

**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	Tensile strength	Charpy V-Notch Impact	
		N/mm ²	N/mm ²	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/mm ²		Tensile strength R_m in N/mm ²		Min. elongation (%) $L_0=5.65(S_0)^{1/2}$	Test temp. C	Impact KV J
	$t \leq 16$ N/mm ²	$16 > t \leq 40$ N/mm ²	$t < 3$ N/mm ²	$3 \geq t \leq 40$ N/mm ²			
	<i>Nominal thickness in mm</i>						
					$t \leq 40$ %		
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: 100≤H, B≤200: H, B >200:	±1% with a minimum of: ±0.5mm. ±0.8% ±0.6 %
Thickness (T)	- For D≤406.4mm: - For D>406.4mm:	T≤5mm: ±10% T>5mm: ±0.50mm ±10% with a max. of 2mm	For T>5mm: For T≤5mm:	±0.50mm ±10%
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: For 6<T≤10mm: For 10<T:	1.6T to 2.4T 2.0T to 3.0T 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, C₁ and C₂= see drawings in chapter “Hot Finished Hollow Sections”.

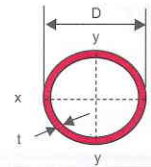
The thickness T of welded sections shall be measured at a position not less than 2T from the weld.

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.

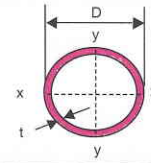


Circular



Designation		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
Outside	Thickness								J	C	
D	t	A	D/t	I	r	Z	S	J	C		
mm	mm	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)

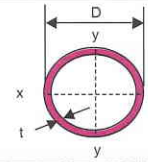


Designation		Mass	Area	Ratio For	Second	Radius	Elastic	Plastic	Torsional		Surface
Outside	Thickness	Per	Of	Local	Moment	Of	Modulus	Modulus	Constants		Area
D	t	Metre	Section	Buckling	Of Inertia	Gyration	Z	S	J	C	Per
mm	mm	kg/m	cm ²	D/t	cm ⁴	cm	cm ³	cm ³	cm ⁴	cm ³	Metre
168.3	4.0	16.21	20.6	42.1	697	5.81	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

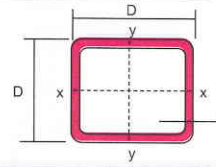


Designation		Mass Per Metre	Area Of Section	Ratio For Local Buckling	Second Moment Of Inertia	Radius Of Gyration	Elastic Modulus	Plastic Modulus	Torsional Constants	Surface Area Per Metre	
Outside	Thickness										
D	t	A	D/t	I	r	Z	S	J	C		
mm	mm	kg/m	cm ²		cm ⁴	cm	cm ³	cm ³	cm ⁴	cm ³	m ² /m
355.6	5.0	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

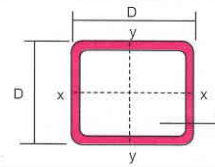


Designation Size	Thickness t	Mass Per Metre	Area Of Section A	Second Moment Of Area I	Radius Of Gyration r	Elastic Modulus Z	Plastic Modulus S	Torsional Constants J	C	Surface Area Per Metre
DxD	t		A	I	r	Z	S	J	C	
mm	mm	kg/m	cm ²	cm ⁴	cm	cm ³	cm ³	cm ⁴	cm ³	m ² /m
12x12	1.0 *	0.357	0.414	0.0808	0.442	0.135	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

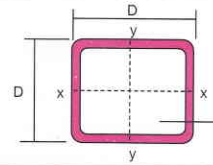


Designation Size	Thickness	Mass Per Metre	Area Of Section A	Second Moment Of Area I	Radius Of Gyration r	Elastic Modulus Z	Plastic Modulus S	Torsional Constants J	C	Surface Area Per Metre	
DxD	t										
mm	mm	kg/m	cm ²	cm ⁴	cm	cm ³	cm ³	cm ⁴	cm ³	m ² /m	
60x60	1.6	*	2.88	3.67	20.7	2.37	6.89	8.0	32.4	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

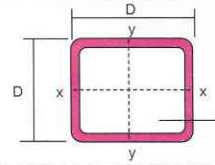


Designation Size	Thickness t	Mass Per Metre	Area Of Section A	Second Moment Of Area I	Radius Of Gyration r	Elastic Modulus Z	Plastic Modulus S	Torsional Constants J	C	Surface Area Per Metre
DxD	mm	kg/m	cm ²	cm ⁴	cm	cm ³	cm ³	cm ⁴	cm ³	m ² /m
100x100	2.3 *	6.95	8.85	140	3.97	27.9	32.3	217	41.9	0.392
	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
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

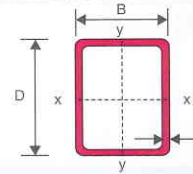


Designation	Mass	Area	Second	Radius	Elastic	Plastic	Torsional		Surface	
Size	Per	Of	Moment	Of	Modulus	Modulus	Constants		Area	
DxD	Metre	Section	Of Area	Gyration	Z	S	J	C	Per Metre	
mm	t	A	I	r	cm ³	cm ³	cm ⁴	cm ³	m ² /m	
200x200	5.0	30.10	38.4	2410	7.93	241	279	3763	362	0.783
	6.0	35.80	45.6	2833	7.88	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

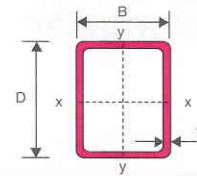


Designation Size	Thickness t	Mass Per Metre kg/m	Area Of Section A cm ²	Second Moment Of Area		Radius Of Gyration		Elastic Modulus		Plastic Modulus		Torsional Constants		Surface Area Per Metre m ² /m
				Axis x-x cm ⁴	Axis y-y cm ⁴	Axis x-x cm	Axis y-y cm	Axis x-x cm ³	Axis y-y cm ³	Axis x-x cm ³	Axis y-y cm ³	J cm ⁴	C cm ³	
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

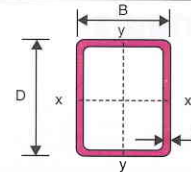


Designation Size	Thickness t	Mass Per Metre	Area Of Section A	Second Moment Of Area		Radius Of Gyration		Elastic Modulus		Plastic Modulus		Torsional Constants		Surface Area Per Metre	
				Axis x-x cm ⁴	Axis y-y cm ⁴	Axis x-x cm	Axis y-y cm	Axis x-x cm ³	Axis y-y cm ³	Axis x-x cm ³	Axis y-y cm ³	J cm ⁴	C cm ³		
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

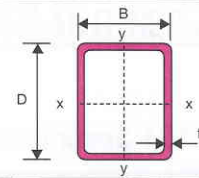


Designation Size	Thickness t	Mass Per Metre	Area Of Section A	Second Moment Of Area		Radius Of Gyration		Elastic Modulus		Plastic Modulus		Torsional Constants		Surface Area Per Metre	
				Axis x-x	Axis y-y	Axis x-x	Axis y-y	Axis x-x	Axis y-y	Axis x-x	Axis y-y	J	C		
DxB mm	t mm	kg/m	cm ²	cm ⁴	cm ⁴	cm	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	Thickness t	Mass Per Metre	Area Of Section A	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	
DxB	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)