

# 11. Wire, Rod, Bar and Profiles — Extruded

## Introduction

Section 11. of Aluminum Standards and Data covers the mechanical property limits and product dimensional tolerances for aluminum alloy extruded wire, rod, bar, and profiles.

## Mechanical Property Limits for Aluminum Alloy Wire, Rod, Bar and Profiles — Extruded

Table 11.1 provides the specified aluminum industry mechanical property limits for extruded aluminum alloy wire, rod, bar, and profiles. Note that the limits shown are statistically-based guaranteed limits, and are thus suitable for design.

**Special Note: The applicable limits for any individual product are those that apply to the specified (ordered) dimension.**

## Dimensional Tolerances for Aluminum Alloy Wire, Rod, Bar and Profiles — Extruded

Specific aluminum industry tolerances for aluminum alloy extruded wire, rod, bar and profiles are shown in Tables 11.2 through 11.14, as listed below:

- Table 11.2, 3 and 4 - Cross-Sectional Dimension Tolerances
- Table 11.5 - Length
- Table 11.6 - Straightness
- Table 11.7 - Twist
- Table 11.8 - Flatness (Flat Surfaces) - Bar, Solid and Semihollow Profiles
- Table 11.9 - Flatness (Flat Surfaces) - Hollow Profiles
- Table 11.10 - Surface Roughness
- Table 11.11 - Contour (Curved Surfaces)
- Table 11.12 - Squareness of Cut Ends
- Table 11.13 - Corner and Fillet Radii
- Table 11.14 - Angularity

Some general comments on the applicability and methods for calculating tolerances from these tables are given on page 4-16 of Aluminum Standards and Data. Precision tolerances may be obtained from individual producers upon request. Aggressive profile characteristics may require wider than standard tolerances. In other cases, substantially tighter tolerances can be achieved.

For additional information of specific tolerances available, contact producers directly.

## References to other Wire, Rod, Bar and Profiles — Extruded information found in Aluminum Standards and Data

Alloy and Temper Designation System . . . . .	Blue Pages, p. 1-3
Specifications for Aluminum Alloy Wire, Rod and Bar . . . . .	Table 1.3, p. 1-15
Available Alloys and Tempers . . . . .	Table 3.1, p. 3-1
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Standard Limits . . . . .	p. 6-1
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Chemical Composition Limits Listings . . . . .	Table 6.2, p. 6-5
Ultrasonic Discontinuity Limits . . . . .	Table 6.3, p. 6-7
Lot Acceptance Criteria for Corrosion Resistant Tempers . . . . .	Table 6.4, p. 6-7
Location for Electrical Conductivity Measurements . . . . .	Table 6.5, p. 6-9
Corrosion Resistance Test Criteria . . . . .	Table 6.7, p. 6-10

# Tri-State Aluminum - Aluminum Standards

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

**TABLE 11.1 Mechanical Property Limits—Extruded Wire, Rod, Bar and Profiles <sup>⑥</sup>**

ALLOY AND TEMPER	SPECIFIED DIAMETER OR THICKNESS <sup>①</sup> OR MINIMUM DISTANCE ACROSS FLATS in.	AREA sq. in.	TENSILE STRENGTH—ksi				ELONGATION <sup>②</sup> percent min. in 2 in. or 4D <sup>③</sup>
			ULTIMATE		YIELD		
			min.	max.	min.	max.	
<b>1100</b>							
1100-O	All	All	11.0	15.5	3.0	..	25
1100-H112	All	All	11.0	..	3.0	..	..
<b>2014</b>							
2014-O	All	All	..	30.0	..	18.0	12
2014-T4, T4510 <sup>⑤</sup> <sup>⑦</sup> and T4511 <sup>⑤</sup> <sup>⑦</sup>	All	All	50.0	..	35.0	..	12
2014-T42 <sup>④</sup> <sup>⑧</sup>	All	All	50.0	..	29.0	..	12
2014-T6, T6510 <sup>⑤</sup> and T6511 <sup>⑤</sup>	Up thru 0.499	All	60.0	..	53.0	..	7
	0.500–0.749	All	64.0	..	58.0	..	7
	0.750 and over	Up thru 25	68.0	..	60.0	..	7
		Over 25 thru 32	68.0	..	58.0	..	6
2014-T62 <sup>④</sup> <sup>⑧</sup>	Up thru 0.749	All	60.0	..	53.0	..	7
	0.750 and over	Up Thru 25	60.0	..	53.0	..	7
	0.750 and over	Over 25 thru 32	60.0	..	53.0	..	6
<b>2024</b>							
2024-O	All	All	..	35.0	..	19.0	12
2024-T3, T3510 <sup>⑤</sup> <sup>⑦</sup> and T3511 <sup>⑤</sup> <sup>⑦</sup>	Up thru 0.249	All	57.0	..	42.0	..	12
	0.250–0.749	All	60.0	..	44.0	..	12
	0.750–1.499	All	65.0	..	46.0	..	10
	1.500 and over	Up thru 25	70.0	..	52.0	..	10
	1.500 and over	Over 25 thru 32	68.0	..	48.0	..	8
2024-T42 <sup>④</sup> <sup>⑧</sup>	Up thru 0.749	All	57.0	..	38.0	..	12
	0.750–1.499	All	57.0	..	38.0	..	10
	1.500 and over	Up thru 25	57.0	..	38.0	..	10
	1.500 and over	Over 25 thru 32	57.0	..	38.0	..	8
2024-T81, T8510 <sup>⑤</sup> and T8511 <sup>⑤</sup>	0.050–0.249	All	64.0	..	56.0	..	4
	0.250–1.499	All	66.0	..	58.0	..	5
	1.500 and over	Up thru 32	66.0	..	58.0	..	5
<b>2219</b>							
2219-O	All	All	..	32.0	..	18.0	12
2219-T31, T3510 <sup>⑤</sup> <sup>⑦</sup> and T3511 <sup>⑤</sup> <sup>⑦</sup>	Up thru 0.499	Up thru 25	42.0	..	26.0	..	14
	0.500–2.999	Up thru 25	45.0	..	27.0	..	14
2219-T62 <sup>④</sup> <sup>⑧</sup>	Up thru 0.999	Up thru 25	54.0	..	36.0	..	6
	1.000 and over	Up thru 32	54.0	..	36.0	..	6
2219-T81, T8510 <sup>⑤</sup> and T8511 <sup>⑤</sup>	Up thru 2.999	Up thru 25	58.0	..	42.0	..	6
<b>3003</b>							
3003-O	All	All	14.0	19.0	5.0	..	25
3003-H112	All	All	14.0	..	5.0	..	..
<b>5083</b>							
5083-O	Up thru 5.000	Up thru 32	39.0	51.0	16.0	..	14
5083-H111	Up thru 5.000	Up thru 32	40.0	..	24.0	..	12
5083-H112	Up thru 5.000	Up thru 32	39.0	..	16.0	..	12
<b>5086</b>							
5086-O	Up thru 5.000	Up thru 32	35.0	46.0	14.0	..	14
5086-H111	Up thru 5.000	Up thru 32	36.0	..	21.0	..	12
5086-H112	Up thru 5.000	Up thru 32	35.0	..	14.0	..	12
<b>5154</b>							
5154-O	All	All	30.0	41.0	11.0	..	..
5154-H112	All	All	30.0	..	11.0	..	..
<b>5454</b>							
5454-O	Up thru 5.000	Up thru 32	31.0	41.0	12.0	..	14
5454-H111	Up thru 5.000	Up thru 32	33.0	..	19.0	..	12
5454-H112	Up thru 5.000	Up thru 32	31.0	..	12.0	..	12
<b>6005</b>							
6005-T1	Up thru 0.500	All	25.0	..	15.0	..	16
6005-T5	Up thru 0.124	All	38.0	..	35.0	..	8
	0.125–1.000	All	38.0	..	35.0	..	10

