



LIBERTY

Hot Rolled and Structural Steel Products

Ninth Edition





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Foreword

This edition of Liberty Steel's Hot Rolled and Structural Steel Product Catalogue incorporates the following changes from the previous edition.

- The depths and widths of Universal Beams (UBs) and Columns (UCs) were previously provided to three significant figures. For consistency with AS/NZS 3679.1 *Structural Steel – Hot rolled bars and sections*, these measurements are now provided to one decimal place. The dimensions for UBs and UCs were converted from imperial to metric units of measure in the mid 1970s and resulted in dimensions that were not whole millimetres. Until this edition they were rounded to three significant figures. The other sections in the Catalogue are metric and therefore in whole millimetres. The section properties for all sections in this version and the previous versions have used depths and widths correct to one decimal place to calculate the tabulated values presented to three significant figures. These values are unchanged from the previous edition.
- The inclusion of tolerance tables for each of the products listed. These values are consistent with AS/NZS 3679.1.
- The inclusion of tables providing the allowable camber and sweep of sections consistent with AS/NZS 3679.1.

Introduction

Liberty Steel owns facilities which have a long and significant presence in the Australian steel industry. These facilities which produce steel and finished steel products, date back to the establishment of steelmaking in Newcastle in 1915 and continues to the present day.

Liberty Steel's major manufacturing facilities for hot rolled products are located in Whyalla, South Australia; in Melbourne, Victoria and in Newcastle and western Sydney, New South Wales. Together they are considered Australia's premier manufacturer of steel long products. These products include structural sections, rail, sleepers, rod, bar, and wire.

This catalogue, which demonstrates Liberty Steel's ongoing commitment to the Australian construction and manufacturing industry, has been produced to provide general information on a range of hot rolled structural steel products.

Commitment to Quality

Liberty Steel supplies products that are compliant to the relevant Australian Standards or its own high quality standards. Liberty Steel's aim is to supply a consistent high quality product which delivers benefits to our customers by minimising variation and reducing waste.

The quality of products is constantly checked in NATA accredited testing laboratories, by skilled technical staff using proven equipment. Strict metallurgical control is maintained, from receipt of raw materials to despatch of the finished product. Products are rigorously tested and certified, with test certificates providing assurance that Liberty Steel sections meet all required specifications. These are made available free of charge via our EzyCommerce® website.

At its manufacturing sites Liberty Steel has third party accreditation to Quality Management System ISO 9001 and Environmental Management System ISO 14001.

Test Certificates – EzyCommerce

NATA accredited test certificates are available for all AS/NZS 3679.1 products. The Steel Structures Design Standard – AS4100, acknowledges these certificates provide designers and certifiers with sufficient evidence that they are acceptable steels for use in designs to AS4100. Our test certificates also comply with EN10204 Type 3.1.

Fabricators can ensure they receive a copy of the relevant certificate covering the steel ordered and delivered by requesting them at the time of order. The certificates can be provided manually, electronically or customers can access these via Liberty Steel's EzyCommerce® website at <https://ezycommerce.libertygfg.com>

All distributors of Liberty Steel AS/NZS 3679.1 products have access to certificates via EzyCommerce® – this is a free service that offers the ability to access and retrieve this information anytime.

Access to EzyCommerce® Online is free to approved customers of Liberty Steel – all you need is a login name and password – please refer to [www/libertygfg.com/steel/ezycommerce](http://www.libertygfg.com/steel/ezycommerce) for more information on obtaining access to the website.



For more information:

Ezycommerce, <https://libertygfg.com/steel/ezycommerce>

ACRS - Third Party Certification

In addition to our quality systems and NATA endorsed laboratories, Liberty Steel's range of AS/NZS 3679.1 hot rolled products are all produced at mills with ACRS certification.

Copies of our ACRS accreditation can be viewed at the Liberty Steel website: www.libertygfg.com

For more information:

Liberty Steel website: www.libertygfg.com

ACRS: www.steelcertification.com



Commitment to Quality

Test Certificate sample



TEST CERTIFICATE

Page 1 of 2
Certificate No.: W971841
 Transmission Date: 28/11/17

Customer:	Supplier: OneSteel Manufacturing Pty Limited Whyalla, SA - 5600, Australia A.B.N. 42 004 651 325
Ship To:	Sales Order No: B7093 Printed on: 28/11/2018



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Sampling undertaken by OneSteel Whyalla 15352
 Approved Signatory - P. Rawnsley
 Chemical results as identified are from Bureau Veritas Minerals Pty Ltd, Whyalla 0834
 Approved Signatory - K. Barsby
 Mechanical results as identified are from Bureau Veritas Minerals Pty Ltd, Whyalla 0794
 Approved Signatory - I. Harrison

STEELMAKING: Basic Oxygen - Slab Cast
 SPECIFICATION: **AS/NZS3679.1-300PLUS/S0**
 PRODUCT: **310UB40.4**

INSPECTION: Supplier
 CERTIFICATION: Supplier

ITEMS COVERED BY THIS TEST CERTIFICATE

Item No	Heat No	Customer Order	Length
2260C	571984	7505648987	10.500
2260C	571985	7505648987	10.500
2260C	571986	7505648987	10.500
2289C	571973	7505649607	18.000
2289C	571984	7505649607	18.000

CHEMICAL ANALYSIS

Percentage of element by mass (L=Cast, P=Product, -S=Soluble, -T=Total, CF=Chemical Formula, n=Min, x=Max)

Item No	Heat / Unit No	NATA Lab	L/P	C	P	Mn	Si	S	Ni	Cr	Mo	Cu	Sn	Al
2260C	571984	0834	L	.188	.018	1.32	.150	.006	.008	.022	.005	.008	.002	.012
2260C	571985	0834	L	.184	.016	1.33	.140	.008	.007	.022	.005	.008	.002	.022
2260C	571986	0834	L	.188	.013	1.34	.130	.007	.007	.022	.005	.008	.001	.023
2289C	571973	0834	L	.157	.016	1.53	.150	.010	.008	.024	.006	.009	.002	.022
2289C	571984	0834	L	.188	.018	1.32	.150	.006	.008	.022	.005	.008	.002	.012

Item No	Heat / Unit No	NATA Lab	L/P	Nb	Ti	B	V	N	Ca	Zr	CF1
2260C	571984	0834	L	.003	.001	.0005	.002	.0042	.0001	.002	.41
2260C	571985	0834	L	.003	.001	.0005	.002	.0050	.0001	.002	.41
2260C	571986	0834	L	.003	.001	.0006	.002	.0044	.0001	.002	.42
2289C	571973	0834	L	.004	.001	.0005	.002	.0060	.0001	.003	.42
2289C	571984	0834	L	.003	.001	.0005	.002	.0042	.0001	.002	.41

CF1=C+Mn/6 + (Cr+Mo+V)/5 + (Ni+Cu)/15

MECHANICAL TESTING

Tensile

Item No	Heat No	Tested Unit	NATA Lab	Test Report	ReH MPa	Rm MPa	ELONGN %
2260C	571984	571984	0794	57196	380	520	37
2260C	571984	571984	0794	57196	365	500	36
2260C	571985	571985	0794	57197	350	500	36
2260C	571985	571985	0794	57197	350	490	36
2260C	571986	571986	0794	57197	355	490	36
2260C	571986	571986	0794	57197	355	500	39
2289C	571973	571973	0794	57196	360	500	38
2289C	571973	571973	0794	57196	345	490	38
2289C	571973	571973	0794	57196	360	510	34
2289C	571984	571984	0794	57196	380	520	37
2289C	571984	571984	0794	57196	365	500	36

Yield Strength - determined in accordance with requirements of nominated product standard

Availability

Structural Steel Sections

Hot Rolled Products

Hot Rolled Structural Steel Sections produced by Liberty Steel are manufactured in accordance with the requirements of Australian Standard AS/NZS 3679.1 Structural steel – hot rolled bars and sections.

Grade Availability

300PLUS® Steel is the standard product manufactured by Liberty Steel for hot rolled Structural Steel Sections for Australia.

300PLUS® Steel for hot rolled products is produced to exceed the minimum requirements of AS/NZS 3679.1 grade 300.

For further information contact Liberty Steel Sales.

The following AS/NZS 3679.1 grades are also available by enquiry and will depend on the section and quantity required.

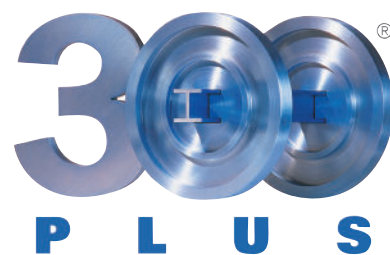
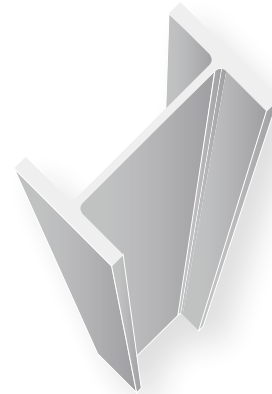
Table 1: Additional Grades Available

Additional Grades Available
300PLUS® L0 – Exceeds the requirements of AS/NZS 3679.1 – 300L0
300PLUS® L15 – Exceeds the requirements of AS/NZS 3679.1 – 300L15
AS/NZS 3679.1 – 350
AS/NZS 3679.1 – 350L0
AS/NZS 3679.1 – 350L15

Length Availability

The majority of Structural Steel Sections produced by Liberty Steel are available in standard length and bundle configurations.

We would recommend that attention be given to the standard lengths produced by Liberty Steel as they are more readily available than other lengths. Table 2 (page 6) indicates the standard lengths produced by Liberty Steel in Structural Steel Sections. For other lengths (including those in excess of 18 metres) please contact Liberty Steel Sales for further details.



Availability

Table 2 Standard Lengths

Section	Length (m)										
	6.0	7.5	9.0	10.5	12.0	13.5	14.0	15.0	16.5	18.0	20.0*
Universal Beams											
610 UB, 530 UB, 460 UB, 410 UB, 360 UB			●	●	●	●		●	●	●	●
310 UB 46.2, 40.4			●	●	●	●		●	●	●	●
310 UB 32.0			●	●	●	●		●		●	
250 UB			●	●	●	●		●	●	●	
200 UB 29.8, 25.4, 22.3			●	●	●	●		●	●	●	
200 UB 18.2			●	●	●	●		●			
180 UB, 150 UB			●	●	●	●		●	●		
Universal Columns											
310 UC 158, 137, 118			●	●	●	●		●	●	●	
310 UC 96.8			●	●	●	●		●	●	●	●
250 UC			●	●	●	●		●	●	●	●
200 UC, 150 UC			●	●	●	●		●	●	●	
100 UC			●		●			●			
Tapered Flange Beams											
125 TFB, 100 TFB		●	●		●		●	●			
Parallel Flange Channels											
380 PFC, 300 PFC, 250 PFC, 230 PFC, 200 PFC, 180 PFC			●	●	●	●		●	●	●	
150 PFC			●	●	●	●		●			
125 PFC, 100 PFC, 75 PFC	●		●		●						
Universal Bearing Piles											
310 UBP, 200 UBP											By enquiry
Equal Angles											
200 EA, 150 EA, 125 EA			●	●	●	●		●			
100 EA, 90 EA **	+	+	●		●						
75 EA, 65 EA, 55 EA, 50 EA **	+	+	●		+						
45 EA, 40EA, 30 EA, 25 EA	+	+	+		+						
Unequal Angles											
150 x 100 UA, 150 x 90 UA			●	●	●	●		●			
125 x 75 UA, 100 x 75 UA	+	+	+		+						
75 x 50 UA, 65 x 50 UA	+	+	+		+						

● The Section/Length combination is available in Standard Bundle configurations.

* By enquiry – delivery to capital cities only.

** Certain thicknesses may not be available in both lengths. Confirm availability with Liberty Steel.

+ By enquiry.

Availability

Merchant Bar Sections

Rounds, Squares and Flats

Availability

Merchant bar rounds, squares and flats are available in a variety of steel grades and sizes.

Due to process limitations not all grades are available in all sizes. For new applications we recommend you confirm product availability with a Liberty Steel Sales Office at an early stage of design. Other specifications and sizes may also be available on enquiry.

Specifications

Merchant bar sections are available in the following standards:

- 300PLUS® and AS/NZS 3679.1 – Structural Steel – Hot rolled bars and sections.
- AS 1442 – Carbon Steels and Carbon Manganese Steels – Hot rolled bars and semifinished products.
- AS 1444 – Wrought Alloy Steels Standard, Hardenability (H) Series and Hardened and Tempered to Designated Mechanical Properties.
- AS 1447 – Hot-rolled spring steels.
- Liberty Steel grades (based on AISI-SAE nomenclature).

Table 3 Rounds – Size Availability and Mass

Diameter (mm)	Mass (kg/m)
10	0.616
12	0.887
13	1.04
14	1.21
15	1.39
16	1.58
17	1.78
18	1.99
19	2.23
20	2.46
22	2.98
24	3.55
27	4.49
30	5.55
33	6.71
36	7.99
39	9.38
42	10.9
45	12.5
48	14.2
50	15.4
56	19.3
60	22.2
65	26.0
75	34.7
90	49.9

Standard Length: 6 metres

Table 4 Squares – Size Availability and Mass

Thickness (mm)	Mass (kg/m)
10*	0.790
12	1.13
16	2.01
20	3.14
25	4.91
40	12.5

Standard Length: 6 metres

* Confirm availability.

