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2.1 General

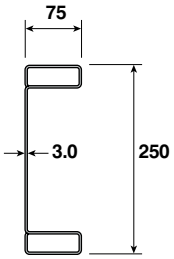
Australian Tube Mills (ATM) manufactures the LiteSteel beam to an in-house specification with a high strength steel which is the most appropriate for the forming process, welding and grade requirements. The specification details required by structural engineers are outlined in this part of the publication. Compliance with this specification (ATM 0402 – LiteSteel beam Specification) is controlled by the ATM Quality Assurance Procedures.

Because it is a cold-formed steel product, the design of the LSB in structures must comply with AS/NZS 4600 Cold-formed steel structures.

The designation for the LSB is illustrated in the following example:

250 × 75 × 3.0 LSB

Where 250 = depth (mm)
75 = flange width (mm)
3.0 = thickness (mm)
LSB = LiteSteel beam



2.2 Properties of Steel

The properties of steel adopted in this publication are shown in the table below. Other properties such as Poisson's Ratio and Coefficient of Thermal Expansion are also listed.

Property	Symbol	Value
Young's Modulus of Elasticity	E	200×10^3 MPa
Shear Modulus of Elasticity	G	80×10^3 MPa
Density	ρ	7850 kg/m^3
Poisson's Ratio	ν	0.25
Coefficient of Thermal Expansion	α_T	11.7×10^{-6} per °C

2.3 LiteSteel beam (LSB)

2.3.1 Dimensions and Section Properties

The dimensions and section properties of the full range of LSB sections are provided in Tables 2.1-1 and 2.1-2. Further information including section and member capacities for structural engineers are available in the Design Capacity Tables (SSLST 2005a).

2.3.2 Mechanical Properties

The DuoSteel grade LiteSteel beam is manufactured from a base steel which has a yield stress f_y = 380 MPa and a tensile strength f_u = 490 MPa. The cold-forming process enhances the yield stress and tensile strength of the flanges of the LSB in the same way it does for the rectangular hollow sections, producing a formed section which complies with the following requirements:

Location	Minimum Yeild Stress f_y MPa	Minimum Tensile Strength f_u MPa	Minimum Elongation as a proportion of Gauge Length $5.65\sqrt{S_o}$ %
Web	380	490	14
Flanges	450	500	14

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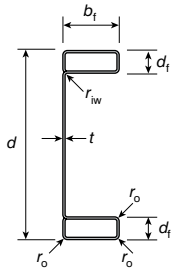
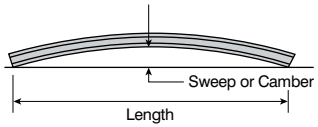
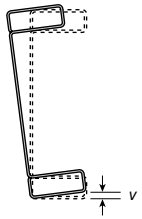
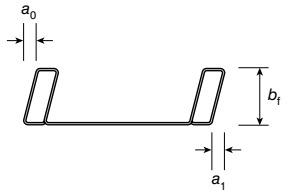
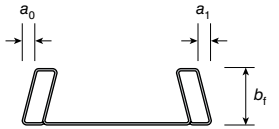
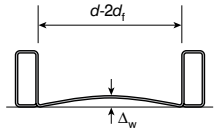
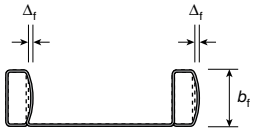
2.3.3 Tolerances

Tolerances for LiteSteel beam sections are as follows:

Parameter	Tolerance	Illustration
Overall depth, d	± 0.01d	
Flange width, b_f ($b_f \le 50$ mm) ($b_f > 50$ mm)	± 0.5 mm ± 0.015b_f	
Flange depth, d_f	± 1.0 mm	
Thickness, t	+ 10%, – 5%	
Mass	≥ 0.96 × specified mass	
Flange outside radius, r_o	1.5t to 4.0t	
Web inside radius, r_{iw}	0.5t to 2.25t	
Straightness	≤ specified length / 500	
Twist	$v \le 2$ mm + 0.5 mm/m length	

Parameter	Tolerance	Illustration
Single flange out-of-square	a_1 or $a_o \le 0.04b_f$	
Two flanges out-of-square	$a_1 + a_o \le 0.06b_f$	
Web flatness	$\Delta_w \le (d - 2d_f) / 150$	
Flange flatness	$\Delta_f \le 0.01b_f$	

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2.3.4 Method of Manufacture

LiteSteel beam sections are manufactured by the same process and on mills similar to those used to manufacture circular, square and rectangular hollow sections. The difference in the mills relates to the shape of the LSB and the patented process of simultaneously producing two complete penetration butt welds to close the hollow flanges during the forming process.

The manufacturing process begins by feeding a single strip of steel through a series of forming rolls which folds outer edges of the strip to form hollow sections, presenting the free edges to the ends of the web portion ready for welding. The flanges are then fully welded using the Dual Electric Resistance Welding (DERW) process. After the welds are checked using non-destructive testing (NDT), the section is sized and shaped to the final dimensions before being cut to length and bundled.

This results in a light weight steel section which has no free edges (hence no sharp edges), and which is very robust and torsionally stiff, making it easy to handle and to use.

