



TS100

ANGLES | CHANNELS | FLATS

TECHNICAL
SPECIFICATIONS

DuraGal **Ultra**[®]



AustubeMills
SHAPING POSSIBILITIES

TABLE OF CONTENTS

1.0	Scope	2
2.0	References	3
3.0	Definitions	3
4.0	Designation	3
5.0	Information To Be Supplied By The Purchaser	4
6.0	Requirements	4
6.1	Profile Condition	4
6.2	Chemical Composition	4
6.3	Mechanical Properties	5
6.4	Surface Finish	5
6.5	Zinc Aluminium Coating	6
6.6	Surface Conversion Coating	6
6.7	Length	6
6.8	End Condition	6
6.9	Straightness (Camber or Sweep)	6
6.10	Corner Radii	7
6.11	Corner Radius Tolerance	7
6.12	Squareness (Angular Tolerance)	8
6.13	Twist	8
6.14	Leg/width Dimensions	8
6.15	Thickness	9
6.16	Mass	10
6.17	Flatness of Sides	10
6.18	Notch Sensitivity	10
6.19	Handling	11
6.20	Any Other Special Requirements	11
6.21	Means for Determining Compliance	11
7.0	Control	11
Annex A		12

TECHNICAL INFORMATION

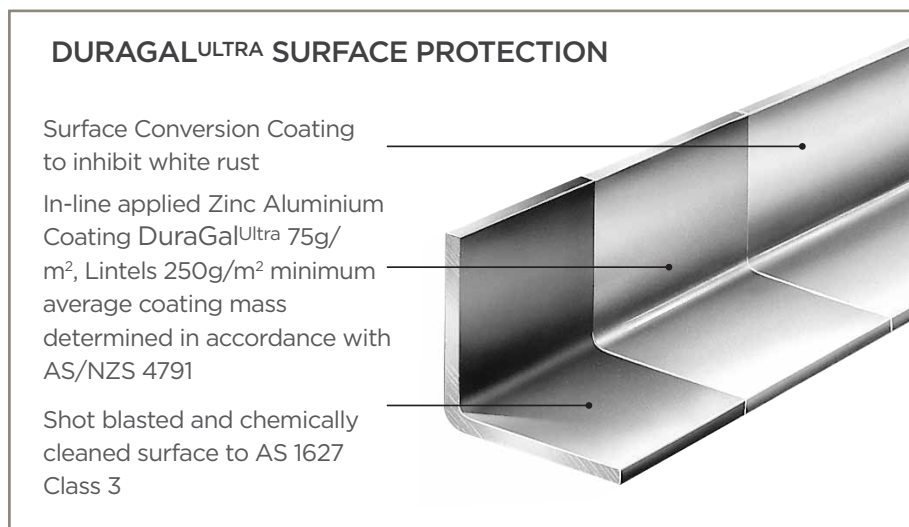
1.0 SCOPE

This specification covers the technical requirements for the production and supply of profiles with the DuraGal^{Ultra} coating. Angles, Channels and Flats are referred to in this specification as profiles.

These profiles are produced by cold forming low carbon (hot rolled) steel strip and coated in-line applying a hot-dip zinc aluminium coating. This product is intended for general engineering and structural uses.

NOTE

- 1 The profile shape is manufactured from hot rolled strip. During the forming process, all surface areas are mechanically and chemically cleaned to the equivalent of AS1627.4 Class 3, and then coated by an in-line hot-dip process.
- 2 The durability performance of DuraGal^{Ultra} is influenced by micro-environments which vary from site to site. In highly corrosive environments it is recommended that a suitable barrier coating, (eg. paint or powder coating) be applied over the galvanized surface, and that the application of such coating be fully in accordance with the supplier's recommendations with regard to surface pretreatment, application, curing and maintenance of the coating.



NOTE

Zinc aluminium coating classes are not currently referenced in AS/NZS 4791-2006 "Hot-dip galvanized (zinc) coating on ferrous open sections applied by an in-line process".

