X46	X52	X56	X60	X65	X70	X80
28		6.4	111.20	698.2	320	400	370	470	680	740	840	900	960	1040	1130	1290
711.0		7.1	123.24	696.8	360	450	420	530	760	830	940	1010	1080	1170	1260	1450
	10	7.9	136.97	695.2	400	500	470	580	840	920	1040	1120	1200	1300	1400	1600
		8.7	150.67	693.6	440	550	520	650	930	1020	1150	1240	1330	1440	1550	1770
		9.5	164.34	692.0	480	600	560	700	1010	1110	1250	1350	1450	1570	1690	1930
		10.3	177.98	690.4	520	650	610	760	1100	1200	1360	1460	1570	1700	1830	2090
		11.1	191.58	688.8	560	700	660	820	1180	1300	1460	1580	1690	1830	1970	2250
		11.9	205.15	687.2	600	750	700	880	1270	1390	1570	1690	1810	1960	2110	2410
	20	12.7	218.69	685.6	640	800	750	940	1350	1480	1670	1800	1930	2090	2250	2570
		14.3	245.68	682.4	720	900	840	1050	1520	1660	1880	2020	2170	2350	2530	2890
	30	15.9	272.54	679.2	800	1000	940	1170	1690	1850	2090	2250	2410	2610	2810	3000
		17.5	299.28	676.0	880	1110	1030	1290	1860	2030	2300	2480	2650	2870	3000	3000
		19.1	325.89	672.8	960	1210	1120	1410	2020	2220	2510	2700	2890	3000	3000	3000
		20.6	350.72	669.8	1040	1300	1220	1520	2190	2400	2710	2920	3000	3000	3000	3000
		22.2	377.08	666.6	1120	1410	1310	1640	2360	2590	2920	3000	3000	3000	3000	3000
		23.8	403.32	663.4	1210	1510	1410	1760	2530	2770	3000	3000	3000	3000	3000	3000
		25.4	429.44	660.2	1290	1610	1500	1880	2700	2960	3000	3000	3000	3000	3000	3000
30		6.4	119.25	749.2	300	370	350	440	630	690	780	840	900	980	1050	1210
762.0		7.1	132.17	747.8	340	420	390	490	710	780	880	940	1010	1100	1180	1360
	10	7.9	146.91	746.2	370	470	440	550	790	860	970	1050	1120	1220	1310	1510
		8.7	161.61	744.6	410	520	480	600	870	950	1070	1160	1240	1340	1440	1660
		9.5	176.29	743.0	450	560	520	660	940	1040	1170	1260	1350	1460	1580	1810
		10.3	190.93	741.4	490	610	590	710	1020	1120	1270	1360	1460	1580	1710	1960
		11.1	205.54	739.8	530	660	610	770	1100	1210	1370	1470	1580	1710	1840	2110
		11.9	220.12	738.2	560	700	660	820	1180	1290	1460	1580	1690	1830	1970	2260
	20	12.7	234.67	736.6	600	750	700	880	1260	1380	1560	1680	1800	1950	2100	2410
