AIRCRAFT ALUMINUM EXTRUSION TOLERANCE

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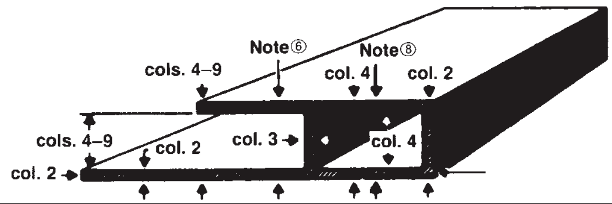
TABLE 11.2 Cross-Sectional Dimension Tolerances—Profiles ①

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

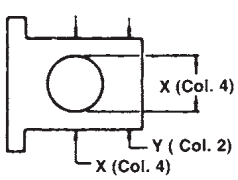


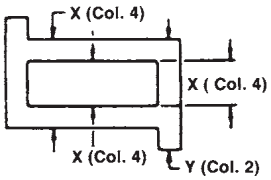
SPECIFIED DIMENSION in.	TOLERANCE ② ③—in. plus and minus															
	METAL DIMENSIONS				SPACE DIMENSIONS											
	ALLOWABLE DEVIATION FROM SPECIFIED DIMENSION WHERE 75 PERCENT OR MORE OF THE DIMENSION IS METAL ⑨ ⑩				ALLOWABLE DEVIATION FROM SPECIFIED DIMENSION WHERE MORE THAN 25 PERCENT OF THE DIMENSION IS SPACE ⑥ ⑧											
	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	. .	. .	. .	. .
0.500–0.749	0.009	0.006			0.016	0.011	0.018	0.012	0.020	0.013	0.022	0.015	. .	. .	. .	. .
0.750–0.999	0.010	0.007			0.018	0.012	0.020	0.013	0.022	0.015	0.025	0.017	0.030	0.020	. .	. .
1.000–1.499	0.012	0.008			0.021	0.014	0.023	0.015	0.026	0.017	0.030	0.020	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. ±.015 min.	±15% of specified dimension; ±.090 max. ±.015 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			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			0.124	0.082	0.134	0.088	0.160	0.106	1.800	1.188	0.200	0.132	0.260	0.172
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	0.178
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	0.185

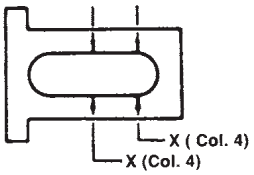
Footnotes for Table 11.2 are found on page 5.

Examples Illustrating Use of Table 11.2, preceding page:

Closed-Space Dimensions

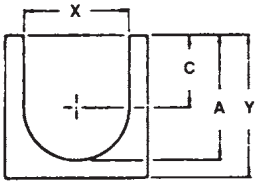


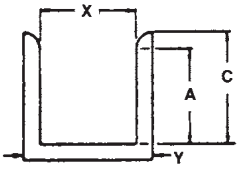


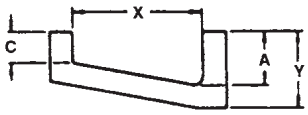


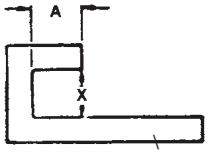
All dimensions designated “Y” are classed as “metal dimensions,” and tolerances are determined from column 2.
Dimensions designated “X” are classed as “space dimensions through an enclosed void,” and the tolerances applicable are determined from column 4 unless 75 percent or more of the dimension is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

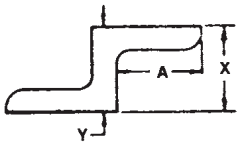
Open-Space Dimensions





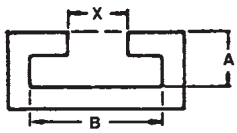


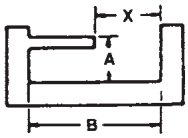




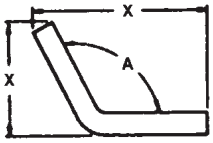
Tolerances applicable to dimensions “X” are determined as follows:
1. Locate dimension “X” in column 1.
2. Determine which of columns 4–9 is applicable, dependent on distance “A.”
3. Locate proper tolerance in column 4, 5, 6, 7, 8 or 9 in the same line as dimension “X.”

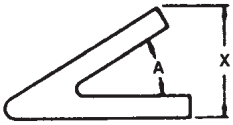
Dimensions “Y” are “metal dimensions”; tolerances are determined from column 2.
Distances “C” are shown merely to indicate incorrect values for determining which of columns 4–9 apply.





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:

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. Agressive 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.

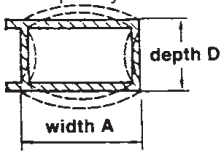
④ Where dimensions specified are outside and inside, rather than wall thickness itself, the allowable deviation (eccentricity) given in Column 3 applies to mean wall thickness. (Mean wall thickness is the average of two wall thickness measurements taken at opposite sides of the void.)

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.)

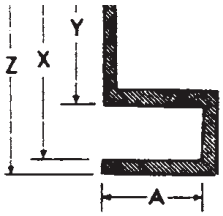
⑥ At points less than 0.250 inch from base of leg the tolerances in Col. 2 are applicable.

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.

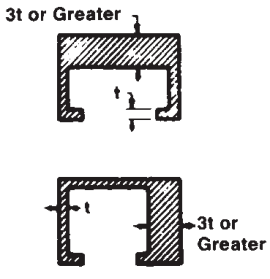
⑧ The following tolerances apply where the space is completely enclosed (hollow profiles); For the width (A), the balance is the value shown in Col. 4 for the depth dimension (D). For the depth (D), the tolerance is the value shown in Col. 4 for the width dimension (A). In no case is the tolerance for 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.