2.0 REFERENCES

- AS 1544.2:2003 Methods for impact tests on metals — Charpy V-notch
- AS 1627.4:2005 Metal Finishing — Preparation and pretreatment of surfaces Part 4: Abrasive blast cleaning of steel
- AS 4100:1998 Steel Structures
- AS/NZS 1163:2009 Cold formed structural steel hollow sections
- AS/NZS 2312:2002 Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings
- AS/NZS 4496:1997 Recommended practice for the colour coding of steel products
- AS/NZS 4600:2005 Cold-Formed Steel Structures
- AS/NZS 4791:2006 Hot-dip galvanized (zinc) coatings on ferrous open sections, applied by an in-line process
- AS/NZS ISO 9001:2008 Quality management systems — Requirements
- ASTM B117 Practice for Operating Salt Spray (FOG) Testing Apparatus
- DuraGal Easy Painting and Corrosion Protection Guide
- DuraGal Easy Welding Guide

3.0 DEFINITION

All terms used in this specification are defined in this specification.

4.0 DESIGNATION

Profiles specified on engineering drawings shall be designated by section dimensions, section shape and grade description as follows:

Shape	Typical Designation
Equal Angles	30x30x2.5 CA DuraGal
Unequal Angles	75x50x5.0 CA DuraGal
Channel	75x40x4.0 CC DuraGal
Flats	50x4.0 CF DuraGal

Profiles shall be ordered as:

Size x Product x Length x Specification

Example — 50 x 50 x 4.0 Profile Angle 9.0m TS100

Profiles are supplied as mill lengths within the range of 6 to 12 metres and standard lengths apply. Therefore for non standard mill lengths, the length requirement must also be specified at the time of ordering.

TECHNICAL INFORMATION

5.0 INFORMATION TO BE SUPPLIED BY THE PURCHASER

The purchaser should supply the following information at the time of enquiry and/or order:

- (a) Full Designation
 - i) TSIOO
 - ii) Dimensions of Web, Flange/Leg Lengths and Thickness
- (b) Length required (in metres)
- (c) Any special requirements
- (d) Quantity and delivery instructions

6.0 REQUIREMENTS

6.1 PROFILE CONDITION

Profiles shall be supplied in the cold rolled, in-line hot-dipped and as formed condition.

6.2 CHEMICAL COMPOSITION

Grades (see note 1)	Chemical Composition (cast or product analysis) (see Note 2) % max.										
	C	Si	Mn	P	S	Cr	Mo	Al (see Note 3)	Ti	Micro- alloying elements	CE (see Note 4)
C350LO C400LO C450LO	0.20	0.45	1.60	0.03	0.03	0.30	0.10	0.10	0.4	0.15 (see Note 5)	0.43

NOTE

- 1 The use of sulphide modification manufacturing techniques for these grades is permitted.
- 2 The following elements may be present to the limits stated:
 - (a) Copper 0.25%
 - (b) Nickel 0.25%
- 3 Limits specified are for soluble or total aluminium.
- 4 Carbon equivalent (CE) is calculated from the following equation:

$$CE = C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Ni + Cu}{15}$$

- 5 Applies to niobium, vanadium and titanium only. However, vanadium greater than 0.10% is not permitted.

6.3 MECHANICAL PROPERTIES

Mechanical properties for Profiles comply with the table below.

Profile	Minimum Yield Strength MPa	Minimum Tensile Strength MPa	Minimum Elongation as a Proportion of Gauge Length of $5.65 \sqrt{s_0}$ %
Flats up to and including 6mm wall thickness	400	450	20
Flats over 6mm wall thickness	350	400	20
Angles and Channels over 2.5mm up to and including 6mm wall thickness	450	500	16
Angles and Channels over 6mm wall thickness	400	450	16
Angles 2.5mm wall thickness	350	400	20
Lintel 6mm	450	500	16
Lintel over 6mm	400	450	16

Test Method

- (a) Test specimens are to be taken longitudinally from a major flat portion of the section, mid way between corners (excluding the corners), or midway between a corner and a free edge (excluding the corner).
- (b) Test specimens are to be taken from the flat portion with the least strength increase from cold forming.
- (c) The yield, tensile strength and elongation shall be determined in accordance with AS 1391, on samples artificially aged to a temperature between 150 and 200°C for a period of not less than 15 minutes.

