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Guideline for the Design of Stainless Steel Structures
Part 1: Dimensions and Section Properties

Prepared For:



Stainless Structurals
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Guideline for the Design of Stainless Steel Structures

Part 1 - Dimensions and Section Properties

Revision History

<u>Revision No.</u>	<u>Date Released</u>	<u>Description</u>
N/A	2/2007	First Edition. It is not intended that the dimensions and section properties in this First Edition be used for analysis or design purposes. Rather, it is intended that the format of this document, and the type and numerical values of information displayed herein be reviewed by the engineering community. Constructive criticism is sought from said community for consideration by the authors and Stainless Structural LLC for the preparation of future editions.

Note that the data is functional only with shapes made by and/or certified by Stainless Structural, LLC. They are not to be used with uncertified shapes, as dimensions, mechanical properties and methods of manufacture vary.

Please access our web site at www.stainless-structurals.com for the most up-to-date information and range of available sections. New shapes and ancillary information are being added on a regular basis.

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P r e f a c e

The Georgia Institute of Technology and Stainless Structural, LLC intend to develop a guideline for the design of stainless steel structures. The first phase of this effort is the development of a set of section properties for stainless steel rolled and laser-fused shapes used for construction. This document contains section property tables for five shapes currently produced by Stainless Structural, LLC. It is anticipated that the number of such tables will be increased and documented through updates to this document as new information becomes available.

Further, as subsequent phases of this effort are completed, this document also will be updated.

STAINLESS STRUCTURALS PRODUCTS

The dimensions and properties for Stainless Structurals Products used in construction are given in this part of the guideline. For design purposes, each cross section is referenced with respect to a local Cartesian coordinate system (x,y,z) where the local x -axis coincides with the centroidal longitudinal axis of the member, while the local y - and z -axes coincide with the principal axes of the member cross-section as shown in Figure 1.

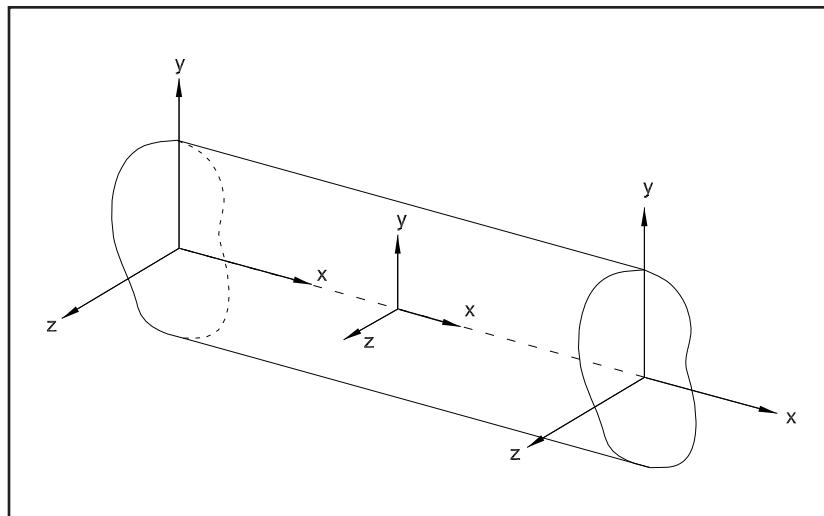


Figure 1. Local Member Reference Frame

Five types of cross section shapes are covered in this document. These are: W-shapes, S-shapes, Channels or C-shapes, Structural Tees, and Angles. Properties of these shapes include cross section area, shear areas, torsion constant, moments of inertia, product moments of inertia, section moduli, radii of gyration, warping constant, centroid and shear center locations, and principal axis orientation, and are computed in accordance with accepted engineering principles. All calculations are carried out by means of a computer program **CIMTEC Calc** developed by the authors. Reported section property values are rounded as follows:

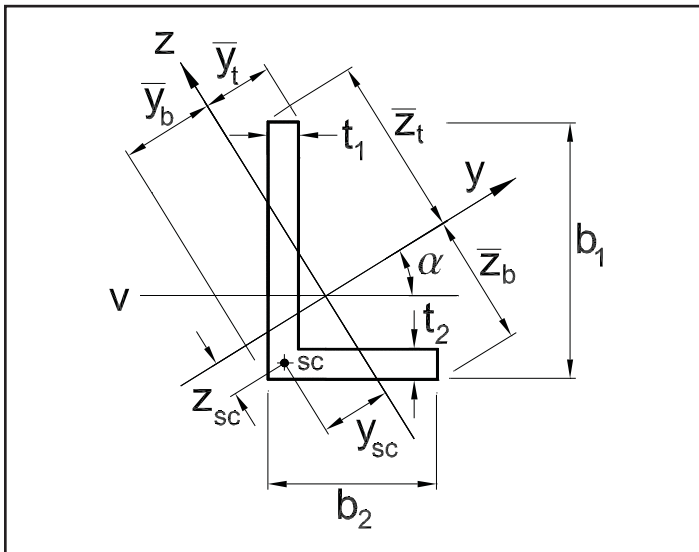
- to the nearest whole number when the computed value is 100 or greater,
- to the nearest one-tenth when the computed value is between 10 and 99,
- to the nearest one-hundredth when the computed value is between 1 and 9, and
- to the nearest ten-thousandth when the computed value is a number less than 1.

Part 1

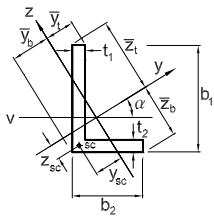
L Shapes Unequal Legs Dimensions and Properties (Principal Axes y,z)

DIMENSIONS AND PROPERTIES OF LASER-FUSED AND HOT-ROLLED UNEQUAL LEG SINGLE ANGLE SHAPES

Dimensions and properties of laser-fused and hot-rolled unequal single angle shapes according to principal axes y,z are given in this section. The following notations are used in these tables.



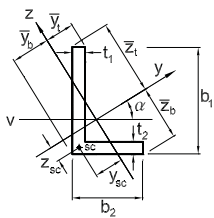
- A** Gross cross sectional area of the section
- b₁** Full nominal length of leg 1
- t₁** Leg 1 thickness
- b₂** Full nominal length of leg 2
- t₂** Leg 2 thickness
- α** Principal angle
- A_y** Shear area with respect to the principal axis y
- I_y** Moment of inertia about the principal axis y
- S_y^{top}** Positive z-direction elastic section modulus corresponding to the principal axis y
- S_y^{bot}** Negative z-direction elastic section modulus corresponding to the principal axis y
- r_y** Radius of gyration corresponding to the principal axis y
- z_t** Positive z direction distance from the centroid to the extreme fiber
- z_b** Negative z direction distance from the centroid to the extreme fiber
- A_z** Shear area with respect to the principal axis z
- I_z** Moment of inertia about the principal axis z
- S_z^{top}** Positive y-direction elastic section modulus corresponding to the principal axis z
- S_z^{bot}** Negative y-direction elastic section modulus corresponding to the principal axis z
- r_z** Radius of gyration corresponding to the principal axis z
- y_t** Positive y direction distance from the centroid to the extreme fiber
- y_b** Negative y direction distance from the centroid to the extreme fiber
- y_{sc}** y-coordinate of the shear center
- z_{sc}** z-coordinate of the shear center
- J** Torsion constant
- C_w** Warping constant
- SC** Shear center



L Shapes UNEQUAL LEGS (Laser Fused) (Principal Axes y, z)

Dimensions and Properties

Shape	A in. ²	Leg1		Leg2		α deg.	Axis y-y						Axis z-z						Shear Center		Torsion Properties			
		b_1 in.	t_1 in.	b_2 in.	t_2 in.		A_y in. ²	I_y in. ⁴	S_y^{top} in. ³	S_y^{bot} in. ³	r_y in.	\bar{z}_t in.	\bar{z}_b in.	A_z in. ²	I_z in. ⁴	S_z^{top} in. ³	S_z^{bot} in. ³	r_z in.	\bar{y}_t in.	\bar{y}_b in.	y_{sc} in.	z_{sc} in.	J in. ⁴	C_w in. ⁶
		L 6x3x1/4	2.19	6.00	0.2500		3.00	0.2500	15.3	0.574	8.95	2.28	3.37	2.02	3.92	2.66	1.25	0.947	0.517	0.840	0.658	1.83	1.13	-0.970
L 6x4x1/4	2.44	6.00	0.2500	4.00	0.2500	24.3	0.845	10.8	2.62	3.59	2.10	4.11	3.00	1.21	1.92	0.890	1.20	0.887	2.16	1.59	-1.42	-1.29	0.0518	0.113
L 8x4x1/4	2.94	8.00	0.2500	4.00	0.2500	15.4	0.765	21.6	4.12	6.14	2.71	5.25	3.52	1.67	2.30	0.937	1.56	0.885	2.45	1.47	-1.31	-2.35	0.0625	0.237
L 8x4x3/8	4.36	8.00	0.3750	4.00	0.3750	15.2	1.15	31.5	6.04	8.89	2.69	5.22	3.55	2.50	3.33	1.36	2.19	0.874	2.44	1.52	-1.28	-2.32	0.208	0.780