		14.3	263.67	733.4	670	840	790	980	1420	1550	1750	1890	2020	2190	2360	2700
	30	15.9	292.54	730.2	750	940	880	1090	1580	1720	1950	2100	2250	2440	2630	3000
		17.5	321.29	727.0	830	1030	960	1200	1730	1900	2150	2310	2480	2680	2890	3000
		19.1	349.91	723.8	900	1120	1050	1310	1890	2070	2340	2520	2700	2920	3000	3000
		20.6	376.63	720.8	970	1220	1140	1420	2050	2240	2530	2730	2920	3000	3000	3000
		22.2	405.00	717.6	1050	1310	1220	1530	2200	2420	2730	2940	3000	3000	3000	3000
		23.8	433.26	714.4	1130	1410	1310	1640	2360	2590	2930	3000	3000	3000	3000	3000
		25.4	461.38	711.2	1200	1500	1400	1750	2520	2760	3000	3000	3000	3000	3000	3000
		27.0	489.38	708.0	1270	1590	1490	1860	2680	2930	3000	3000	3000	3000	3000	3000
		28.6	517.25	704.8	1350	1690	1580	1970	2840	3000	3000	3000	3000	3000	3000	3000
		30.2	544.99	701.6	1430	1780	1660	2080	2990	3000	3000	3000	3000	3000	3000	3000
32		6.4	127.30	800.2	280	350	330	410	590	650	730	790	840	910	980	1130
813.0		7.1	141.10	798.8	320	400	370	460	660	730	820	890	950	1030	1110	1270
	10	7.9	156.84	797.2	350	440	410	510	740	810	910	980	1050	1140	1230	1410
		8.7	172.56	795.6	390	480	450	560	810	890	1010	1080	1160	1260	1350	1550
		9.5	188.24	794.0	420	530	490	620	890	970	1100	1180	1270	1370	1480	1690
		10.3	203.88	792.4	460	570	530	670	960	1050	1190	1280	1370	1480	1600	1830
		11.1	219.50	790.8	490	620	570	720	1030	1130	1280	1380	1480	1600	1720	1970
		11.9	235.09	789.2	530	660	620	770	1110	1210	1370	1480	1580	1710	1850	2110
	20	12.7	250.64	787.6	560	700	660	820	1180	1290	1460	1580	1690	1830	1970	2250
		14.3	281.65	784.4	630	790	740	920	1330	1450	1640	1770	1900	2050	2210	2520
	30	15.9	312.54	781.2	700	880	820	1030	1480	1620	1830	1970	2110	2290	2460	2800
	40	17.5	343.30	778.0	770	970	900	1130	1630	1780	2010	2170	2320	2520	2710	3000
		19.1	373.93	774.8	840	1050	980	1230	1770	1940	2190	2360	2530	2740	2950	3000
		20.6	402.54	771.8	910	1140	1070	1330	1920	2100	2380	2560	2740	2970	3000	3000
		22.2	432.93	768.6	980	1230	1150	1440	2070	2260	2560	2760	2950	3000	3000	3000
		23.8	463.19	765.4	1060	1320	1230	1540	2220	2430	2740	2950	3000	3000	3000	3000