Availability

Table 5 Flats – Size Availability and Mass (kg/m)

Width (mm)	Thickness (mm)							
	5	6	8	10	12	16	20	25
20				1.57				
25	0.981	1.18	1.57	1.96	2.36			
32	1.26	1.51	2.01	2.51	3.01			
40	1.57	1.88	2.51	3.14	3.77	5.02	6.28	
50	1.96	2.36	3.14	3.93	4.71	6.28	7.85	9.81
65	2.55	3.06	4.08	5.10	6.12	8.16	10.2	
75	2.94	3.53	4.71	5.89	7.07	9.42	11.8	14.7
90		4.24	5.65	7.07	8.48			
100	3.93	4.71	6.28	7.85	9.42	12.6	15.7	19.6
110				8.64				
130			8.16	10.2	12.2	16.3	20.4	25.5
150			9.42	11.8	14.1	18.8	23.6	29.4

Standard Length: 6 metres



Availability

Table 6 Merchant Bar Sections – Regular Grade

Steel Type	Standard	Grades Available
Structural Steels	Liberty Steel AS/NZS 3679.1	300PLUS® 350
Carbon and Carbon-Manganese Steels	AS 1442	1016 1022 1045
Spring Steels	AS 1447	XK5160S XK9258S XK9261S
Liberty Steel Grades	Liberty Steel	X4K92M61S

Note

Liberty Steel 300PLUS® exceeds the requirements of AS/NZS 3679.1 Grade 300. Grade availability can vary with section.

Rods and Light Billets

Rods and light billets are available in a wide range of Liberty Steel grades, and selected grades from AS 1442, AS 1444 and AS 1447 specifications.

These sections are not available in structural grades 300PLUS® or 350 grade.

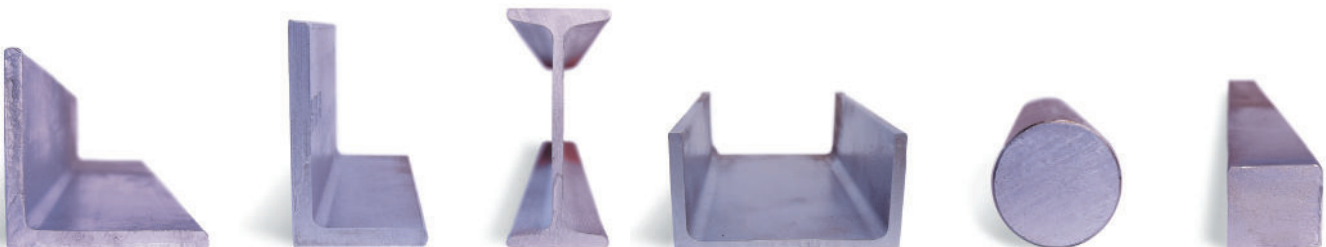
Due to process limitations not all grades are available in all sizes. Confirm product availability with a Liberty Steel Sales Office at an early stage of design.

Table 7 Rods – Size Availability

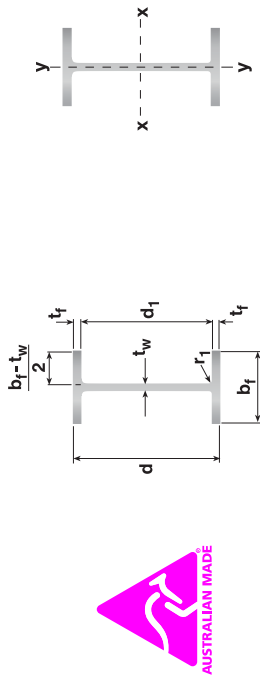
Diameter (mm)										
5.5	6.5	7.0	8.0	9.0	10.0	11.2	12.5	13.0	14.0	
15.0	16.0	17.0	18.0							

Table 8 Light Billets – Size Availability

Sizes Available (mm x mm)	
	45 x 45
	50 x 50
	63 x 63
	75 x 75



Universal Beams


Table 9 Universal Beams – Dimensions and Properties

Designation	Depth of Section		Flange Thickness	Web Thickness	Root Radius	Depth Between Flanges	Gross Area of Cross Section		About x-axis			About y-axis			Torsion Constant	Warping Constant	Designation	
	d	d ₁					A _b	A _y	I _x	Z _x	S _x	r _x	I _y	Z _y				S _y
kg/m	mm	mm	mm	mm	mm	mm	mm ²	mm ²	10 ⁶ mm ⁴	10 ³ mm ³	10 ³ mm ³	10 ⁶ mm ⁴	10 ³ mm ³	10 ⁶ mm ⁴	10 ³ mm ⁴	10 ⁹ mm ⁶		
610UB125	611.6	229.0	19.6	11.9	14.0	572.4	48.1	5.54	986	3230	3680	249	39.3	343	536	49.6	1560	610UB125
113	607.0	228.0	17.3	11.2	14.0	572.4	51.1	6.27	875	2880	3290	246	34.3	300	469	48.7	1140	2980
101	602.0	228.0	14.8	10.6	14.0	572.4	54.0	7.34	761	2530	2900	242	29.0	257	402	47.5	790	2530
530UB92.4	533.0	209.0	15.6	10.2	14.0	501.8	49.2	6.37	554	2080	2370	217	23.8	228	355	44.9	775	530UB92.4
82.0	528.2	209.0	13.2	9.6	14.0	501.8	52.3	7.55	477	1810	2070	213	20.1	193	301	43.8	526	1330
460UB82.1	460.4	191.0	16.0	9.9	11.4	428.4	43.3	5.66	372	1610	1840	188	18.6	195	303	42.2	701	919
74.6	457.4	190.0	14.5	9.1	11.4	428.4	47.1	6.24	335	1460	1660	188	16.6	175	271	41.8	530	815
67.1	453.8	190.0	12.7	8.5	11.4	428.4	50.4	7.15	296	1300	1480	186	14.5	153	238	41.2	378	708
410UB59.7	406.4	178.0	12.8	7.8	11.4	380.8	48.8	6.65	216	1060	1200	168	12.1	135	209	39.7	337	467
53.7	402.6	178.0	10.9	7.6	11.4	380.8	50.1	7.82	188	933	1060	165	10.3	115	179	38.6	234	394
360UB56.7	358.6	172.0	13.0	8.0	11.4	332.6	41.6	6.31	161	899	1010	149	11.0	128	198	39.0	338	330
50.7	355.6	171.0	11.5	7.3	11.4	332.6	45.6	7.12	142	798	897	148	9.60	112	173	38.5	241	284
44.7	352.0	171.0	9.7	6.9	11.4	332.6	48.2	8.46	121	689	777	146	8.10	94.7	146	37.6	161	237
310UB46.2	307.2	166.0	11.8	6.7	11.4	283.6	42.3	6.75	100	654	729	130	9.01	109	166	39.0	233	197
40.4	304.0	165.0	10.2	6.1	11.4	283.6	46.5	7.79	86.4	569	633	129	7.65	92.7	142	38.3	157	165
32.0	298.0	149.0	8.0	5.5	13.0	282.0	51.3	8.97	63.2	424	475	124	4.42	59.3	91.8	32.9	86.5	92.9
250UB37.3	256.2	146.0	10.9	6.4	8.9	234.4	36.6	6.40	55.7	435	486	108	5.66	77.5	119	34.5	158	85.2
31.4	251.6	146.0	8.6	6.1	8.9	234.4	38.4	8.13	44.5	354	397	105	4.47	61.2	94.2	33.4	89.3	65.9
25.7	248.0	124.0	8.0	5.0	12.0	232.0	46.4	7.44	35.4	285	319	104	2.55	41.1	63.6	27.9	67.4	36.7
200UB29.8	207.0	134.0	9.6	6.3	8.9	187.8	29.8	6.65	29.1	281	316	87.3	3.86	57.5	88.4	31.8	105	37.6
25.4	203.2	133.0	7.8	5.8	8.9	187.6	32.3	8.15	23.6	232	260	85.4	3.06	46.1	70.9	30.8	62.7	29.2
22.3	201.6	133.0	7.0	5.0	8.9	187.6	37.5	9.14	21.0	208	231	85.5	2.75	41.3	63.4	31.4	45.0	26.0
18.2	198.0	99.0	7.0	4.5	11.0	184.0	40.9	6.75	15.8	160	180	82.6	1.14	23.0	35.7	22.1	38.6	10.4
180UB22.2	179.0	90.0	10.0	6.0	8.9	159.0	26.5	4.20	15.3	171	195	73.6	1.22	27.1	42.3	20.8	81.6	8.71
18.1	175.0	90.0	8.0	5.0	8.9	159.0	31.8	5.31	12.1	139	157	72.6	0.975	21.7	33.7	20.6	44.8	6.80
16.1	173.0	90.0	7.0	4.5	8.9	159.0	35.3	6.11	10.6	123	138	72.0	0.853	19.0	29.4	20.4	31.5	5.88
150UB18.0	155.0	75.0	9.5	6.0	8.0	136.0	22.7	3.63	9.05	117	135	62.8	0.672	17.9	28.2	17.1	60.5	3.56
14.0	150.0	75.0	7.0	5.0	8.0	136.0	27.2	5.00	6.66	88.8	102	61.1	0.495	13.2	20.8	16.6	28.1	2.53

Universal Beams

Table 10 Universal Beams – Properties for Assessing Section Capacity

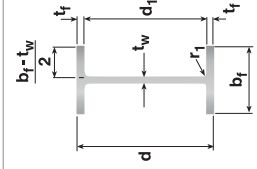
Designation	Yield Stress			Form Factor			About x-axis			About y-axis			Designation			
	Flange f_y MPa	Web f_y MPa	MPa	k_f	Compactness	Z_{xx} 10^3mm^3	Compactness	Z_{yy} 10^3mm^3	Flange f_y MPa	Web f_y MPa	MPa	k_f		Compactness	Z_{xx} 10^3mm^3	Compactness
300PLUS® *																
610 UB 125	280	300	300	0.950	C	3680	C	515	340	340	340	0.916	C	3680	C	515
113	280	300	300	0.926	C	3290	C	451	340	340	340	0.891	C	3290	C	451
101	300	320	320	0.888	C	2900	C	386	340	360	360	0.867	C	2900	C	386
530 UB 92.4	300	320	320	0.928	C	2370	C	342	340	360	360	0.907	C	2370	C	342
82.0	300	320	320	0.902	C	2070	C	289	340	360	360	0.880	C	2070	C	289
460 UB 82.1	300	320	320	0.979	C	1840	C	292	340	360	360	0.956	C	1840	C	292
74.6	300	320	320	0.948	C	1660	C	262	340	360	360	0.926	C	1660	C	262
67.1	300	320	320	0.922	C	1480	C	230	340	360	360	0.901	C	1480	C	230
410 UB 59.7	300	320	320	0.938	C	1200	C	203	340	360	360	0.918	C	1200	C	203
53.7	320	320	320	0.913	C	1060	C	173	360	360	360	0.894	N	1050	N	172
360 UB 56.7	300	320	320	0.996	C	1010	C	193	340	360	360	0.974	C	1010	C	193
50.7	300	320	320	0.963	C	897	C	168	340	360	360	0.943	C	897	C	168
44.7	320	320	320	0.930	N	770	N	140	360	360	360	0.911	N	762	N	139
310 UB 46.2	300	320	320	0.991	C	729	C	163	340	360	360	0.972	C	729	C	163
40.4	320	320	320	0.952	C	633	C	139	360	360	360	0.936	N	629	N	138
32.0	320	320	320	0.915	N	467	N	86.9	360	360	360	0.898	N	462	N	85.7
250 UB 37.3	320	320	320	1.00	C	486	C	116	360	360	360	1.00	C	486	C	116
31.4	320	320	320	1.00	N	395	N	91.4	360	360	360	0.991	N	392	N	90.3
25.7	320	320	320	0.949	C	319	C	61.7	360	360	360	0.932	C	319	C	61.7
200 UB 29.8	320	320	320	1.00	C	316	C	86.3	360	360	360	1.00	C	316	C	86.3
25.4	320	320	320	1.00	N	259	N	68.8	360	360	360	1.00	N	257	N	68.0
22.3	320	320	320	1.00	N	227	N	60.3	360	360	360	1.00	N	225	N	59.4
18.2	320	320	320	0.990	C	180	C	34.4	360	360	360	0.970	C	180	C	34.4
180 UB 22.2	320	320	320	1.00	C	195	C	40.7	360	360	360	1.00	C	195	C	40.7
18.1	320	320	320	1.00	C	157	C	32.5	360	360	360	1.00	C	157	C	32.5
16.1	320	320	320	1.00	C	138	C	28.4	360	360	360	1.00	C	138	C	28.4
150 UB 18.0	320	320	320	1.00	C	135	C	26.9	360	360	360	1.00	C	135	C	26.9
14.0	320	320	320	1.00	C	102	C	19.8	360	360	360	1.00	C	102	C	19.8

* 300PLUS® replaced Grade 250 as the base grade for these sections in 1994.

300PLUS® hot rolled sections are produced to exceed the minimum requirements of AS/NZS 3679.1-300.

Notes

1. For 300PLUS® sections the tensile strength (f_t) is 440 MPa.
2. For Grade 350 sections the tensile strength (f_t) is 480 MPa.
3. C: Compact Section; N: Non-compact Section; S: Slender Section.



