Statics Homework Handout 9:

Homework Assignment #9: 9.49, 9.50, 9.51, 9.54, 9.115, 9.127

9.31 and 9.32 Determine the moment of inertia and the radius of gyration of the shaded area with respect to the x axis.

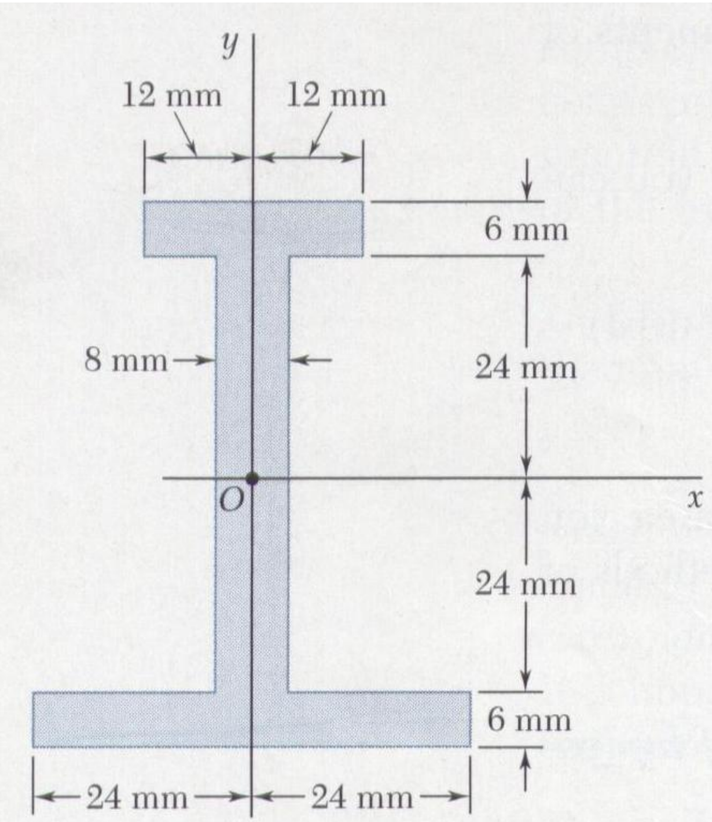


Fig. P9.31 and P9.33

9.33 and 9.34 Determine the moment of inertia and the radius of gyration of the shaded area with respect to the y axis.

9.49 Two 20-mm steel plates are welded to a rolled S section as shown. Determine the moments of inertia and the radii of gyration of the section with respect to the centroidal x and y axes.

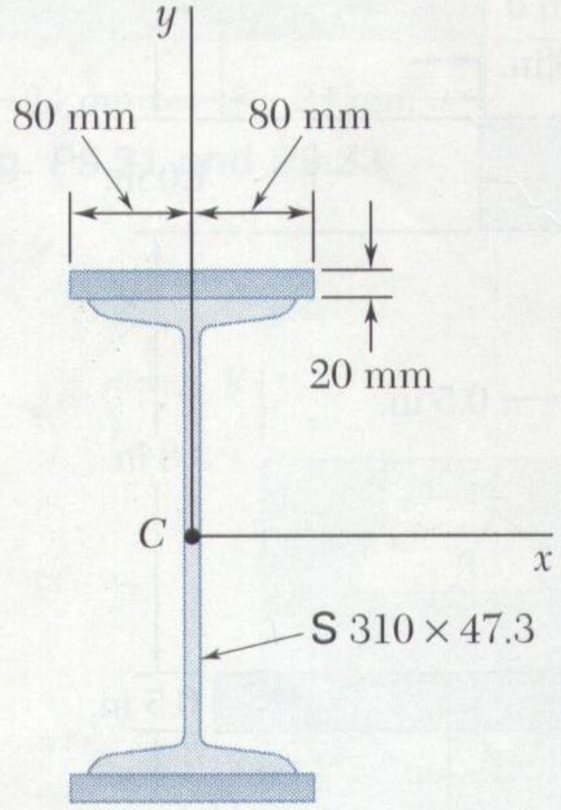


Fig. P9.49

9.50 To form a reinforced box section, two rolled W sections and two plates are welded together. Determine the moments of inertia and the radii of gyration of the combined section with respect to the centroidal axes shown.

