

**TABLE 11.5 Length<sup>①</sup>—Wire, Rod, Bar and Profiles**

SPECIFIED DIAMETER (WIRE AND ROD): SPECIFIED WIDTH (BAR): CIRCUMSCRIBING CIRCLE DIAMETER <sup>④</sup> : (PROFILES) in.	TOLERANCE—in. plus			
	ALLOWABLE DEVIATION FROM SPECIFIED LENGTH			
	SPECIFIED LENGTH—ft.			
	Up thru 12	Over 12 thru 30	Over 30 thru 50	Over 50
Up thru 2.999	1/8	1/4	3/8	1
3.000–7.999	3/16	5/16	7/16	1
8.000 and over	1/4	3/8	1/2	1

**TABLE 11.6 Straightness<sup>①</sup>—Rod, Bar and Profiles**

PRODUCT	TEMPER	SPECIFIED DIAMETER (ROD): SPECIFIED WIDTH (BAR): CIRCUMSCRIBING CIRCLE DIAMETER <sup>④</sup> : (PROFILES) in.	SPECIFIED THICKNESS (RECTANGLES): MINIMUM THICKNESS: (PROFILES) in.	TOLERANCE <sup>③</sup> —in.
				ALLOWABLE DEVIATION (D) FROM STRAIGHT <sup>⑨</sup>
				IN TOTAL LENGTH OR IN ANY MEASURED SEGMENT OF ONE FT. OR MORE OF TOTAL LENGTH
Rod and Square, Hexagonal and Octagonal Bar	All except O TX510 <sup>②</sup> TX511 <sup>②</sup>	All	..	.0125 · Measured length, ft.
	O	0.500 and over	..	.050 · Measured length, ft.
	TX510 <sup>②</sup>	0.500 and over	..	.050 · Measured length, ft.
	TX511 <sup>②</sup>	0.500 and over	..	.0125 · Measured length, ft.
Rectangular Bar	All except O TX510 <sup>②</sup> TX511 <sup>②</sup>	Up thru 1.499	Up thru 0.094 <sup>⑦</sup> 0.095 and over	.050 · Measured length, ft. .0125 · Measured length, ft.
		1.500 and over	All	.0125 · Measured length, ft.
	O	Over 0.500	0.500 and over	.050 · Measured length, ft.
	TX510 <sup>②</sup>	Over 0.500	0.500 and over	.050 · Measured length, ft.
	TX511 <sup>②</sup>	Over 0.500	0.500 and over	.0125 · Measured length, ft.
Profiles	All except O TX510 <sup>②</sup> <sup>⑤</sup> TX511 <sup>②</sup>	Up thru 1.499	Up thru 0.094 <sup>⑦</sup> 0.095 and over	.050 · Measured length, ft. .0125 · Measured length, ft.
		1.500 and over	All	.0125 · Measured length, ft.
	O	0.500 and over	Up thru 0.094 <sup>⑦</sup> 0.095 and over	.200 · Measured length, ft. .050 · Measured length, ft.
	TX511 <sup>②</sup>	0.500 and over	Up thru 0.094 <sup>⑦</sup> 0.095 and over	.050 · Measured length, ft. .0125 · Measured length, ft.

**Footnotes for Tables 11.5 through 11.8**

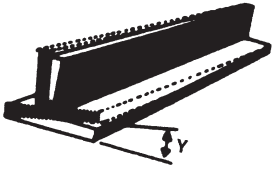
- ① These Standard Tolerances are applicable to the average profile; wider tolerances may be required for some profiles, and closer tolerances may be possible for others.
- ② TX510 and TX511 are general designations for the following stress relieved tempers: T3510, T4510, T61510, T6510, T8510, T73510, T76510 and T3511, T4511, T61511, T6511, T8511, T73511, T76511, respectively.
- ③ When weight of piece on the flat surface minimizes deviation.
- ④ The circumscribing circle diameter is the diameter of the smallest circle that will completely enclose the cross section of the extruded product.
- ⑤ Tolerances for T3510, T4510, T6510, T73510, T76510, and T8510 tempers shall be as agreed upon between purchaser and vendor at the time the contract or order is entered.
- ⑥ Twist is normally measured by placing the extruded section on a flat surface and at any point along its length measuring the maximum distance between the bottom surface of the extruded section and the flat surface. From this measurement, the actual deviation from straightness of the extruded section at that point is subtracted. The remainder is the twist. To convert the standard twist tolerance (degrees) to an equivalent linear value, the sine of the standard tolerance is multiplied by the width of the surface of the section that is on the flat surface. The following values are