Universal Columns

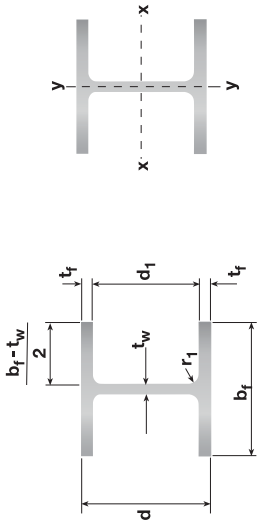


Table 11 Universal Columns – Dimensions and Properties

Designation	Depth of Section	Flange		Web Thickness	Root Radius	Depth Between Flanges		Gross Area of Cross Section	About x-axis				About y-axis				Torsion Constant	Warping Constant	Designation
		Width	Thickness			t_f	t_w		d_1	t_w	$2t_f$	A_g	I_x	Z_x	S_x	r_x			
kg/m	mm	mm	mm	mm	mm	mm	mm	mm ²	10 ⁶ mm ⁴	10 ³ mm ³	10 ³ mm ³	mm	10 ⁶ mm ⁴	10 ³ mm ³	10 ³ mm ³	mm	10 ³ mm ⁴	10 ⁷ mm ⁶	
310 UC 158	327.2	311.0	25.0	15.7	16.5	277.2	17.7	20100	388	2370	2680	139	125	807	1230	78.9	3810	2860	310 UC 158
	137	320.6	309.0	21.7	13.8	277.2	20.1	17500	329	2050	2300	137	107	691	1050	78.2	2520	2390	137
	118	314.6	307.0	18.7	11.9	277.2	23.3	15000	277	1760	1960	136	90.2	588	893	77.5	1630	1980	118
	96.8	308.0	305.0	15.4	9.9	277.2	28.0	12400	223	1450	1600	134	72.9	478	725	76.7	928	1560	96.8
250 UC 89.5	260.0	256.0	17.3	10.5	14.0	225.4	21.5	11400	143	1100	1230	112	48.4	378	575	65.2	1040	713	250 UC 89.5
	72.9	253.8	254.0	14.2	8.6	225.4	26.2	9320	114	897	992	111	38.8	306	463	64.5	586	557	72.9
200 UC 59.5	209.8	205.0	14.2	9.3	11.4	181.4	19.5	7620	61.3	584	656	89.7	20.4	199	303	51.7	477	195	200 UC 59.5
	52.2	206.4	204.0	12.5	8.0	181.4	22.7	6660	52.8	512	570	89.1	17.7	174	264	51.5	325	166	52.2
	46.2	203.4	203.0	11.0	7.3	181.4	24.8	5900	45.9	451	500	88.2	15.3	151	230	51.0	228	142	46.2
150 UC 37.2	161.8	154.0	11.5	8.1	8.9	138.8	17.1	4730	22.2	274	310	68.4	7.01	91.0	139	38.5	197	39.6	150 UC 37.2
	30.0	157.6	153.0	9.4	6.6	138.8	21.0	3860	17.6	223	250	67.5	5.62	73.4	112	38.1	109	30.8	30.0
	23.4	152.4	152.0	6.8	6.1	138.8	22.8	2980	12.6	166	184	65.1	3.98	52.4	80.2	36.6	50.2	21.1	23.4
100 UC 14.8	97.0	99.0	7.0	5.0	10.0	83.0	16.6	1890	3.18	65.6	74.4	41.1	1.14	22.9	35.2	24.5	34.9	2.30	100 UC 14.8

Universal Columns

Table 12 Universal Columns – Properties for Assessing Section Capacity

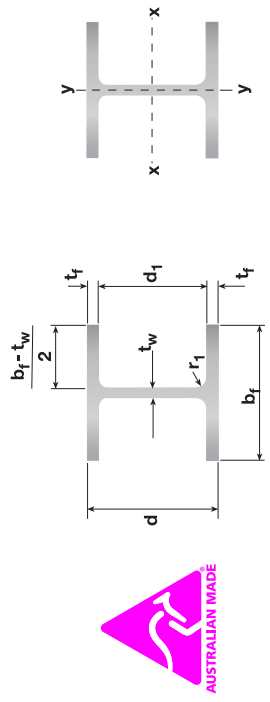
Designation	Yield Stress		Form Factor	About x-axis		About y-axis		Designation
	Flange f_y	Web f_y		Compactness	Z_{xx}	Compactness	Z_{yy}	
	MPa	MPa		10^3mm^3		10^3mm^3		
300PLUS® *								
310 UC 158	280	300	1.00	C	2680	C	1210	310 UC 158
137	280	300	1.00	C	2300	C	1040	137
118	280	300	1.00	C	1960	C	882	118
96.8	300	320	1.00	N	1560	N	694	96.8
250 UC 89.5	280	320	1.00	C	1230	C	567	250 UC 89.5
72.9	300	320	1.00	N	986	N	454	72.9
200 UC 59.5	300	320	1.00	C	656	C	299	200 UC 59.5
52.2	300	320	1.00	C	570	C	260	52.2
46.2	300	320	1.00	N	494	N	223	46.2
150 UC 37.2	300	320	1.00	C	310	C	137	150 UC 37.2
30.0	320	320	1.00	C	250	C	110	30.0
23.4	320	320	1.00	N	176	N	73.5	23.4
100 UC 14.8	320	320	1.00	C	74.4	C	34.4	100 UC 14.8

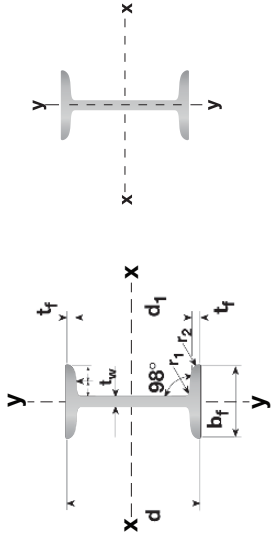
Designation	Yield Stress		Form Factor	About x-axis		About y-axis		Designation
	Flange f_y	Web f_y		Compactness	Z_{xx}	Compactness	Z_{yy}	
	MPa	MPa		10^3mm^3		10^3mm^3		
AS/NZS 3679.1-350								
310 UC 158	340	340	1.00	C	2680	C	1210	310 UC 158
137	340	340	1.00	C	2300	C	1040	137
118	340	340	1.00	N	1950	N	878	118
96.8	340	360	1.00	N	1550	N	684	96.8
250 UC 89.5	340	360	1.00	C	1230	C	567	250 UC 89.5
72.9	340	360	1.00	N	977	N	448	72.9
200 UC 59.5	340	360	1.00	C	656	C	299	200 UC 59.5
52.2	340	360	1.00	N	569	N	260	52.2
46.2	340	360	1.00	N	490	N	219	46.2
150 UC 37.2	340	360	1.00	C	310	C	137	150 UC 37.2
30.0	360	360	1.00	N	248	N	109	30.0
23.4	360	360	1.00	N	174	N	72.3	23.4
100 UC 14.8	360	360	1.00	C	74.4	C	34.4	100 UC 14.8

* 300PLUS® replaced Grade 250 as the base grade for these sections in 1994.
300PLUS® hot rolled sections are produced to exceed the minimum requirements of AS/NZS 3679.1-300.

Notes

1. For 300PLUS® sections the tensile strength (f_t) is 440 MPa.
2. For Grade 350 sections the tensile strength (f_t) is 480 MPa.
3. C: Compact Section; N: Non-compact Section; S: Slender Section.





Tapered Flange Beams

Table 13 Tapered Flange Beams – Dimensions and Properties

Designation	Mass per metre	Depth of Section	Flange Width	Flange Thickness	Web Thickness	Radii			Depth Between Flanges	Gross Area of Cross Section		About x-axis			About y-axis			Torsion Constant	Warping Constant	Designation		
						Root	Toe	Flange		d_1	t_w	$2t_f$	A_g	I_x	Z_x	S_x	r_x				I_y	Z_y
	kg/m	mm	mm	mm	mm	mm	mm	mm	mm	mm ²	10 ⁶ mm ⁴	10 ³ mm ³	10 ⁶ mm ⁴	10 ³ mm ³	10 ⁶ mm ⁴	10 ³ mm ³	mm	mm	10 ³ mm ⁶	10 ³ mm ⁶		
125 TFB	13.1	125	65.0	8.5	5.0	8.0	4.0	108	21.6	3.53	1670	4.34	80.3	69.4	80.3	50.9	50.9	14.2	17.2	40.2	1.14	125 TFB
100 TFB	7.20	100	45.0	6.0	4.0	7.0	3.0	88	22.0	3.42	917	1.46	29.2	29.2	34.1	39.9	39.9	9.31	6.00	11.6	0.176	100 TFB

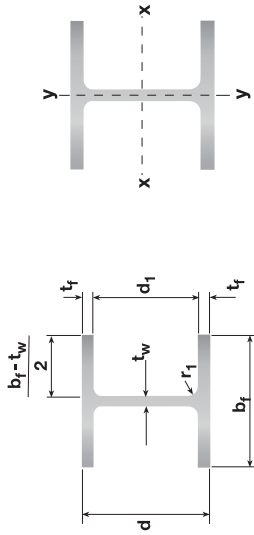
Table 14 Tapered Flange Beams – Properties for Assessing Section Capacity

Designation	Yield Stress			Form Factor	About x-axis			About y-axis			Yield Stress			Form Factor	About x-axis			About y-axis			Designation		
	Flange	Web	f_y		Compactness	Z_{ex}	Z_{ey}	Compactness	Flange	Web	f_y	Compactness	Z_{ex}		Z_{ey}	Compactness	Flange	Web	f_y	Compactness		Z_{ex}	Z_{ey}
	MPa	MPa	MPa		10 ³ mm ³	10 ³ mm ³		MPa	MPa	MPa		10 ³ mm ³	10 ³ mm ³		MPa	MPa	MPa		10 ³ mm ³	10 ³ mm ³			
125 TFB	320	320	320	1.00	C	80.3	C	360	360	360	1.00	C	80.3	C	360	360	360	1.00	C	80.3	C	15.6	125 TFB
100 TFB	320	320	320	1.00	C	34.1	C	360	360	360	1.00	C	34.1	C	360	360	360	1.00	C	34.1	C	5.30	100 TFB

* 300PLUS® replaced Grade 250 as the base grade for these sections in 1997.
300PLUS® hot rolled sections are produced to exceed the minimum requirements of AS/NZS 3679.1-300.

Notes

1. For 300PLUS® sections the tensile strength (f_u) is 430 MPa.
2. For Grade 350 sections the tensile strength (f_u) is 480 MPa.
3. C: Compact Section; N: Non-compact Section; S: Slender Section.



Universal Bearing Piles (refer Note 4)

Table 17 Universal Bearing Piles – Dimensions and Properties

Designation	Depth of Section	Flange		Web		Root Radius	Depth Between Flanges	Gross Area of Cross Section	About x-axis			About y-axis			Torsion Constant	Warping Constant	Designation		
		Width	Thickness	Thickness	Thickness				d_1	$(b_f t_w)$	A_g	I_x	Z_x	S_x				r_x	I_y
kg/m	d	mm	b_f	t_f	t_w	r_f	d_1	mm^2	$10^6 mm^4$	$10^3 mm^3$	$10^3 mm^3$	$10^6 mm^4$	$10^3 mm^3$	$10^3 mm^3$	mm	$10^3 mm^4$	$10^9 mm^6$		
310UBP149	318	316	20.6	20.5	16.5	277	13.5	7.14	19000	330	2080	2370	1070	691	109	1070	2970	2410	310UBP 149
110	308	311	15.4	15.3	16.5	277	18.1	9.57	14000	236	1530	1720	759	494	76.6	759	1240	1640	110
78.8	299	306	11.1	11.1	16.5	277	24.9	13.3	10100	165	1100	1220	530	347	53.1	530	484	1100	78.8
200UBP122	230	220	25.0	25.0	11.4	180	7.20	3.90	15600	129	1120	1340	635	406	44.6	635	3540	469	200UBP 122

Table 18 Universal Bearing Piles – Properties for Assessing Section Capacity

Designation	Yield Stress		Form Factor		About x-axis		About y-axis		Yield Stress		Form Factor		About x-axis		About y-axis		Designation
	Flange f_y	Web f_y	k_f	Compactness	Z_{rx}	Compactness	Z_{ry}	Compactness	Flange f_y	Web f_y	k_f	Compactness	Z_{rx}	Compactness	Z_{ry}	Compactness	
	MPa	MPa			$10^3 mm^3$		$10^3 mm^3$		MPa	MPa			$10^3 mm^3$		$10^3 mm^3$		
	300PLUS® *																
310 UB P 149	280	280	1.00	C	2370	C	1040	C	340	340	1.00	C	2370	C	1040	C	310 UB P 149
110	300	300	1.00	N	1680	N	718	N	340	340	1.00	N	1680	N	708	N	110
78.8	300	300	1.00	N	1130	N	460	N	340	340	1.00	N	1110	N	450	N	78.8
200 UB P 122	280	280	1.00	C	1340	C	609	C	340	340	1.00	C	1340	C	609	C	200 UB P 122

* 300PLUS® hot rolled sections are produced to exceed the minimum requirements of AS/NZS 3679.1-300.

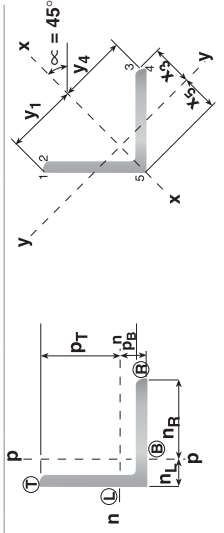
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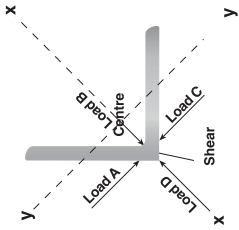
1. For 300PLUS® sections the tensile strength (f_t) is 440 MPa.
2. For Grade 350 sections the tensile strength (f_t) is 480 MPa.
3. C: Compact Section; N: Non-compact Section; S: Slender Section.
4. These sections are generally not stocked and are available for project orders only subject to enquiry from your nearest Liberty Steel Sales Office.