For all numbered footnotes, see page 11-5.

**TABLE 11.1 Mechanical Property Limits—Extruded Wire, Rod, Bar and Profiles<sup>⑥</sup>**  
(continued)

ALLOY AND TEMPER	SPECIFIED DIAMETER OR THICKNESS <sup>①</sup> OR MINIMUM DISTANCE ACROSS FLATS in.	AREA sq. in.	TENSILE STRENGTH—ksi				ELONGATION <sup>②</sup> percent min. in 2 in. or 4D <sup>③</sup>
			ULTIMATE		YIELD		
			min.	max.	min.	max.	
<b>6005A</b>							
6005A-T1	Up thru 0.249	All	25.0	..	14.5	..	15
6005A-T5	Up thru 0.249	All	38.0	..	31.0	..	7
	0.250-0.999	All	38.0	..	31.0	..	9
6005A-T61	Up thru 0.249	All	38.0	..	35.0	..	8
	0.250-1.000	All	38.0	..	35.0	..	10
<b>6061</b>							
6061-O	All	All	..	22.0	..	16.0	16
6061-T1	Up thru 0.625	All	26.0	..	14.0	..	16
6061-T4, T4510 <sup>⑤</sup> ⑦ and T4511 <sup>⑤</sup> ⑦	All	All	26.0	..	16.0	..	16
6061-T42 <sup>④</sup> ⑧	All	All	26.0	..	12.0	..	16
6061-T51	Up thru 0.625	All	35.0	..	30.0	..	8
6061-T6, T62 <sup>④</sup> ⑧, T6510 <sup>⑤</sup> and T6511 <sup>⑤</sup>	Up thru 0.249	All	38.0	..	35.0	..	8
	0.250 and over	All	38.0	..	35.0	..	10
<b>6063</b>							
6063-O	All	..	..	19.0	..	..	18
6063-T1	Up thru 0.500	All	17.0	..	9.0	..	12
	0.501-1.000	All	16.0	..	8.0	..	12
6063-T4 and T42 <sup>④</sup> ⑧	Up thru 0.500	All	19.0	..	10.0	..	14
	0.501-1.000	All	18.0	..	9.0	..	14
6063-T5	Up thru 0.500	All	22.0	..	16.0	..	8
	0.501-1.000	All	21.0	..	15.0	..	8
6063-T52 <sup>⑭</sup>	Up thru 1.000	All	22.0	30.0	16.0	25.0	8
6063-T6 and T62 <sup>④</sup> ⑧	Up thru 0.124	All	30.0	..	25.0	..	8
	0.125-1.000	All	30.0	..	25.0	..	10
<b>6066</b>							
6066-O	All	All	..	29.0	..	18.0	16
6066-T4, T4510 <sup>⑤</sup> ⑦ and T4511 <sup>⑤</sup> ⑦	All	All	40.0	..	25.0	..	14
6066-T42 <sup>④</sup> ⑧	All	All	40.0	..	24.0	..	14
6066-T6, T6510 <sup>⑤</sup> and T6511 <sup>⑤</sup>	All	All	50.0	..	45.0	..	8
6066-T62 <sup>④</sup> ⑧	All	All	50.0	..	42.0	..	8
<b>6070</b>							
6070-T6 and T62 <sup>④</sup> ⑧	Up thru 2.999	Up thru 32	48.0	..	45.0	..	6
<b>6082</b>							
6082-T6, T6511	0.200-0.750	All	45.0	..	38.0	..	6
	0.751-6.000	All	45.0	..	38.0	..	8
	6.001-8.000	All	41.0	..	35.0	..	6
<b>6105</b>							
6105-T1	Up thru 0.500	All	25.0	..	15.0	..	16
6105-T5	Up thru 0.500	All	38.0	..	35.0	..	8
<b>6162</b>							
6162-T5, T5510 <sup>⑤</sup> and T5511 <sup>⑤</sup>	Up thru 1.000	All	37.0	..	34.0	..	7
6162-T6, T6510 <sup>⑤</sup> and T6511 <sup>⑤</sup>	Up thru 0.249	All	38.0	..	35.0	..	8
	0.250-0.499	All	38.0	..	35.0	..	10
<b>6262</b>							
6262-T6, T62 <sup>④</sup> ⑧, T6510 <sup>⑤</sup> and T6511 <sup>⑤</sup>	All	All	38.0	..	35.0	..	10
<b>6351</b>							
6351-T1	Up thru 0.499	Up thru 20	26.0	..	13.0	..	15
6351-T4	Up thru 0.749	All	32.0	..	19.0	..	16
6351-T5	Up thru 0.249	All	38.0	..	35.0	..	8
	0.250-1.000	All	38.0	..	35.0	..	10
6351-T51	0.125-1.000	Up thru 20	36.0	..	33.0	..	10
6351-T54	Up thru 0.500	Up thru 20	30.0	..	20.0	..	10
6351-T6	Up thru 0.124	All	42.0	..	37.0	..	8
	0.125-0.749	All	42.0	..	37.0	..	10