L Shapes UNEQUAL LEGS (Hot Rolled) (Principal Axes y, z)

Dimensions and Properties

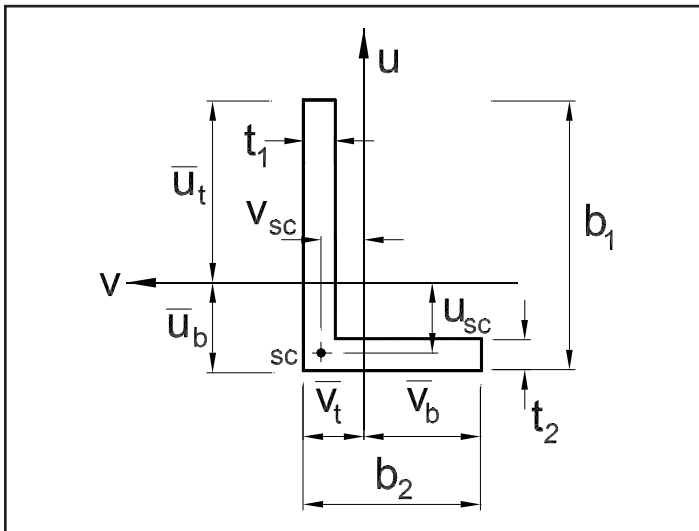
Shape	A in. ²	Leg1		Leg2		α deg.	Axis y-y						Axis z-z						Shear Center		Torsion Properties			
		b_1 in.	t_1 in.	b_2 in.	t_2 in.		A_y in. ²	I_y in. ⁴	S_y^{top} in. ³	S_y^{bot} in. ³	r_y in.	\bar{z}_t in.	\bar{z}_b in.	A_z in. ²	I_z in. ⁴	S_z^{top} in. ³	S_z^{bot} in. ³	r_z in.	\bar{y}_t in.	\bar{y}_b in.	y_{sc} in.	z_{sc} in.	J in. ⁴	C_w in. ⁶
		L 2x1x1/4	0.688	2.00	0.2500		1.00	0.2500	13.9	0.218	0.287	0.227	0.313	0.646	1.27	0.916	0.416	0.0307	0.0517	0.0704	0.211	0.594	0.436	-0.274
L 3x1-1/2x1/4	1.06	3.00	0.2500	1.50	0.2500	14.6	0.298	1.04	0.539	0.770	0.990	1.93	1.35	0.624	0.109	0.121	0.179	0.321	0.904	0.611	-0.451	-0.830	0.0221	0.0114
L 3x2x3/16	0.900	3.00	0.1875	2.00	0.1875	24.0	0.316	0.972	0.475	0.644	1.04	2.05	1.51	0.451	0.173	0.161	0.210	0.439	1.08	0.825	-0.696	-0.635	0.0105	0.0057
L 3x2x1/4	1.19	3.00	0.2500	2.00	0.2500	23.8	0.427	1.25	0.616	0.827	1.03	2.04	1.52	0.603	0.225	0.208	0.264	0.435	1.08	0.852	-0.678	-0.623	0.0247	0.0132
L 3x2x3/8	1.73	3.00	0.3750	2.00	0.3750	23.2	0.663	1.75	0.870	1.15	1.01	2.01	1.53	0.909	0.320	0.296	0.354	0.430	1.08	0.904	-0.638	-0.592	0.0804	0.0413
L 4x3x1/4	1.69	4.00	0.2500	3.00	0.2500	29.2	0.647	3.41	1.23	1.56	1.42	2.77	2.18	0.794	0.716	0.478	0.575	0.651	1.50	1.25	-1.07	-0.662	0.0353	0.0356
L 4x3x3/8	2.48	4.00	0.3750	3.00	0.3750	28.8	0.979	4.85	1.76	2.21	1.40	2.76	2.19	1.19	1.03	0.684	0.790	0.644	1.51	1.30	-1.03	-0.647	0.116	0.114
L 5x3x1/4	1.94	5.00	0.2500	3.00	0.2500	20.4	0.615	5.70	1.69	2.40	1.71	3.36	2.37	1.02	0.851	0.499	0.714	0.663	1.71	1.19	-1.03	-1.23	0.0406	0.0606
L 5x3x3/8	2.86	5.00	0.3750	3.00	0.3750	20.0	0.932	8.19	2.45	3.43	1.69	3.34	2.39	1.53	1.22	0.719	0.983	0.654	1.70	1.24	-0.993	-1.21	0.134	0.196
L 6x3x3/8	3.23	6.00	0.3750	3.00	0.3750	15.0	0.872	12.9	3.33	4.83	2.00	3.89	2.68	1.87	1.36	0.748	1.16	0.649	1.82	1.18	-0.937	-1.71	0.152	0.320
L 6x4x3/8	3.61	6.00	0.3750	4.00	0.3750	24.0	1.27	15.6	3.81	5.17	2.08	4.09	3.02	1.81	2.78	1.29	1.68	0.877	2.16	1.65	-1.39	-1.27	0.170	0.369
L 6x4x1/2	4.75	6.00	0.5000	4.00	0.5000	23.8	1.71	20.1	4.93	6.62	2.06	4.07	3.03	2.41	3.59	1.66	2.11	0.870	2.16	1.70	-1.36	-1.25	0.396	0.843