"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.

TABLE 11.3 Diameter or Distance Across Flats—Round Wire and Rod - Square, Hexagonal and Octagonal Wire and Bar①

SPECIFIED DIMENSION in.	TOLERANCE ③—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	
	Standard Tolerance, All Except 5XXX Alloys ⑪	Precsion 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
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 preceding page 5.

TABLE 11.4 Thickness or Width (Distance Across Flats)—Rectangular Wire and Bar①

SPECIFIED DEIMENSION IN.	TOLERANCE—in. plus and minus — ALLOWABLE DEVIATION FROM SPECIFIED WIDTH OR THICKNESS ACROSS FLATS			
	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
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

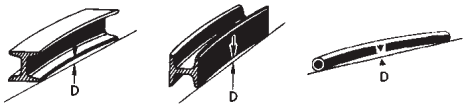
Note: Shaded tolerances denote products with a circumscribing circle size of 10 inches in diameter and over.

For numbered footnotes, see preceding page 5.

TABLE 11.5 Length①—Wire, Rod, Bar and Profiles

SPECIFIED DIAMETER (WIRE AND ROD): SPECIFIED WIDTH (BAR): CIRCUMSCRIBING CIRCLE DIAMETER ④: (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 Straightness①—Rod, Bar and Profiles

PRODUCT	TEMPER	SPECIFIED DIAMETER (ROD): SPECIFIED WIDTH (BAR): CIRCUMSCRIBING CIRCLE DIAMETER ④: (PROFILES) in.	SPECIFIED THICKNESS (RECTANGLES): MINIMUM THICKNESS: (PROFILES) in.	TOLERANCE ③—in. ALLOWABLE DEVIATION (D) FROM STRAIGHT ⑨  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 ② TX511 ②	All	. .	.0125 × Measured length, ft.
	O	0.500 and over	. .	.050 × Measured length, ft.
	TX510 ②	0.500 and over	. .	.050 × Measured length, ft.
	TX511 ②	0.500 and over	. .	.0125 × Measured length, ft.
Rectangular Bar	All except O TX510 ② TX511 ②	Up thru 1.499	Up thru 0.094 ⑦ 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 ②	Over 0.500	0.500 and over	.050 × Measured length, ft.
	TX511 ②	Over 0.500	0.500 and over	.0125 × Measured length, ft.
Profiles	All except O TX510 ② ⑤ TX511 ②	Up thru 1.499	Up thru 0.094 ⑦ 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 ⑦ 0.095 and over	.200 × Measured length, ft. .050 × Measured length, ft.
	TX511 ②	0.500 and over	Up thru 0.094 ⑦ 0.095 and over	.050 × Measured length, ft. .0125 × Measured length, ft.

For numbered footnotes, see page 9.

TABLE 11.7 Twist ① ⑥—Bar and Profiles

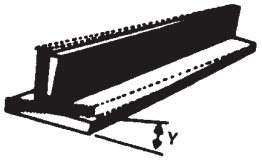
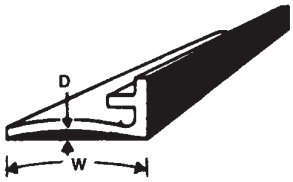
PRODUCT	TEMPER	SPECIFIED WIDTH (BAR): CIRCUMSCRIBING CIRCLE DIAMETER ④: (PROFILES) in.	SPECIFIED THICKNESS (RECTANGLES): MINIMUM THICKNESS: (PROFILES) in.	TOLERANCE ③—Degrees ALLOWABLE DEVIATION FROM STRAIGHT 	
				IN TOTAL LENGTH OR IN ANY MEASURED SEGMENT OF ONE FT. OR MORE OF TOTAL LENGTH	MAXIMUM 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	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 ②	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 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	1 × Measured length, ft. ½ × Measured length, ft. ¼ × Measured length, ft.	7 5 3
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 TEMPERS ⑤



SURFACES WIDTHS UP THRU 1 INCH OR ANY 1 INCH INCREMENT OF WIDER SURFACES
Maximum Allowable Deviation D = TOLERANCE (in.)

WIDTHS OVER 1 INCH
Maximum Allowable Deviation D = TOLERANCE × W (in.)

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										
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	.008	.008	.008	.008
2.000 and up	.004	.004	.004	.004	.004	.006	.006	.006	.008	.008	.008

For numbered footnotes, see page 9.

TABLE 11.9 Flatness (Flat Surfaces) ①—Hollow Profiles (EXCEPT FOR PROFILES IN O ⑩, T3510, T4510, T6510, T73510, T76510 and T8510 TEMPERS 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 (in.) WIDTHS OVER 1 INCH Maximum Allowable Deviation D = TOLERANCE × 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										
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

For numbered footnotes, see page 10.

TABLE 11.11 Contour (Curved Surfaces) ①③—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.**

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
¼	0.004
½	0.009
1	0.017
1½	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 ⅓ 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 11.12 Squareness of Cut Ends ①—Extruded Rod, Bar and Profiles

Allowable deviation from square: 1 degree

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

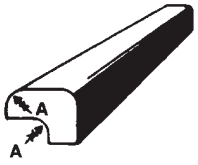
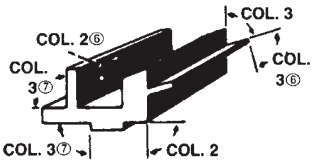
SPECIFIED RADIUS ⑨ in.	TOLERANCE—in. ALLOWABLE DEVIATION FROM SPECIFIED RADIUS
	 Difference between radius A and specified radius
Sharp corners	+1/64
0.016–0.187	±1/64
0.188 and over	±10%

TABLE 11.14 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

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 1/32 in. maximum including tolerances.

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