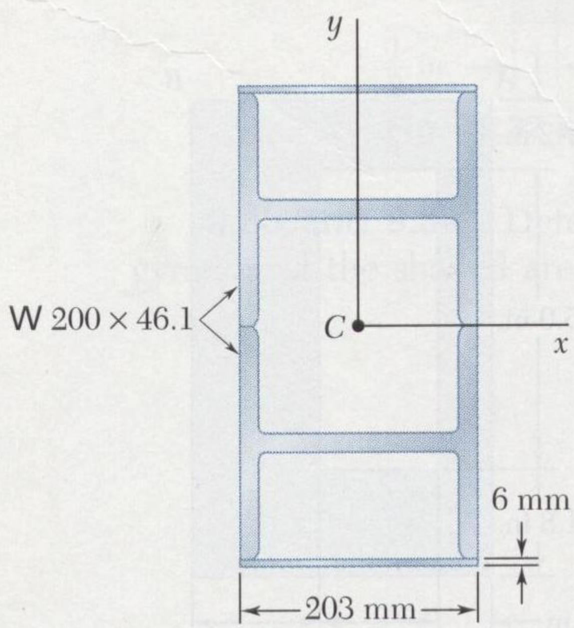


Fig. P9.50

9.51 Four 3 × 3 × $\frac{1}{4}$-in. angles are welded to a rolled W section as shown. Determine the moments of inertia and the radii of gyration of the combined section with respect to its centroidal x and y axes.

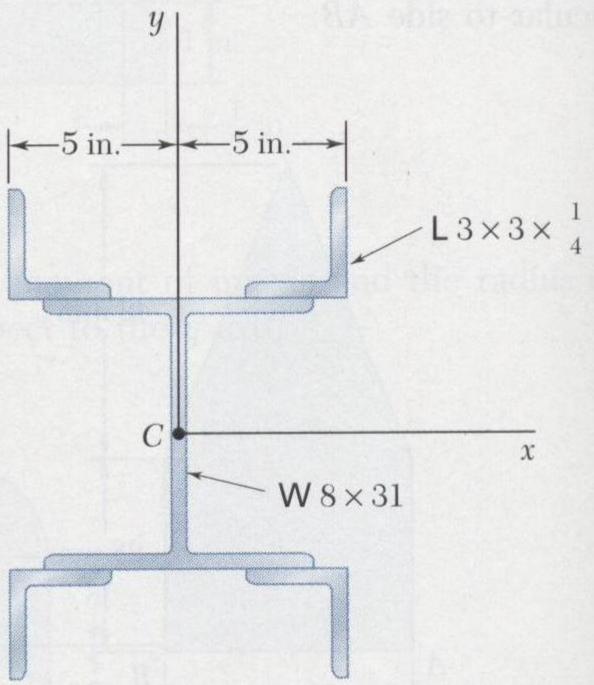


Fig. P9.51

9.54 To form an unsymmetrical girder, two 76 × 76 × 6.4-mm angles and two 152 × 102 × 12.7-mm angles are welded to a 16-mm steel plate as shown. Determine the moments of inertia of the combined section with respect to its centroidal x and y axes.