Size OD	Wall thickness		Unit weight	ID	Hydrostatic test pressure Values given in (psi). 1psi = 6.895MPa.											
inch	Sch. No.	t			A		B									
mm	(Class)	mm	kg/m	mm	Std.	Alt.	Std.	Alt.	X42	X46	X52	X56	X60	X65	X70	X80
32		25.4	493.32	762.2	1120	1410	1310	1640	2360	2590	2920	3000	3000	3000	3000	3000
813.0		27.0	523.33	759.0	1190	1490	1390	1740	2510	2750	3000	3000	3000	3000	3000	3000
		28.6	553.22	755.8	1270	1580	1480	1850	2660	2910	3000	3000	3000	3000	3000	3000
		30.2	582.98	752.6	1340	1670	1560	1950	2810	3000	3000	3000	3000	3000	3000	3000
		31.8	612.61	749.4	1410	1760	1640	2050	2950	3000	3000	3000	3000	3000	3000	3000
34		6.4	135.35	851.2	260	330	310	390	560	610	690	740	790	860	930	1060
864.0		7.1	150.03	849.8	300	370	350	430	620	680	770	830	890	970	1040	1190
		7.9	166.78	848.2	330	410	390	480	690	760	860	920	990	1070	1160	1330
	10	8.7	183.50	846.6	360	460	420	530	760	840	950	1020	1090	1180	1270	1460
		9.5	200.18	845.0	400	500	460	580	830	910	1030	1110	1190	1290	1390	1590
		10.3	216.84	843.4	430	540	500	630	900	990	1120	1200	1290	1400	1500	1720
		11.1	233.46	841.8	460	580	540	680	970	1070	1210	1300	1390	1510	1620	1860
		11.9	250.05	840.2	500	620	580	720	1040	1140	1290	1390	1490	1610	1740	1990
		12.7	266.61	838.6	530	660	620	770	1110	1220	1380	1480	1590	1720	1850	2130
		14.3	299.64	835.4	600	740	690	870	1250	1370	1550	1670	1790	1930	2080	2380
	30	15.9	332.53	832.2	660	830	770	970	1390	1520	1720	1850	1990	2150	2320	2650
	40	17.5	365.31	829.0	730	910	850	1060	1530	1680	1890	2040	2190	2370	2550	2910
		19.1	397.95	825.8	790	990	930	1160	1670	1830	2060	2220	2380	2580	2780	3000
		20.6	428.44	822.8	860	1070	1000	1250	1810	1980	2240	2410	2580	2790	3000	3000
		22.2	460.85	819.6	930	1160	1080	1350	1950	2130	2410	2590	2780	3000	3000	3000
		23.8	493.12	816.4	990	1240	1160	1450	2090	2280	2580	2780	2980	3000	3000	3000
		25.4	525.27	813.2	1060	1320	1240	1540	2220	2440	2750	2960	3000	3000	3000	3000
		27.0	557.29	810.0	1120	1410	1310	1640	2360	2590	2920	3000	3000	3000	3000	3000
		28.6	589.19	806.8	1190	1490	1390	1740	2500	2740	3000	3000	3000	3000	3000	3000
		30.2	620.96	803.6	1260	1570	1470	1830	2640	2890	3000	3000	3000	3000	3000	3000
		31.8	652.60	800.4	1320	1650	1540	1930	2780	3000	3000	3000	3000	3000	3000	3000
36		6.4	143.24	901.2	250	310	290	360	520	580	650	700	750	810	880	1000
914.0		7.1	158.79	899.8	280	350	330	410	590	650	730	790	840	910	980	1120
	10	7.9	176.52	898.2	310	390	360	450	660	720	810	870	940	1010	1090	1250
		8.7	194.22	896.6	340	430	400	500	720	790	890	960	1030	1120	1200	1380
		9.5	211.90	895.0	380	470	440	550	790	860	980	1050	1120	1220	1310	1500
		10.3	229.54	893.4	410	510	470	590	850	930	1060	1140	1220	1320	1420	1620
		11.1	247.15	891.8	440	550	510	640	920	1010	1140	1230	1310	1420	1530	1750
		11.9	264.72	890.2	470	590	550	680	980	1080	1220	1310	1410	1520	1640	1880
	20	12.7	282.27	888.6	500	620	580	730	1050	1150	1300	1400	1500	1620	1750	2000
		14.3	317.27	885.4	560	700	660	820	1180	1290	1460	1570	1690	1820	1970	2250
	30	15.9	352.14	882.2	620	780	730	910	1310	1440	1620	1750	1880	2030	2190	2500
		17.5	386.88	879.0	690	860	800	1000	1440	1580	1790	1930	2060	2240	2410	2750
	40	19.1	421.50	875.8	750	940	880	1090	1580	1720	1950	2100	2250	2440	2630	3000
		20.6	453.84	872.8	810	1020	950	1180	1710	1870	2110	2270	2440	2640	2840	3000
		22.2	488.22	869.6	880	1090	1020	1280	1840	2010	2280	2450	2620	2840	3000	3000
		23.8	522.47	866.4	940	1170	1090	1370	1970	2160	2440	2630	2810	3000	3000	3000
		25.4	556.59	863.2	1000	1250	1170	1460	2100	2300	2600	2800	3000	3000	3000	3000
		27.0	590.58	860.0	1060	1330	1240	1550	2230	2440	2760	2970	3000	3000	3000	3000
		28.6	624.45	856.8	1130	1410	1310	1640	2360	2590	2930	3000	3000	3000	3000	3000
		30.2	658.19	853.6	1190	1480	1390	1730	2490	2730	3000	3000	3000	3000	3000	3000
		31.8	691.81	850.4	1250	1560	1460	1820	2630	2870	3000	3000	3000	3000	3000	3000

