BRITISH STANDARD

BS 4848 :
Part 2 : 1991

Hot-rolled structural steel sections

Part 2. Specification for hot-finished hollow sections

BSI STANDARDS

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Piping Systems Components Standards Policy Committee (PSE/-) to Technical Committee PSE/8, upon which the following bodies were represented:

Adhesive Tape Manufacturers' Association
British Compressed Air Society
British Gas plc
British Malleable Tube Fittings Association
British Steel Industry
British Valve and Actuator Manufacturers' Association
British Welded Steel Tube Association
Engineering Equipment and Materials Users' Association
Food and Drink Federation
Institution of Civil Engineers
Institution of Gas Engineers
Institution of Water and Environmental Management
Mechanical Handling Engineers' Association
Stainless Steel Fabricators' Association of Great Britain
TI (Group Services) Ltd.
Water Companies Association
Water Research Centre
Water Services Association of England and Wales
Wrought Fitting Makers' Association

This British Standard, having been prepared under the direction of the Piping Systems Components Standards Policy Committee, was published under the authority of the Board of BSI and comes into effect on 31 January 1991

First published December 1975
Second edition January 1991

Amendments issued since publication

Amd. No.	Date	Text affected

The following BSI references relate to the work on this standard:
Committee reference PSE/8
Draft for comment 86/73708 DC

ISBN 0 580 18587 7

Contents

Foreword

This revision of BS 4848 : Part 2 has been prepared under the direction of the Piping Systems Components Standards Policy Committee. It supersedes BS 4848 : Part 2 : 1975 which is withdrawn.

It is intended that BS 4848 will ultimately comprise five Parts, each Part will cover different section shapes, as follows.

Part 1 Beams, columns and tee bars[1)]

Part 2 Hot-finished hollow sections

Part 3 Channels[1)]

Part 4 Equal and unequal angles[2)]

Part 5 Bulb flats[2)]

This Part of BS 4848 gives the requirements for tolerances and sectional properties for hot-finished structural steel hollow sections and gives the sectional properties for a range of sizes and thicknesses. The range of sizes and thicknesses has been selected from ISO 657 : Part 14 published by the International Organization for Standardization (ISO) but includes some additional sizes and thicknesses. Other sizes and thicknesses contained in ISO 657 : Part 14 but not specified in this standard are given in appendix A and may be available, as well as other intermediate thicknesses to those listed, by special order from the manufacturer. If the purchaser specifies such hollow sections in his enquiry or order it is recommended that he states the size and that he indicates that the hollow sections should comply with all the requirements other than size and/or thickness, of BS 4848 : Part 2 including tolerances.

For circular sections, square sections up to and including 120 mm × 120 mm and rectangular sections up to and including 160 mm × 80 mm the geometric properties given in this standard are the same as those given in ISO 657 : Part 14. For both square and rectangular sections above the limits of 120 mm × 120 mm and 160 mm × 80 mm respectively the geometric properties given in this standard differ from those in ISO 657 : Part 14 because of differences in the corner radius used for their calculation.

ISO 657 : Part 14 does not give geometric properties for sections greater than 10 mm thick.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

[1)] At present BS 4 : Part 1.

[2)] At present BS 4848 : Part 4 and BS 4848 : Part 5.

Specification

1 Scope

This Part of BS 4848 specifies the requirements for tolerances and sectional properties for hot-finished steel structural hollow sections manufactured by a seamless or electrically welded process and gives sectional properties for the following range of sizes and thicknesses:

(a) circular, hot-formed with or without subsequent heat treatment or cold-formed with subsequent heat treatment, in the size range 21.3 mm to 508 mm diameter;

(b) rectangular, hot-formed with or without subsequent heat treatment, in the size range 50 mm × 25 mm to 500 mm × 300 mm;

(c) square, hot-formed with or without subsequent heat treatment, in the size range 20 mm × 20 mm to 400 mm × 400 mm.

NOTE 1. Dimensions and properties of welded cold-formed structural steel hollow sections are specified in BS 6363.

NOTE 2. The titles of the publications referred to in this standard are listed on the inside back cover.

2 Definition

For the purposes of this Part of BS 4848 the following definition applies.

hot-finished

A product manufactured by a hot-forming process with or without subsequent heat treatment, or by cold-forming with subsequent heat treatment to obtain similar metallurgical conditions to those obtained by hot-forming.

3 Information to be supplied by the purchaser

The following information to be supplied by the purchaser shall be fully documented:

(a) the number and Part of this British Standard, i.e. BS 4848 : Part 2;

(b) the designation of the hollow section(s) (see clause 4);

(c) the steel grade in accordance with BS 4360 (see clause 5);

(d) quantities and length required (see 7.3).

NOTE. It is essential that this information is supplied by the purchaser when placing an order.

4 Designation

A hot-finished hollow section shall be designated by its outside dimensions and thickness in millimetres and by the symbols HFCHS for circular hollow sections or HFRHS for rectangular and square hollow sections.

NOTE 1. The purchaser should state in his enquiry or order the designation of the hollow section(s) (see clause 3).

NOTE 2. The following are examples of designations:

(a) A circular hollow section of 114.3 mm outside diameter and 6.3 mm thick is designated

114.3 × 6.3 HFCHS.

(b) A rectangular hollow section of 100 mm × 50 mm sides and 4.0 mm thick is designated

100 × 50 × 4.0 HFRHS.

(c) A square hollow section of 100 mm × 100 mm sides and 6.3 mm thick is designated

100 × 100 × 6.3 HFRHS.

5 Materials

The steel shall comply with sections 1, 3 and 7 or 8, as appropriate, of BS 4360 : 1990.

NOTE. The purchaser should state in his enquiry or order, the grade of steel.

6 Dimensions and sectional properties

The nominal section dimensions and sectional properties of hollow sections shall comply with tables 1, 2 and 3 (see also figures 4, 5 and 6), where

B is the nominal length of the shorter side of a rectangular hollow section (in mm);

D is the nominal outside diameter of a circular hollow section or the nominal length of the longer side of a rectangular hollow section (in mm);

t is the nominal thickness of the section (in mm).