For all numbered footnotes, see page 11-5.

## Tri-State Aluminum - Aluminum Standards

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

**TABLE 11.1 Mechanical Property Limits—Extruded Wire, Rod, Bar and Profiles <sup>⑥</sup>**  
(concluded)

ALLOY AND TEMPER	SPECIFIED DIAMETER OR THICKNESS <sup>①</sup> OR MINIMUM DISTANCE ACROSS FLATS in.	AREA sq. in.	TENSILE STRENGTH—ksi				ELONGATION <sup>②</sup> percent min. in 2 in. or 4D <sup>③</sup>
			ULTIMATE		YIELD		
			min.	max.	min.	max.	
<b>6463</b>							
6463-T1	Up thru 0.500	Up thru 20	17.0	..	9.0	..	12
6463-T5	Up thru 0.500	Up thru 20	22.0	..	16.0	..	8
6463-T6 and T62 <sup>④</sup> <sup>⑧</sup>	Up thru 0.124 0.125–0.500	Up thru 20	30.0	..	25.0	..	8
		Up thru 20	30.0	..	25.0	..	10
<b>7005</b>							
7005-T53	Up thru 0.750	All	50.0	..	44.0	..	10
<b>7050</b>							
7050-T73510 <sup>⑤</sup> <sup>⑨</sup> and T73511 <sup>⑤</sup> <sup>⑨</sup>	Up thru 5.000	Up thru 32	70.0	..	60.0	..	8
7050-T74510 <sup>⑤</sup> <sup>⑪</sup> <sup>⑬</sup> and T74511 <sup>⑤</sup> <sup>⑪</sup> <sup>⑬</sup>	Up thru 5.000	Up thru 32	73.0	..	63.0	..	7
7050-T76510 <sup>⑫</sup> and T76511 <sup>⑫</sup>	Up thru 0.499 0.500–5.000	Up thru 32	77.0	..	68.0	..	7
		Up thru 32	79.0	..	69.0	..	7
<b>7075</b>							
7075-O	All	All	..	40.0	..	24.0	10
7075-T6, T62 <sup>④</sup> <sup>⑧</sup> , T6510 <sup>⑤</sup> and T6511 <sup>⑤</sup>	Up thru 0.249	All	78.0	..	70.0	..	7
	0.250–0.499	All	81.0	..	73.0	..	7
	0.500–1.499	All	81.0	..	72.0	..	7
	1.500–2.999	All	81.0	..	72.0	..	7
	3.000–4.499	Up thru 20	81.0	..	71.0	..	7
	3.000–4.499	Over 20 thru 32	78.0	..	70.0	..	6
7075-T73 <sup>⑨</sup> , T73510 <sup>⑤</sup> <sup>⑨</sup> and T73511 <sup>⑤</sup> <sup>⑨</sup>	0.062–0.249	Up thru 20	68.0	..	58.0	..	7
	0.250–1.499	Up thru 25	70.0	..	61.0	..	8
	1.500–2.999	Up thru 25	69.0	..	59.0	..	8
	3.000–4.499	Up thru 20	68.0	..	57.0	..	7
	3.000–4.499	Over 20 thru 32	65.0	..	55.0	..	7
	4.500–5.000	Up thru 36	65.0	..	53.0	..	7
7075-T76 <sup>⑩</sup> , T76510 <sup>⑤</sup> <sup>⑩</sup> and T76511 <sup>⑤</sup> <sup>⑩</sup>	Up thru 0.049	All	73.0	..	63.0	..	7
	0.050–0.124	All	74.0	..	64.0	..	7
	0.125–0.249	Up thru 20	74.0	..	64.0	..	7
	0.250–0.499	Up thru 20	75.0	..	65.0	..	7
	0.500–1.000	Up thru 20	75.0	..	65.0	..	7
	1.001–2.000	Up thru 20	75.0	..	65.0	..	7
	2.001–3.000	Up thru 20	74.0	..	64.0	..	7
	3.001–4.000	Up thru 20	74.0	..	63.0	..	7
<b>7178</b>							
7178-O	All	Up thru 32	..	40.0	..	24.0	10
7178-T6, T6510 <sup>⑤</sup> and T6511 <sup>⑤</sup>	Up thru 0.061	All	82.0	..	76.0	..	..
	0.062–0.249	Up thru 20	84.0	..	76.0	..	5
	0.250–1.499	Up thru 25	87.0	..	78.0	..	5
	1.500–2.499	Up thru 25	86.0	..	77.0	..	5
	1.500–2.499	Over 25 thru 32	84.0	..	75.0	..	5
	2.500–2.999	Up thru 32	82.0	..	71.0	..	5
7178-T62 <sup>④</sup> <sup>⑧</sup>	Up thru 0.061	All	79.0	..	73.0	..	..
	0.062–0.249	Up thru 20	82.0	..	74.0	..	5
	0.250–1.499	Up thru 25	86.0	..	77.0	..	5
	1.500–2.499	Up thru 25	86.0	..	77.0	..	5
	1.500–2.499	Up thru 25	86.0	..	77.0	..	5
	2.500–2.999	Up thru 32	82.0	..	71.0	..	7
7178-T76 <sup>⑩</sup> , T76510 <sup>⑤</sup> <sup>⑩</sup> and T76511 <sup>⑤</sup> <sup>⑩</sup>	0.125–0.249	Up thru 20	76.0	..	66.0	..	7
	0.250–0.499	Up thru 20	77.0	..	67.0	..	7
	0.500–1.000	Up thru 20	77.0	..	67.0	..	7
<b>7475</b>							
7475-T62	1.001–2.000	All	75.0	..	66.0	..	7