Ultimate to Yield Ratio

The ratio of actual tensile strength to yield strength shall not be less than 1.08 and the total elongation shall be not less than 10% for a 50mm gauge length or 7% for a 200mm gauge length standard specimen tested in accordance with AS 1391, (Refer AS/NZS 4600:2500 clause 1.5.1.4).

6.4 SURFACE FINISH

The section as manufactured shall be free from lamination, surface flaws and other defects detrimental to its use for structural purposes.

A coating of zinc aluminium is applied by the in-line, hot-dip process to a shot blasted and chemically cleaned bright metal surface equivalent to AS 1627.4 Class 3. For all profiles with a DuraGal^{Ultra} coating a surface conversion coating acts to protect the coating from white rust.

TECHNICAL INFORMATION

6.5 ZINC ALUMINUM COATING

Zinc aluminium coating composition has a target range of 11% to 12% aluminium, with a minimum of 10% and a maximum of 13%.

Sections coated with DuraGal^{Ultra} shall have a minimum average zinc aluminium coating mass of 75g/m².

Lintels shall have a minimum average zinc aluminium coating mass of 250g/m².

The determination of the coating mass and the assessment of coating adherence shall be in accordance with the requirements of AS/NZS 4791:2006 — Hot-dip galvanized (zinc) coatings on ferrous open sections, applied by an in-line process.

Lintels shall comply with the R3 Durability Classification requirements as specified in AS/NZS 2699.3:2002 — Built-in components for masonry construction Part 3: Lintels and shelf angles (durability requirements), Clause 2.4.5, test methods.

6.6 SURFACE CONVERSION COATING

All profiles shall have a surface conversion coating applied to increase resistance to white rust and enhance adhesion of paint and powder coatings.

6.7 LENGTH

Profiles shall be supplied in standard mill lengths or, subject to inquiry, can be supplied ex the forming mill as a non-standard mill length in the range 6 to 12 metres. In both cases, a length tolerance of plus 25mm, minus nil, shall apply. No short lengths are to be included in the consignment.

Note: Angles and channels outside the length range 6 to 12 metres are also subject to inquiry.

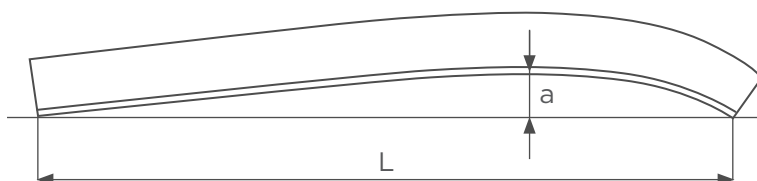
6.8 END CONDITION

Profiles shall be supplied with mill cut ends. Ends will be colour coded to designate product thickness as specified in table 8 of AS/NZS 4496:1997. Colour coding will be applied both ends with marking paint, but rust on the profile cut ends after colour coding will not be cause for rejection.

Lintels shall be supplied with mill cut ends sealed with a zinc rich polyurethane paint. This paint shall comply with AS/NZS 3750.9:2009, paints for steel structures. Paint will have a target thickness of 100 µm and a minimum thickness of 80 µm.

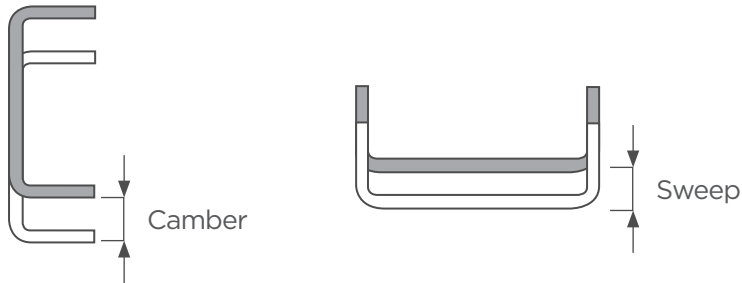
6.9 STRAIGHTNESS (CAMBER OR SWEEP)

Standard and non-standard mill lengths shall be supplied to a straightness of 1 in 500, measured over the ordered length, i.e. a 7.5 metre long angle, when measured against a straight edge can have a deviation from straight of up to 15mm. The straightness shall be determined by laying the product horizontally and measuring the horizontal deviation (a) of the product from a straight line, i.e. $\leq L/500$.