Steel Sheet Piles

PU Steel Sheet Piles

Mechanical properties

PU steel sheet piles can be supplied in grades up to yield strength of 430 N/mm^2.

Dimensions and sectional properties

The PU steel sheet piles are available in the following sizes:

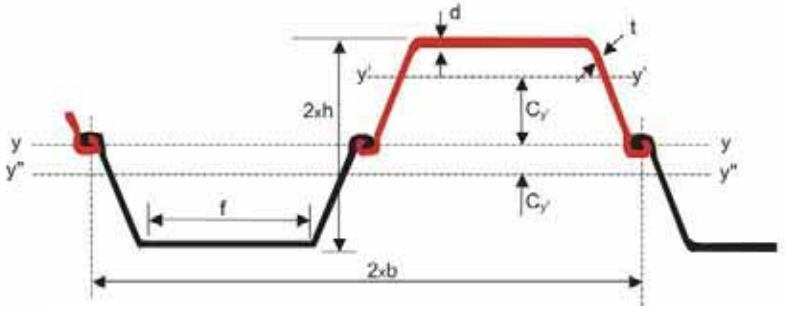


Figure 11 – PU Steel Sheet Piles: Dimensions

Section		h	b	Flat of pan f	Thickness of pan	Thickness of web	$C_{y'}$	$C_{y''}$	Mass per m	Section area A	Section Modulus Z_y	Moment Of Inertia I_y	Moment Of Inertia I_z	Radius of gyration r
		mm	mm	mm	mm	mm	mm	Mm	kg/m	cm^2	cm^3	cm^4	cm^4	cm
PU 6	per pile	113	600	330	7.5	6.4	68.9	23.0	45.3	57.7	146	1,290	23,900	4.73
	per m wall								75.0	96.0	600	6,720	-	8.36
PU 8	per pile	140	600	317	8.0	8.0	81.5	27.2	54.5	69.5	232	2,360	30,062	5.82
	per m wall								91.0	116.0	830	11,610	-	10.02
PU 12	per pile	180	600	257	9.8	9.0	100.4	33.5	65.9	84.0	366	4,450	34,937	7.28
	per m wall								110	140.0	1,200	21,550	-	12.41
PU 16	per pile	190	600	303	12.0	9.0	115.8	38.6	74.7	95.2	405	5,560	38,037	7.64
	per m wall								124	159.0	1600	30,520	-	13.87
PU 20	per pile	200	600	365	12.4	9.7	125.3	41.8	84.7	107.9	480	7,080	46,021	8.1
	per m wall								141	180.0	2000	39,970	-	14.92
PU 25	per pile	226	600	339	14.2	10.0	142.1	47.4	94.1	119.9	588	9,670	49,089	8.98
	per m wall								157	200.0	2,500	56,500	-	16.81
PU 32	per pile	226	600	341	19.5	11.0	148.6	49.5	114.6	146.0	645	11,100	55,134	8.72
	per m wall								191	243.0	3,200	72,260	-	17.23

Table 30 – PU Steel Sheet Piles: Section sizes

The PU sheet piles can be delivered in material according to British BS-standards, American ASTM-standards, Euronorms, and Japanese JIS-standards.

Interlocking options

Section	PU 6	PU 8	PU 12	PU 16	PU 20	PU 25	PU 32
PU 6							
PU 8	♣	♣	♣	♣			
PU 12	♣	♣	♣	♣	♣	♣	
PU 16	♣	♣	♣	♣	♣	♣	
PU 20			♣	♣	♣	♣	♣
PU 25			♣	♣	♣	♣	♣
PU 32					♣	♣	♣

♣ Interlocking possible

On request (require in advance indicating length of piles)

Table 31 – PU Steel Sheet Piles: Interlocking options

Dimensional tolerances

Width		Thickness of Pan				Weight [1]	Length	Squareness of ends [2]	Straightness [3]
single pile	interlocked piles	e≤8mm	8<e≤12	12<e≤18	e>18mm				
± 2%	± 3%	±0.5mm	±0.6mm	±0.8mm	±1.2mm	± 4%	± 200mm	≤10mm	0.2%

Notes: 1) Of total mass of the complete order.
2) Of the distance between 2 points of the cross-section.
3) Maximum deflection on the length of the pile.

Table 32 – PU Steel Sheet Piles: Dimensional tolerances

The maximum length for this U-type pile is usually between 25 to 31 metres, but longer lengths can be supplied.

Handling holes and double piles

The piles can on request be delivered with flame cut handling holes, 50mm diameter, located in the centre of the pan at 200-250 mm from the end.