Equal Angles

Table 19 Equal Angles – x-axis and y-axis – Dimensions and Properties

Designation	Nominal Thickness	Mass per metre	Actual Thickness		Radii		Gross Area of Cross Section		Coordinate of Centroid		About x-axis						About y-axis						Torsion Constant	Designation
			t	t	Root	Toe	(b ₁ -t)	A _g	P _B	n _c	n _r	I _x	y ₄	Z _{x4}	S _x	r _x	I _y	x ₃	Z _{y3}	x ₅	Z _{y5}	S _y		
200 x 200 x 26 EA	26.0	76.8	18.0	6.69	9780	59.3	141	56.8	141	402	643	76.2	14.9	73.9	202	83.8	178	329	39.0	2250	200 x 200 x 26 EA			
20 EA	20.0	60.1	18.0	9.00	7660	57.0	143	45.7	143	323	511	77.2	11.8	72.9	162	80.6	147	260	39.3	1060	20 EA			
18 EA	18.0	54.4	18.0	10.1	6930	56.2	144	41.7	144	266	417	77.9	10.8	72.6	149	79.5	136	236	39.4	778	18 EA			
16 EA	16.0	48.7	18.0	11.5	6200	55.4	145	37.6	145	211	344	78.3	9.72	72.3	135	78.4	124	212	39.6	554	16 EA			
13 EA	13.0	40.0	18.0	14.4	5090	54.2	146	31.2	146	166	265	57.8	8.08	71.9	112	76.6	105	176	39.8	304	13 EA			
150 x 150 x 19 EA	19.0	42.1	13.0	6.89	5360	44.2	106	17.6	106	106	166	265	4.60	54.9	83.8	62.6	73.5	135	29.3	657	150 x 150 x 19 EA			
16 EA	15.8	35.4	13.0	8.49	4520	43.0	107	15.1	106	142	225	57.2	3.91	54.3	71.9	60.8	64.2	115	29.4	386	16 EA			
12 EA	12.0	27.3	13.0	11.5	3480	41.5	108	11.9	108	112	175	58.4	3.06	53.7	56.9	58.7	52.1	89.3	29.6	174	12 EA			
10 EA	10.0	21.9	13.0	14.8	2790	40.5	109	9.61	109	96.1	106	90.6	2.48	53.4	46.4	57.3	43.3	72.0	29.8	88.9	10 EA			
125 x 125 x 16 EA	29.1	15.8	10.0	6.91	3710	36.8	88.2	8.43	88.4	95.4	153	47.7	2.20	45.4	48.5	52.1	42.3	77.8	24.4	313	125 x 125 x 16 EA			
12 EA	22.5	12.0	10.0	9.42	2870	35.4	89.6	6.69	88.4	75.7	120	48.3	1.73	44.7	38.6	50.1	34.5	60.8	24.5	141	12 EA			
10 EA	18.0	9.5	10.0	12.2	2300	34.4	90.6	5.44	88.4	61.6	96.5	48.7	1.40	44.4	31.5	48.7	28.8	49.0	24.7	71.9	10 EA			
8 EA	14.9	7.8	10.0	15.0	1900	33.7	91.3	4.55	88.4	51.5	80.2	48.9	1.17	44.2	26.5	47.7	24.5	40.8	24.8	40.6	8 EA			
100 x 100 x 12 EA	17.7	12.0	8.0	7.33	2260	29.2	70.8	3.29	70.7	46.6	74.5	38.2	0.857	35.8	23.9	41.3	20.8	37.9	19.5	110	100 x 100 x 12 EA			
10 EA	14.2	9.5	8.0	9.53	1810	28.2	71.8	2.70	70.7	38.2	60.4	38.6	0.695	35.4	19.6	39.9	17.4	30.7	19.6	56.2	10 EA			
8 EA	11.8	7.8	8.0	11.8	1500	27.5	72.5	2.27	70.7	32.0	50.3	38.8	0.582	35.2	16.5	38.9	14.9	25.6	19.7	31.7	8 EA			
6 EA	9.16	6.0	8.0	15.7	1170	26.8	73.2	1.78	70.7	25.2	39.3	39.1	0.458	35.0	13.1	37.9	12.1	20.0	19.8	14.8	6 EA			
90 x 90 x 10 EA	12.7	9.5	8.0	8.47	1620	25.7	64.3	1.93	63.6	30.4	48.3	34.5	0.500	31.9	15.7	36.4	13.8	24.6	17.6	50.5	90 x 90 x 10 EA			
8 EA	10.6	7.8	8.0	10.5	1350	25.0	65.0	1.63	63.6	25.6	40.4	34.8	0.419	31.7	13.2	35.4	11.8	20.5	17.6	28.6	8 EA			
6 EA	8.22	6.0	8.0	14.0	1050	24.3	65.7	1.28	63.6	20.1	31.6	35.0	0.330	31.5	10.5	34.3	9.62	16.1	17.8	13.4	6 EA			
75 x 75 x 10 EA	10.5	9.5	8.0	6.89	1340	22.0	53.0	1.08	53.0	20.4	32.8	28.4	0.282	26.6	10.6	31.1	9.09	16.8	14.5	41.9	75 x 75 x 10 EA			
8 EA	8.73	7.8	8.0	8.62	1110	21.3	53.7	0.913	53.0	17.2	27.5	28.7	0.237	26.4	8.99	30.1	7.87	14.0	14.6	23.8	8 EA			
6 EA	6.81	6.0	8.0	11.5	867	20.5	54.5	0.722	53.0	13.6	21.6	28.9	0.187	26.2	7.15	29.0	6.44	11.0	14.7	11.2	6 EA			
5 EA	5.27	4.6	8.0	15.3	672	19.9	55.1	0.563	53.0	10.6	16.7	29.0	0.147	26.1	5.62	28.1	5.22	8.61	14.8	5.28	5 EA			
65 x 65 x 10 EA	9.02	9.5	6.0	5.84	1150	19.6	45.4	0.691	46.0	15.0	24.3	24.5	0.183	23.7	7.71	27.7	6.60	12.5	12.6	35.1	65 x 65 x 10 EA			
8 EA	7.51	7.8	6.0	7.33	957	19.0	46.0	0.589	46.0	12.8	20.5	24.8	0.154	23.4	6.56	26.8	5.73	10.5	12.7	20.0	8 EA			
6 EA	5.87	6.0	6.0	9.83	748	18.3	46.7	0.471	46.0	10.2	16.2	25.1	0.122	23.1	5.26	25.8	4.71	8.25	12.8	9.37	6 EA			
5 EA	4.56	4.6	6.0	13.1	581	17.7	47.3	0.371	46.0	8.08	12.7	25.3	0.0959	23.0	4.18	25.0	3.83	6.46	12.9	4.36	5 EA			
55 x 55 x 6 EA	4.93	6.0	6.0	8.17	628	15.8	39.2	0.278	38.9	7.14	11.4	21.0	0.0723	19.6	3.69	22.3	3.24	5.82	10.7	7.93	55 x 55 x 6 EA			
5 EA	3.84	4.6	6.0	11.0	489	15.2	39.8	0.220	38.9	5.66	8.93	21.2	0.0571	19.4	2.94	21.5	2.66	4.57	10.8	3.71	5 EA			
50 x 50 x 8 EA	5.68	7.8	6.0	5.41	723	15.2	34.8	0.253	35.4	7.16	11.7	18.7	0.0675	18.1	3.73	21.5	3.14	6.00	9.66	15.2	50 x 50 x 8 EA			
6 EA	4.46	6.0	6.0	7.33	568	14.5	35.5	0.205	35.4	5.79	9.30	19.0	0.0536	17.8	3.01	20.5	2.61	4.76	9.71	7.21	6 EA			
5 EA	3.48	4.6	6.0	9.87	443	13.9	36.1	0.163	35.4	4.61	7.32	19.2	0.0424	17.6	2.40	19.7	2.15	3.75	9.78	3.38	5 EA			
3 EA	2.31	3.0	6.0	15.7	295	13.2	36.8	0.110	35.4	3.11	4.90	19.3	0.0289	17.6	1.65	18.7	1.55	2.53	9.90	1.01	3 EA			
45 x 45 x 6 EA	3.97	6.0	5.0	6.50	506	13.3	31.7	0.146	31.8	4.59	7.41	17.0	0.0383	16.0	2.39	18.8	2.04	3.79	8.71	6.32	45 x 45 x 6 EA			
5 EA	3.10	4.6	5.0	8.78	394	12.7	32.3	0.117	31.8	3.66	5.84	17.2	0.0303	15.8	1.91	18.0	1.68	2.99	8.76	2.96	5 EA			
3 EA	2.06	3.0	5.0	14.0	263	12.0	33.0	0.0790	31.8	2.48	3.92	17.3	0.0206	15.7	1.31	17.0	1.21	2.02	8.85	0.875	3 EA			
40 x 40 x 6 EA	3.50	6.0	5.0	5.67	446	12.0	28.0	0.0997	28.3	3.53	5.75	15.0	0.0265	14.3	1.86	17.0	1.55	2.95	7.71	5.60	40 x 40 x 6 EA			
5 EA	2.73	4.6	5.0	7.70	348	11.5	28.5	0.0801	28.3	2.83	4.55	15.2	0.0209	14.0	1.49	16.2	1.29	2.33	7.75	2.63	5 EA			
3 EA	1.83	3.0	5.0	12.3	233	10.8	29.2	0.0545	28.3	1.93	3.06	15.3	0.0142	13.9	1.02	15.3	0.933	1.58	7.82	0.785	3 EA			
30 x 30 x 6 EA	2.56	6.0	5.0	4.00	326	9.53	20.5	0.0387	21.2	1.83	3.06	10.9	0.0107	10.7	0.993	13.5	0.790	1.59	5.72	4.16	30 x 30 x 6 EA			
5 EA	2.01	4.6	5.0	5.52	256	8.99	21.0	0.0316	21.2	1.49	2.45	11.1	0.00839	10.5	0.799	12.7	0.660	1.26	5.72	1.98	5 EA			
3 EA	1.35	3.0	5.0	9.00	173	8.30	21.7	0.0218	21.2	1.03	1.67	11.2	0.00573	10.3	0.554	11.7	0.488	0.862	5.76	0.605	3 EA			
25 x 25 x 6 EA	2.08	6.0	5.0	3.17	266	8.28	16.7	0.0210	17.7	1.19	2.03	8.89	0.00600	8.97	0.669	11.7	0.513	1.07	4.75	3.44	25 x 25 x 6 EA			
5 EA	1.65	4.6	5.0	4.43	210	7.75	17.3	0.0173	17.7	0.980	1.65	9.07	0.00469	8.73	0.537	11.0	0.428	0.849	4.72	1.66	5 EA			
3 EA	1.12	3.0	5.0	7.33	143	7.07	17.9	0.0121	17.7	0.685	1.13	9.22	0.00319	8.56	0.373	9.99	0.319	0.583	4.73	0.515	3 EA			





Equal Angles

Table 20 Equal Angles – x-axis and y-axis – Properties for Assessing Section Capacity

