

# STRUCTURAL TUBING

## ASTM A-500 SQUARE AND RECTANGULAR STEEL TUBING

### Mechanical Properties

	Shaped Structural Tubing		
	Grade A	Grade B	Grade C
Tensile Strength min. psi (M Pa)	45,000 (310)	58,000 (400)	62,000 (427)
Yield Strength min. psi (M Pa)	39,000 (269)	46,000 (317)	50,000 (345)
Elongation in 2 in. (50.8 mm), min	25 <sup>1</sup>	23 <sup>2</sup>	21 <sup>3</sup>

<sup>1</sup> Applies to specified wall thicknesses 0.120 in. (3.05 mm) and over. For wall thicknesses under 0.120 in., the minimum elongation shall be calculated by the formula: percent elongation in 2 in. =  $56t + 17.5$ .

<sup>2</sup> Applies to specified wall thicknesses 0.180 in. (4.57 mm) and over. For wall thicknesses under 0.180 in., the minimum elongation shall be calculated by the formula: percent elongation in 2 in. =  $61t + 12$ .

<sup>3</sup> Applies to specified wall thicknesses 0.120 in. (3.05 mm) and over. For lighter wall thicknesses, elongation shall be by agreement with the manufacturer.

### Chemical Composition

Element	Composition, %			
	Grades A and B		Grade C	
	Heat Analysis	Product Analysis	Heat Analysis	Product Analysis
Carbon, max	0.26	0.30	0.23	0.27
Manganese, max	—	—	1.35	1.40
Phosphorus, max	0.035	0.045	0.035	0.045
Sulfur, max	0.035	0.045	0.035	0.045
Copper, when copper steel is specified, min	0.20	0.18	0.20	0.18

### Tolerances – Outside Dimensions for Square and Rectangular Structural Tubing

Outside Large Flat Dimension in. (mm)	Large Flat Dimension Tolerance, <sup>A</sup> plus and minus, in. (mm)
2-1/2 (63.5) or under	0.020 (0.51)
Over 2-1/2' to 3-1/2' (63.5 to 88.9), incl	0.025 (0.64)
Over 3-1/2' to 5-1/2' (88.9 to 139.7), incl	0.030 (0.76)
Over 5-1/2' (139.7)	0.01 times large flat dimension

<sup>A</sup> Tolerances include allowance for convexity or concavity. For rectangular tubing having a ratio of outside large to small flat dimension less than 1.5, and for square tubing, the tolerance on small flat dimension shall be identical to the large flat dimension tolerance. For rectangular tubing having a ratio of outside large to small flat dimension in the range of 1.5 to 3.0 inclusive, the tolerance on small flat dimension shall be 1.5 times the large flat dimension tolerance. For rectangular tubing having a ratio of outside large to small flat dimension greater than 3.0, the tolerance on small flat dimension shall be 2.0 times the large flat dimension tolerance.

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#### Tolerances – Wall Thickness

The tolerance for wall thickness exclusive of the weld area shall be plus or minus 10 percent of the nominal wall thickness specified. The wall thickness is to be measured at the center of the flat.

#### Square of Sides

For square or rectangular structural tubing, adjacent sides may deviate from 90 degrees by a tolerance of plus or minus 2 degrees maximum.

#### Straightness

The permissible variation for straightness of square and rectangular structural tubing shall be 1/8 in. times the number of feet of total length divided by 5.

#### Corner Radii

For square or rectangular structural tubing, the radius of any outside corner of the section shall not exceed three times the specified wall thickness.

Twist Tolerances			Lengths and Allowable Variation			
Specified Dimension of Longest Side, In. (mm)	Maximum Twist in the First 3 ft. (1 m) and in Each Additional 3 ft.					
	in.	mm	22 ft. and Under		Over 22 ft. to 44 ft., incl.	
			Over	Under	Over	Under
1-1/2 (38.1) and under	0.050	1.39	Length tolerance for specified mill length			
Over 1-1/2 to 2-1/2 (38.1 to 63.5), incl.	0.062	1.72	1/2"	1/4"	3/4"	1/4"
Over 2-1/2 to 4 (63.5 to 101.5), incl.	0.075	2.09				
Over 4 to 6 (101.6 to 152.4), incl.	0.087	2.42				
Over 6 to 8 (152.4 to 203.2), incl.	0.100	2.78				
Over 8 (203)	0.112	3.11				