Maximum sweep or camber in angles and channels, shall be no greater than 1 in 500 measured against a straight edge. The maximum camber for flats is also 1 in 500 over the ordered length.

Plane of Measurement



6.10 CORNER RADII

Corner radii shall be as follows:

Normal Thickness (mm)	Inside Corner Radius (mm)
2.5	2.5
4.0 and 5.0	4.0
6.0 and 8.0	8.0

6.11 CORNER RADIUS TOLERANCE

The tolerance of the inside corner radius shall be the greater of 3 0.5mm or 3 20%. i.e:

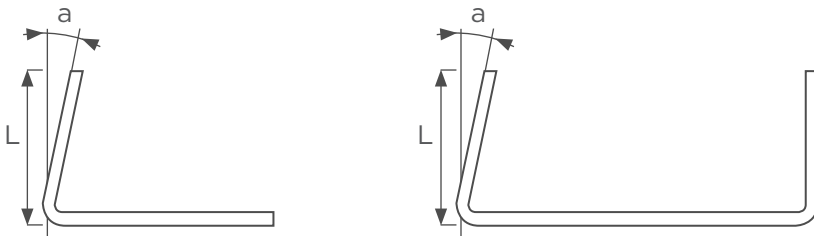
Inside Corner Radius (mm)	Tolerance (mm)
< 2.5mm	± 0.5mm
≥ 2.5mm	± 20% of the normal inside corner radius

TECHNICAL INFORMATION

6.12 SQUARENESS (ANGULAR TOLERANCE)

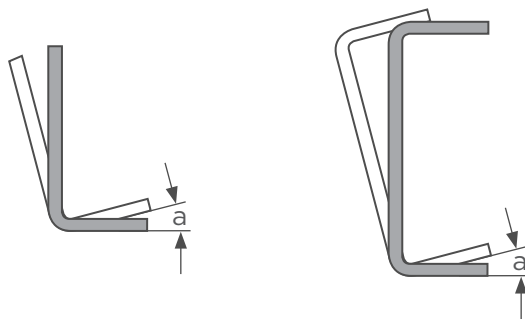
The included angle between the sides of a profile shall be 90 degrees. The maximum out of squareness of a profile shall be in accordance with the following table:

Shorter Leg Length (L) (mm)	Angular Tolerance (a)
$L \leq 50$	± 2.0 degrees
$50 < L \leq 80$	± 1.5 degrees
$L > 80$	± 1.0 degrees



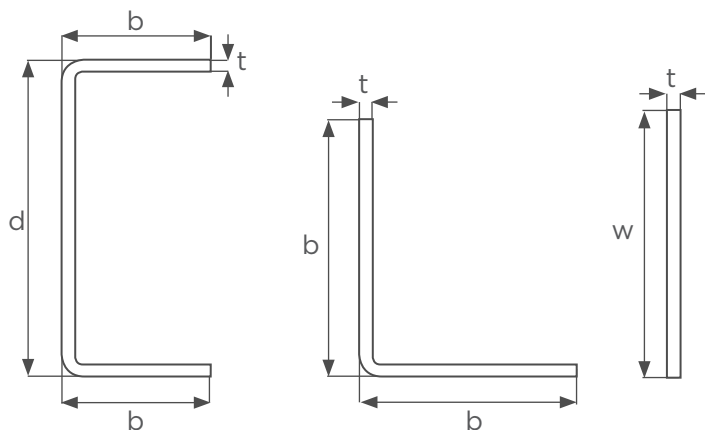
6.13 TWIST

The maximum angle of twist (a) is 1 degree over 1 metre.



6.14 LEG/WIDTH DIMENSIONS

Permissible variation in leg or flange (b), web (d) or width (w) dimensions.



(i) For a face between a bend and a free edge.

Designated Strip Thickness (t)

Leg Length (b) (mm)	Length Tolerance for a face between a bend and a free edge (mm)		
	Designated Strip Thickness (t)		
	1.5 < t ≤ 3 (mm)	3 < t ≤ 6 (mm)	6 < t ≤ 8 (mm)
b ≤ 40	± 0.80	± 1.00	± 1.25
40 < b ≤ 100	± 1.00	± 1.25	± 1.50
100 < b ≤ 150	± 1.25	± 1.50	± 1.75
150 < b ≤ 200	± 1.50	± 1.75	± 2.00
b > 200	-	± 2.00	± 2.25

Note: The maximum variation between leg lengths on channels is 1.5mm for up to and including 150 channels. For over 150 channels refer the flange length (b) tolerance

(ii) For a face between two bends.