Piles can also be fastened together to form double piles by pressing or welding the interlocks. Two to six pressing points per meter can be applied according to design requirements. A minimum shear force of 80 kN per one crimping point is admitted.

KSP Steel Sheet Piles

Mechanical properties

KSP steel sheet piles are manufactured according to JIS 5528 “Hot Rolled Steel Sheet Piles” (1988).

Designation JIS A 5528	Min. Yield Strength R_{eH}	Min. Tensile Strength R_m	Min. Elongation
Steel Name	N/mm^2	N/mm^2	%
SY295	295	490	17
SY390	390	540	15

Table 33 – KSP Steel Sheet Piles: Mechanical properties

Dimensions and sectional properties

The KSP steel sheet piles are available in the sizes shown in Table 35 under. Note the three new sizes KSP II$_W$, ons.

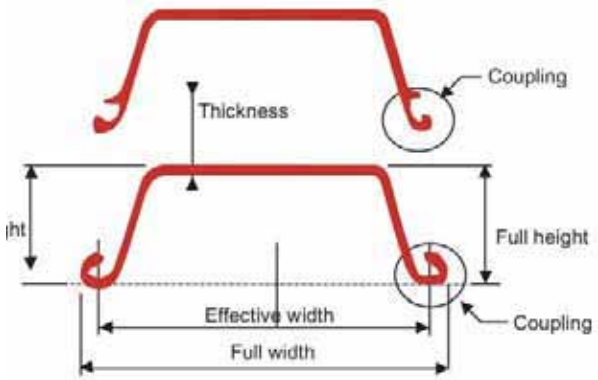


Figure 12 – KSP Steel Sheet Piles: Dimensions

Section	Dimensions			Section Area		Unit weight		Moment of Inertia		Modulus of section	
	width	height	thickness								
	w	h	t	A	A/m	M	M/m	I	I/m	Z_y	Z_y/m
	mm	mm	mm	cm^2	cm^2/m	kg/m	kg/m^2	cm^4	cm^4/m	cm^3	cm^3/m
KSP I_A	400	85	8.0	45.21	113.0	35.5	88.8	598	4,500	88	529
KSP II	400	100	10.5	61.18	153.0	48.0	120	1,240	8,740	152	874
KSP II_A	400	120	9.2	55.01	137.5	43.2	108	1,450	10,600	162	880
KSP III	400	130	13.0	76.42	191.0	60.0	150	2,320	17,400	232	1,340
KSP III_A	400	150	13.1	74.40	186.0	58.4	146	2,840	22,800	253	1,520
KSP IV	400	170	15.5	96.99	242.5	76.1	190	4,670	38,600	362	2,270
KSP IV_A	400	185	16.1	94.21	235.5	74.0	185	5,300	41,600	400	2,250
KSP V_L	500	200	24.3	133.8	267.6	105	210	7,960	63,000	520	3,150
KSP VI_L	500	225	27.6	153.0	306.0	120	240	11,400	86,000	680	3,820
KSP II_W	600	130	10.3	78.70	131.2	61.8	103	2,110	13,000	203	1,000
KSP III_W	600	180	13.4	103.9	173.2	81.6	136	5,220	32,400	376	1,800
KSP IV_W	600	210	18.0	135.3	225.5	106	177	8,630	56,700	539	2,700

Note: The sizes are also available in FSP sheet piles.
Sectional properties given per single pile, and per linear metre wall.

Table 34 – KSP Steel Sheet Piles: Section sizes and properties

Interlocking options

The sections can be interlocked with each other as shown in Table 36.

Section	KSP I_A	KSP II	KSP II_A	KSP III	KSP III_A	KSP IV	KSP IV_A	KSP V_L	KSP VI_L	KSP II_W	KSP III_W	KSP IV_W
KSP I_A	♣	♣	♣							♣		
KSP II	♣	♣	♣	♣						♣		
KSP II_A	♣	♣	♣		♣					♣		
KSP III		♣		♣	♣	♣				♣	♣	
KSP III_A			♣	♣	♣		♣			♣	♣	
KSP IV				♣		♣	♣	♣			♣	♣
KSP IV_A					♣	♣	♣	♣			♣	♣
KSP V_L						♣	♣	♣	♣			♣
KSP VI_L								♣	♣			
KSP II_W	♣	♣	♣	♣	♣					♣	♣	
KSP III_W				♣	♣	♣	♣			♣	♣	♣
KSP IV_W						♣	♣	♣			♣	♣

Table 35 – KSP Steel Sheet Piles: Interlocking options

The sheet piles can also be welded together to form box piles, as shown in section "Other section types" under the chapter "Steel sheet piles according to EN 10248:1996".