NOTE 1. The masses per unit length are calculated on the basis that steel weighs 0.785 kg/cm^2 per metre run.

NOTE 2. The sectional properties are calculated from the nominal outside dimensions and thicknesses, for rectangular and square hollow sections using the corner radii of $1.25t$ externally and $1.0t$ internally (see 7.1.3(b)).

NOTE 3. Dimensions of structural hollow sections complying with ISO 657 : Part 14 but not included in this Part of BS 4848 are given in appendix A (see the foreword also).

7 Tolerances

7.1 Size and shape tolerances

7.1.1 *Outside dimensions*

The tolerance on outside dimensions, D and B, shall be as follows:

± 1 % with a minimum of ± 0.5 mm.

For rectangular and square hollow sections, these dimensions shall be measured across opposite faces as shown in figure 1.

7.1.2 *Thickness*

The tolerance on thickness (t) shall be as follows.

(a) *Seamless sections*: +15 %, −12.5 % excluding the corners of square and rectangular hollow sections. The minimum thickness in the corners of square and rectangular hollow sections shall be not less than that permitted in the body of the section.

(b) *Welded sections*: ± 10 % with a minimum of ± 0.4 mm excluding the weld area and the corners of square and rectangular hollow sections. The minimum thickness in the weld area and the corners of square and rectangular hollow sections shall be not less than that permitted in the body of the section.

7.1.3 *Rectangular and square hollow sections shape*

The tolerances on shape shall be as follows.

(a) *Squareness of sides*: 90 ° ± 1°.

(b) *Radius of external corners*: 0.5t to 2.0t.

Radius of internal corners: 0.5t to 1.5t.

NOTE. The radius need not be tangential to the sides.

(c) *Concavity* (x_1)/convexity (x_2): ± 1 % of the outside dimension, D or B, of the side (see figure 2).

This tolerance shall be measured independently of the tolerance on the outside dimension.

(d) *Twist* (measured as specified): 2 mm (+ 0.5 mm per metre maximum).

The twist shall be measured as follows.

(1) The section as produced shall be placed on a horizontal surface with one face at one end pressed flat against the surface.

(2) At the opposite end of the section, the difference in height, V (see figure 3), of the two lower corners from the horizontal surface shall be measured, where V is a measure of twist and is measured where the corner arc meets the sidewall.

7.2 Mass tolerance

The tolerance on mass shall be as follows:

(a) ± 6 % on individual lengths;

(b) +6 %, −4 % on lots of 10 t and over.

7.3 Length tolerance

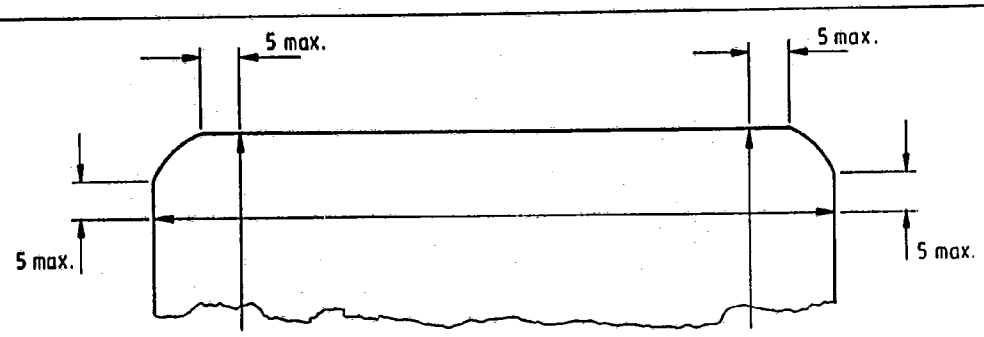
Where hollow sections are ordered to exact length the tolerance on length shall be +6 mm, −0 mm.

NOTE. The purchaser should state in his enquiry or order the length, type of length and also the tolerance on the length for lengths other than exact lengths. (See clause 3.)

7.4 Straightness tolerance

Hollow sections shall not deviate from straightness by more than 0.2 % of the total length, measured at the centre of that length.

NOTE. Smaller tolerances on straightness may be available, the purchaser should consult the manufacturer.



All dimensions are in millimetres.

Figure 1. Limiting positions for measuring the dimensions across opposite faces of square and rectangular hollow sections

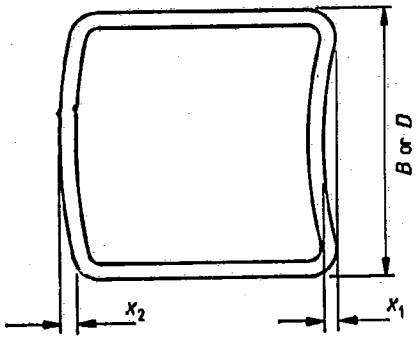


Figure 2. Measurements of concavity/convexity

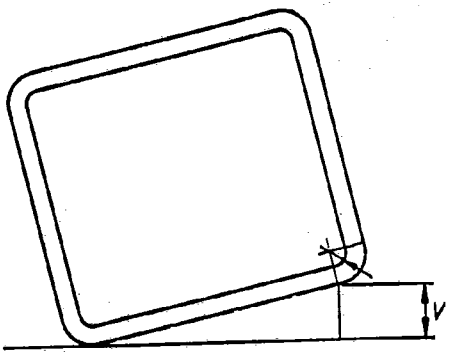


Figure 3. Measurement of twist

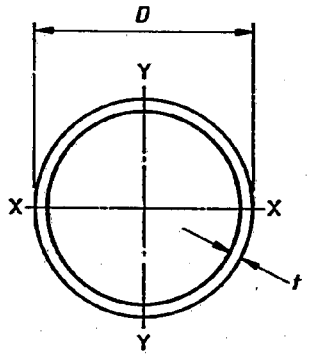


Figure 4. Circular hollow section (see table 1)

Table 1. Circular hollow sections (see figure 4)