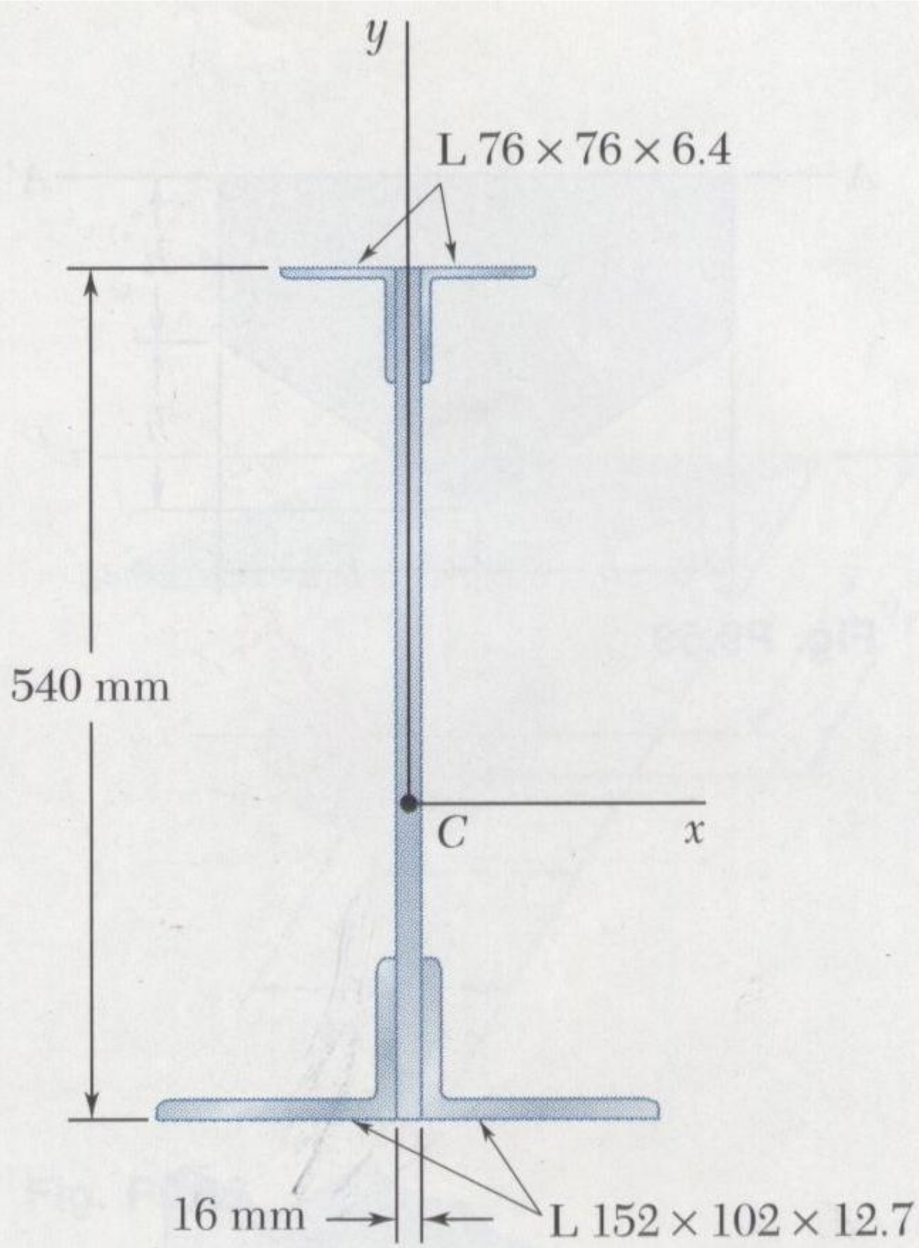


Fig. P9.54

9.115 A piece of thin, uniform sheet metal is cut to form the machine component shown. Denoting the mass of the component by m, determine its moment of inertia with respect to (*a*) the x axis, (*b*) the y axis.

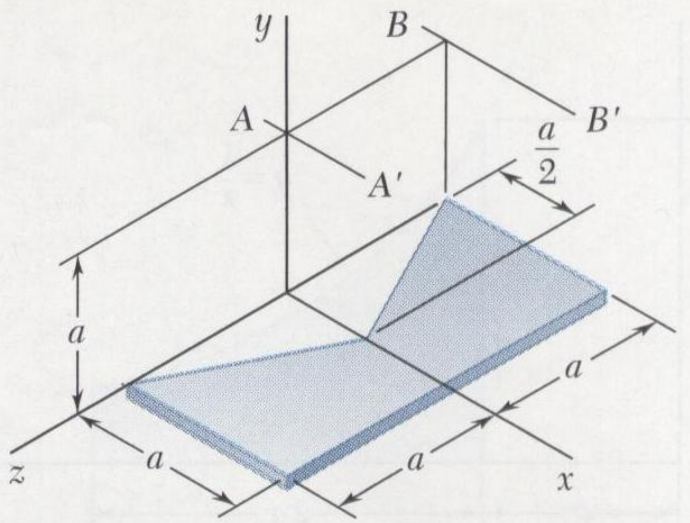


Fig. P9.115 and P9.116

9.117 A thin plate of mass m has the trapezoidal shape shown. Determine the mass moment of inertia of the plate with respect to (*a*) the x axis, (*b*) the y axis.