For all numbered footnotes, see page 11-5.

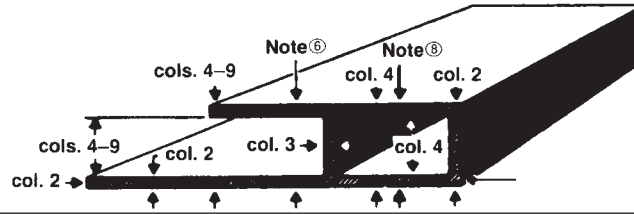
## Footnotes for Table 11.1

- ① The thickness of the cross section from which the tension test specimen is taken determines the applicable mechanical properties. The data base and criteria upon which these mechanical property limits are established are outlined on page 6-1 under "Mechanical Properties."
- ② For material of such dimensions that a standard test specimen cannot be taken, or for profiles thinner than 0.062 inch, the test for elongation is not required.
- ③ D represents specimen diameter.
- ④ These properties can usually be obtained by the user when the material is properly solution heat treated or solution and precipitation heat treated from the O (annealed) or F (as fabricated) temper. These properties also apply to samples of material in the O or F tempers that are solution heat treated or solution and precipitation treated by the producer to determine that the material will respond to proper heat treatment. Properties attained by the user, however, may be lower than those listed if the material has been formed or otherwise cold or hot worked, particularly in the annealed temper, prior to solution heat treatment.
- ⑤ For stress-relieved tempers the characteristics and properties other than those specified may differ somewhat from the corresponding characteristics and properties of material in the basic temper.
- ⑥ Processes such as flattening, leveling, or straightening coiled products subsequent to shipment by the producer may alter the mechanical properties of the metal (refer to Certification Documentation, Section 4).
- ⑦ Upon artificial aging, T31, T3510, T3511, T4, T4510 and T4511 temper material shall be capable of developing the mechanical properties applicable to the T81, T8510, T8511, T6, T6510 and T6511 tempers, respectively.
- ⑧ This temper is not available from the material producer.
- ⑨ Material in this temper, 0.750 inch and thicker, when tested in accordance with ASTM G47 in the short transverse direction at a stress level of 75 percent of the specified minimum yield strength, will exhibit no evidence of stress corrosion cracking. Capability of individual lots to resist stress corrosion is determined by testing the previously selected tensile test sample in accordance with the applicable lot acceptance criteria outlined on pages 6-7 through 6-10.
- ⑩ Material in this temper, when tested in accordance with ASTM G34, will exhibit exfoliation less than that shown in Photo EB, Figure 2 of ASTM G34. Also, material 0.750 inch and thicker, when tested in accordance with ASTM G47 in the short transverse direction at a stress level of 25 ksi, will exhibit no evidence of stress corrosion cracking. Capability of individual lots to resist exfoliation corrosion and stress corrosion cracking is determined by testing the previously selected tensile test sample in accordance with the applicable lot acceptance criteria outlined on pages 6-7 through 6-10.
- ⑪ Material in this temper, when tested at the t/10 plane in accordance with ASTM G34, will exhibit exfoliation less than that shown in Photo EB, Figure 2 of ASTM G34. Also, material 0.750 inch and thicker, when tested in accordance with ASTM G47 in the short transverse direction at a stress level of 35 ksi, will exhibit no evidence of stress corrosion cracking. Capability of individual lots to resist exfoliation corrosion and stress corrosion cracking is determined by testing the previously selected tensile test sample in accordance with the applicable lot acceptance criteria outlined on pages 6-7 through 6-10.
- ⑫ Material in this temper, when tested at the t/10 plane in accordance with ASTM G34, will exhibit exfoliation less than that shown in Photo EB, Figure 2 of ASTM G34. Also, material 0.750 inch and thicker, when tested in accordance with ASTM G47 in the short transverse direction at a stress level of 17 ksi, will exhibit no evidence of stress corrosion cracking. Capability of individual lots to resist exfoliation corrosion and stress corrosion cracking is determined by testing the previously selected tensile test sample in accordance with the applicable lot acceptance criteria outlined on pages 6-7 through 6-10.
- ⑬ T74 type tempers, although not previously registered, have appeared in the literature and in some specifications as T736 type tempers.
- ⑭ 6063-T52 is a producer temper and is an exception to ANSI H35.1/H35.1(M) paragraphs A2.2 Temper Designation for Purchaser/User Heat-Treatment, A2.3 Temper Designations for Producer/Supplier Demonstration of Response to Temper Conversion, and A2.4 Temper Designation for Purchaser/User Heat-Treatment.