Dimensional tolerances

Full width		Effective width		Thickness of Section		
Traditional Single pile	Wider width Single pile	Traditional Single pile	Wider width Single pile	<10mm	≥10mm <16mm	≥16mm
W x ± 1%	+ 6mm - 5mm	Per meter wall width: Max 4mm deviation.		+ 1.0mm - 0.3mm	+ 1.2mm - 0.3mm	+ 1.5mm - 0.3mm

Full height	Length	Deflection of full length		Camber of full length		Difference in vertically cut sections
		L≤10m	L>10m	L≤10m	L>10m	
± 4%	- 0mm	L x 0.12%	L x 0.10%	L x 0.25% max.	L x 0.20% + 25mm max.	Within 4% of width

Notes: The deflection shall be in the direction parallel to the sheet pile wall and the camber shall be in the direction vertical to the sheet pile wall.

Table 36 – KSP Steel Sheet Piles: Dimensional tolerances

Recommended maximum lengths for driving

The recommended driving length for KSP steel sheet piles is maximum 30metres.

KSP Straight Web Sections

Mechanical properties

KSP straight web sections are manufactured according to JIS 5528 “Hot Rolled Steel Sheet Piles” (1988).

Designation JIS A 5528	Min. Yield Strength R_{eH}	Min. Tensile Strength R_m	Min. Elongation
Steel Name	N/mm^2	N/mm^2	%
SY295	295	490	17
SY390	390	540	15

Table 37 – KSP Straight Web Sections: Mechanical properties

Dimensions and sectional properties

The KSP straight web sections are available in the following sizes:

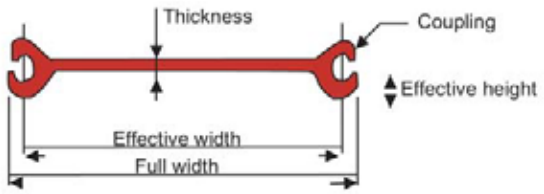


Figure 13 – KSP Straight Web Sections: Dimensions

Section	Dimensions			Section area	Unit weight		Moment of Inertia		Modulus of section	
	width	height	thickness	Per pile	Per pile	Per wall width	Per pile	Per wall width	Per pile	Per wall width
	mm	mm	mm	cm^2	kg/m	kg/m^2	cm^4	cm^4/m	cm^3	cm^3/m
KSP FL	500	44.5	9.5	78.57	61.7	123	184	396	45.7	89
KSP FXL	500	47.0	12.7	98.36	77.2	154	245	570	60.3	121

Table 38 – KSP Straight Web Sections: Section sizes and properties

Standard specification	Section size	Interlocking strength MN/m
JIS A 5528 SY295	KSP FL	4
	KSP FXL	6

Table 39 – KSP Straight Web Sections: Interlocking strength

The two sections can be interlocked with each other.

Dimensional tolerances

Full width Single pile	Full height	Thickness of Section			Length
		<10mm	≥10mm <16mm	≥16mm	
± 4mm	-	+ 1.5mm - 0.7mm	+ 1.5mm - 0.7mm	-	+ not specified - 0 mm

Deflection of full length		Camber of full length		Difference in vertically cut sections
L≤10m	L>10m	L≤10m	L>10m	
L x 0.15% max.	(L-10m) x 0.10% + 15mm max.	L x 0.20% max.	(L-10m) x 0.10% + 20mm max.	Within 4% of width

Notes: The deflection shall be in the direction parallel to the sheet pile wall and the camber shall be in the direction vertical to the sheet pile wall.

Table 40 – KSP Straight Web Sections: Dimensional tolerances

Gratings

General

- **Applications**

Stairways, walkways, catwalks, pedestrian ramp, machine access platform, etc.