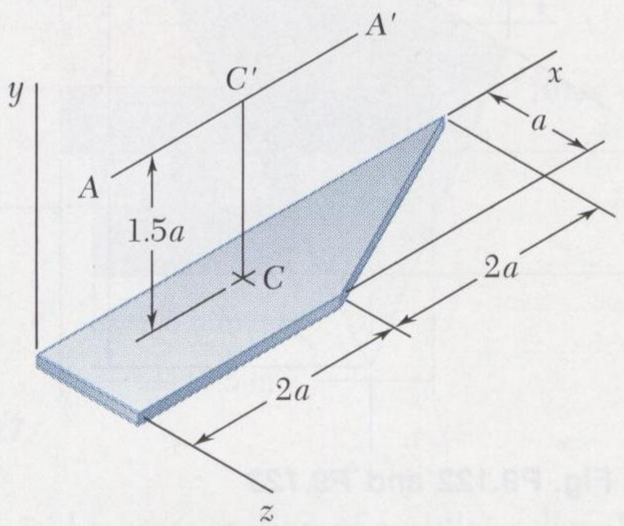


Fig. *P9.117* and *P9.118*

9.127 Shown is the cross section of a molded flat-belt pulley. Determine its moment of inertia and its radius of gyration with respect to the axis AA'. (The density of brass is 8650 kg/m^3 and the density of the fiber-reinforced polycarbonate used is 1250 kg/m^3.)