2.3.5 Surface Coating – AZ+

LiteSteel beam AZ+ hollow flange channels are supplied with a 55% Aluminium-Zinc alloy protective coating which provides significantly greater protection against atmospheric corrosion than galvanised coatings of the same coating mass.

LSB AZ+ sections 1.6 and 2.0 mm thick are manufactured from AZ150 coated steel coil, and 2.5 and 3.0 mm thick sections are manufactured from AZ120 coated steel coil. The pre-coated steel coil is manufactured in accordance with JIS G 3321 Hot-dip 55% aluminium-zinc alloy coated steel sheets and coils. The coating in the external weld zone is restored to the same level of protection as the original coating by the application of aluminium and zinc hot metal sprays. Using pre-coated strip ensures that the inside surfaces of the LSB flanges have the same corrosion protection as the external surfaces.

Unprotected surfaces that have been cut or drilled require re-coating with a zinc-rich paint application to maintain protection. Zinc-rich paints should conform to AS/NZS 375001: Paints for steel structures – Organic zinc-rich primer. Best results can be achieved with single component or multi component epoxy zinc-rich paints applied to a minimum 100 micron coating thickness.

LSB Thickness (mm)	Coating Class
3.0	AZ120
2.5	AZ120
2.0	AZ150
1.6	AZ150

2.3.6 Availability

All LSB sizes listed in the tables are normally readily available cut to length from any steel stockist.

The maximum standard length available is 14.5 m for sections with 75 mm and 60 mm wide flanges, and 12.0 m for sections with 45 mm wide flanges.

Longer lengths up to 15.0 m may be ordered subject to minimum order requirements and rolling schedules. Lengths greater than 12.0 m for sections with 45 mm wide flanges require special handling procedures. Please refer to the manufacturer for further details.

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2.4 Square Hollow Sections (SHS)

All square hollow sections specified in this manual refer to DualGrade® C350L0/C450L0 manufactured by Australian Tube Mills. The minimum yield stress and tensile strength used for DualGrade SHS in design are given in the table below.

Australian Standard	Steel Grade	Minimum Yield Stress f_y MPa	Minimum Tensile Strength f_u MPa
AS 1163	C450L0	450	500

2.5 Hot Rolled Angles, Flats and Plates

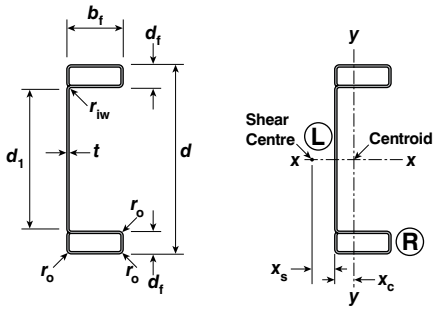
Steel angles, flats and plate are used for connection components. It is generally more economical to use flats rather than plate, so standard flat sizes have been specified wherever possible in this publication. The minimum yield stresses and tensile strengths of the standard grades of angle, flat and plate are given in the table below. These have been used for design in this publication.

Australian Standard	Form	Steel Grade	Thickness t mm	Minimum Yield Stress f_y MPa	Minimum Tensile Strength f_u MPa
AS/NZS 3679.1	Angles Flats	300	$t < 11$	320	440
			$11 \le t \le 17$	300	440
			$t > 17$	280	440
AS/NZS 3678	Plate	250	$t \le 8$	280	410
			$8 < t \le 12$	260	410
			$12 < t \le 50$	250	410