- **Process**

Steel gratings are manufactured using a simultaneous application of heat and pressure on the load bar and cross bar at their intersection points, welding them together.

Sizes

Panel Size	Serial Size	Mass	Pitch	Type
ft	inch	kg/m^2	mm	
3' x 20'	1'' x 3/16'' 11/4''x 3/16'' 11/2'' x 3/16'' 2'' x 3/16''	28.4 35.4 43.2 53	40 x 100	twisted / straight cross / round bar

Table 41 – Gratings: Sizes

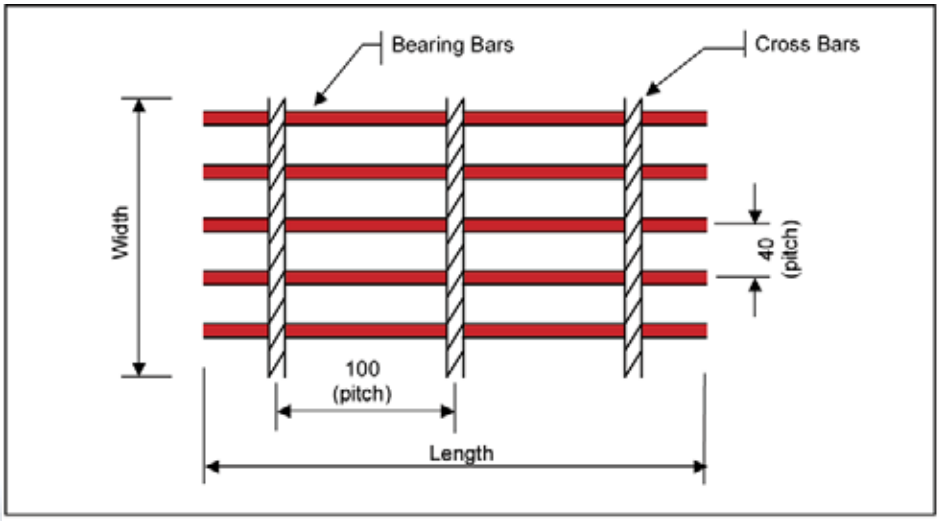


Figure 14 – Gratings: Dimensions

Appendix

Conversion factors

Note: The small sub numerals following a zero indicate that the zero is to be repeated that number of times, thus $0.0_34 = 0.0004$.

Linear measure

	Millimetre	Centimetre	Metre	Inch	Foot	Yard	Mile
	mm	cm	m	in	ft	yd	mi
Millimetre (mm)	1	0.1	0.001	0.03937	0.00328	0.00109	0.0_66214
Centimetre (cm)	10	1	0.01	0.3937	0.03280	0.01093	0.0_56214
Metre (m)	1000	100	1	39.37	3.28083	1.0936	0.0_36214
Inch (in)	25.4	2.54	0.0254	1	0.0833	0.02778	0.0_41578
Foot (ft)	304.8	30.48	0.3048	12	1	0.3333	0.0_31894
Yard (yd)	914.4	91.44	0.9144	36	3	1	0.0_35682
Mile (mi)	1,609,347	160,935	1,609.35	63,360	5,280	1,760	1

Square measure	Square millimetre	Square centimetre	Square metre	Square inch	Square foot	Square yard	Square miles
	mm^2	cm^2	m^2	in^2	ft^2	yd^2	mi^2
Square millimetre (mm^2)	1	0.01	0.0_51	0.00155	0.0_410764	$0.0_5119599$	$0.0_{12}386$
Square centimetre (cm^2)	100	1	0.0001	0.154999	0.0010764	$0.0_3119599$	$0.0_{10}386$
Square metre (m^2)	1,000,000	10,000	1	1,549.99	10.7639	1.19599	0.0_6386
Square inch (in^2)	645.16	6.452	0.0_36452	1	0.006944	0.0_37616	0.0_9249
Square foot (ft^2)	92,903	929	0.0929	144	1	0.11111	0.0_73587
Square yard (yd^2)	836,127	8,361	0.8361	1,296	9	1	0.0_63229
Square miles (mi^2)	$2.59*10^{12}$	$25.9*10^9$	$2.59*10^6$	$4.014*10^9$	$27.878*10^6$	$3.098*10^6$	1