Designated Strip Thickness (t)

Web Length (d) (mm)	Length Tolerance for a face between two bends (mm)		
	Designated Strip Thickness (t)		
	1.5 < t ≤ 3 (mm)	3 < t ≤ 6 (mm)	6 < t ≤ 8 (mm)
40 < d ≤ 100	± 0.75	± 1.00	± 1.25
100 < d ≤ 200	± 1.00	± 1.25	± 1.50
200 < d ≤ 400	± 1.50	± 1.75	± 2.00

(iii) Width tolerances for Flats.

Specified Width — W (mm)	Width Tolerance (mm)
40 < W ≤ 100	± 0.75
100 < W ≤ 200	± 1.00
200 < W ≤ 400	± 1.50

6.15 THICKNESS

The uncoated wall thickness of any length of profile shall lie within the band + (plus) 10% – (minus) 5%, of the actual thickness excluding the corner. Actual thickness is the ordered thickness of the strip as follows:

Nominal Thickness (mm)	Actual Thickness (mm)
2.5	2.4
4.0	3.8
5.0	4.7
6.0	6.0
8.0	8.0

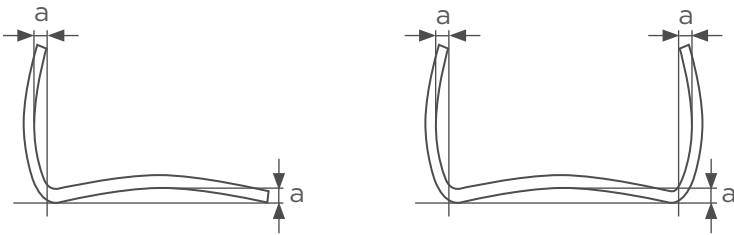
TECHNICAL INFORMATION

6.16 MASS

The mass of a profile shall not be less than 0.95 times the mass, as given in the attached table. See Annex A. (Ref AS/NZS 4600:2005 Clause 1.5.1.5).

6.17 FLATNESS OF SIDES

The flatness of any side (a) will be limited to less than 1 % of the width of that side or 0.5mm, whichever is the largest.



6.18 NOTCH SENSITIVITY

Profiles 6 mm and thicker, comply with the following table for notch sensitivity. Profiles less than 6 mm thick are deemed to comply with the following table if one or both of the following are satisfied:

- (a) The sections are manufactured using the same steel supplier, steel grade, steel processing as those 6 mm and greater which demonstrated compliance with the following table.
- (b) Ensuring that the finished product ferrite grain size is greater than or equal to 6 as verified by the method specified in AS 1733 (ISO 643), when the steel feed is aluminium killed. Alternatively, when aluminium is used as the grain-refining element, the grain size requirement shall be deemed to have been fulfilled if the cast analysis shows the aluminium content to be not less than 0.020% total aluminium, or alternatively, 0.015% soluble aluminium. In these cases, verification of the grain size shall not be required.

This method of verification is only acceptable when the following evidence is provided by the manufacturer or supplier:

- (i) That the steel is made by the basic oxygen process or an electric process at the steel manufacturer's option, and
- (ii) The steelmaking process shall be shown on test certificates. Additional refining by vacuum arc remelt, electro slag refining or secondary steelmaking practices such as vacuum degassing or calcium injection, or both, is permitted, and
- (iii) The steel shall be fine-grained and be made from fully killed, continuously cast steels. Profiles comply with the AS 1163 LO classification. Table 10.4.1 of AS 4100 permits impact tested LO Grades for material of 6mm thickness and less to be used down to -30 degrees centigrade, and above 6mm thickness for -20 degrees centigrade, (lowest one day mean ambient temperature).