Outside diameter, *D*	Thickness, *t*	Mass per unit length, *M*	Sectional area, *A*	Moment of inertia, *I*	Radius of gyration, *r*	Elastic modulus, *Z*	Plastic modulus, *S*	Torsional moment of inertia, *J*	Torsional modulus, *C*	Superficial area per metre length
mm	mm	kg/m	cm^2	cm^4	cm	cm^3	cm^3	cm^4	cm^3	m^2
21.3	3.2	1.43	1.82	0.77	0.650	0.72	1.06	1.54	1.44	0.067
26.9	3.2	1.87	2.38	1.70	0.846	1.27	1.81	3.41	2.53	0.085
33.7	2.6	1.99	2.54	3.09	1.10	1.84	2.52	6.19	3.67	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
42.4	2.6	2.55	3.25	6.46	1.41	3.05	4.12	12.9	6.10	0.133
	3.2	3.09	3.94	7.62	1.39	3.59	4.93	15.2	7.19	0.133
	4.0	3.79	4.83	8.99	1.36	4.24	5.92	18.0	8.48	0.133
48.3	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	6.99	9.42	32.3	13.4	0.152

Table 1. Circular hollow sections (see figure 4) *(continued)*

Outside diameter, D	Thickness, t	Mass per unit length, M	Sectional area, A	Moment of inertia, I	Radius of gyration, r	Elastic modulus, Z	Plastic modulus, S	Torsional moment of inertia, J	Torsional modulus, C	Superficial area per metre length
mm	mm	kg/m	cm^2	cm^4	cm	cm^3	cm^3	cm^4	cm^3	m^2
60.3	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
76.1	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
88.9	3.2	6.76	8.62	79.2	3.03	17.8	23.5	158	35.6	0.279
	4.0	8.38	10.7	96.3	3.00	21.7	28.9	193	43.3	0.279
	5.0	10.3	13.2	116	2.97	26.2	35.2	233	52.4	0.279
114.3	3.6	9.83	12.5	192	3.92	33.6	44.1	384	67.2	0.359
	5.0	13.5	17.2	257	3.87	45.0	59.8	514	89.9	0.359
	6.3	16.8	21.4	313	3.82	54.7	73.6	625	109	0.359
139.7	5.0	16.6	21.2	481	4.77	68.8	90.8	961	138	0.439
	6.3	20.7	26.4	589	4.72	84.3	112	1177	169	0.439
	8.0	26.0	33.1	720	4.66	103	139	1441	206	0.439
	10.0	32.0	40.7	862	4.60	123	169	1724	247	0.439
168.3	5.0	20.1	25.7	856	5.78	102	133	1712	203	0.529
	6.3	25.2	32.1	1053	5.73	125	165	2107	250	0.529
	8.0	31.6	40.3	1297	5.67	154	206	2595	308	0.529
	10.0	39.0	49.7	1564	5.61	186	251	3128	372	0.529
193.7	5.0	23.3	29.6	1320	6.67	136	178	2640	273	0.609
	6.3	29.1	37.1	1630	6.63	168	221	3260	337	0.609
	8.0	36.6	46.7	2016	6.57	208	276	4031	416	0.609
	10.0	45.3	57.7	2442	6.50	252	338	4883	504	0.609
	12.5	55.9	71.2	2934	6.42	303	411	5869	606	0.609
	16.0	70.1	89.3	3554	6.31	367	507	7109	734	0.609

Table 1. Circular hollow sections (see figure 4) *(continued)*

Outside diameter, *D*	Thickness, *t*	Mass per unit length, *M*	Sectional area, *A*	Moment of inertia, *I*	Radius of gyration, *r*	Elastic modulus, *Z*	Plastic modulus, *S*	Torsional moment of inertia, *J*	Torsional modulus, *C*	Superficial area per metre length
mm	mm	kg/m	cm^2	cm^4	cm	cm^3	cm^3	cm^4	cm^3	m^2
219.1	5.0	26.4	33.6	1928	7.57	176	229	3856	352	0.688
	6.3	33.1	42.1	2386	7.53	218	285	4772	436	0.688
	8.0	41.6	53.1	2960	7.47	270	357	5919	540	0.688
	10.0	51.6	65.7	3598	7.40	328	438	7197	657	0.688
	12.5	63.7	81.1	4345	7.32	397	534	8689	793	0.688
	16.0	80.1	102	5297	7.20	483	661	10590	967	0.688
	20.0	98.2	125	6261	7.07	572	795	12520	1143	0.688
244.5	6.3	37.0	47.1	3346	8.42	274	358	6692	547	0.768
	8.0	46.7	59.4	4160	8.37	340	448	8321	681	0.768
	10.0	57.8	73.7	5073	8.30	415	550	10150	830	0.768
	12.5	71.5	91.1	6147	8.21	503	673	12290	1006	0.768
	16.0	90.2	115	7533	8.10	616	837	15070	1232	0.768
	20.0	111	141	8957	7.97	733	1011	17910	1465	0.768
273	6.3	41.4	52.8	4696	9.43	344	448	9392	688	0.858
	8.0	52.3	66.6	5852	9.37	429	562	11700	857	0.858
	10.0	64.9	82.6	7154	9.31	524	692	14310	1048	0.858
	12.5	80.3	102	8697	9.22	637	849	17390	1274	0.858
	16.0	101	129	10710	9.10	784	1058	21410	1569	0.858
	20.0	125	159	12800	8.97	938	1283	25600	1875	0.858
	25.0	153	195	15130	8.81	1108	1543	30250	2216	0.858
323.9	6.3	49.3	62.9	7929	11.2	490	636	15860	980	1.02
	8.0	62.3	79.4	9910	11.2	612	799	19820	1224	1.02
	10.0	77.4	98.6	12160	11.1	751	986	24320	1501	1.02
	12.5	96.0	122	14850	11.0	917	1213	29690	1833	1.02
	16.0	121	155	18390	10.9	1136	1518	36780	2271	1.02
	20.0	150	191	22140	10.8	1367	1850	44280	2734	1.02
	25.0	184	235	26400	10.6	1630	2239	52800	3260	1.02