used to convert angular tolerances to linear deviation:

Tolerance, degrees	Maximum allowable linear deviation inch per inch of width
1/4	0.004
1/2	0.009
1	0.017
1 1/2	0.026
3	0.052
5	0.087
7	0.122
9	0.156
15	0.259
21	0.358

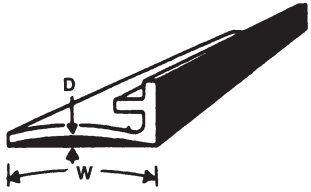
- ⑦ Applies only if the thickness along at least 1/3 of the total perimeter is 0.094 or less. Otherwise use the tolerance shown for 0.095 and over.
- ⑧ Tolerance for “O” temper material is four times the standard tolerances shown.
- ⑨ Straightness must be met in all orientations, including orientations which are not self-supporting.

**TABLE 11.7 Twist ① ⑥—Bar and Profiles**

PRODUCT	TEMPER	SPECIFIED WIDTH (BAR):  CIRCUMSCRIBING CIRCLE DIAMETER ④: (PROFILES)  in.	SPECIFIED THICKNESS (RECTANGLES):  MINIMUM THICKNESS: (PROFILES)  in.	TOLERANCE ③—Degrees	
				ALLOWABLE DEVIATION FROM STRAIGHT	
				IN TOTAL LENGTH OR IN ANY MEASURED SEGMENT OF ONE FT. OR MORE OF TOTAL LENGTH	MAXIMUM FOR TOTAL LENGTH
Bar	All except O TX510 ② TX511 ②	Up thru 1.499 1.500–2.999 3.000 and over	All All All		
	O	0.500–1.499 1.500–2.999 3.000 and over	0.500 and over 0.500 and over 0.500 and over	1 · Measured length, ft. ½ · Measured length, ft. ¼ · Measured length, ft.	7 5 3
	TX510 ②	0.500–2.999 3.000 and over	0.500 and over 0.500 and over	3 · Measured length, ft. 1½ · Measured length, ft. ¾ · Measured length, ft.	21 15 9
	TX511 ②	0.500–1.499 1.500–2.999 3.000 and over	0.500 and over 0.500 and over 0.500 and over	1½ · Measured length, ft. ½ · Measured length, ft.	7 5
Profiles	All except O TX510 ② ⑤ TX511 ②	Up thru 1.499 1.500–2.999 3.000 and over	All All All	1 · Measured length, ft. ½ · Measured length, ft. ¼ · Measured length, ft.	7 5 3
	O	0.500 and over 0.500–1.499 1.500–2.999 3.000 and over	Up thru 0.094 ⑦ 0.095 and over 0.095 and over 0.095 and over	3 · Measured length, ft. 3 · Measured length, ft. 1½ · Measured length, ft. ¾ · Measured length, ft.	21 21 15 9
	TX511 ②	0.500 and over 0.500–1.499 1.500–2.999 3.000 and over	Up thru 0.094 ⑦ 0.095 and over 0.095 and over 0.095 and over	1 · Measured length, ft. 1 · Measured length, ft. ½ · Measured length, ft. ¼ · Measured length, ft.	7 7 5 3