Grade	Test Temp Degrees C	Minimum Absorbed Energy - Joules					
		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
C350LO C400LO C450LO	0	27	20	22	16	18	13

Note: Test pieces shall be cut parallel to the longitudinal axis of the section, with the axis of the notch perpendicular to the longitudinal axis. Test pieces shall be taken from the middle of the face of the major length leg or web of the section.

Impact testing shall be carried out at 0 degrees centigrade in accordance with AS 1544.2.

6.19 HANDLING

Care should be taken in transit and in storage of profiles to keep them clean, dry and presentable.

6.20 ANY OTHER SPECIAL REQUIREMENTS

Any other requirements not covered by the above clauses should be subject to enquiry prior to placement of order.

Note: The measurement of cross section dimensions are to be checked at a distance of 250mm from the ends of the section, to allow for the effect of residual stress relief on cutting. For the measurement of straightness and twist, the section is laid to rest under its own weight on a flat and level surface.

6.21 MEANS FOR DETERMINING COMPLIANCE

Compliance to the requirements of this specification will be achieved through the Australian Tube Mills Quality System plan maintained under AS 3902/ISO 9002 and the methods used to demonstrate compliance shall comply with those listed in AS/NZS 1163:2009 Appendix B - Product Conformity.

Any special requirements need to be agreed between the customer and Australian Tube Mills, and should include a quality inspection and test plan to ensure product conformity.

7.0 CONTROL

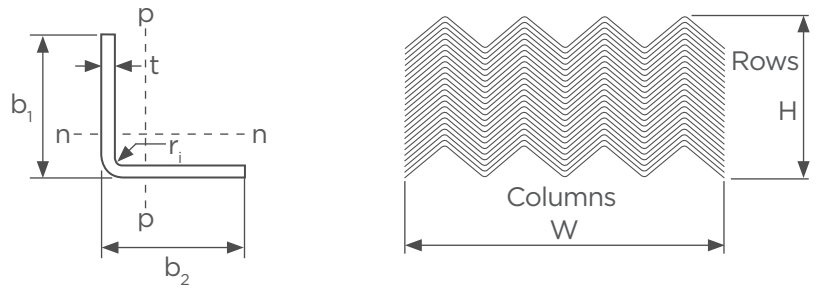
Document control of this standard extends to the Regional Sales and Development Offices. Holders of this specification (customer/end user) should determine its current validity prior to use, by reference to the Regional Sales/Development Office. No changes to this document can be made without the approval of the Site Manager Somerton and Manager Marketing Australian Tube Mills.

TECHNICAL INFORMATION

ANNEX A

MASS AND BUNDLING DATA

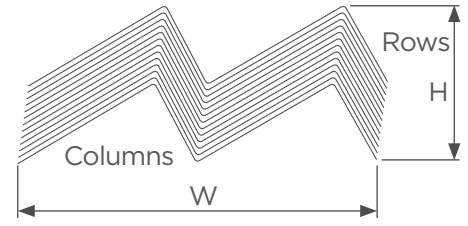
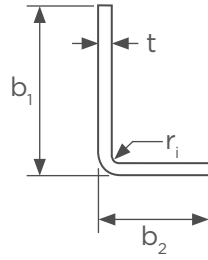
Profile Equal Angles