Table 1. Circular hollow sections (see figure 4) *(continued)*

Outside diameter, *D*	Thickness, *t*	Mass per unit length, *M*	Sectional area, *A*	Moment of inertia, *I*	Radius of gyration, *r*	Elastic modulus, *Z*	Plastic modulus, *S*	Torsional moment of inertia, *J*	Torsional modulus, *C*	Superficial area per metre length
mm	mm	kg/m	cm^2	cm^4	cm	cm^3	cm^3	cm^4	cm^3	m^2
355.6	8.0	68.6	87.4	13200	12.3	742	967	26400	1485	1.12
	10.0	85.2	109	16220	12.2	912	1195	32450	1825	1.12
	12.5	106	135	19850	12.1	1117	1472	39700	2233	1.12
	16.0	134	171	24660	12.0	1387	1847	49330	2774	1.12
	20.0	166	211	29790	11.9	1676	2255	59580	3351	1.12
	25.0	204	260	35680	11.7	2007	2738	71350	4013	1.12
406.4	10.0	97.8	125	24480	14.0	1205	1572	48950	2409	1.28
	12.5	121	155	30030	13.9	1478	1940	60060	2956	1.28
	16.0	154	196	37450	13.8	1843	2440	74900	3686	1.28
	20.0	191	243	45430	13.7	2236	2989	90860	4472	1.28
	25.0	235	300	54700	13.5	2692	3642	109400	5384	1.28
	32.0	295	376	66430	13.3	3269	4497	132900	6539	1.28
457	10.0	110	140	35090	15.8	1536	1998	70180	3071	1.44
	12.5	137	175	43140	15.7	1888	2470	86290	3776	1.44
	16.0	174	222	53960	15.6	2361	3113	107900	4723	1.44
	20.0	216	275	65680	15.5	2874	3822	131400	5749	1.44
	25.0	266	339	79420	15.3	3476	4671	158800	6951	1.44
	32.0	335	427	97010	15.1	4246	5791	194000	8491	1.44
	40.0	411	524	114900	14.8	5031	6977	229900	10060	1.44
508	10.0	123	156	48520	17.6	1910	2480	97040	3821	1.60
	12.5	153	195	59760	17.5	2353	3070	119500	4705	1.60
	16.0	194	247	74910	17.4	2949	3874	149800	5898	1.60
	20.0	241	307	91430	17.3	3600	4766	182900	7199	1.60
	25.0	298	379	110900	17.1	4367	5837	221800	8734	1.60
	32.0	376	479	136100	16.9	5360	7261	272300	10720	1.60
	40.0	462	588	142200	16.6	6385	8782	324400	12770	1.60
	50.0	565	719	190900	16.3	7515	10530	381800	15030	1.60

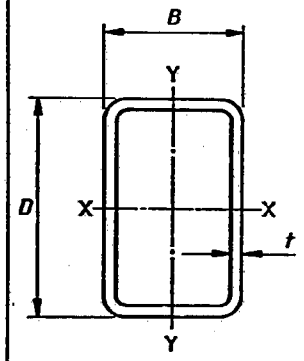


Figure 5. Rectangular hollow section (see table 2)

Table 2. Rectangular hollow sections (see figure 5)

Size, $D \times B$	Thickness, t	Mass per unit length, M	Sectional area, A	Moment of inertia, I		Radius of gyration, r		Elastic modulus, Z		Plastic modulus, S		Torsional moment of inertia, J	Torsional modulus, C	Superficial area per metre length
				x-x	y-y	x-x	y-y	x-x	y-y	x-x	y-y			
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
50 × 25	2.5	2.72	3.47	10.5	3.44	1.75	1.00	4.25	2.75	5.41	3.25	8.41	4.62	0.145
	3.0	3.22	4.10	12.2	3.89	1.73	0.98	4.88	3.11	6.30	3.77	9.64	5.21	0.144
	3.2	3.41	4.34	12.8	4.05	1.72	0.97	5.11	3.24	6.64	3.96	10.1	5.42	0.143
50 × 30	2.5	2.92	3.72	12.0	5.30	1.80	1.19	4.81	3.53	6.01	4.16	11.7	5.74	0.155
	3.0	3.45	4.40	13.9	6.04	1.78	1.17	5.54	4.03	7.01	4.83	13.5	6.52	0.154
	3.2	3.66	4.66	14.5	6.31	1.77	1.16	5.82	4.21	7.39	5.08	14.2	6.81	0.153
	4.0	4.46	5.68	17.0	7.25	1.73	1.13	6.80	4.83	8.81	6.01	16.6	7.79	0.151
	5.0	5.40	6.88	19.5	8.13	1.68	1.09	7.79	5.42	10.4	6.98	19.0	8.71	0.149