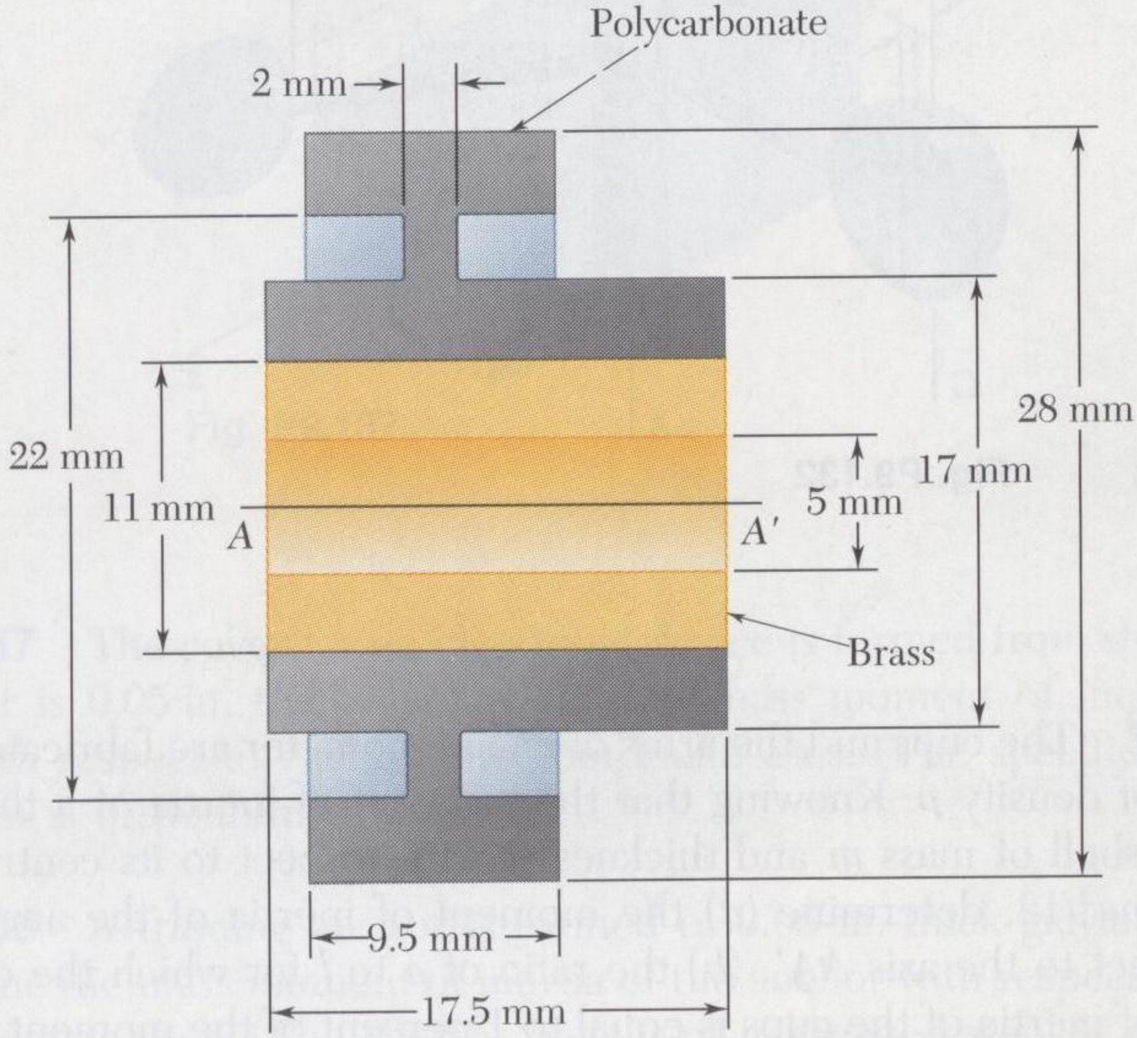


Fig. P9.127

9.128 Shown is the cross section of an idler roller. Determine its mass moment of inertia and its radius of gyration with respect to the axis AA'. (The specific weight of bronze is 0.310 lb/in^3; of aluminum, 0.100 lb/in^3; and of neoprene, 0.0452 lb/in^3.)

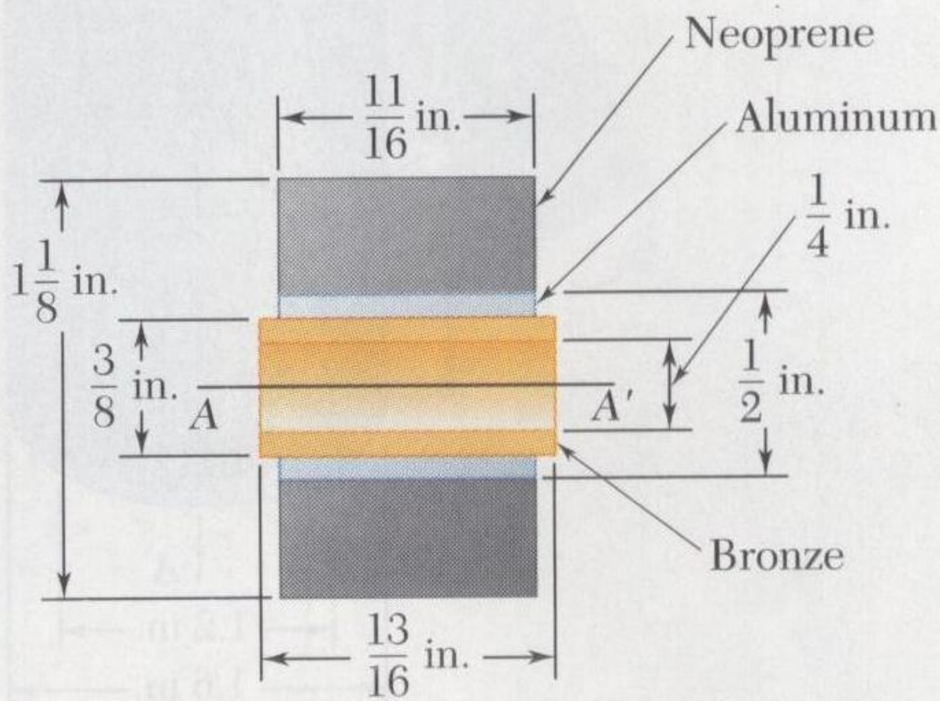
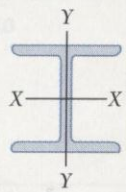
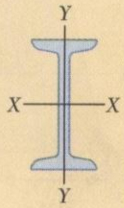
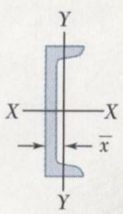
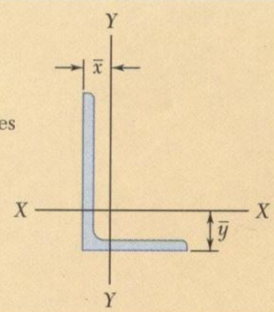
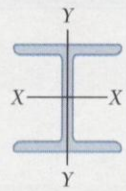
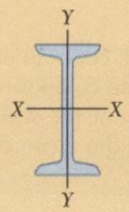
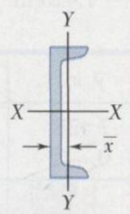
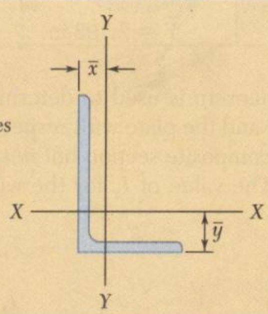