**TABLE 11.8 Flatness (Flat Surfaces) ①—Bar, Solid Profiles and Semihollow Profiles**

EXCEPT FOR PROFILES IN O ⑧, T3510, T4510, T6510, T73510, T76510 and T8510 TEMPER ⑤

MINIMUM THICKNESS OF METAL FORMING THE SURFACE in.	SURFACE WIDTH—in.										
	UP TO 5.999	6.000 TO 7.999	8.000 TO 9.999	10.000 TO 11.999	12.000 TO 13.999	14.000 TO 15.999	16.000 TO 17.999	18.000 TO 19.999	20.000 TO 21.999	22.000 TO 23.999	24.000 AND UP
											
	SURFACES WIDTHS UP THRU 1 INCH OR ANY 1 INCH INCREMENT OF WIDER SURFACES Maximum Allowable Deviation D = TOLERANCE FACTOR (in.)										
	WIDTHS OVER 1 INCH Maximum Allowable Deviation D = TOLERANCE FACTOR · W (in.)										
	TOLERANCE FACTOR										
Up thru 0.124	.004	.006	.010	.014	..	..	..	..	..	..	..
0.125–0.187	.004	.006	.008	.012	.014	.014	.014	..	..	..	..
0.188–0.249	.004	.006	.008	.010	.012	.012	.012	.014	.014	..	..
0.250–0.374	.004	.006	.006	.008	.010	.010	.012	.012	.012	.014	..
0.375–0.499	.004	.004	.006	.008	.008	.008	.010	.010	.010	.012	.014
0.500–0.749	.004	.004	.006	.006	.008	.008	.008	.008	.010	.010	.012
0.750–0.999	.004	.004	.006	.006	.008	.008	.008	.008	.008	.008	.010
1.000–1.499	.004	.004	.004	.006	.006	.008	.008	.008	.008	.008	.008
1.500–1.999	.004	.004	.004	.004	.006	.006	.006	.006	.008	.008	.008
2.000 and up	.004	.004	.004	.004	.004	.006	.006	.006	.006	.008	.008

For all numbered footnotes, see page 11-9.

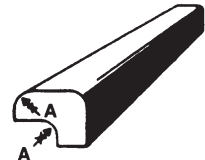
**TABLE 11.9 Flatness (Flat Surfaces) ①—Hollow Profiles** (EXCEPT FOR PROFILES IN O ⑩, T3510, T4510, T6510, T73510, T76510 and T8510 TEMPER ④)

	SURFACES WIDTHS UP THRU 1 INCH OR ANY 1 INCH INCREMENT OF WIDER SURFACES										
	Maximum Allowable Deviation D = TOLERANCE FACTOR (in.)										
	WIDTHS OVER 1 INCH										
MINIMUM THICKNESS OF METAL FORMING THE SURFACE in.	SURFACE WIDTH—in.										
	UP TO 5.999	6.000 TO 7.999	8.000 TO 9.999	10.000 TO 11.999	12.000 TO 13.999	14.000 TO 15.999	16.000 TO 17.999	18.000 TO 19.999	20.000 TO 21.999	22.000 TO 23.999	24.000 AND UP
	TOLERANCE FACTOR										
Up thru 0.124	.006	.008	.012	.016	..	..	..	..	..	..	..
0.125–0.187	.006	.008	.010	.014	.016	..	..	..	..	..	..
0.188–0.249	.004	.006	.010	.012	.014	.014	.014	.016	..	..	..
0.250–0.374	.004	.006	.008	.010	.012	.012	.012	.014	.014	.016	..
0.375–0.499	.004	.006	.008	.010	.010	.010	.012	.012	.012	.014	.016
0.500–0.749	.004	.004	.006	.008	.008	.008	.010	.010	.012	.012	.014
0.750–0.999	.004	.004	.006	.006	.008	.008	.008	.008	.010	.010	.012
1.000 and up	.004	.004	.004	.006	.006	.008	.008	.008	.008	.008	.008

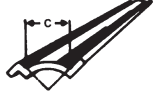
**TABLE 11.10 Surface Roughness ① ⑧—Extruded Wire, Rod, Bar and Profiles**