Designation	Yield Stress			Form Factor	About x-axis			About y-axis			Designation					
	f _y MPa	k _f	Z _{ex} 10 ³ mm ³		Load A or C	Z _{ey} 10 ³ mm ³	Load D	f _y MPa	k _f	Z _{ex} 10 ³ mm ³		Load A or C	Z _{ey} 10 ³ mm ³	Load D		
300PLUS® *																
200 x 200 x 26 EA	280	1.00	602	1.00	267	267	340	1.00	602	267	267	340	1.00	602	267	200 x 200 x 26 EA
20 EA	280	1.00	479	1.00	218	220	340	1.00	469	214	220	340	1.00	469	214	20 EA
18 EA	280	1.00	427	1.00	196	204	340	1.00	417	192	204	340	1.00	417	192	18 EA
16 EA	300	1.00	369	1.00	172	186	340	1.00	362	169	186	340	1.00	362	169	16 EA
13 EA	300	1.00	285	1.00	136	158	340	0.956	278	132	158	340	0.956	278	132	13 EA
150 x 150 x 19 EA	280	1.00	248	1.00	110	110	340	1.00	248	110	110	340	1.00	248	110	150 x 150 x 19 EA
16 EA	300	1.00	212	1.00	95.7	96.3	340	1.00	209	94.5	96.3	340	1.00	209	94.5	16 EA
12 EA	300	1.00	155	1.00	72.3	78.1	340	1.00	152	70.9	78.1	340	1.00	152	70.9	12 EA
10 EA	320	0.958	114	1.00	54.5	64.9	360	0.906	111	53.1	64.9	360	0.906	111	53.1	10 EA
125 x 125 x 16 EA	300	1.00	143	1.00	63.4	63.4	340	1.00	143	63.4	63.4	340	1.00	143	63.4	125 x 125 x 16 EA
12 EA	300	1.00	110	1.00	50.3	51.7	340	1.00	109	49.6	51.7	340	1.00	109	49.6	12 EA
10 EA	320	1.00	83.2	1.00	38.9	43.1	360	1.00	81.6	38.1	43.1	360	1.00	81.6	38.1	10 EA
8 EA	320	0.943	64.3	1.00	30.7	36.8	360	0.892	62.7	29.9	36.8	360	0.892	62.7	29.9	8 EA
100 x 100 x 12 EA	300	1.00	69.9	1.00	31.1	31.1	340	1.00	69.9	31.1	31.1	340	1.00	69.9	31.1	100 x 100 x 12 EA
10 EA	320	1.00	55.1	1.00	25.2	26.1	360	1.00	54.4	24.8	26.1	360	1.00	54.4	24.8	10 EA
8 EA	320	1.00	43.7	1.00	20.4	22.4	360	1.00	42.9	20.0	22.4	360	1.00	42.9	20.0	8 EA
6 EA	320	0.906	30.9	1.00	14.8	18.1	360	0.856	30.0	14.4	18.1	360	0.856	30.0	14.4	6 EA
90 x 90 x 10 EA	320	1.00	45.0	1.00	20.4	20.6	360	1.00	44.5	20.1	20.6	360	1.00	44.5	20.1	90 x 90 x 10 EA
8 EA	320	1.00	36.0	1.00	16.7	17.8	360	1.00	35.4	16.4	17.8	360	1.00	35.4	16.4	8 EA
6 EA	320	1.00	25.9	1.00	12.4	14.4	360	0.954	25.3	12.1	14.4	360	0.954	25.3	12.1	6 EA
75 x 75 x 10 EA	320	1.00	30.5	1.00	13.6	13.6	360	1.00	30.5	13.6	13.6	360	1.00	30.5	13.6	75 x 75 x 10 EA
8 EA	320	1.00	25.4	1.00	11.6	11.8	360	1.00	25.1	11.5	11.8	360	1.00	25.1	11.5	8 EA
6 EA	320	1.00	18.7	1.00	8.85	9.66	360	1.00	18.4	8.70	9.66	360	1.00	18.4	8.70	6 EA
5 EA	320	0.927	13.2	1.00	6.47	7.82	360	0.876	12.8	6.30	7.82	360	0.876	12.8	6.30	5 EA
65 x 65 x 10 EA	320	1.00	22.5	1.00	9.90	9.90	360	1.00	22.5	9.90	9.90	360	1.00	22.5	9.90	65 x 65 x 10 EA
8 EA	320	1.00	19.2	1.00	8.59	8.59	360	1.00	19.2	8.59	8.59	360	1.00	19.2	8.59	8 EA
6 EA	320	1.00	14.7	1.00	6.76	7.07	360	1.00	14.5	6.66	7.07	360	1.00	14.5	6.66	6 EA
5 EA	320	1.00	10.6	1.00	5.05	5.75	360	1.00	10.4	4.94	5.75	360	1.00	10.4	4.94	5 EA
55 x 55 x 6 EA	320	1.00	10.7	1.00	4.84	4.86	360	1.00	10.5	4.78	4.86	360	1.00	10.5	4.78	55 x 55 x 6 EA
5 EA	320	1.00	7.88	1.00	3.70	3.98	360	1.00	7.75	3.64	3.98	360	1.00	7.75	3.64	5 EA
50 x 50 x 8 EA	320	1.00	10.7	1.00	4.71	4.71	360	1.00	10.7	4.71	4.71	360	1.00	10.7	4.71	50 x 50 x 8 EA
6 EA	320	1.00	8.69	1.00	3.92	3.92	360	1.00	8.69	3.92	3.92	360	1.00	8.69	3.92	6 EA
5 EA	320	1.00	6.60	1.00	3.08	3.22	360	1.00	6.50	3.03	3.22	360	1.00	6.50	3.03	5 EA
3 EA	320	0.907	3.82	1.00	1.90	2.32	360	0.858	3.71	1.85	2.32	360	0.858	3.71	1.85	3 EA
45 x 45 x 6 EA	320	1.00	6.88	1.00	3.06	3.06	360	1.00	6.88	3.06	3.06	360	1.00	6.88	3.06	45 x 45 x 6 EA
5 EA	320	1.00	5.39	1.00	2.47	2.52	360	1.00	5.32	2.44	2.52	360	1.00	5.32	2.44	5 EA
3 EA	320	1.00	3.19	1.00	1.55	1.81	360	0.954	3.12	1.52	1.81	360	0.954	3.12	1.52	3 EA
40 x 40 x 6 EA	320	1.00	5.29	1.00	2.33	2.33	360	1.00	5.29	2.33	2.33	360	1.00	5.29	2.33	40 x 40 x 6 EA
5 EA	320	1.00	4.25	1.00	1.93	1.93	360	1.00	4.22	1.92	1.93	360	1.00	4.22	1.92	5 EA
3 EA	320	1.00	2.59	1.00	1.25	1.40	360	1.00	2.54	1.23	1.40	360	1.00	2.54	1.23	3 EA
30 x 30 x 6 EA	320	1.00	2.74	1.00	1.19	1.19	360	1.00	2.74	1.19	1.19	360	1.00	2.74	1.19	30 x 30 x 6 EA
5 EA	320	1.00	2.23	1.00	0.990	0.990	360	1.00	2.23	0.990	0.990	360	1.00	2.23	0.990	5 EA
3 EA	320	1.00	1.50	1.00	0.714	0.732	360	1.00	1.48	0.705	0.732	360	1.00	1.48	0.705	3 EA
25 x 25 x 6 EA	320	1.00	1.78	1.00	0.769	0.769	360	1.00	1.78	0.769	0.769	360	1.00	1.78	0.769	25 x 25 x 6 EA
5 EA	320	1.00	1.47	1.00	0.642	0.642	360	1.00	1.47	0.642	0.642	360	1.00	1.47	0.642	5 EA
3 EA	320	1.00	1.03	1.00	0.479	0.479	360	1.00	1.03	0.479	0.479	360	1.00	1.03	0.479	3 EA

Notes

1. For 300PLUS® sections the tensile strength (fu) is 440 MPa.
2. For Grade 350 sections the tensile strength (fu) is 480 MPa.

* 300PLUS® replaced Grade 250 as the base grade for 125 x 125 x 8 equal angles and larger in 1994.

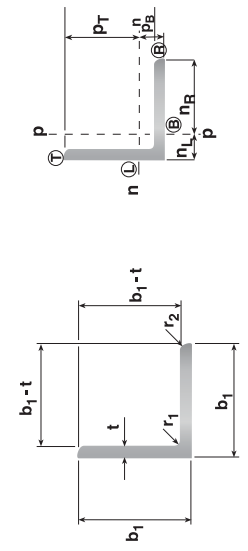
300PLUS® replaced Grade 250 as the base grade for 100 x 100 x 12 equal angles and smaller in 1997.

300PLUS® hot rolled sections are produced to exceed the minimum requirements of AS/NZS 3679:1-300.

Equal Angles

Table 21 Equal Angles – n-axis and p-axis – Properties

Designation	About n-axis and p-axis						Product of 2nd Moment of Area		Designation
	$I_n = I_p$ 10^6mm^4	$I_n = P_B$ mm	$Z_{nB} = Z_{pL}$ 10^3mm^3	$I_n = P_T$ mm	$Z_{nT} = Z_{pR}$ 10^3mm^3	$S_n = S_p$ 10^3mm^3	$r_n = r_p$ mm	I_{np} 10^6mm^4	
200 x 200 x 26 EA	358	593	605	141	255	460	605	-209	
20 EA	288	570	505	143	201	363	613	-169	
18 EA	263	562	467	144	183	330	615	-155	
16 EA	237	554	427	145	164	296	618	-140	
13 EA	197	542	363	146	135	243	622	-116	
150 x 150 x 19 EA	11.1	442	250	106	105	189	454	-648	
16 EA	9.48	430	220	107	88.7	160	458	-558	
12 EA	7.46	415	180	108	68.8	124	463	-440	
10 EA	6.04	405	149	109	55.2	99.9	466	-356	
125 x 125 x 16 EA	5.32	368	144	88.2	60.3	109	37.9	-3.11	
12 EA	4.21	354	119	89.6	47.0	85.0	38.3	-2.48	
10 EA	3.42	344	99.4	90.6	37.8	68.4	38.6	-2.02	
8 EA	2.86	337	84.9	91.3	31.3	56.8	38.8	-1.69	
100 x 100 x 12 EA	2.08	292	71.1	70.8	29.3	53.2	30.3	-1.22	
10 EA	1.70	282	60.1	71.8	23.6	42.9	30.6	-1.00	
8 EA	1.42	275	51.7	72.5	19.6	35.7	30.8	-0.842	
6 EA	1.12	268	41.8	73.2	15.3	27.8	31.0	-0.661	
90 x 90 x 10 EA	1.22	257	47.3	64.3	18.9	34.4	27.4	-0.716	
8 EA	1.02	250	40.9	65.0	15.7	28.7	27.6	-0.604	
6 EA	0.805	243	33.2	65.7	12.3	22.4	27.7	-0.475	
75 x 75 x 10 EA	0.681	220	31.0	53.0	12.8	23.4	22.6	-0.399	
8 EA	0.575	213	27.0	53.7	10.7	19.6	22.7	-0.338	
6 EA	0.455	205	22.1	54.5	8.35	15.3	22.9	-0.268	
5 EA	0.355	199	17.9	55.1	6.44	11.8	23.0	-0.208	
65 x 65 x 10 EA	0.437	196	22.3	45.4	9.62	17.4	19.5	-0.254	
8 EA	0.371	190	19.6	46.0	8.07	14.6	19.7	-0.218	
6 EA	0.296	183	16.2	46.7	6.34	11.5	19.9	-0.175	
5 EA	0.234	177	13.2	47.3	4.94	8.97	20.1	-0.138	
55 x 55 x 6 EA	0.175	158	11.1	39.2	4.46	8.11	16.7	-0.103	
5 EA	0.139	152	9.12	39.8	3.48	6.34	16.8	-0.0814	
50 x 50 x 8 EA	0.160	152	10.5	34.8	4.61	8.38	14.9	-0.0928	
6 EA	0.129	145	8.90	35.5	3.64	6.63	15.1	-0.0756	
5 EA	0.103	139	7.36	36.1	2.85	5.19	15.2	-0.0602	
3 EA	0.0694	132	5.25	36.8	1.89	3.46	15.3	-0.0405	
45 x 45 x 6 EA	0.0922	133	6.93	31.7	2.91	5.30	13.5	-0.0538	
5 EA	0.0734	127	5.76	32.3	2.28	4.16	13.6	-0.0432	
3 EA	0.0498	120	4.14	33.0	1.51	2.77	13.8	-0.0292	
40 x 40 x 6 EA	0.0631	120	5.24	28.0	2.26	4.12	11.9	-0.0366	
5 EA	0.0505	115	4.39	28.5	1.77	3.24	12.0	-0.0296	
3 EA	0.0344	108	3.19	29.2	1.18	2.17	12.2	-0.0201	
30 x 30 x 6 EA	0.0247	95.3	2.59	20.5	1.21	2.22	8.71	-0.0140	
5 EA	0.0200	89.9	2.22	21.0	0.951	1.76	8.83	-0.0116	
3 EA	0.0138	83.0	1.66	21.7	0.635	1.18	8.93	-0.00804	
25 x 25 x 6 EA	0.0135	82.8	1.63	16.7	0.807	1.49	7.13	-0.00750	
5 EA	0.0110	77.5	1.42	17.3	0.638	1.19	7.23	-0.00632	
3 EA	0.00765	70.7	1.08	17.9	0.426	0.802	7.33	-0.00446	



Unequal Angles

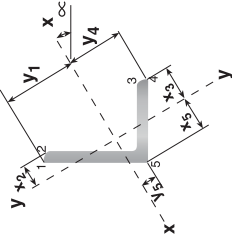
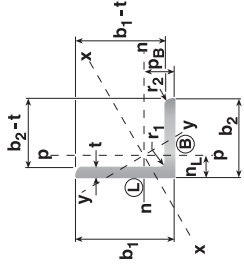


Table 22 Unequal Angles – x-axis and y-axis – Dimensions and Properties

Designation	Nominal Mass Thickness p/ mm	Actual Thickness mm	Radii	Gross Area of Cross Section mm ²	About x-axis					About y-axis					Torsion Constant mm ⁴	Tan Alpha	Designation												
					I_x	I_y	I_{xy}	Z_{x1}	Z_{x2}	Z_{x3}	Z_{x4}	Z_{x5}	Z_{x6}	Z_{y1}				Z_{y2}	Z_{y3}	Z_{y4}	Z_{y5}	Z_{y6}	S_x	S_y	J				
150 x 100 x 12 UA	22.5	12.0	100 5.0	11.5	7.33	2870	49.1	24.3	7.51	102	73.5	75.3	99.7	35.2	213	127	51.2	1.35	27.6	48.8	52.9	25.5	42.0	32.1	51.7	21.7	141	0.438	150 x 100 x 12 UA
10 UA	18.0	9.5	100 5.0	14.8	9.53	2300	48.1	23.3	6.11	103	59.5	74.9	81.5	34.6	177	102	51.6	1.09	26.9	40.7	53.0	20.6	40.7	26.9	41.8	21.8	71.9	0.441	10 UA
150 x 90 x 16 UA	27.9	15.8	100 5.0	8.49	4.70	3550	52.5	22.7	8.80	99.5	88.4	71.9	122	41.9	210	154	49.8	1.32	24.6	53.8	49.9	26.5	38.9	34.0	55.9	19.3	300	0.353	150 x 90 x 16 UA
12 UA	21.6	12.0	100 5.0	11.5	6.50	2750	51.0	21.2	6.97	100	69.4	71.3	97.8	40.8	171	120	50.4	1.04	23.4	44.5	50.1	20.8	37.2	28.0	43.8	19.5	136	0.360	12 UA
10 UA	17.3	9.5	100 5.0	14.8	8.47	2200	50.0	20.2	5.66	101	56.1	70.7	80.1	40.1	141	96.6	50.7	0.847	22.6	37.4	50.4	16.8	36.1	23.5	35.4	19.6	69.0	0.363	10 UA
8 UA	14.3	7.8	100 5.0	18.2	10.5	1820	49.2	19.6	4.73	101	46.7	70.3	67.3	39.5	120	80.1	51.0	0.710	22.1	32.2	50.6	14.0	35.2	20.2	29.5	19.7	39.0	0.364	8 UA
125 x 75 x 12 UA	17.7	12.0	80 5.0	9.42	5.25	2260	43.3	18.4	3.91	83.2	47.0	59.7	65.5	34.6	113	81.4	41.6	0.585	19.9	29.3	41.4	14.1	31.9	18.4	29.7	16.1	110	0.356	125 x 75 x 12 UA
10 UA	14.2	9.5	80 5.0	12.2	6.89	1810	42.3	17.5	3.20	83.8	38.2	59.3	53.9	33.9	94.4	65.8	42.0	0.476	19.2	24.9	41.6	11.4	30.7	15.5	24.1	16.2	56.2	0.360	10 UA
8 UA	11.8	7.8	80 5.0	15.0	8.62	1500	41.5	16.8	2.68	84.2	31.8	58.9	45.5	33.3	80.4	54.6	42.2	0.399	18.6	21.5	41.8	9.55	29.9	13.3	20.1	16.3	31.7	0.363	8 UA
6 UA	9.16	6.0	80 5.0	19.8	11.5	1170	40.7	16.0	2.10	84.7	24.8	58.5	36.0	32.8	64.1	42.4	42.5	0.315	18.0	17.5	42.1	7.47	29.0	10.8	15.7	16.4	14.8	0.364	6 UA
100 x 75 x 10 UA	12.4	9.5	80 5.0	9.53	6.89	1580	31.8	19.4	1.89	69.2	27.3	54.5	34.6	18.6	101	46.5	34.6	0.401	22.3	18.0	36.4	11.0	32.2	12.5	21.2	16.0	49.1	0.546	100 x 75 x 10 UA
8 UA	10.3	7.8	80 5.0	11.8	8.62	1310	31.1	18.7	1.59	69.4	22.9	54.3	29.2	18.2	87.0	38.7	34.8	0.337	21.8	15.4	36.4	9.26	31.3	10.7	17.8	16.0	27.8	0.549	8 UA
6 UA	7.98	6.0	80 5.0	15.7	11.5	1020	30.3	17.9	1.25	69.7	17.9	54.0	23.1	17.9	70.0	30.1	35.1	0.265	21.4	12.4	36.5	7.27	30.3	8.75	13.9	16.2	13.0	0.551	6 UA
75 x 50 x 8 UA	7.23	7.8	70 3.0	8.62	5.41	921	25.2	12.8	0.586	50.8	11.5	37.8	15.5	18.0	32.5	20.0	25.2	0.106	14.2	7.46	26.4	4.01	21.7	4.88	8.19	10.7	19.5	0.430	75 x 50 x 8 UA
6 UA	5.66	6.0	70 3.0	11.5	7.33	721	24.4	12.1	0.468	51.2	9.15	37.5	12.5	17.6	26.7	15.8	25.5	0.0842	13.6	6.17	26.5	3.18	20.8	4.04	6.48	10.8	9.21	0.435	6 UA
5 UA	4.40	4.6	70 3.0	15.3	9.87	560	23.8	11.5	0.370	51.5	7.17	37.2	9.93	17.2	21.5	12.3	25.7	0.0666	13.2	5.03	26.6	2.50	20.1	3.32	5.09	10.9	4.32	0.437	5 UA
65 x 50 x 8 UA	6.59	7.8	60 3.0	7.33	5.41	840	21.1	13.6	0.421	44.9	9.37	36.3	11.6	11.6	36.4	16.1	22.4	0.0936	15.6	6.00	23.9	3.91	22.3	4.20	7.49	10.6	17.6	0.570	65 x 50 x 8 UA
6 UA	5.16	6.0	60 3.0	9.83	7.33	658	20.4	12.9	0.338	45.2	7.48	36.1	9.35	11.2	30.2	12.7	22.7	0.0743	15.1	4.91	23.9	3.11	21.4	3.48	5.93	10.6	8.29	0.575	6 UA
5 UA	4.02	4.6	60 3.0	13.1	9.87	512	19.8	12.4	0.267	45.4	5.89	35.9	7.43	10.9	24.5	9.92	22.8	0.0587	14.8	3.97	23.9	2.46	20.6	2.85	4.66	10.7	3.87	0.577	5 UA