wire, rod, bar and profiles—extruded/standard tolerances

TABLE 11.2 Cross-Sectional Dimension Tolerances—Profiles ①

EXCEPT FOR T3510, T4510, T6510, T73510, T76510 AND T8510 TEMPER ⑦



SPECIFIED DIMENSION	TOLERANCE ② ③—in. plus and minus															
	METAL DIMENSIONS				SPACE DIMENSIONS											
	ALLOWABLE DEVIATION FROM SPECIFIED DIMENSION WHERE 75 PERCENT OR MORE OF THE DIMENSION IS METAL ⑨ ⑩				ALLOWABLE DEVIATION FROM SPECIFIED DIMENSION WHERE MORE THAN 25 PERCENT OF THE DIMENSION IS SPACE ⑥ ⑧											
in.	All Except Those Covered by Column 3		Wall Thickness ④ Completely ⑤ Enclosing Space 0.11 sq. in. and Over (Eccentricity)		At Dimensioned Points 0.250–0.624 inches from Base of Leg		At Dimensioned Points 0.625–1.249 inches from Base of Leg		At Dimensioned Points 1.250–2.499 inches from Base of Leg		At Dimensioned Points 2.500–3.999 inches from Base of Leg		At Dimensioned Points 4.000–5.999 inches from Base of Leg		At Dimensioned Points 6.000–8.000 inches from Base of Leg	
Col. 1	Col. 2		Col. 3		Col. 4		Col. 5		Col. 6		Col. 7		Col. 8		Col. 9	
	Standard Tolerance, All Except 5XXX Alloys ⑪	Precision Tolerance, All Except 5XXX Alloys	Standard Tolerance, All Except 5XXX Alloys ⑪	Precision Tolerance, All Except 5XXX Alloys	Standard Tolerance, All Except 5XXX Alloys ⑪	Precision Tolerance, All Except 5XXX Alloys	Standard Tolerance, All Except 5XXX Alloys ⑪	Precision Tolerance, All Except 5XXX Alloys	Standard Tolerance, All Except 5XXX Alloys ⑪	Precision Tolerance, All Except 5XXX Alloys	Standard Tolerance, All Except 5XXX Alloys ⑪	Precision Tolerance, All Except 5XXX Alloys	Standard Tolerance, All Except 5XXX Alloys ⑪	Precision Tolerance, All Except 5XXX Alloys	Standard Tolerance, All Except 5XXX Alloys ⑪	Precision Tolerance, All Except 5XXX Alloys

CIRCUMSCRIBING CIRCLE SIZES LESS THAN 10 INCHES IN DIAMETER

Up thru 0.124	0.006	0.004	±10% of specified dimension; ±.060 max. ±.010 min.	±10% of specified dimension; ±.060 max. ±.010 min.	0.010	0.007	0.012	0.008	..	..	..	..	..	..	..	..	
0.125–0.249	0.007	0.005			0.012	0.008	0.014	0.009	0.016	0.011	..	..	..	..	..	..	..
0.250–0.499	0.008	0.005			0.014	0.009	0.016	0.011	0.018	0.012	0.020	0.013	0.022	0.015	..	..	..
0.500–0.749	0.009	0.006			0.016	0.011	0.018	0.012	0.020	0.013	0.022	0.015	0.025	0.017	0.030	0.020	..
0.750–0.999	0.010	0.007			0.018	0.012	0.020	0.013	0.022	0.015	0.025	0.017	0.025	0.017	0.030	0.020	..
1.000–1.499	0.012	0.008	±15% of specified dimension; ±.090 max. ±.025 min.	±15% of specified dimension; ±.090 max. ±.025 min.	0.021	0.014	0.023	0.015	0.026	0.017	0.030	0.024	0.035	0.023	..	..	
1.500–1.999	0.014	0.009			0.024	0.016	0.026	0.017	0.031	0.020	0.036	0.024	0.042	0.028	0.050	0.033	
2.000–3.999	0.024	0.016			0.034	0.022	0.038	0.025	0.048	0.032	0.057	0.038	0.068	0.045	0.080	0.053	
4.000–5.999	0.034	0.022			0.044	0.029	0.050	0.033	0.064	0.042	0.078	0.051	0.094	0.062	0.110	0.073	
6.000–7.999	0.044	0.029			0.054	0.036	0.062	0.041	0.082	0.054	0.099	0.065	0.120	0.079	0.140	0.092	
8.000–9.999	0.054	0.036			0.064	0.042	0.074	0.049	0.100	0.066	0.120	0.079	0.145	0.096	0.170	0.112	