Table 2. Rectangular hollow sections (see figure 5) *(continued)*

Size, $D \times B$	Thickness, t	Mass per unit length, M	Sectional area, A	Moment of inertia, I		Radius of gyration, r		Elastic modulus, Z		Plastic modulus, S		Torsional moment of inertia, J	Torsional modulus, C	Superficial area per metre length
				x-x	y-y	x-x	y-y	x-x	y-y	x-x	y-y			
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
60 × 40	2.5	3.71	4.72	23.1	12.2	2.21	1.61	7.71	6.10	9.43	7.09	25.0	9.74	0.195
	3.0	4.39	5.60	26.9	14.1	2.19	1.59	8.96	7.04	11.1	8.29	29.2	11.2	0.194
	3.2	4.66	5.94	28.3	14.8	2.18	1.58	9.44	7.39	11.7	8.75	30.8	11.8	0.193
	4.0	5.72	7.28	33.6	17.3	2.15	1.54	11.2	8.67	14.1	10.5	36.6	13.7	0.191
	5.0	6.97	8.88	39.2	20.0	2.10	1.50	13.1	10.0	16.8	12.4	43.0	15.8	0.189
	6.3	8.49	10.8	45.1	22.6	2.04	1.45	15.0	11.3	19.9	14.6	49.7	17.7	0.186
80 × 40	3.0	5.34	6.80	55.0	18.2	2.85	1.64	13.8	9.10	17.3	10.5	43.7	15.3	0.234
	3.2	5.67	7.22	58.1	19.1	2.84	1.63	14.5	9.56	18.3	11.1	46.1	16.1	0.233
	4.0	6.97	8.88	69.6	22.6	2.80	1.59	17.4	11.3	22.2	13.4	55.1	18.9	0.231
	5.0	8.54	10.9	82.4	26.2	2.75	1.55	20.6	13.1	26.7	15.9	65.0	21.9	0.229
	6.3	10.5	13.3	96.5	29.8	2.69	1.50	24.1	14.9	31.9	18.8	75.8	24.9	0.226
	8.0	12.8	16.3	111	33.1	2.61	1.42	27.7	16.6	37.8	21.8	86.3	27.6	0.223
90 × 50	3.0	6.28	8.00	85.4	33.8	3.27	2.05	19.0	13.5	23.4	15.5	76.4	22.4	0.274
	3.6	7.46	9.50	99.8	39.1	3.24	2.03	22.2	15.6	27.6	18.1	89.3	25.9	0.272
	5.0	10.1	12.9	130	50.0	3.18	1.97	28.9	20.0	36.6	23.9	116	32.9	0.269
	6.3	12.5	15.9	154	58.1	3.12	1.91	34.2	23.3	44.2	28.5	138	38.2	0.266
	8.0	15.3	19.5	180	66.3	3.04	1.84	40.0	26.5	53.0	33.7	161	43.4	0.263
100 × 50	3.0	6.75	8.60	111	37.1	3.59	2.08	22.2	14.8	27.6	16.9	88.3	25.0	0.294
	3.2	7.18	9.14	117	39.1	3.58	2.07	23.5	15.6	29.2	17.9	93.3	26.4	0.293
	4.0	8.86	11.3	142	46.7	3.55	2.03	28.4	18.7	35.7	21.7	113	31.4	0.291
	5.0	10.9	13.9	170	55.1	3.50	1.99	34.0	22.0	43.3	26.1	135	37.0	0.289
	6.3	13.4	17.1	202	64.2	3.44	1.94	40.5	25.7	52.5	31.3	160	43.0	0.286
	8.0	16.6	21.1	238	73.5	3.36	1.86	47.6	29.4	63.1	37.1	187	49.1	0.283
100 × 60	3.0	7.22	9.20	125	56.2	3.69	2.47	25.0	18.7	30.5	21.3	121	30.7	0.314
	3.6	8.59	10.9	147	65.4	3.66	2.45	29.3	21.8	36.0	25.1	142	35.6	0.312
	5.0	11.7	14.9	192	84.7	3.60	2.39	38.5	28.2	48.1	33.3	187	45.9	0.309
	6.3	14.4	18.4	230	99.9	3.54	2.33	46.0	33.3	58.4	40.2	224	53.9	0.306
	8.0	17.8	22.7	272	116	3.46	2.26	54.4	38.7	70.5	48.1	266	62.4	0.303

Table 2. Rectangular hollow sections (see figure 5) *(continued)*

Size, $D \times B$	Thickness, t	Mass per unit length, M	Sectional area, A	Moment of inertia, I		Radius of gyration, r		Elastic modulus, Z		Plastic modulus, S		Torsional moment of inertia, J	Torsional modulus, C	Superficial area per metre length
				x-x	y-y	x-x	y-y	x-x	y-y	x-x	y-y			
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
120 × 60	3.6	9.72	12.4	230	76.9	4.31	2.49	38.3	25.6	47.6	29.2	183	43.3	0.352
	5.0	13.3	16.9	304	99.9	4.24	2.43	50.7	33.3	63.9	38.8	242	56.0	0.349
	6.3	16.4	20.9	366	118	4.18	2.38	61.0	39.4	78.0	46.9	290	66.0	0.346
	8.0	20.4	25.9	437	138	4.10	2.31	72.8	45.9	94.8	56.4	344	76.8	0.343
120 × 80	5.0	14.8	18.9	370	195	4.43	3.21	61.7	48.8	75.4	56.7	401	77.9	0.389
	6.3	18.4	23.4	447	234	4.37	3.16	74.6	58.4	92.3	69.1	486	93.0	0.386
	8.0	22.9	29.1	537	278	4.29	3.09	89.5	69.4	113	83.9	586	110	0.383
	10.0	27.9	35.5	628	320	4.20	3.00	105	80.0	134	99.4	688	126	0.379
150 × 100	5.0	18.7	23.9	747	396	5.59	4.07	99.5	79.1	121	90.8	806	127	0.489
	6.3	23.3	29.7	910	479	5.53	4.02	121	95.9	148	111	985	153	0.486
	8.0	29.1	37.1	1106	577	5.46	3.94	147	115	183	137	1202	184	0.483
	10.0	35.7	45.5	1312	678	5.37	3.86	175	136	220	164	1431	215	0.479
	12.5	43.6	55.5	1532	781	5.25	3.75	204	156	263	194	1680	246	0.473
160 × 80	5.0	18.0	22.9	753	251	5.74	3.31	94.1	62.8	117	71.7	599	106	0.469
	6.3	22.3	28.5	917	302	5.68	3.26	115	75.6	144	87.7	729	127	0.466
	8.0	27.9	35.5	1113	361	5.60	3.19	139	90.2	177	107	882	151	0.463
	10.0	34.2	43.5	1318	419	5.50	3.10	165	105	213	127	1041	175	0.459
	12.5	41.6	53.0	1536	476	5.38	3.00	192	119	254	150	1206	199	0.453
200 × 100	5.0	22.7	28.9	1509	509	7.23	4.20	151	102	186	115	1202	172	0.589
	6.3	28.3	36.0	1851	618	7.17	4.14	185	124	231	141	1473	208	0.586
	8.0	35.4	45.1	2269	747	7.09	4.07	227	149	286	174	1802	251	0.583
	10.0	43.6	55.5	2718	881	7.00	3.98	272	176	346	209	2154	296	0.579
	12.5	53.4	68.0	3218	1022	6.88	3.88	322	204	417	249	2541	342	0.573
	16.0	66.4	84.5	3808	1175	6.71	3.73	381	235	505	297	2988	393	0.566
250 × 150	6.3	38.2	48.6	4178	1886	9.27	6.23	334	252	405	284	4049	413	0.786
	8.0	48.0	61.1	5167	2317	9.19	6.16	413	309	505	353	5014	506	0.783
	10.0	59.3	75.5	6259	2784	9.10	6.07	501	371	618	430	6082	606	0.779
	12.5	73.0	93.0	7518	3310	8.99	5.97	601	441	751	520	7317	717	0.773
	16.0	91.5	117	9089	3943	8.83	5.82	727	526	924	635	8863	851	0.766