Unequal Angles

Table 23 Unequal Angles – x-axis and y-axis – Properties for Assessing Section Capacity

Designation	Yield Stress f_y MPa	Form Factor k_f	About x-axis			About y-axis			Yield Stress f_y MPa	Form Factor k_f	About x-axis			About y-axis			Designation
			Load A Z_{ex}	Load C Z_{ex}	Load B Z_{ey}	Load D Z_{ey}	Load A Z_{ex}	Load C Z_{ex}			Load B Z_{ey}	Load D Z_{ey}	Load A Z_{ex}	Load C Z_{ex}	Load B Z_{ey}	Load D Z_{ey}	
300PLUS® *																	
150 x 100 x 12 UA	300	1.00	102	110	35.3	38.2	100	110	1.00	100	110	34.7	38.2	150 x 100 x 12 UA			
10 UA	320	0.975	74.8	81.7	26.0	30.9	73.0	78.9	0.943	73.0	78.9	25.3	30.9	10 UA			
150 x 90 x 16 UA	300	1.00	132	133	39.5	39.8	130	133	1.00	130	133	39.0	39.8	150 x 90 x 16 UA			
12 UA	300	1.00	96.3	104	28.8	31.1	94.6	104	1.00	94.6	104	28.3	31.1	12 UA			
10 UA	320	0.973	70.6	81.8	21.2	25.2	68.8	79.5	0.940	68.8	79.5	20.6	25.2	10 UA			
8 UA	320	0.863	53.1	60.3	15.9	21.0	51.2	57.9	0.836	51.2	57.9	15.4	21.0	8 UA			
125 x 75 x 12 UA	300	1.00	68.6	70.5	20.6	21.2	67.6	70.5	1.00	67.6	70.5	20.3	21.2	125 x 75 x 12 UA			
10 UA	320	1.00	51.6	57.2	15.5	17.2	50.6	57.2	1.00	50.6	57.2	15.2	17.2	10 UA			
8 UA	320	0.964	39.8	46.0	11.9	14.3	38.8	44.7	0.931	38.8	44.7	11.6	14.3	8 UA			
6 UA	320	0.824	26.8	30.1	8.07	11.2	25.8	28.7	0.799	25.8	28.7	7.75	11.2	6 UA			
100 x 75 x 10 UA	320	1.00	39.4	40.9	15.9	16.6	38.8	40.9	1.00	38.8	40.9	15.7	16.6	100 x 75 x 10 UA			
8 UA	320	1.00	31.2	33.1	12.6	13.9	30.6	32.1	1.00	30.6	32.1	12.4	13.9	8 UA			
6 UA	320	0.946	22.0	21.8	8.93	10.9	21.4	20.7	0.917	21.4	20.7	8.68	10.9	6 UA			
75 x 50 x 8 UA	320	1.00	17.0	17.3	5.93	6.02	16.8	17.3	1.00	16.8	17.3	5.85	6.02	75 x 50 x 8 UA			
6 UA	320	1.00	12.6	13.7	4.37	4.77	12.4	13.7	1.00	12.4	13.7	4.30	4.77	6 UA			
5 UA	320	0.956	8.89	9.65	3.10	3.75	8.66	9.30	0.926	8.66	9.30	3.02	3.75	5 UA			
65 x 50 x 8 UA	320	1.00	14.1	14.1	5.86	5.86	14.1	14.1	1.00	14.1	14.1	5.86	5.86	65 x 50 x 8 UA			
6 UA	320	1.00	10.7	11.2	4.46	4.67	10.6	11.2	1.00	10.6	11.2	4.40	4.67	6 UA			
5 UA	320	1.00	7.76	7.92	3.23	3.68	7.59	7.64	1.00	7.59	7.64	3.17	3.68	5 UA			

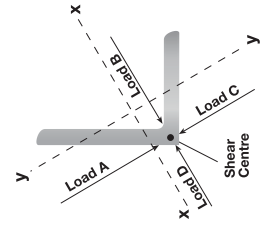
* 300PLUS® replaced Grade 250 as the base grade for 150 x 90 x 8 unequal angles and larger in 1994.

300PLUS® replaced Grade 250 as the base grade for 125 x 75 x 12 unequal angles and smaller in 1997.

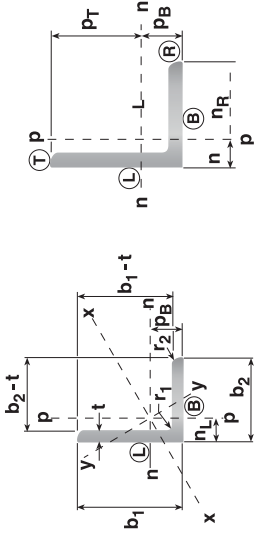
300PLUS® hot rolled sections are produced to exceed the minimum requirements of AS/NZS 3679.1:300.

Notes

1. For 300PLUS® sections the tensile strength (fu) is 440 MPa.
2. For Grade 350 sections the tensile strength (fu) is 480 MPa.



Unequal Angles


Table 24 Unequal Angles – n-axis and p-axis – Dimensions and Properties

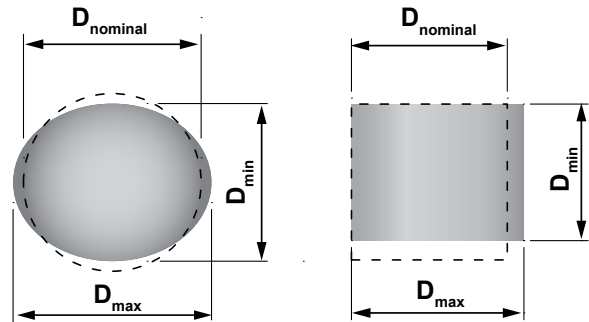
Designation	About n-axis										About p-axis										Product of 2nd Moment of Area	Designation
	I_n	P_B	Z_{nB}	P_T	Z_{nT}	S_n	r_n	I_p	n_L	Z_{pL}	n_R	Z_{pR}	S_p	r_p	I_{np}							
150 x 100 x 12 UA	6.52	49.1	133	101	64.6	117	47.7	2.34	24.3	96.2	75.7	30.9	56.0	28.6	-2.27	150 x 100 x 12 UA						
10 UA	5.29	48.1	110	102	51.9	94.0	48.0	1.91	23.3	81.9	76.7	24.9	44.7	28.8	-1.85	10 UA						
150 x 90 x 16 UA	7.97	52.5	152	97.5	81.7	145	47.4	2.15	22.7	94.9	67.3	32.0	59.5	24.6	-2.35	150 x 90 x 16 UA						
12 UA	6.29	51.0	123	99.0	63.5	114	47.8	1.72	21.2	81.0	68.8	25.0	45.7	25.0	-1.89	12 UA						
10 UA	5.10	50.0	102	100	51.0	91.5	48.2	1.41	20.2	69.5	69.8	20.2	36.5	25.3	-1.54	10 UA						
8 UA	4.26	49.2	86.6	101	42.3	76.0	48.4	1.18	19.6	60.4	70.4	16.8	30.1	25.5	-1.29	8 UA						
125 x 75 x 12 UA	3.54	43.3	81.8	81.7	43.3	77.3	39.6	0.958	18.4	52.0	56.6	16.9	31.4	20.6	-1.05	125 x 75 x 12 UA						
10 UA	2.88	42.3	68.2	82.7	34.9	62.5	39.9	0.789	17.5	45.2	57.5	13.7	25.1	20.9	-0.867	10 UA						
8 UA	2.41	41.5	58.1	83.5	28.9	52.0	40.1	0.664	16.8	39.6	58.2	11.4	20.7	21.0	-0.731	8 UA						
6 UA	1.89	40.7	46.5	84.3	22.5	40.6	40.3	0.524	16.0	32.7	59.0	8.89	16.0	21.2	-0.575	6 UA						
100 x 75 x 10 UA	1.55	31.8	48.6	68.2	22.6	41.3	31.3	0.743	19.4	38.3	55.6	13.4	24.3	21.7	-0.625	100 x 75 x 10 UA						
8 UA	1.30	31.1	41.8	68.9	18.8	34.4	31.5	0.626	18.7	33.5	56.3	11.1	20.2	21.9	-0.528	8 UA						
6 UA	1.02	30.3	33.7	69.7	14.6	26.9	31.7	0.494	17.9	27.5	57.1	8.67	15.7	22.0	-0.416	6 UA						
75 x 50 x 8 UA	0.511	25.2	20.3	49.8	10.3	18.5	23.6	0.181	12.8	14.1	37.2	4.86	8.96	14.0	-0.174	75 x 50 x 8 UA						
6 UA	0.407	24.4	16.7	50.6	8.05	14.6	23.8	0.145	12.1	12.0	37.9	3.84	6.98	14.2	-0.140	6 UA						
5 UA	0.321	23.8	13.5	51.2	6.27	11.4	23.9	0.115	11.5	10.0	38.5	3.00	5.41	14.3	-0.111	5 UA						
65 x 50 x 8 UA	0.341	21.1	16.2	43.9	7.75	14.1	20.1	0.174	13.6	12.7	36.4	4.78	8.74	14.4	-0.141	65 x 50 x 8 UA						
6 UA	0.272	20.4	13.4	44.6	6.10	11.1	20.3	0.140	12.9	10.8	37.1	3.77	6.85	14.6	-0.114	6 UA						
5 UA	0.215	19.8	10.9	45.2	4.75	8.70	20.5	0.111	12.4	8.96	37.6	2.95	5.32	14.7	-0.0903	5 UA						

Tolerances

Rounds and Squares

Table 25 Permissible variations in cross-sectional dimensions for Rounds and Squares

Nominal Dimension	Permissible Variation	Permissible out-of-round or out-of-square
D_{nominal}		$D_{\text{max}} - D_{\text{min}}$
mm	mm	mm
≤ 25	± 0.25	0.40
$> 25 \leq 30$	± 0.30	0.45
$> 30 \leq 40$	± 0.40	0.60
$> 40 \leq 50$	± 0.50	0.75
$> 50 \leq 60$	± 0.60	0.90
$> 60 \leq 70$	± 0.70	1.05
$> 70 \leq 80$	± 0.80	1.20
$> 80 \leq 100$	± 0.90	1.35
$> 80^* \leq 100^*$	+2.45 to -0*	1.85*

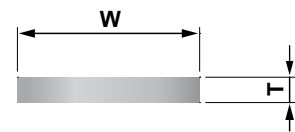


Note: * indicates alternative for material produced as primary-rolled product.