Fig. P9.128

	Designation	Area in^2	Depth in.	Width in.	Axis X-X $\bar{I}_x$, in^4	$\bar{k}_x$, in.	$\bar{y}$, in.	Axis Y-Y $\bar{I}_y$, in^4	$\bar{k}_y$, in.	$\bar{x}$, in.
W Shapes (Wide-Flange Shapes) 	W18 × 76†	22.3	18.21	11.035	1330	7.73		152	2.61	
	W16 × 57	16.8	16.43	7.120	758	6.72		43.1	1.60	
	W14 × 38	11.2	14.10	6.770	385	5.88		26.7	1.55	
	W8 × 31	9.13	8.00	7.995	110	3.47		37.1	2.02	
S Shapes (American Standard Shapes) 	S18 × 55.7†	16.1	18.00	6.001	804	7.07		20.8	1.14	
	S12 × 31.8	9.35	12.00	5.000	218	4.83		9.36	1.00	
	S10 × 25.4	7.46	10.00	4.661	124	4.07		6.79	0.954	
	S6 × 12.5	3.67	6.00	3.332	22.1	2.45		1.82	0.705	
C Shapes (American Standard Channels) 	C12 × 20.7†	6.09	12.00	2.942	129	4.61		3.88	0.799	0.698
	C10 × 15.3	4.49	10.00	2.600	67.4	3.87		2.28	0.713	0.634
	C8 × 11.5	3.38	8.00	2.260	32.6	3.11		1.32	0.625	0.571
	C6 × 8.2	2.40	6.00	1.920	13.1	2.34		0.692	0.537	0.512
Angles 	L6 × 6 × 1‡	11.00			35.5	1.80	1.86	35.5	1.80	1.86
	L4 × 4 × $\frac{1}{2}$	3.75			5.56	1.22	1.18	5.56	1.22	1.18
	L3 × 3 × $\frac{1}{4}$	1.44			1.24	0.930	0.842	1.24	0.930	0.842
	L6 × 4 × $\frac{1}{2}$	4.75			17.4	1.91	1.99	6.27	1.15	0.987
	L5 × 3 × $\frac{1}{2}$	3.75			9.45	1.59	1.75	2.58	0.829	0.750
	L3 × 2 × $\frac{1}{4}$	1.19			1.09	0.957	0.993	0.392	0.574	0.493

	Designation	Area mm²	Depth mm	Width mm	Axis X-X: $\bar{I}_x$ 10^6 mm⁴	Axis X-X: $\bar{k}_x$ mm	Axis X-X: $\bar{y}$ mm	Axis Y-Y: $\bar{I}_y$ 10^6 mm⁴	Axis Y-Y: $\bar{k}_y$ mm	Axis Y-Y: $\bar{x}$ mm
W Shapes (Wide-Flange Shapes) 	W460 × 113†	14400	463	280	554	196.3		63.3	66.3	
	W410 × 85	10800	417	181	316	170.7		17.94	40.6	
	W360 × 57	7230	358	172	160.2	149.4		11.11	39.4	
	W200 × 46.1	5890	203	203	45.8	88.1		15.44	51.3	
S Shapes (American Standard Shapes) 	S460 × 81.4†	10390	457	152	335	179.6		8.66	29.0	
	S310 × 47.3	6032	305	127	90.7	122.7		3.90	25.4	
	S250 × 37.8	4806	254	118	51.6	103.4		2.83	24.2	
	S150 × 18.6	2362	152	84	9.2	62.2		0.758	17.91	
C Shapes (American Standard Channels) 	C310 × 30.8†	3929	305	74	53.7	117.1		1.615	20.29	17.73
	C250 × 22.8	2897	254	65	28.1	98.3		0.949	18.11	16.10
	C200 × 17.1	2181	203	57	13.57	79.0		0.549	15.88	14.50
	C150 × 12.2	1548	152	48	5.45	59.4		0.288	13.64	13.00
Angles 	L152 × 152 × 25.4‡	7100			14.78	45.6	47.2	14.78	45.6	47.2
	L102 × 102 × 12.7	2420			2.31	30.9	30.0	2.31	30.9	30.0
	L76 × 76 × 6.4	929			0.516	23.6	21.4	0.516	23.6	21.4
	L152 × 102 × 12.7	3060			7.24	48.6	50.5	2.61	29.2	25.1
	L127 × 76 × 12.7	2420			3.93	40.3	44.5	1.074	21.1	19.05
	L76 × 51 × 6.4	768			0.454	24.3	25.2	0.163	14.58	12.52