Table 2. Rectangular hollow sections (see figure 5) (*concluded*)

Size, $D \times B$	Thickness, t	Mass per unit length, M	Sectional area, A	Moment of inertia, I		Radius of gyration, r		Elastic modulus, Z		Plastic modulus, S		Torsional moment of inertia, J	Torsional modulus, C	Superficial area per metre length
				x-x	y-y	x-x	y-y	x-x	y-y	x-x	y-y			
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
300 × 200	6.3	48.1	61.2	7880	4216	11.3	8.30	525	422	627	475	8468	681	0.986
	8.0	60.5	77.1	9798	5219	11.3	8.23	653	522	785	593	10550	840	0.983
	10.0	75.0	95.5	11940	6331	11.2	8.14	796	633	964	726	12890	1016	0.979
	12.5	92.6	118	14460	7619	11.1	8.04	964	762	1179	866	15650	1217	0.973
	16.0	117	149	17700	9239	10.9	7.89	1180	924	1462	1094	19230	1469	0.966
400 × 200	8.0	73.1	93.1	19710	6695	14.5	8.48	985	669	1210	746	15720	1135	1.18
	10.0	90.7	116	24140	8138	14.5	8.39	1207	814	1492	916	19240	1377	1.18
	12.5	112	143	29410	9820	14.3	8.29	1471	982	1831	1120	23410	1657	1.17
	16.0	142	181	36300	11950	14.2	8.14	1815	1195	2285	1388	28840	2011	1.17
450 × 250	10.0	106	136	37180	14900	16.6	10.5	1653	1192	2013	1338	33250	1986	1.38
	12.5	132	168	45470	18100	16.5	10.4	2021	1448	2478	1642	40670	2407	1.37
	16.0	167	213	56420	22250	16.3	10.2	2508	1780	3103	2047	50480	2948	1.37
500 × 300	10.0	122	156	54120	24560	18.7	12.6	2165	1638	2609	1834	52400	2696	1.58
	12.5	152	193	66360	29970	18.5	12.5	2655	1998	3218	2257	84310	3282	1.57
	16.0	192	245	82670	37080	18.4	12.3	3307	2472	4042	2825	80220	4046	1.57
	20.0	237	302	100100	44550	18.2	12.1	4006	2970	4942	3442	97320	4845	1.56

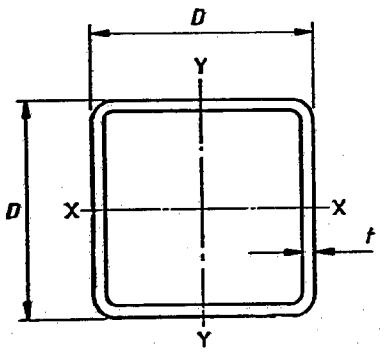


Figure 6. Square hollow section (see table 3)

Table 3. Square hollow sections (see figure 6)

Size, $D \times D$	Thickness, t	Mass per unit length, M	Sectional area, A	Moment of inertia, I	Radius of gyration, r	Elastic modulus, Z	Plastic modulus, S	Torsional moment of inertia, J	Torsional modulus, C	Superficial area per metre length
mm	mm	kg/m	cm^2	cm^4	cm	cm^3	cm^3	cm^4	cm^3	m^2
20 × 20	2.0	1.12	1.42	0.76	0.73	0.76	0.95	1.22	1.07	0.076
	2.5	1.35	1.72	0.87	0.71	0.88	1.12	1.41	1.21	0.075
25 × 25	2.0	1.43	1.82	1.59	0.94	1.27	1.56	2.52	1.81	0.096
	2.5	1.74	2.22	1.85	0.91	1.48	1.86	2.97	2.09	0.095
	3.0	2.04	2.60	2.06	0.89	1.65	2.12	3.36	2.31	0.094
	3.2	2.15	2.74	2.14	0.88	1.71	2.21	3.49	2.38	0.093
30 × 30	2.5	2.14	2.72	3.40	1.12	2.27	2.79	5.40	3.22	0.115
	3.0	2.51	3.20	3.84	1.10	2.56	3.21	6.17	3.61	0.114
	3.2	2.65	3.38	4.00	1.09	2.67	3.37	6.45	3.75	0.113
40 × 40	2.5	2.92	3.72	8.67	1.53	4.33	5.21	13.6	6.23	0.155
	3.0	3.45	4.40	9.96	1.51	4.98	6.07	15.7	7.11	0.154
	3.2	3.66	4.66	10.4	1.50	5.22	6.40	16.5	7.43	0.153
	4.0	4.46	5.68	12.1	1.46	6.07	7.61	19.5	8.56	0.151
	5.0	5.40	6.88	13.8	1.42	6.92	8.92	22.6	9.65	0.149