Flats

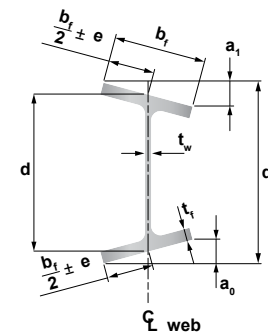
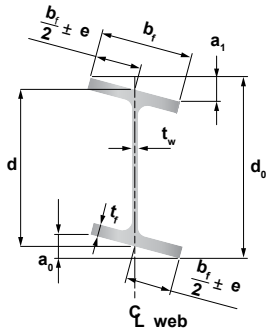
Table 26 Permissible variations in cross-sectional dimensions for Flats

Nominal Width		Width Tolerance	Thickness Tolerance				
W			T				
mm		mm	mm				
			<6	$\geq 6 \leq 12$	$> 12 \leq 25$	$> 25 \leq 50$	>50
≤ 25		± 0.40	± 0.20	± 0.20	± 0.25	-	-
> 25	≤ 50	± 0.80	± 0.20	± 0.30	± 0.40	± 0.80	-
> 50	≤ 100	+1.60 to -0.80	± 0.20	± 0.40	± 0.50	± 0.80	± 1.20
> 100	≤ 150	+2.40 to -1.60	± 0.25	± 0.40	± 0.50	± 0.80	± 1.60



Universal Beam

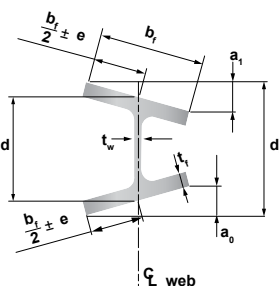
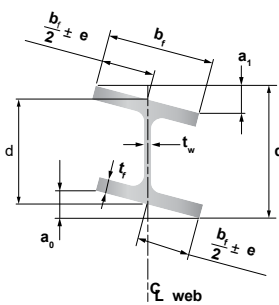
Table 27 Universal Beam Tolerances



Designation	Permissible variation of depth	Permissible variation of flange width	Permissible variation of flange thickness	Permissible variation of web thickness	Maximum difference of flange over four flanges	Permissible out-of-square on each flange	Permissible total out-of-square	Permissible web off-centre	Permissible overall depth over specified depth
	d	bf	tf	tw	mm	(a1 or a0)	(a1 + a0)	e	(d0 - d)
610UB125	±3.0	+6.0 to -5.0	±1.5	±0.7	1.5	5.0	8.0	5.0	6.0
610UB113	±3.0	+6.0 to -5.0	±1.5	±0.7	1.5	5.0	8.0	5.0	6.0
610UB101	±3.0	+6.0 to -5.0	±1.0	±0.7	1.0	5.0	8.0	5.0	6.0
530UB92.4	±3.0	+6.0 to -5.0	±1.5	±0.7	1.5	5.0	8.0	5.0	6.0
530UB82.0	±3.0	+6.0 to -5.0	±1.0	±0.7	1.0	5.0	8.0	5.0	6.0
460UB82.1	±3.0	+6.0 to -5.0	±1.5	±0.7	1.5	5.0	8.0	5.0	6.0
460UB74.6	±3.0	+6.0 to -5.0	±1.0	±0.7	1.0	5.0	8.0	5.0	6.0
460UB67.1	±3.0	+6.0 to -5.0	±1.0	±0.7	1.0	5.0	8.0	5.0	6.0
410UB59.7	±3.0	+6.0 to -5.0	±1.0	±0.7	1.0	5.0	8.0	5.0	6.0
410UB53.7	±3.0	+6.0 to -5.0	±1.0	±0.7	1.0	5.0	8.0	5.0	6.0
360UB56.7	±3.0	+6.0 to -5.0	±1.0	±0.7	1.0	5.0	8.0	5.0	6.0
360UB50.7	±3.0	+6.0 to -5.0	±1.0	±0.7	1.0	5.0	8.0	5.0	6.0
360UB44.7	±3.0	+6.0 to -5.0	±1.0	±0.7	1.0	5.0	8.0	5.0	6.0
310UB46.2	±3.0	+6.0 to -5.0	±1.0	±0.7	1.0	5.0	8.0	5.0	6.0
310UB40.4	±3.0	+6.0 to -5.0	±1.0	±0.7	1.0	5.0	8.0	5.0	6.0
310UB32.0	±3.0	+6.0 to -5.0	±1.0	±0.7	1.0	5.0	8.0	5.0	6.0
250UB37.3	±3.0	+6.0 to -5.0	±1.0	±0.7	1.0	4.0	6.0	5.0	6.0
250UB31.4	±3.0	+6.0 to -5.0	±1.0	±0.7	1.0	4.0	6.0	5.0	6.0
250UB25.7	±3.0	+6.0 to -5.0	±1.0	±0.7	1.0	4.0	6.0	5.0	6.0
200UB29.8	±3.0	+6.0 to -5.0	±1.0	±0.7	1.0	4.0	6.0	5.0	6.0
200UB25.4	±3.0	+6.0 to -5.0	±1.0	±0.7	1.0	4.0	6.0	5.0	6.0
200UB22.3	±3.0	+6.0 to -5.0	±1.0	±0.7	1.0	4.0	6.0	5.0	6.0
200UB18.2	±3.0	+6.0 to -5.0	±1.0	±0.7	1.0	4.0	6.0	5.0	6.0
180UB22.2	+2.5 to -1.5	±3.0	±1.0	±0.7	1.0	2.0	2.5	2.5	4.0
180UB18.1	+2.5 to -1.5	±3.0	±1.0	±0.7	1.0	2.0	2.5	2.5	4.0
180UB16.1	+2.5 to -1.5	±3.0	±1.0	±0.7	1.0	2.0	2.5	2.5	4.0
150UB18.0	+2.5 to -1.5	±3.0	±1.0	±0.7	1.0	1.5	2.5	2.5	4.0
150UB14.0	+2.5 to -1.5	±3.0	±1.0	±0.7	1.0	1.5	2.5	2.5	4.0

Universal Column

Table 28 Universal Column Tolerances

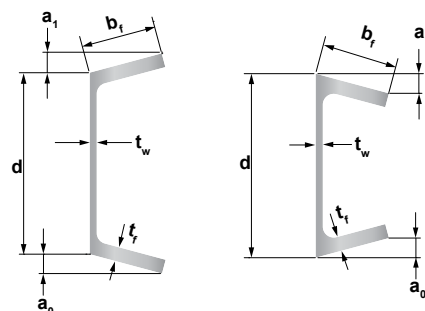


Designation	Permissible variation of depth	Permissible variation of flange width	Permissible variation of flange thickness	Permissible variation of web thickness	Maximum difference of flange over four flanges	Permissible out-of-square on each flange	Permissible total out-of-square	Permissible web off-centre	Permissible overall depth over specified depth
	d	bf	tf	tw	mm	(a1 or a0)	(a1 + a0)	e	(d0 - d)
310UC158	±3.0	+6.0 to -5.0	±1.5	±1.0	1.5	5.0	8.0	5.0	6.0
310UC137	±3.0	+6.0 to -5.0	±1.5	±0.7	1.5	5.0	8.0	5.0	6.0
310UC118	±3.0	+6.0 to -5.0	±1.5	±0.7	1.5	5.0	8.0	5.0	6.0
310UC96.8	±3.0	+6.0 to -5.0	±1.5	±0.7	1.5	5.0	8.0	5.0	6.0
250UC89.5	±3.0	+6.0 to -5.0	±1.5	±0.7	1.5	4.0	6.0	5.0	6.0
250UC72.9	±3.0	+6.0 to -5.0	±1.0	±0.7	1.0	4.0	6.0	5.0	6.0
200UC59.5	±3.0	+6.0 to -5.0	±1.0	±0.7	1.0	4.0	6.0	5.0	6.0
200UC52.2	±3.0	+6.0 to -5.0	±1.0	±0.7	1.0	4.0	6.0	5.0	6.0
200UC46.2	±3.0	+6.0 to -5.0	±1.0	±0.7	1.0	4.0	6.0	5.0	6.0
150UC37.2	±3.0	+6.0 to -5.0	±1.0	±0.7	1.0	4.0	6.0	5.0	6.0
150UC30.0	±3.0	+6.0 to -5.0	±1.0	±0.7	1.0	4.0	6.0	5.0	6.0
150UC23.4	±3.0	+6.0 to -5.0	±1.0	±0.7	1.0	4.0	6.0	5.0	6.0
100UC14.8	±3.0	+6.0 to -5.0	±1.0	±0.7	1.0	4.0	6.0	5.0	6.0

Parallel Flange Channels

Table 29 Parallel Flange Channel Tolerances

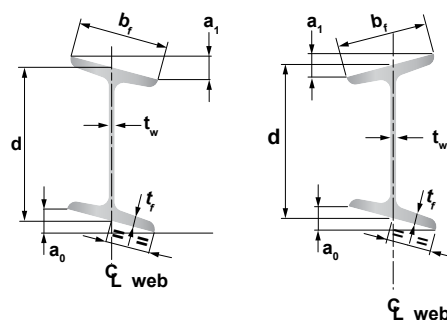
	Permissible variation of depth	Permissible variation of flange width	Permissible variation of flange thickness	Permissible variation of web thickness	Permissible out-of-square on each flange	Permissible total out-of-square
	d	b_f	t_f	t_w	$(a_1 \text{ or } a_0)$	$(a_1 + a_0)$
Designation	mm	mm	mm	mm	mm	mm
380PFC	+5.0 to -3.0	+3.0 to -4.0	±1.0	±1.0	2.0	3.0
300PFC	+3.0 to -1.5	±3.0	±1.0	±1.0	1.5	2.7
250PFC	+3.0 to -1.5	±3.0	±1.0	±1.0	1.5	2.7
230PFC	+3.0 to -1.5	±3.0	±1.0	±1.0	1.5	2.3
200PFC	+3.0 to -1.5	±3.0	±1.0	±1.0	1.5	2.3
180PFC	+3.0 to -1.5	±3.0	±1.0	±1.0	1.5	2.3
150PFC	+3.0 to -1.5	±3.0	±1.0	±1.0	1.5	2.3
125PFC	+3.0 to -1.5	±3.0	±1.0	±1.0	1.5	2.0
100PFC	+3.0 to -1.5	±3.0	±0.7	±0.7	1.0	1.5
75PFC	+3.0 to -1.5	±3.0	±0.7	±0.7	1.0	1.2



Tapered Flange Beam

Table 30 Tapered Flange Beam Tolerances

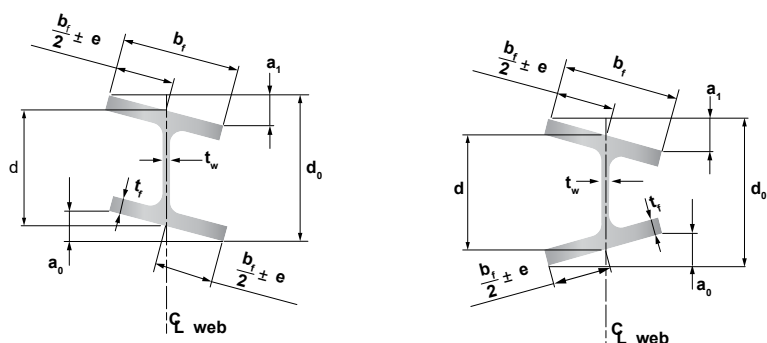
	Permissible variation of depth	Permissible variation of flange width	Permissible variation of flange thickness	Permissible variation of web thickness	Permissible out-of-square on each flange	Permissible total out-of-square
	d	b_f	t_f	t_w	$(a_1 \text{ or } a_0)$	$(a_1 + a_0)$
Designation	mm	mm	mm	mm	mm	mm
125TFB	+2.5 to -1.5	±3.0	±0.7	±0.7	1.5	2.0
100TFB	+2.5 to -1.5	±3.0	±0.7	±0.7	1.5	1.4



Universal Bearing Piles

Table 31 Universal Bearing Pile Tolerances

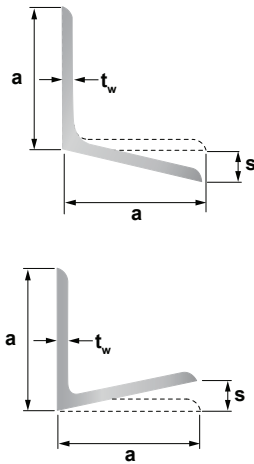
	Permissible variation of depth	Permissible variation of flange width	Permissible variation of flange thickness	Permissible variation of web thickness	Maximum difference of flange over four flanges	Permissible out-of-square on each flange	Permissible total out-of-square	Permissible web off-centre	Permissible overall depth over specified depth
	d	b_f	t_f	t_w		$(a_1 \text{ or } a_0)$	$(a_1 + a_0)$	e	$(d_0 - d)$
Designation	mm	mm	mm	mm	mm	mm	mm	mm	mm
310UBP149	+3.0 to -2.0	±4.0	±1.5	±0.7	1.5	4.0	6.3	3.5	6.0
310UBP110	+3.0 to -2.0	±4.0	±1.5	±0.7	1.5	4.0	6.2	3.5	6.0
310UBP78.8	+3.5 to -3.5	+6.5 to -5.4	±1.0	±0.7	1.0	5.0	8.0	5.0	6.0
200UBP122	+3.4 to -3.4	+6.5 to -5.4	±1.5	±1.0	1.5	4.0	6.0	5.0	6.0



Tolerances

Equal Angle

Table 32 Equal Angle Tolerances

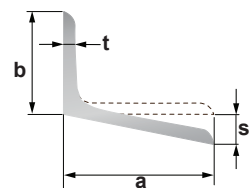
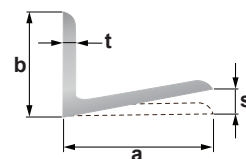


