LiteSteel beam Part 2 Materials

Residential Construction Manual For LiteSteel® beam

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Corrosion Protection Brilliance.

AZ+ Galvanised Protection

Contents

Section		Page
2.1	**General**	**2-2**
2.2	**Properties of Steel**	**2-2**
2.3	**Dimensions and Section Properties**	**2-2**
2.4	**Specification**	**2-2**
2.4.1	Mechanical Properties	2-2
2.4.2	Tolerances	2-3
2.5	**Method of Manufacture**	**2-4**
2.6	**Surface Treatment**	**2-4**
2.7	**Availability**	**2-4**

Table	Page
Table 2.1-1: Dimensions and Full Section Properties	2-5
Table 2.1-2: Effective Section Properties	2-6

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2.1 General

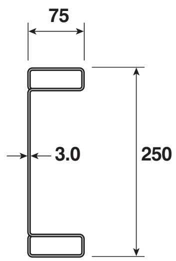
Australian Tube Mills (ATM) manufactures the LSB to an in-house specification with a high strength steel which is the most appropriate for the forming process, welding and grade requirements. The specification details required by structural engineers are outlined in this part of the publication. Compliance 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 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 (LST 2005a).

2.4 Specification

2.4.1 Mechanical Properties

The DuoSteel grade LiteSteel beam is manufactured from a base steel which has a minimum yield stress f_y = 380 MPa and a minimum 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 rectangular hollow sections, producing a formed section which complies with the following requirements:

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

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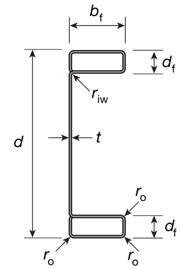
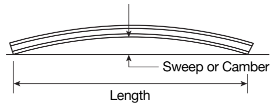
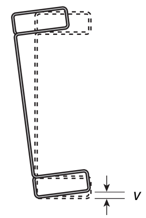
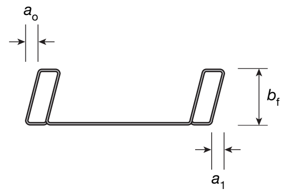
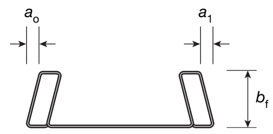
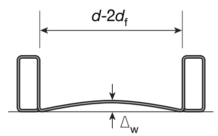
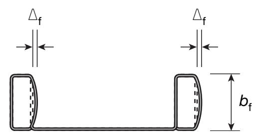
2.4.2 Tolerances

Tolerances for LiteSteel beam sections are as follows:

Parameter	Tolerance	Illustration
Overall depth, d	$\pm 0.01d$	
Flange width, b_f ($b_f \leq 50$ mm) ($b_f > 50$ mm)	$\pm$ 0.5 mm $\pm 0.015b_f$	
Flange depth, d_f	$\pm$ 1.0 mm	
Thickness, t	+ 10%, – 5%	
Mass	$\geq$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	$\leq$specified length / 500	
Twist	$v \leq$ 2 mm + 0.5 mm/m length	

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

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2.5 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.

2.6 Surface Treatment

LSB AZ+ sections are supplied with an Aluminium-Zinc alloy protective coating. AZ+ provides significantly greater protection against atmospheric corrosion than plain galvanised coatings of the same mass.

LSB AZ+ is manufactured from pre-coated strip complying with JIS G 3321 Hot-dip 55% Aluminium-Zinc alloy coated steel sheets and coils. AZ150 coated strip is used to manufacture 1.6 and 2.0 mm thick sections and AZ120 coated strip is used to manufacture 2.5 and 3.0 mm thick sections. Hot metal spraying with a combination of Zinc and Aluminium wire is used to repair the weld zone to the same level of protection as the original Aluminium-Zinc alloy protective coating. The use of pre-coated strip ensures that the flanges on the finished product are protected on the inside surface as well as the outside surface.

For top coating, the surface should be prepared with an etch primer or galvanised metal primer prior to painting. Water based acrylic primers and self priming paints are not suitable for direct painting on the AZ+ surface.

2.7 Availability

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

The maximum standard length available is 13.5 m. The maximum standard length may vary in some states. Please refer to LiteSteel Technologies or the local LSB stockist for current standard length availability.

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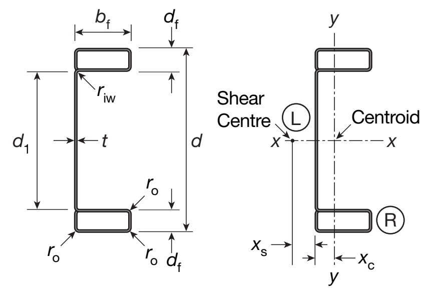
Table 2.1-1
LiteSteel beam
Dimensions and Full Section Properties



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	m^2/m	mm^2	$10^6 mm^4$	$10^3 mm^3$	mm	$10^6 mm^4$	$10^3 mm^3$	$10^3 mm^3$	mm	$10^6 Nmm^2$	$10^3 mm^4$	$10^9 mm^6$
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.

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Table 2.1-2
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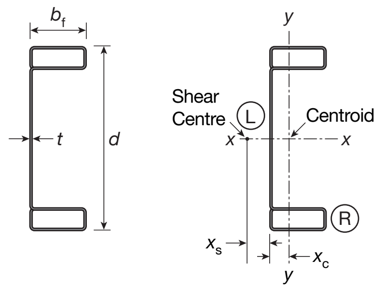
Effective Section Properties



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	mm²	mm	10^6mm⁴	10^3mm³	10^6mm⁴	10^3mm³	10^6mm⁴	10^3mm³
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

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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".