Nominal Size			Mass per Metre	Metres per Tonne kg/m	No. of Lengths per Bundle	Arrangement of Bundle		Overall Bundle		Total Metres per Bundle	Total Weight per Bundle
b ₁ (mm)	b ₂ (mm)	t (mm)	kg/m	m/t		Columns	Rows	W (mm)	H (mm)	m	tonnes
6.0 Metre Standard Lengths											
30	30	2.5	1.06	948	80	4	20	170	85	480	0.507
40	40	2.5	1.43	698	60	3	20	170	92	360	0.516
40	40	4.0	2.20	455	39	3	13	170	92	234	0.514
45	45	2.5	1.62	617	54	3	18	191	89	324	0.525
45	45	4.0	2.50	401	36	3	12	191	90	216	0.539
9.0 Metre Standard Lengths											
50	50	2.5	1.81	553	33	3	11	212	69	297	0.537
50	50	4.0	2.79	358	27	3	9	212	78	243	0.679
50	50	5.0	3.42	293	24	3	8	212	82	216	0.738
50	50	6.0	4.21	238	21	3	7	212	85	189	0.795
65	65	4.0	3.69	271	22	2	11	184	99	198	0.730
65	65	5.0	4.52	221	22	2	11	184	112	198	0.895
65	65	6.0	5.62	178	18	2	9	184	112	162	0.910
75	75	4.0	4.29	233	22	2	11	212	106	198	0.849
75	75	5.0	5.26	190	22	2	11	212	119	198	1.04
75	75	6.0	6.56	152	18	2	9	212	119	162	1.06
75	75	8.0	8.59	116	18	2	9	212	143	162	1.39
90	90	5.0	6.37	157	22	2	11	255	130	198	1.26
90	90	8.0	10.5	95.4	18	2	9	255	153	162	1.70
12.0 Metre Standard Lengths											
100	100	6.0	8.92	112	16	2	8	283	129	192	1.71
100	100	8.0	11.7	85.2	14	2	7	283	138	168	1.97
125	125	4.0	7.27	138	20	2	10	354	136	240	1.74
125	125	5.0	8.95	112	18	2	9	354	141	216	1.93
125	125	8.0	14.9	67.2	12	2	6	354	144	144	2.14
150	150	5.0	10.8	92.6	18	2	9	424	159	216	2.33
150	150	6.0	13.6	73.4	18	2	9	424	172	216	2.94
150	150	8.0	18.0	55.5	12	2	6	424	162	144	2.59

MASS AND BUNDLING DATA

Profile Unequal Angles

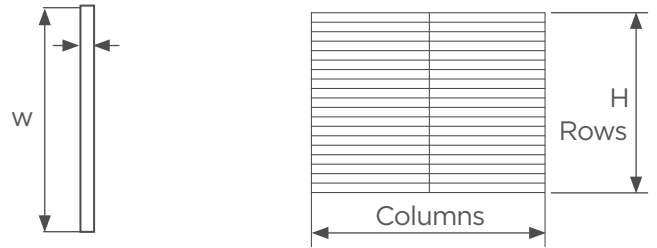


Nominal Size			Mass per Metre	Metres per Tonne kg/m	No. of Lengths per Bundle	Arrangement of Bundle		Overall Bundle		Total Metres per Bundle	Total Weight per Bundle
b ₁ (mm)	b ₂ (mm)	t (mm)	kg/m	m/t		Columns	Rows	W (mm)	H (mm)	m	tonnes
9.0 Metre Standard Lengths											
75	50	4.0	3.54	282	22	2	11	191	94	198	0.701
75	50	5.0	4.34	231	22	2	11	193	106	180	0.859
75	50	6.0	5.38	186	18	2	9	194	106	162	0.872
12.0 Metre Standard Lengths											
100	75	6.0	7.74	129	16	2	8	258	117	192	1.49
100	75	8.0	10.2	98.4	16	2	8	261	137	192	1.95
125	75	6.0	8.92	112	16	2	8	306	120	192	1.71
125	75	8.0	11.7	85.2	14	2	7	308	129	168	1.97
150	100	6.0	11.3	88.7	16	2	8	372	140	192	2.16
150	100	8.0	14.9	67.2	12	2	6	371	137	144	2.14