Designation	Permissible variation of leg length	Permissible variation of thickness	Permissible out-of-square
	a	t_w	s
	mm	mm	mm
200x200x26 EA	+5.0 to -3.0	±1.5	±5.0
200x200x20 EA	+5.0 to -3.0	±1.0	±5.0
200x200x18 EA	+5.0 to -3.0	±1.0	±5.0
200x200x16 EA	+5.0 to -3.0	±1.0	±5.0
200x200x13 EA	+5.0 to -3.0	±0.7	±5.0
150x150x19 EA	±3.0	±1.0	±4.0
150x150x16 EA	±3.0	±1.0	±4.0
150x150x12 EA	±3.0	±0.7	±4.0
150x150x10 EA	±3.0	±0.5	±4.0
125x125x16 EA	±3.0	±1.0	±3.0
125x125x12 EA	±3.0	±0.7	±3.0
125x125x10 EA	±3.0	±0.5	±3.0
125x125x8 EA	±3.0	±0.5	±3.0
100x100x12 EA	±3.0	±0.7	±3.0
100x100x10 EA	±3.0	±0.5	±3.0
100x100x8 EA	±3.0	±0.5	±3.0
100x100x6 EA	±3.0	±0.5	±3.0
90x90x10 EA	±3.0	±0.5	±3.0
90x90x8 EA	±3.0	±0.5	±3.0
90x90x6 EA	±3.0	±0.5	±3.0
75x75x10 EA	+2.5 to -1.5	±0.5	±2.0
75x75x8 EA	+2.5 to -1.5	±0.5	±2.0
75x75x6 EA	+2.5 to -1.5	±0.5	±2.0
75x75x5 EA	+2.5 to -1.5	±0.5	±2.0
65x65x10 EA	+2.5 to -1.5	±0.5	±2.0
65x65x8 EA	+2.5 to -1.5	±0.5	±2.0
65x65x6 EA	+2.5 to -1.5	±0.5	±2.0
65x65x5 EA	+2.5 to -1.5	±0.5	±2.0
55x55x6 EA	+2.5 to -1.5	±0.5	±2.0
55x55x5 EA	+2.5 to -1.5	±0.5	±2.0
50x50x8 EA	+2.5 to -1.5	±0.5	±2.0
50x50x6 EA	+2.5 to -1.5	±0.5	±2.0
50x50x5 EA	+2.5 to -1.5	±0.5	±2.0
50x50x3 EA	+2.5 to -1.5	±0.5	±2.0
45x45x6 EA	+2.5 to -1.5	±0.5	±2.0
45x45x5 EA	+2.5 to -1.5	±0.5	±2.0
45x45x3 EA	+2.5 to -1.5	±0.5	±2.0
40x40x6 EA	+2.5 to -1.5	±0.5	±1.0
40x40x5 EA	+2.5 to -1.5	±0.5	±1.0
40x40x3 EA	+2.5 to -1.5	±0.5	±1.0
30x30x6 EA	+2.5 to -1.5	±0.5	±1.0
30x30x5 EA	+2.5 to -1.5	±0.5	±1.0
30x30x3 EA	+2.5 to -1.5	±0.5	±1.0
25x25x6 EA	+2.5 to -1.5	±0.5	±1.0
25x25x5 EA	+2.5 to -1.5	±0.5	±1.0
25x25x3 EA	+2.5 to -1.5	±0.5	±1.0

Unequal Angle

Table 33 Unequal Angle Tolerances

Designation	Permissible variation of leg length – Long Leg	Permissible variation of leg length – Short Leg	Permissible variation of thickness	Permissible out-of-square
	a	b	t_w	s
	mm		mm	mm
150x100x12 UA	±3.0	±3.0	±0.7	±4.0
150x100x10 UA	±3.0	±3.0	±0.5	±4.0
150x90x16 UA	±3.0	±3.0	±1.0	±4.0
150x90x12 UA	±3.0	±3.0	±0.7	±4.0
150x90x10 UA	±3.0	±3.0	±0.5	±4.0
150x90x8 UA	±3.0	±3.0	±0.5	±4.0
125x75x12 UA	±3.0	+2.5 to -1.5	±0.7	±3.0
125x75x10 UA	±3.0	+2.5 to -1.5	±0.5	±3.0
125x75x8 UA	±3.0	+2.5 to -1.5	±0.5	±3.0
125x75x6 UA	±3.0	+2.5 to -1.5	±0.5	±3.0
100x75x10 UA	±3.0	+2.5 to -1.5	±0.5	±3.0
100x75x8 UA	±3.0	+2.5 to -1.5	±0.5	±3.0
100x75x6 UA	±3.0	+2.5 to -1.5	±0.5	±3.0
75x50x8 UA	+2.5 to -1.5	+2.5 to -1.5	±0.5	±2.0
75x50x6 UA	+2.5 to -1.5	+2.5 to -1.5	±0.5	±2.0
75x50x5 UA	+2.5 to -1.5	+2.5 to -1.5	±0.5	±2.0
65x50x8 UA	+2.5 to -1.5	+2.5 to -1.5	±0.5	±2.0
65x50x6 UA	+2.5 to -1.5	+2.5 to -1.5	±0.5	±2.0
65x50x5 UA	+2.5 to -1.5	+2.5 to -1.5	±0.5	±2.0



Straightness

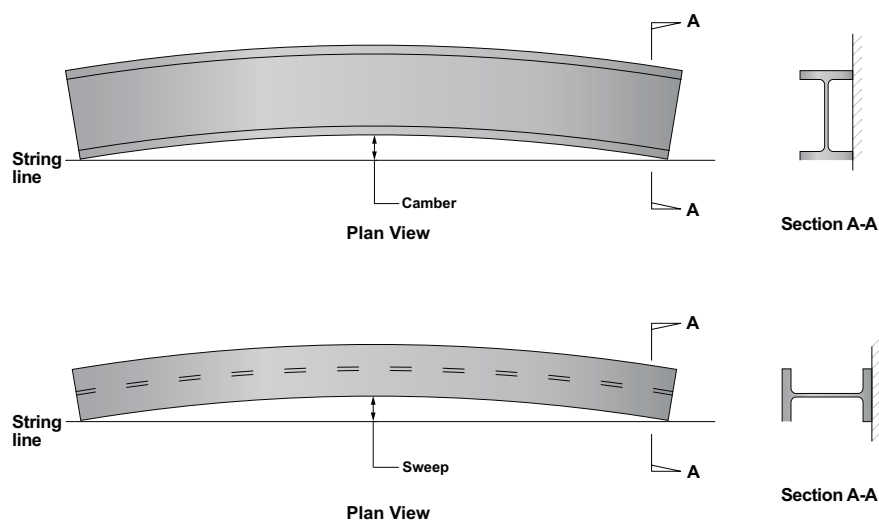
Universal Sections

Table 34 Permissible Variations in Straightness for Universal Sections

Section	Camber (mm)	Sweep (mm)
Beams with flange $b_f < 150\text{mm}$	$\frac{\text{Length (mm)}}{1000}$	$\frac{\text{Length (mm)}}{500}$
Beams with flange $b_f \geq 150\text{mm}$	$\frac{\text{Length (mm)}}{1000}$	(See Note 2)
Columns $\leq 14000\text{mm}$ long	$\frac{\text{Length (mm)}}{1000}$ but no more than 10mm	(See Note 2)
Columns $> 14000\text{mm}$ long	$10\text{mm} + \frac{\text{Length (mm)} - 14000}{10000}$	(See Note 2)

Notes:

1. Measuring of the camber and sweep shall be in accordance with the figure below.
2. Owing to the extreme variation in the elastic flexibility of these sections about the y axis, difficulty may be experienced in obtaining reproducible sweep measurements.



Non-universal Sections

Table 35 Permissible Variations in Straightness for Channels, Taper Flange Beams and Angles

Section	Camber (mm)	Sweep (mm)
Channels	$\frac{\text{Length (mm)}}{500}$	(See Note 2)
Taper Flange Beams		
Angles		

Notes:

1. For angles having a combined leg length of greater than 150mm this is the straightness tolerance.
2. Owing to the extreme variation in flexibility of these sections about the y axis, straightness tolerances are as specified by the purchaser for the individual sections involved.

Standard Specifications

Structural Steel – Hot Rolled Bars and Sections – Standard: AS/NZS 3679.1

Table 36 Chemical Composition – Bars and Sections

Grade (see Note 1)	Cast analysis (max.) (See Notes 2 and 3)							
	%							
	C	Si	Mn	P	S	B	Micro-alloying elements (see Note 4)	CE (see Note 5)
300PLUS®, 300PLUS®L0, 300PLUS®L15, 300PLUS®S0	0.25	0.50	1.60	0.040	0.040	<0.0008	(see Note 6)	0.44
350, 350L0, 350L15, 350S0	0.22	0.50	1.60	0.040	0.040	<0.0008	(see Note 7)	0.45

Notes

- The use of sulfide modification steel making techniques for these grades is permitted.
- Grain refining elements, i.e. aluminium and titanium, may be added, provided that the total content does not exceed 0.15%. Limits are for total or soluble aluminium.
- The following elements may be present to the limits stated, subject to a maximum total of 1.00%:

(a) Copper	0.50%
(b) Nickel	0.50%
(c) Chromium	0.30%
(d) Molybdenum	0.10%
- For grade 300PLUS, the following are not considered as micro-alloying elements:

(a) Titanium	0.040% maximum
(b) Niobium	0.020% maximum
(c) Vanadium	0.030% maximum
(d) Niobium plus vanadium	0.030% maximum
- Carbon equivalent (CE) is calculated from the following equation:

$$CE = C + \frac{Mn}{6} + \frac{Cr}{5} + \frac{Mo}{5} + \frac{V}{15} + \frac{Ni}{15} + \frac{Cu}{15}$$
- Micro-alloying elements are not permitted in grade 300 except for thicknesses greater than or equal to 15mm, where the following apply:
 - the maximum combined micro-alloying element content is 0.15%
 - where micro-alloying elements are used, the percentage of each element is to be shown on certificates.
- For grade 350, micro-alloying elements niobium, vanadium and titanium may be added, provided that their total combined content does not exceed 0.15%.

Table 37 Tensile Properties – Flat Bars and Sections – Standard: AS/NZS 3679.1

Grade	Minimum yield stress, MPa Thickness (see Note 1) mm			Minimum tensile strength MPa	Minimum elongation on a gauge length of $5.65\sqrt{S_0}$ % (see Note 2)
	< 11	≥ 11 to ≤ 17	> 17 to < 40		
300PLUS®, 300PLUS®L0, 300PLUS®L15	320	300	280	440	22
350, 350L0, 350L15	360	340	340	480	20

Table 38 Tensile Properties – Round and Square Bars – Standard: AS/NZS 3679.1

Grade	Minimum yield stress, MPa Thickness mm			Minimum tensile strength MPa	Minimum elongation on a gauge length of $5.65\sqrt{S_0}$ %
	≤ 50	> 50 to < 100	≥ 100		
300PLUS®	300	290	280	440	22
350	340	330	320	480	20

Notes (apply to tables 37 and 38)

- For a section, the term 'thickness' refers to the nominal thickness of the part from which the sample is taken.
- S_0 is the cross-sectional area of the test piece before testing.
- For precise details of properties reference should be made to the latest edition of AS/NZS 3679.1 or the latest Liberty Steel specification.
- 300PLUS® steel is produced to exceed the latest requirements for grade 300 in AS/NZS 3679.1.

Table 39 Charpy V-Notch Impact Test Requirements – Bars and Sections – Standard: AS/NZS 3679.1

Grade	Minimum Absorbed Energy, J Size of Test Piece						
	Test Temperature °C	10mm x 10mm		10mm x 7.5mm		10mm x 5mm	
		Average of 3 Tests	Individual Test	Average of 3 Tests	Individual Test	Average of 3 Tests	Individual Test
300PLUS®L0, 350L0*	0	27	20	22	16	18	13
300PLUS®L15, 350L15	-15	27	20	22	16	18	13

Notes

- This does not cover impact tested grades for thickness less than 7mm.
 *Impact testing is not available for bars and is only available for some sections by enquiry.

Standard Specifications

Merchant Bar Sections

Table 40 Chemical Composition – For Liberty Steel Merchant Bar Sections – Regular Grades – AS 1442

Steel Type	Grade	C		Si		Mn		P		S	
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
Carbon and Carbon Manganese Steels	1016	0.13	0.18	0.10	0.35	0.60	0.90	*	0.040	*	0.040
	1022	0.18	0.23	0.10	0.35	0.70	1.00	*	0.040	*	0.040
	1045	0.43	0.50	0.10	0.35	0.60	0.90	*	0.040	*	0.040

Table 41 Chemical Composition – For Liberty Steel Merchant Bar Sections – Regular Grades – AS 1447

Steel Type	Grade	C		Si		Mn		P		S		Cr	
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
Spring Steels	5160	0.55	0.65	0.10	0.35	0.70	1.00	*	0.040	*	0.040	0.70	0.90
	9258	0.50	0.65	1.60	2.20	0.70	1.05	*	0.040	*	0.040	*	*
	9261	0.55	0.65	1.80	2.20	0.70	1.00	*	0.040	*	0.040	0.10	0.25

Table 42 Liberty Steel Grades

Steel Type	Grade	C		Si		Mn		P		S		Cr		V	
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
Liberty Steel	X4K92M61S*	0.55	0.65	1.60	1.90	0.70	1.00	*	0.040	*	0.040	0.10	0.25	0.15	0.25

Table 43 Heat Treatment Limitations

Maximum Recommended Cross Section*			
Grade	Rounds	Squares	Flats
5160	40mm	36mm	28mm
9261	27mm	25mm	19mm
9258			16mm

* The recommendations are based on the criterion that, at the maximum dimensions, a hardness of 50 HRC can be achieved in the centre of the quenched section.

The actual properties obtained are dependent on both grade and heat treatment process control. As Liberty Steel has no control over the springmakers' heat treatment process, the above recommendations cannot be guaranteed. However, springmakers with efficient heat treatment facilities will be able to achieve a hardness value of 50 HRC as recommended.

Customer Technical Service

MORE INFORMATION

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