SPECIFIED SECTION THICKNESS in.	ALLOWABLE DEPTH OF CONDITIONS ② in. max.
Up thru 0.063	0.0015
0.064–0.125	0.002
0.126–0.188	0.0025
0.189–0.250	0.003
0.251–0.500	0.004
0.501- and over	0.008

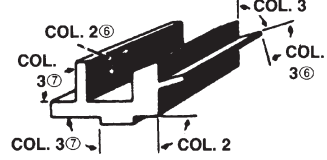
**TABLE 11.13 Corner and Fillet Radii ①—Extruded Bar and Profiles**

SPECIFIED RADIUS ⑨ in.	TOLERANCE—in.	
	ALLOWABLE DEVIATION FROM SPECIFIED RADIUS	
	Difference between radius A and specified radius	
	Sharp corners	+1/64
	0.016–0.187	±1/64
0.188 and over	±10%	

**TABLE 11.11 Contour (Curved Surfaces) ① ③—Extruded Profiles**

Temper	
All except O, TX510 ④	Allowable deviation from specified contour: 0.005 inch per inch of chord length; 0.005 inch minimum. Not applicable to contours with chord length 6 inch and over.
O	Allowable deviation from specified contour: 0.015 inch per inch of chord length; 0.015 inch minimum. Not applicable to contours with chord length 6 inches and over.

**TABLE 11.14 Angularity ① ⑤—Extruded Bar and Profiles**

TEMPER	MINIMUM SPECIFIED LEG THICKNESS in.	TOLERANCE Degrees plus and minus		
		ALLOWABLE DEVIATION FROM SPECIFIED ANGLE		
				
		RATIO: ⑥ ⑦ LEG OR SURFACE LENGTH TO LEG OR METAL THICKNESS		
		1 and less	Over 1 thru 40	
		Col. 1	Col.2	Col.3
All except O, TX510 ④	Up thru 0.187	1	2	
	0.188–0.749	1	1½	
	0.750 and over	1	1	
O	Up thru 0.187	3	6	
	0.188–0.749	3	4½	
	0.750 and over	3	3	

**TABLE 11.12 Squareness of Cut Ends ①—Extruded Rod, Bar and Profiles**

Allowable deviation from square: 1 degree
---

For all numbered footnotes, see page 11-12.

## wire, rod, bar and profiles—extruded/mechanical properties

### Footnotes for Tables 11.9 through 11.14

① These Standard Tolerances are applicable to the average profile; wider tolerances may be required for some profiles, and closer tolerances may be possible for others.

② Conditions include die lines and handling marks.

③ As measured with a contour gauge whose surface is limited to a maximum subtended angle of 90 degrees. Extruded curved surfaces comprising more than a 90-degree subtended angle are checked by sliding the gauge across the surface, thus checking two or more 90-degree portions of the surface. Extruded profile surfaces comprising arcs formed by two or more radii require the use of a separate contour gauge for each portion of the surface formed by an individual radius.

④ Tolerances for T3510, T4510, T6510, T73510, T76510 and T8510 tempers shall be as agreed upon between the purchaser and vendor and at the time the contract or order is entered.

⑤ Angles are measured with protractors or with gauges. As illustrated, a four-point contact system is used, two contact points being as close to the angle vertex as practical, and the others near the ends of the respective surfaces forming the angle. Between these points of measurement surface flatness is the controlling tolerance.



⑥ When the area between the surface forming an angle is all metal, values in column 2 apply if the larger surface length to metal thickness ratio is 1 or less.

⑦ When two legs are involved the one having the larger ratio determines the applicable column.

⑧ Not applicable to 2219 alloy extrusions. Most profiles in 2219 alloy will have die lines about twice the depth shown in the table; however, for each profile the supplier should be contacted for the roughness value to apply.

⑨ If unspecified, the radius shall be  $\frac{1}{32}$  in. maximum including tolerances.

⑩ Tolerance for "O" temper material is four times the standard tolerances shown.