Part 1

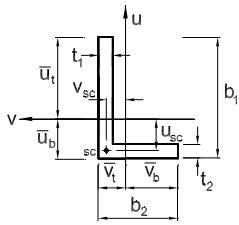
L Shapes Unequal Legs Dimensions and Properties (Axes u,v)

DIMENSIONS AND PROPERTIES OF LASER-FUSED AND HOT ROLLED UNEQUAL LEG SINGLE ANGLE SHAPES

Dimensions and properties of laser-fused and hot-rolled unequal single angle shapes according to axes u,v are given in this section. The following notations are used in these tables.



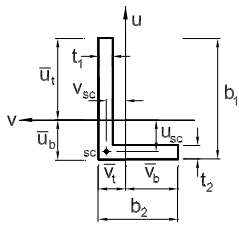
- A** Gross cross sectional area of the section
- b₁** Full nominal length of leg 1
- t₁** Leg 1 thickness
- b₂** Full nominal length of leg 2
- t₂** Leg 2 thickness
- A_v** Shear area with respect to the axis v
- I_v** Moment of inertia about the axis v
- S_v^{top}** Positive u-direction elastic section modulus corresponding to the axis v
- S_v^{bot}** Negative u-direction elastic section modulus corresponding to the axis v
- r_v** Radius of gyration corresponding to the axis v
- \bar{u}_t** Positive u direction distance from the centroid to the extreme fiber
- \bar{u}_b** Negative u direction distance from the centroid to the extreme fiber
- A_u** Shear area with respect to the axis u
- I_u** Moment of inertia about the axis u
- S_u^{top}** Positive v-direction elastic section modulus corresponding to the axis u
- S_u^{bot}** Negative v-direction elastic section modulus corresponding to the axis u
- r_u** Radius of gyration corresponding to the axis u
- \bar{v}_t** Positive v direction distance from the centroid to the extreme fiber
- \bar{v}_b** Negative v direction distance from the centroid to the extreme fiber
- I_{uv}** Product moment of inertia about the axes u, v
- u_{sc}** u-coordinate of the shear center
- v_{sc}** v-coordinate of the shear center
- J** Torsion constant
- C_w** Warping constant
- SC** Shear center



L Shapes UNEQUAL LEGS (Laser Fused) (Axes u,v)

Dimensions and Properties

Shape	A	Leg1		Leg2		Axis v-v						Axis u-u						Axis u-v		Shear Center		Torsion Properties		
		b ₁	t ₁	b ₂	t ₂	A _v	I _v	S _v ^{top}	S _v ^{bot}	r _v	u _t	u _b	A _u	I _u	S _u ^{top}	S _u ^{bot}	r _u	v _t	v _b	I _{uv}	u _{sc}	v _{sc}	J	C _w
		in. ²	in.	in.	in.	in. ²	in. ⁴	in. ³	in. ³	in.	in.	in.	in. ²	in. ⁴	in. ³	in. ³	in.	in.	in.	in. ⁴	in.	in.	in. ⁴	in. ⁶
L 6x3x1/4	2.19	6.00	0.2500	3.00	0.2500	0.537	8.40	2.15	4.01	1.96	3.90	2.10	1.29	1.50	2.52	0.625	1.96	0.596	2.40	2.03	-1.95	0.475	0.0464	0.0983
L 6x4x1/4	2.44	6.00	0.2500	4.00	0.2500	0.772	9.27	2.26	4.90	1.95	4.11	1.89	1.28	3.41	3.82	1.10	1.95	0.894	3.11	3.32	-1.76	0.770	0.0518	0.113
L 8x4x1/4	2.94	8.00	0.2500	4.00	0.2500	0.713	20.3	3.87	7.33	2.63	5.24	2.76	1.72	3.66	4.80	1.13	2.63	0.763	3.24	4.95	-2.62	0.641	0.0625	0.237
L 8x4x3/8	4.36	8.00	0.3750	4.00	0.3750	1.08	29.6	5.71	10.5	2.61	5.19	2.81	2.58	5.27	6.49	1.65	2.61	0.811	3.19	7.13	-2.58	0.629	0.208	0.780