CIRCUMSCRIBING CIRCLE SIZES 10 INCHES IN DIAMETER AND OVER

Up thru 0.124	0.014	0.009	±15% of specified dimension; ±.090 max. ±.025 min.	±15% of specified dimension; ±.090 max. ±.025 min.	0.018	0.012	0.020	0.013	..	..	..	..	..	..	..		
0.125–0.249	0.015	0.010			0.019	0.013	0.022	0.015	0.028	0.018	..	..	..	..	..	..	
0.250–0.499	0.016	0.011			0.020	0.013	0.024	0.016	0.030	0.020	0.050	0.033	..	..	..	..	
0.500–0.749	0.017	0.011			0.022	0.015	0.027	0.018	0.040	0.026	0.060	0.040	..	..	..	..	
0.750–0.999	0.018	0.012			0.023	0.015	0.030	0.020	0.050	0.033	0.070	0.046	0.090	0.059	..	..	
1.000–1.499	0.019	0.013	±15% of specified dimension; ±.090 max. ±.025 min.	±15% of specified dimension; ±.090 max. ±.025 min.	0.024	0.016	0.034	0.022	0.060	0.040	0.080	0.053	0.100	0.066	..		
1.500–1.999	0.024	0.016			0.034	0.022	0.044	0.029	0.070	0.046	0.090	0.059	0.110	0.073	0.170	0.112	
2.000–3.999	0.034	0.022			0.044	0.029	0.054	0.036	0.080	0.053	0.100	0.066	0.120	0.079	0.180	0.119	
4.000–5.999	0.044	0.029			0.054	0.036	0.064	0.042	0.090	0.059	0.110	0.073	0.130	0.086	0.190	0.125	
6.000–7.999	0.054	0.036			0.064	0.042	0.074	0.049	0.100	0.066	0.120	0.079	0.140	0.092	0.200	0.132	
8.000–9.999	0.064	0.042			0.074	0.049	0.084	0.055	0.110	0.073	0.130	0.086	0.150	0.099	0.210	0.139	
10.000–11.999	0.074	0.049			0.084	0.055	0.094	0.062	0.120	0.079	0.140	0.092	0.160	0.106	0.220	0.145	
12.000–13.999	0.084	0.055			0.094	0.062	0.104	0.069	0.130	0.086	0.150	0.099	0.170	0.112	0.230	0.152	
14.000–15.999	0.094	0.062			0.104	0.069	0.114	0.075	0.140	0.092	0.160	0.106	0.180	0.119	0.240	0.158	
16.000–17.999	0.104	0.069			0.114	0.075	0.124	0.082	0.150	0.099	0.170	0.112	0.190	0.125	0.250	0.165	
18.000–19.999	0.114	0.075			±15% of specified dimension; ±.090 max. ±.025 min.	±15% of specified dimension; ±.090 max. ±.025 min.	0.124	0.082	0.134	0.088	0.160	0.106	1.800	1.188	0.200	0.132	0.260
20.000–21.999	0.124	0.082					0.134	0.088	0.144	0.095	0.170	0.112	0.190	0.125	0.210	0.139	0.270
22.000–24.000	0.134	0.088					0.144	0.095	0.154	0.102	0.180	0.119	0.200	0.132	0.220	0.145	0.280

Footnotes for Tables 11.2 through 11.4

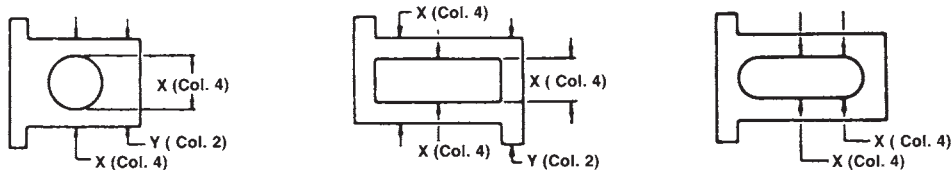
- ① These Standard and Precision Tolerances are applicable to the average profile. The extrusion conditions required to produce the wide variety of alloy-temper and profile combinations require close review between customer and producer to determine critical characteristics and tolerance capability. Aggressive profile characteristics may require wider than standard tolerance and closer than precision tolerance may be feasible for other characteristics.
- ② The tolerance applicable to a dimension composed of two or more component dimensions is the sum of the tolerances of the component dimensions if all of the component dimensions are indicated.
- ③ When a dimension tolerance is specified other than as an equal bilateral tolerance, the value of the standard tolerance is that which applies to the mean of the

- maximum and minimum dimensions permissible under the tolerance for the dimension under consideration.
- ④ Where dimensions specified are outside and inside, rather than wall thickness itself, the allowable deviation (eccentricity) given in Column 3 applies to mean wall thickness. (Mean wall thickness is the average of two wall thickness measurements taken at opposite sides of the void.)
- ⑤ In the case of Class 1 Hollow Profiles the standard wall thickness tolerance for extruded round tube is applicable. (A Class 1 Hollow Profile is one whose void is round and one inch or more in diameter and whose weight is equally distributed on opposite sides of two or more equally spaced axes.)

(Continued on bottom of next page)

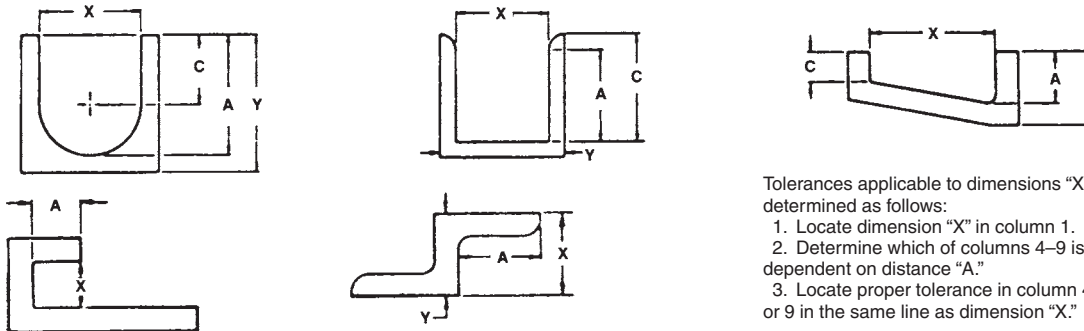
Examples Illustrating Use of Table 11.2

Closed-Space Dimensions



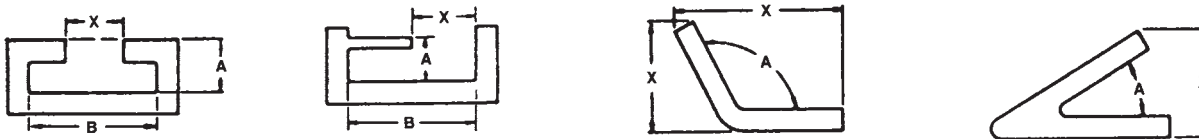
All dimensions designated "Y" are classed as "metal dimensions," and tolerances are determined from column 2.  
 Dimensions designated "X" are classed as "space dimensions through an enclosed void," and the tolerances applicable are determined from column 4 unless 75 percent or more of the dimension is metal, in which case column 2 applies.