TECHNICAL INFORMATION

MASS AND BUNDLING DATA

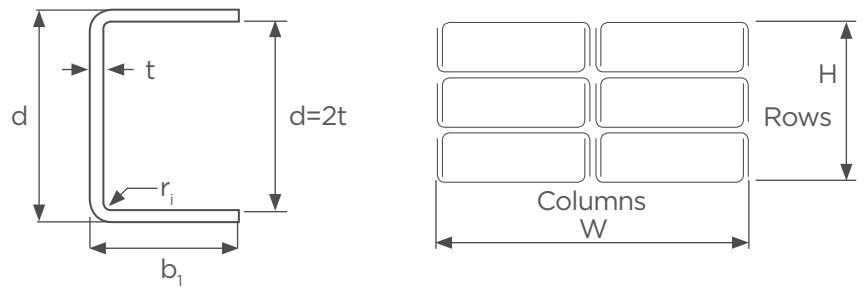
Profile Flats



Nominal Size		Mass per Metre	Metres per Tonne	No. of Lengths per Bundle	Arrangement of Bundle		Overall Bundle		Total Metres per Bundle	Total Weight per Bundle
w (mm)	t (mm)	kg/m	m/t		Columns	Rows	W (mm)	H (mm)	m	tonnes
50	4.0	1.49	670	57	3	19	150	76	342	0.510
50	5.0	1.84	542	45	3	15	150	75	270	0.498
65	4.0	1.94	516	44	2	22	130	88	264	0.512
65	5.0	2.40	417	36	2	18	130	90	216	0.518
75	4.0	2.24	447	38	2	19	150	76	228	0.510
75	5.0	2.77	361	32	2	16	150	80	192	0.530
90	6.0	4.24	236	26	2	13	180	78	156	0.661
100	4.0	2.98	335	28	2	14	200	56	168	0.501
100	5.0	3.69	271	28	2	14	200	70	168	0.620
100	6.0	4.71	212	26	2	13	200	78	156	0.735
100	8.0	6.28	159	22	2	11	200	88	132	0.829
130	5.0	4.80	208	28	2	14	260	70	168	0.806
150	5.0	5.53	181	28	2	14	300	70	168	0.930
150	6.0	7.07	142	24	2	12	300	72	144	1.017
150	8.0	9.42	106	22	2	11	300	88	132	1.243
200	5.0	7.38	136	32	2	16	400	80	192	1.417
200	6.0	9.42	106	28	2	14	400	84	168	1.583
200	8.0	12.6	79.6	22	2	11	400	88	132	1.658
250	5.0	9.22	108	23	1	23	250	115	138	1.273
250	8.0	15.7	63.7	16	1	16	250	128	96	1.507
300	5.0	11.1	90.3	19	1	19	300	95	114	1.262
300	8.0	18.8	53.1	12	1	12	300	96	72	1.356

MASS AND BUNDLING DATA

Profile Channels



Nominal Size			Mass per Metre	Metres per Tonne kg/m	No. of Lengths per Bundle	Arrangement of Bundle		Overall Bundle		Total Metres per Bundle	Total Weight per Bundle
d (mm)	b _f (mm)	t (mm)	kg/m	m/t		Columns	Rows	W (mm)	H (mm)	m	tonnes
9.0 Metre Standard Lengths											
75	40	4.0	4.25	236	18	3	6	237	131	162	0.688
100	50	4.0	5.59	179	18	3	6	312	161	162	0.905
125	65	4.0	7.23	138	18	3	6	387	206	162	1.17
12.0 Metre Standard Lengths											
150	75	5.0	10.5	95.1	12	2	6	313	239	144	1.51
180	75	5.0	11.6	86.0	12	2	6	373	239	144	1.67
200	75	5.0	12.4	80.9	12	2	6	413	239	144	1.78
200	75	6.0	15.5	64.6	12	2	6	420	243	144	2.23
230	75	6.0	16.9	59.2	12	2	6	480	243	144	2.43
250	90	6.0	19.2	52.0	8	2	4	520	192	96	1.85
300	90	6.0	21.6	46.3	6	1	6	314	288	72	1.56
300	90	8.0	28.5	35.1	6	1	6	316	294	72	2.05



Address 146 Ingram Road, Acacia Ridge Qld 4110 | PO Box 246, Sunnybank Qld 4109 Australia

Phone +61 7 3909 6600 | **Fax** +61 7 3909 6660

Web austubemills.com

This publication has been prepared as a guide only to assist anyone that may specify or use the products described in this publication. Accordingly, while Australian Tube Mills has endeavoured to ensure that all information provided in this publication is accurate and up-to-date, the following must be noted: this publication does not take into account any individual circumstances and is therefore not a substitute for informed or professional individual advice; the specifications and technical data relating to the products described in this publication are approximate and subject to change without notice, and users should check the currency of the information before relying upon it; and unless required by law, Australian Tube Mills does not accept any responsibility for any loss, damage or consequence resulting from the contents of this publication or from any omission of information in this publication.

© Copyright Australian Tube Mills Pty Ltd. DuraGal[®], DuraGal^{Plus}[®] and DuraGal^{Ultra}[®] are registered trade marks of Australian Tube Mills Pty Ltd. August 2013. TS1888.