TABLE 2.1-1

LiteSteel beam

DIMENSIONS AND FULL SECTION PROPERTIES



Dimensions											Properties										
Designation			Mass per metre	Flange Depth	Outside Flange Radius	Inside Web Radius	Web Flat Depth	Coord. of Centroid	Coord. of Shear Centre	External Surface Area	Gross Area of Section	about x-axis			about y-axis				Torsional Rigidity of Flange	Torsion Constant	Warping Constant
d	b_f	t		d_f	r_o	r_{iw}	d_1	x_c	x_s		A_g	I_x	Z_x	r_x	I_y	Z_{yL}	Z_{yR}	r_y	$G J_f$	J	I_w
mm	mm	mm	kg/m	mm	mm	mm	mm	mm	mm	m²/m	mm²	10^6mm⁴	10^3mm³	mm	10^6mm⁴	10^3mm³	10^3mm³	mm	10^6Nmm²	10^3mm⁴	10^9mm⁶
300 × 75 × 3.0		LSB	14.5	25.0	6.00	3.00	244	22.7	26.8	0.877	1840	24.6	164	116	1.23	54.3	23.5	25.9	13000	328	17.1
		2.5 LSB	12.2	25.0	5.00	3.00	244	22.8	27.1	0.881	1550	20.8	139	116	1.06	46.6	20.3	26.2	11400	287	14.7
300 × 60 × 2.0		LSB	8.80	20.0	4.00	3.00	254	16.4	20.5	0.825	1110	14.5	96.8	114	0.466	28.5	10.7	20.5	4670	118	6.47
250 × 75 × 3.0		LSB	13.3	25.0	6.00	3.00	194	24.6	27.9	0.777	1690	15.9	127	96.9	1.16	47.1	23.0	26.2	13000	328	11.1
		2.5 LSB	11.2	25.0	5.00	3.00	194	24.7	28.2	0.781	1420	13.4	107	97.2	0.998	40.5	19.8	26.5	11400	286	9.58
250 × 60 × 2.0		LSB	8.00	20.0	4.00	3.00	204	17.9	21.5	0.725	1010	9.38	75.0	96.4	0.440	24.6	10.4	20.9	4670	117	4.24
200 × 60 × 2.5		LSB	8.86	20.0	5.00	3.00	154	19.7	22.3	0.621	1120	6.74	67.4	77.5	0.490	24.9	12.1	20.9	5500	138	3.00
		2.0 LSB	7.21	20.0	4.00	3.00	154	19.7	22.6	0.625	910	5.50	55.0	77.7	0.408	20.7	10.1	21.2	4670	117	2.51
200 × 45 × 1.6		LSB	4.95	15.0	3.20	3.00	164	13.0	15.9	0.568	624	3.67	36.7	76.8	0.150	11.5	4.68	15.5	1550	39.1	0.923
150 × 45 × 2.0		LSB	5.31	15.0	4.00	3.00	114	14.7	16.8	0.465	670	2.26	30.1	58.1	0.163	11.0	5.38	15.6	1820	45.8	0.560
		1.6 LSB	4.32	15.0	3.20	3.00	114	14.8	17.0	0.468	544	1.84	24.6	58.2	0.136	9.20	4.51	15.8	1550	39.0	0.469

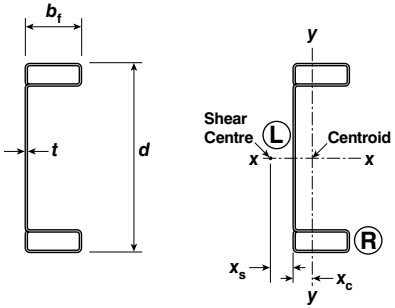
Notes:

1. **Always ensure that you are using current information on the LSB product range. This can be verified by comparing the document version date (noted at the bottom of the page) with the current version date of each publication. The current version date and downloadable versions of all LSB publications can be obtained by referring to www.litesteelbeam.com.au or by contacting LST.**
2. Steel grade DuoSteel (flange f_{yf} = 450 MPa and f_{uf} = 500 MPa; web f_{yw} = 380 MPa and f_{uw} = 490 MPa).
3. Full section properties are calculated in accordance with AS/NZS 4600.

TABLE 2.1-2

LiteSteel beam

EFFECTIVE SECTION PROPERTIES



Designation				Mass per metre	Yield Stress		Axial Compression		Bending					
					Flange	Web	Effective Area	Coord. of Centroid	about x-axis		about y-axis			
d	b_f	t			f_{yf}	f_{yw}	A_e	x_c	I_{ex}	Z_{ex}	I_{eyL}	Z_{eyL}	I_{eyR}	Z_{eyR}
mm	mm	mm		kg/m	MPa	MPa	mm^2	mm	10^6mm^4	10^3mm^3	10^6mm^4	10^3mm^3	10^6mm^4	10^3mm^3
300 ×	75 ×	3.0	LSB	14.5	450	380	1450	22.7	24.6	164	1.09	22.4	1.23	23.5
		2.5	LSB	12.2	450	380	1180	22.8	20.8	139	0.901	19.0	1.06	20.3
300 ×	60 ×	2.0	LSB	8.80	450	380	763	16.4	14.5	96.8	0.379	9.84	0.466	10.7
250 ×	75 ×	3.0	LSB	13.3	450	380	1440	24.6	15.9	127	1.06	22.1	1.16	23.0
		2.5	LSB	11.2	450	380	1180	24.7	13.4	107	0.881	18.8	0.998	19.8
250 ×	60 ×	2.0	LSB	8.00	450	380	760	17.9	9.38	75.0	0.371	9.75	0.440	10.4
200 ×	60 ×	2.5	LSB	8.86	450	380	967	19.7	6.74	67.4	0.453	11.7	0.490	12.1
		2.0	LSB	7.21	450	380	755	19.7	5.50	55.0	0.361	9.64	0.408	10.1
200 ×	45 ×	1.6	LSB	4.95	450	380	462	13.0	3.67	36.7	0.127	4.38	0.150	4.68
150 ×	45 ×	2.0	LSB	5.31	450	380	587	14.7	2.26	30.1	0.153	5.23	0.163	5.38
		1.6	LSB	4.32	450	380	458	14.8	1.84	24.6	0.122	4.31	0.136	4.51

Notes:

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2. Steel grade DuoSteel (flange f_{yf} = 450 MPa and f_{uf} = 500 MPa; web f_{yw} = 380 MPa and f_{uw} = 490 MPa).
3. Effective section properties are calculated in accordance with AS/NZS 4600.
4. I_{eL} and Z_{eL} are for bending about the y-axis that causes compression in the web "L".
5. I_{eR} and Z_{eR} are for bending about the y-axis that causes compression in the flange tips "R".

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