Open-Space Dimensions



Tolerances applicable to dimensions "X" are determined as follows:  
 1. Locate dimension "X" in column 1.  
 2. Determine which of columns 4–9 is applicable, dependent on distance "A."  
 3. Locate proper tolerance in column 4, 5, 6, 7, 8 or 9 in the same line as dimension "X."

Dimensions "Y" are "metal dimensions"; tolerances are determined from column 2.  
 Distances "C" are shown merely to indicate incorrect values for determining which of columns 4–9 apply.



Tolerances applicable to dimensions "X" are determined as follows:  
 1. Locate distance "B" in column 1.  
 2. Determine which of columns 4–9 is applicable, dependent on distance "A."  
 3. Locate proper tolerance in column 4, 5, 6, 7, 8 or 9 in the same line as value chosen in column 1.

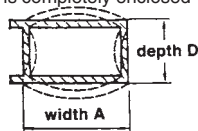
Tolerances applicable to dimensions "X" are not determined from Table 11.2; tolerances are determined by standard tolerances applicable to angles "A."

Footnotes for Tables 11.2 through 11.4 (Continued)

⑥ At points less than 0.250 inch from base of leg the tolerances in Col. 2 are applicable.

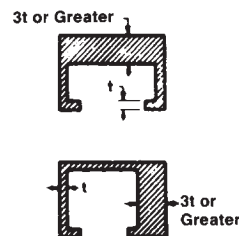
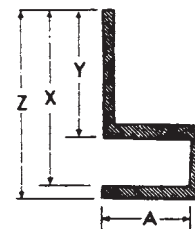
⑦ Tolerances for extruded profiles in T3510, T4510, T6510, T73510, T76510 and T8510 tempers shall be as agreed upon between purchaser and vendor at the time the contract or order is entered.

⑧ The following tolerances apply where the space is completely enclosed (hollow profiles); For the width (A), the balance is the value shown in Col. 4 for the depth dimension (D). For the depth (D), the tolerance is the value shown in Col. 4 for the width dimension (A). In no case is the tolerance for either width or depth less than the metal dimensions (Col. 2) at the corners.



Example—Alloy 6061 hollow profile having 1 · 3 rectangular outside dimensions; width tolerance is ±0.021 inch and depth tolerance ±.034 inch. (Tolerances at corners, Col. 2, metal dimensions, are ±0.024 inch for the width and ±0.012 inch for the depth.) Note that the Col. 4 tolerance of 0.021 inch must be adjusted to 0.024 inch so that it is not less than the Col. 2 tolerance.

⑨ These tolerances do not apply to space dimensions such as dimensions "X" and "Z" of the example (right), even when "Y" is 75 percent or more of "X." For the tolerance applicable to dimensions "X" and "Z," use Col. 4, 5, 6, 7, 8 or 9, dependent on distance "A."



⑩ The wall thickness tolerance for hollow or semihollow profiles shall be as agreed upon between purchaser and vendor at the time the contract or order is entered when the nominal thickness of one wall is three times or greater than that of the opposite wall.

⑪ For those 5xxx alloys with a magnesium content of greater than or equal to 4.0% nominal, tolerances are 150% of those values shown in the standard tolerance columns.

wire, rod, bar and profiles—extruded/standard tolerances

**TABLE 11.3 Diameter or Distance Across Flats—Round Wire and Rod - Square, Hexagonal and Octagonal Wire and Bar<sup>①</sup>**

SPECIFIED DIMENSION	TOLERANCE <sup>③</sup> —in. plus and minus							
	ALLOWABLE DEVIATION FROM SPECIFIED DIMENSION ACROSS FLATS OR DIAMETER							
	ROUND WIRE AND ROD		SQUARE WIRE AND BAR		HEXAGONAL WIRE AND BAR		OCTAGONAL WIRE AND BAR	
in.	Standard Tolerance, All Except 5XXX Alloys <sup>①</sup>	Precision Tolerance, All Except 5XXX Alloys	Standard Tolerance, All Except 5XXX Alloys <sup>①</sup>	Precision Tolerance, All Except 5XXX Alloys	Standard Tolerance, All Except 5XXX Alloys <sup>①</sup>	Precision Tolerance, All Except 5XXX Alloys	Standard Tolerance, All Except 5XXX Alloys <sup>①</sup>	Precision Tolerance, All Except 5XXX Alloys
Up thru 0.124	0.006	0.004	0.006	0.004	0.006	0.004	0.006	0.004
0.125–0.249	0.007	0.005	0.007	0.005	0.007	0.005	0.007	0.005
0.250–0.499	0.008	0.005	0.008	0.005	0.008	0.005	0.008	0.005
0.500–0.749	0.009	0.006	0.009	0.006	0.009	0.006	0.009	0.006
0.750–0.999	0.010	0.007	0.010	0.007	0.010	0.007	0.010	0.007
1.000–1.499	0.012	0.008	0.012	0.008	0.012	0.008	0.012	0.008
1.500–1.999	0.014	0.009	0.014	0.009	0.014	0.009	0.014	0.009
2.000–3.999	0.024	0.016	0.024	0.016	0.024	0.016	0.024	0.016
4.000–5.999	0.034	0.022	0.034	0.022	0.034	0.022	0.034	0.022
6.000–7.070	0.044	0.029	0.044	0.029	0.044	0.029	0.044	0.029
7.071–7.999	0.044	0.029	0.054	0.036	0.044	0.029	0.044	0.029
8.000–8.659	0.054	0.036	0.064	0.042	0.054	0.036	0.054	0.036
8.660–8.999	0.054	0.036	0.064	0.042	0.064	0.042	0.054	0.036
9.000–9.238	0.054	0.036	0.064	0.042	0.064	0.042	0.054	0.036
9.239–9.999	0.054	0.036	0.064	0.042	0.064	0.042	0.064	0.042
10.000–11.999	0.074	0.049	0.074	0.049	0.074	0.049	0.074	0.049
12.000–13.999	0.084	0.055	0.084	0.055	0.084	0.055	0.084	0.055
14.000–15.999	0.094	0.062	0.094	0.062	0.094	0.062	0.094	0.062

Note: Shaded tolerances denote products with a circumscribing circle size of 10 inches in diameter and over.