Table 3. Square hollow sections (see figure 6) *(continued)*

Size, $D \times D$	Thickness, t	Mass per unit length, M	Sectional area, A	Moment of inertia, I	Radius of gyration, r	Elastic modulus, Z	Plastic modulus, S	Torsional moment of inertia, J	Torsional modulus, C	Superficial area per metre length
mm	mm	kg/m	cm^2	cm^4	cm	cm^3	cm^3	cm^4	cm^3	m^2
50 × 50	2.5	3.71	4.72	17.7	1.94	7.07	8.38	27.4	10.2	0.195
	3.0	4.39	5.60	20.5	1.91	8.20	9.83	32.0	11.8	0.194
	3.2	4.66	5.94	21.6	1.91	8.62	10.4	33.8	12.4	0.193
	4.0	5.72	7.28	25.5	1.87	10.2	12.5	40.4	14.5	0.191
	5.0	6.97	8.88	29.6	1.83	11.9	14.9	47.6	16.7	0.189
	6.3	8.49	10.8	33.9	1.77	13.6	17.5	55.3	18.9	0.186
60 × 60	3.0	5.34	6.80	36.6	2.32	12.2	14.5	56.9	17.7	0.234
	3.2	5.67	7.22	38.7	2.31	12.9	15.3	60.1	18.6	0.233
	4.0	6.97	8.88	46.1	2.28	15.4	18.6	72.4	22.1	0.231
	5.0	8.54	10.9	54.4	2.24	18.1	22.3	86.3	25.8	0.229
	6.3	10.5	13.3	63.4	2.18	21.1	26.6	102	29.7	0.226
	8.0	12.8	16.3	72.4	2.11	24.1	31.4	119	33.5	0.223
70 × 70	3.0	6.28	8.00	59.6	2.73	17.0	20.0	92.1	24.8	0.274
	3.6	7.46	9.50	69.5	2.70	19.9	23.6	108	28.7	0.272
	5.0	10.1	12.9	90.1	2.64	25.7	31.2	142	36.8	0.269
	6.3	12.5	15.9	106	2.58	30.4	37.6	169	43.0	0.266
	8.0	15.3	19.5	123	2.51	35.3	45.0	200	49.4	0.263
80 × 80	3.0	7.22	9.20	90.6	3.14	22.7	26.5	139	33.1	0.314
	3.6	8.59	10.9	106	3.11	26.5	31.3	164	38.5	0.312
	5.0	11.7	14.9	139	3.05	34.7	41.7	217	49.8	0.309
	6.3	14.4	18.4	165	3.00	41.3	50.5	261	58.8	0.306
	8.0	17.8	22.7	194	2.92	48.6	60.9	312	68.5	0.303
90 × 90	3.6	9.72	12.4	154	3.52	34.1	40.0	237	49.7	0.352
	5.0	13.3	16.9	202	3.46	45.0	53.6	315	64.9	0.349
	6.3	16.4	20.9	242	3.41	53.9	65.3	381	77.1	0.346
	8.0	20.4	25.9	288	3.33	64.0	79.2	459	90.7	0.343
100 × 100	4.0	12.0	15.3	234	3.91	46.8	54.9	361	68.2	0.391
	5.0	14.8	18.9	283	3.87	56.6	67.1	439	81.9	0.389
	6.3	18.4	23.4	341	3.81	68.2	82.0	533	97.9	0.386
	8.0	22.9	29.1	408	3.74	81.5	99.9	646	116	0.383
	10.0	27.9	35.5	474	3.65	94.9	119	761	134	0.379

Table 3. Square hollow sections (see figure 6) *(continued)*

Size, $D \times D$	Thickness, t	Mass per unit length, M	Sectional area, A	Moment of inertia, I	Radius of gyration, r	Elastic modulus, Z	Plastic modulus, S	Torsional moment of inertia, J	Torsional modulus, C	Superficial area per metre length
mm	mm	kg/m	cm^2	cm^4	cm	cm^3	cm^3	cm^4	cm^3	m^2
120 × 120	5.0	18.0	22.9	503	4.69	83.8	98.4	775	122	0.469
	6.3	22.3	28.5	610	4.63	102	121	949	147	0.466
	8.0	27.9	35.5	738	4.56	123	149	1159	176	0.463
	10.0	34.2	43.5	870	4.47	145	178	1381	206	0.459
	12.5	41.6	53.0	1009	4.36	168	212	1624	237	0.453
150 × 150	5.0	22.7	28.9	1009	5.91	135	157	1548	197	0.589
	6.3	28.3	36.0	1236	5.86	165	194	1907	240	0.586
	8.0	35.4	45.1	1510	5.78	201	240	2348	291	0.583
	10.0	43.6	55.5	1803	5.70	240	290	2829	345	0.579
	12.5	53.4	68.0	2125	5.59	283	348	3372	403	0.573
	16.0	66.4	84.5	2500	5.44	333	421	4029	468	0.566
180 × 180	6.3	34.2	43.6	2186	7.08	243	283	3357	355	0.706
	8.0	43.0	54.7	2689	7.01	299	352	4156	434	0.703
	10.0	53.0	67.5	3237	6.92	360	429	5041	519	0.699
	12.5	65.2	83.0	3856	6.82	428	519	6062	613	0.693
	16.0	81.4	104	4607	6.66	512	634	7339	725	0.686
200 × 200	6.3	38.2	48.6	3033	7.90	303	353	4647	444	0.786
	8.0	48.0	61.1	3744	7.83	374	439	5770	545	0.783
	10.0	59.3	75.5	4525	7.74	452	536	7020	655	0.779
	12.5	73.0	93.0	5419	7.63	542	651	8479	779	0.773
	16.0	91.5	117.0	6524	7.48	652	799	10330	929	0.766
250 × 250	6.3	48.1	61.2	6049	9.94	484	559	9288	712	0.986
	8.0	60.5	77.1	7510	9.87	601	699	11510	880	0.983
	10.0	75.0	95.5	9141	9.78	731	858	14090	1065	0.979
	12.5	92.6	118	11050	9.68	884	1048	17140	1279	0.973
	16.0	117	149	13480	9.53	1078	1298	21110	1548	0.966
300 × 300	8.0	73.1	93.1	13210	11.9	881	1018	20170	1294	1.18
	10.0	90.7	116	16150	11.8	1077	1254	24780	1575	1.18
	12.5	112	143	19630	11.7	1309	1538	30290	1905	1.17
	16.0	142	181	24160	11.6	1610	1916	37570	2327	1.17

Table 3. Square hollow sections (see figure 6) *(concluded)*

Size, $D \times D$	Thickness, t	Mass per unit length, M	Sectional area, A	Moment of inertia, I	Radius of gyration, r	Elastic modulus, Z	Plastic modulus, S	Torsional moment of inertia, J	Torsional modulus, C	Superficial area per metre length
mm	mm	kg/m	cm^2	cm^4	cm	cm^3	cm^3	cm^4	cm^3	m^2
350 × 350	8.0	85.7	109	21240	14.0	1214	1398	32350	1789	1.38
	10.0	106	136	26050	13.9	1489	1725	39840	2186	1.38
	12.5	132	168	31810	13.8	1817	2122	48870	2655	1.37
	16.0	167	213	39370	13.6	2250	2655	60900	3265	1.37
400 × 400	10.0	122	156	39350	15.9	1968	2272	60030	2896	1.58
	12.5	152	193	48190	15.8	2409	2800	73820	3530	1.57
	16.0	192	245	59910	15.7	2995	3514	92310	4363	1.57
	20.0	237	302	72400	15.5	3620	4292	112300	5240	1.56

Appendix

Appendix A. Dimensions of ISO structural hollow sections not included in this British Standard

The sizes and thicknesses contained in ISO 657 : Part 14 but not covered by this standard are given in tables 4, 5 and 6 (see also figures 7, 8 and 9).