Cubic measure	Cubic centimetre	Cubic metre	Cubic inch	Cubic foot	Cubic yard
	cm^3	m^3	in^3	ft^3	yd^3
Cubic centimetre (cm^3)	1	0.0_51	0.06102	0.0_43531	0.0_51308
Cubic metre (m^3)	1,000,000	1	61,023	35.31	1.308
Cubic inch (in^3)	16.39	0.0_41639	1	0.0_35787	0.0_42143
Cubic foot (ft^3)	28,317	0.028317	1,728	1	0.03704
Cubic yard (yd^3)	764,500	0.7645	46,660	27	1

Weight measure

	Kilogram	Pound	Net ton	Gross ton	Metric ton
	kg	lb	nt	gt	t
Kilogram (kg)	1	2.20462	0.001102	0.0_39842	0.001
Pound (lb)	0.45359	1	0.0005	0.0_34464	0.0_34536
Net ton (nt)	907.185	2,000	1	0.89286	0.90719
Gross ton (gt)	1,016.05	2,240	1.12	1	1.01605
Metric ton (t)	1,000	2,204.62	1.10231	0.98421	1

Weight per linear unit	Gram per centimetre	Kilogram per metre	Pound per inch	Pound per foot	Pound per yard
	g/cm	kg/m	lb/in	lb/ft	lb/yd
Gram per centimetre (g/cm)	1	0.1	0.0056	0.0672	0.20165
Kilogram per metre (kg/m)	10	1	0.056	0.67197	2.0165
Pound per inch (lb/in)	178.579	17.8579	1	12	36
Pound per foot (lb/ft)	14.8816	1.48816	0.08333	1	3
Pound per yard (lb/yd)	4.96054	0.49605	0.02778	0.3333	1

Weight per unit area	Kilogram per square centimetre	Kilogram per square metre	Metric ton per square metre	Pound per square inch	Pound per square foot
	kg/cm^2	kg/m^2	t/m^2	lb/in^2	lb/ft^2
Kilogram per square centimetre (kg/cm^2)	1	10,000	10	14.21945	2047.58498
Kilogram per square metre (kg/m^2)	0.0001	1	0.001	0.0014219	0.204758
Metric ton per square metre (t/m^2)	0.1	1,000	1	1.42195	204.75849
Pound per square inch (lb/in^2)	0.0703022	703.02232	0.7030	1	144
Pound per square foot (lb/ft^2)	0.000487	4.8717976	0.004872	0.006944	1

Weight per unit volume	Kilogram per cubic centimetre	Kilogram per cubic metre	Metric ton per cubic metre	Pound per cubic inch	Pound per cubic foot
	kg/cm^3	kg/m^3	t/m^3	lb/in^3	lb/ft^3
Kilogram per cubic centimetre (kg/cm^3)	1	1,000,000	1,000	36.1193	62,419
Kilogram per cubic metre (kg/m^3)	0.0_51	1	0.001	0.0_436117	0.062419
Metric ton per cubic metre (t/m^3)	0.001	1,000	1	0.0361175	62.41857
Pound per cubic inch (lb/in^3)	0.02768	27,680.4	27.6804	1	1,728.011
Pound per cubic foot (lb/ft^3)	0.0_416	16.0196	0.01602	0.0005787	1

Tension, pressure	Kilopounds /square inch	Pounds per square foot	Pounds per square inch	Atmospheric pressure	Atmospheric pressure	Pressure
	ksi	psf	psi	bar	atm	(MPa)
Kilopounds per square inch (ksi)	1	1,441,379.3	1,000	68.96	68.062	6.896
Pounds per square foot (psf)	0.0_7694	1	0.000694	0.0004788	0.000473	0.0_4479
Pounds per square inch (psi)	0.001	1,441.38	1	0.06896	0.0681	0.006896
Atmospheric pressure (bar)	0.0145	2,088.5	14.5	1	0.987	0.10
Atmospheric pressure (atm)	0.0147	2,116.22	14.69	1.0133	1	0.10133
Pressure (MPa)	0.145	20,886	145	10	9.869	1