For numbered footnotes, see two preceding pages.

**TABLE 11.4 Thickness or Width (Distance Across Flats)—Rectangular Wire and Bar<sup>①</sup>**

SPECIFIED DEIMENSION IN.	TOLERANCE—in. plus and minus			
	ALLOWABLE DEVIATION FROM SPECIFIED WIDTH OR THICKNESS ACROSS FLATS			
	Standard Tolerance, All Except, 5XXX Alloys <sup>①</sup>	Precision Tolerance, All Except, 5XXX Alloys	Standard Tolerance, All Except, 5XXX Alloys <sup>①</sup>	Precision Tolerance, All Except, 5XXX Alloys
Up thru 0.124	0.006	0.004	0.014	0.009
0.125–0.249	0.007	0.005	0.015	0.010
0.250–0.499	0.008	0.005	0.016	0.011
0.500–0.749	0.009	0.006	0.017	0.011
0.750–0.999	0.010	0.007	0.018	0.012
1.000–1.499	0.012	0.008	0.019	0.013
1.500–1.999	0.014	0.009	0.024	0.016
2.000–3.999	0.024	0.016	0.034	0.022
4.000–5.999	0.034	0.022	0.044	0.029
6.000–7.999	0.044	0.029	0.054	0.036
8.000–9.999	0.054	0.036	0.064	0.042
10.000–11.999	..	..	0.074	0.049
12.000–13.999	..	..	0.084	0.055
14.000–15.999	..	..	0.094	0.062
16.000–17.999	..	..	0.104	0.069
18.000–19.999	..	..	0.114	0.075
20.000–21.999	..	..	0.124	0.082
22.000–24.000	..	..	0.134	0.088

Note: Shaded tolerances denote products with a circumscribing circle size of 10 inches in diameter and over.

For all numbered footnotes, see two preceding pages.



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.

wire, rod, bar and profiles—extruded/standard tolerances

TABLE 11.7 Twist <sup>①</sup> <sup>⑥</sup>—Bar and Profiles

PRODUCT	TEMPER	SPECIFIED WIDTH (BAR):  CIRCUMSCRIBING CIRCLE DIAMETER <sup>④</sup> : (PROFILES)  in.	SPECIFIED THICKNESS (RECTANGLES):  MINIMUM THICKNESS: (PROFILES)  in.	TOLERANCE <sup>③</sup> —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 <sup>②</sup> TX511 <sup>②</sup>	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	0.500–1.499 1.500–2.999 3.000 and over	0.500 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
	TX510 <sup>②</sup>	0.500–2.999 3.000 and over	0.500 and over 0.500 and over	1½ - Measured length, ft. ½ - Measured length, ft.	7 5
	TX511 <sup>②</sup>	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
Profiles	All except O TX510 <sup>②</sup> <sup>⑤</sup> TX511 <sup>②</sup>	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 <sup>⑦</sup> 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 <sup>②</sup>	0.500 and over 0.500–1.499 1.500–2.999 3.000 and over	Up thru 0.094 <sup>⑦</sup> 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

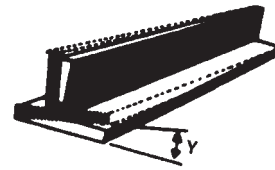
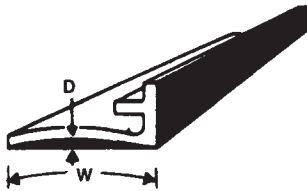


TABLE 11.8 Flatness (Flat Surfaces) <sup>①</sup>—Bar, Solid Profiles and Semihollow Profiles

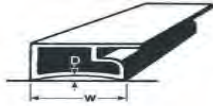
EXCEPT FOR PROFILES IN O <sup>⑧</sup>, T3510, T4510, T6510, T73510, T76510 and T8510 TEMPER <sup>⑤</sup>

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)

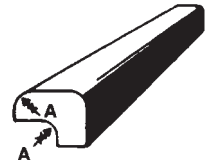


MINIMUM THICKNESS OF METAL FORMING THE SURFACE in.	SURFACES WIDTHS UP THRU 1 INCH OR ANY 1 INCH INCREMENT OF WIDER SURFACES										
	Maximum Allowable Deviation D = TOLERANCE FACTOR (in.)										
	WIDTHS OVER 1 INCH										
Maximum Allowable Deviation D = TOLERANCE FACTOR · W (in.)											
SURFACE 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 ⑧ in.	TOLERANCE—in.
	ALLOWABLE DEVIATION FROM SPECIFIED RADIUS
Sharp corners	+1/64
0.016–0.187	±1/64
0.188 and over	±10%

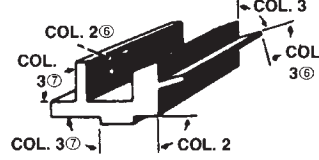
Difference between radius A and specified radius

**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	
		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

RATIO: ⑥ ⑦ LEG OR SURFACE LENGTH TO LEG OR METAL THICKNESS

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

Allowable deviation from square: 1 degree
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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.