Table 4. Dimensions of circular hollow sections described in ISO 657 : Part 14 but not covered by this standard (see figure 7)

Outside diameter, *D*	Thickness, *t*
mm	mm
21.3	2.3
26.9	2.3
48.3	2.9
60.3	2.9
76.1	2.9
88.9	6.3
101.6	3.6 5.0 6.3 8.0 10.0
114.3	8.0 10.0
139.7	4.0 12.5
168.3	4.5 12.5
193.7	5.4
219.1	5.9
323.9	7.1
406.4	8.8

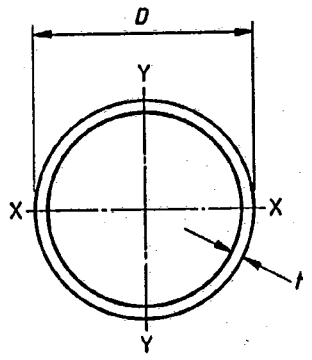


Figure 7. Dimensions of circular hollow sections described in ISO 657 : Part 14 but not covered by this standard (see table 4)

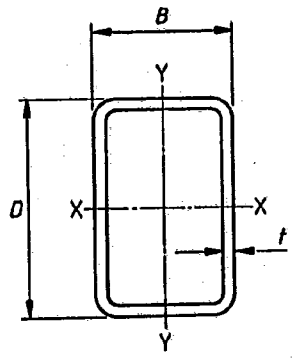


Figure 8. Dimensions of rectangular hollow sections described in ISO 657 : Part 14 but not covered by this standard (see table 5)

Table 5. Dimensions of rectangular hollow sections described in ISO 657 : Part 14 but not covered by this standard (see figure 8)

Size, $D \times B$	Thickness, t
mm	mm
50 × 30	2.6
70 × 40	3.2 4.0 5.0
90 × 50	3.2 4.0
100 × 50	3.6
100 × 60	3.2 4.0
120 × 60	3.2 4.0
120 × 80	3.2 4.0
140 × 80	3.2 4.0 5.0 6.3 8.0 10.0
150 × 100	3.2 4.0
160 × 80	3.2 4.0
180 × 100	3.6 5.0 6.3 8.0 10.0

Table 5. Dimensions of rectangular hollow sections described in ISO 657 : Part 14 but not covered by this standard (see figure 8) *(concluded)*

mm	mm
200 × 100	4.0
200 × 120	4.0 5.0 6.3 8.0 10.0
220 × 140	4.0 5.0 6.3 8.0 10.0
250 × 150	5.0
300 × 200	5.9
400 × 200	7.1 8.0
400 × 250	8.0

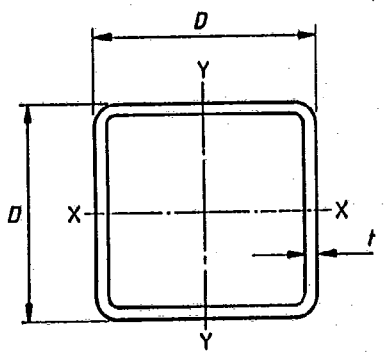


Figure 9. Dimensions of square hollow sections described in ISO 657 : Part 14 but not covered by this standard (see table 6)

Table 6. Dimensions of square hollow sections described in ISO 657 : Part 14 but not covered by this standard (see figure 9)

Size, $D \times D$	Thickness, t,
mm	mm
20 × 20	2.6
30 × 30	2.0 2.6
40 × 40	2.6
70 × 70	3.2 4.0
80 × 80	3.2 4.0
90 × 90	3.2 4.0
100 × 100	3.2
120 × 120	3.2 4.0
140 × 140	3.6 5.0 6.3 8.0 10.0
150 × 150	4.0

Table 6. Dimensions of square hollow sections described in ISO 657 : Part 14 but not covered by this standard (see figure 9) *(concluded)*

Size, $D \times D$	Thickness, t,
mm	mm
160 × 160	4.0 5.0 6.3 8.0 10.0
180 × 180	4.0 5.0
200 × 200	5.0
220 × 220	5.0 6.3 8.0 10.0
250 × 250	5.9
260 × 260	5.9 6.3 8.0 10.0
300 × 300	7.1

Publications referred to

BS 4	Structural steel sections Part 1 Specification for hot-rolled sections[1)]
BS 4360	Specification for weldable structural steels
BS 4848	Specification for hot-rolled structural steel sections Part 1 Beams, columns and tee bars[1)] Part 3 Channels[1)] Part 4 Equal and unequal angles[1)] Part 5 Bulb flats[1)]
BS 6363	Specification for welded cold formed steel structural hollow sections
ISO 657	Hot-rolled steel sections Part 14 Hot-finished structural hollow sections — Dimensions and sectional properties

[1)] Referred to in the foreword only.

BS 4848 :
Part 2 : 1991

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STANDARDS

Amendment No 1
published and effective from 28 June 1991
to BS 4848 : Part 2 : 1991

Hot-rolled structural steel sections
Part 2. Specification for hot-finished hollow sections

Correction

AMD 6747
June 1991

Table 1. Circular hollow sections

Delete the row of entries for outside diameter 48.3 mm and substitute the attached row.

Outside diameter, *D*	Thickness, *t*	Mass per unit length, *M*	Sectional area, *A*	Moment of inertia, *I*	Radius of gyration, *r*	Elastic modulus, *Z*	Plastic modulus, *S*	Torsional moment of inertia, *J*	Torsional modulus, *C*	Superficial area per metre length
mm	mm	kg/m	cm^2	cm^4	cm	cm^3	cm^3	cm^4	cm^3	m^2
48.3	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	6.99	9.42	32.3	13.4	0.152