L Shapes UNEQUAL LEGS (Hot Rolled) (Axes u,v)

Dimensions and Properties

Shape	A	Leg1		Leg2		Axis v-v						Axis u-u						Axis u-v	Shear Center		Torsion Properties				
		b ₁	t ₁	b ₂	t ₂	A _v	I _v	S _v ^{top}	S _v ^{bot}	r _v	u _t	u _b	A _u	I _u	S _u ^{top}	S _u ^{bot}	r _u		v _t	v _b	I _{uv}	u _{sc}	v _{sc}	J	C _w
		in. ²	in.	in.	in.	in. ²	in. ⁴	in. ³	in. ³	in.	in.	in.	in. ²	in. ⁴	in. ³	in. ³	in.		in.	in.	in.	in. ⁴	in.	in.	in. ⁴
L 2x1x1/4	0.688	2.00	0.2500	1.00	0.2500	0.207	0.272	0.220	0.357	0.629	1.24	0.761	0.427	0.0455	0.174	0.0616	0.629	0.261	0.739	0.0597	-0.554	0.145	0.0141	0.0032	
L 3x1-1/2x1/4	1.06	3.00	0.2500	1.50	0.2500	0.281	0.981	0.515	0.896	0.961	1.90	1.10	0.641	0.169	0.488	0.146	0.961	0.346	1.15	0.227	-0.917	0.227	0.0221	0.0114	
L 3x2x3/16	0.900	3.00	0.1875	2.00	0.1875	0.290	0.840	0.414	0.866	0.966	2.03	0.970	0.477	0.306	0.650	0.200	0.966	0.470	1.53	0.297	-0.863	0.377	0.0105	0.0057	
L 3x2x1/4	1.19	3.00	0.2500	2.00	0.2500	0.393	1.09	0.542	1.09	0.957	2.01	0.993	0.637	0.392	0.794	0.260	0.957	0.493	1.51	0.380	-0.844	0.369	0.0247	0.0132	
L 3x2x3/8	1.73	3.00	0.3750	2.00	0.3750	0.613	1.53	0.781	1.47	0.940	1.96	1.04	0.959	0.543	1.01	0.371	0.940	0.539	1.46	0.519	-0.795	0.353	0.0804	0.0413	
L 4x3x1/4	1.69	4.00	0.2500	3.00	0.2500	0.595	2.77	1.00	2.24	1.28	2.76	1.24	0.846	1.36	1.84	0.599	1.28	0.736	2.26	1.15	-1.10	0.610	0.0353	0.0356	
L 4x3x3/8	2.48	4.00	0.3750	3.00	0.3750	0.904	3.96	1.46	3.09	1.26	2.72	1.28	1.27	1.92	2.46	0.866	1.26	0.782	2.22	1.62	-1.06	0.592	0.116	0.114	
L 5x3x1/4	1.94	5.00	0.2500	3.00	0.2500	0.566	5.11	1.53	3.08	1.62	3.34	1.66	1.07	1.44	2.19	0.614	1.62	0.657	2.34	1.58	-1.51	0.534	0.0406	0.0606	
L 5x3x3/8	2.86	5.00	0.3750	3.00	0.3750	0.862	7.37	2.24	4.33	1.61	3.30	1.70	1.60	2.04	2.90	0.888	1.61	0.704	2.30	2.24	-1.47	0.520	0.134	0.196	
L 6x3x3/8	3.23	6.00	0.3750	3.00	0.3750	0.819	12.2	3.16	5.68	1.94	3.86	2.14	1.93	2.13	3.31	0.905	1.94	0.644	2.36	2.89	-1.90	0.464	0.152	0.320	
L 6x4x3/8	3.61	6.00	0.3750	4.00	0.3750	1.16	13.5	3.32	6.94	1.93	4.06	1.94	1.91	4.90	5.21	1.60	1.93	0.941	3.06	4.77	-1.73	0.754	0.170	0.369	
L 6x4x1/2	4.75	6.00	0.5000	4.00	0.5000	1.57	17.4	4.33	8.76	1.91	4.01	1.99	2.55	6.27	6.35	2.08	1.91	0.987	3.01	6.08	-1.69	0.739	0.396	0.843	