

TABLE 12.1 Mechanical Property Limits—Extruded Tube

ALLOY AND TEMPER	SPECIFIED WALL THICKNESS ① in.	AREA sq. in.	TENSILE STRENGTH—ksi				ELONGATION percent min. in 2 in. or 4D ②
			ULTIMATE		YIELD		
			min.	max.	min.	max.	
<b>1060</b>							
1060-O	All	All	8.5	14.0	2.5	..	25
1060-H112	All	All	8.5	..	2.5	..	25
<b>1100</b>							
1100-O	All	All	11.0	15.5	3.0	..	25
1100-H112	All	All	11.0	..	3.0	..	25
<b>2014</b>							
2014-O	All	All	..	30.0	..	18.0	12
2014-T4, T4510 ④ and T4511 ④	All	All	50.0	..	35.0	..	12
2014-T42 ③ ⑤	All	All	50.0	..	29.0	..	12
2014-T6, T6510 ④ and T6511 ④	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
	0.750 and over	Over 25 thru 32	68.0	..	58.0	..	6
2014-T62 ③ ⑤	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 ④ and T3511 ④	Up thru 0.249	All	57.0	..	42.0	..	10
	0.250–0.749	All	60.0	..	44.0	..	10
	0.750–1.499	All	65.0	..	46.0	..	10
	1.500 and over	Up thru 25	70.0	..	48.0	..	10
	1.500 and over	Over 25 thru 32	68.0	..	46.0	..	8
2024-T42 ③ ⑤	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 ④ and T8511 ④	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 ④ and T3511 ④	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 ③ ⑤	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 ④, and T8511 ④	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	..	25
<b>ALCLAD 3003</b>							
ALCLAD 3003-O	All	All	13.0	18.0	4.5	..	25
ALCLAD 3003-H112	All	All	13.0	..	4.5	..	25
<b>3004</b>							
3004-O	All	All	23.0	29.0	8.5	..	..

For all numbered footnotes, see page 12-5.

**TABLE 12.1 Mechanical Property Limits—Extruded Tube (continued)**

ALLOY AND TEMPER	SPECIFIED WALL THICKNESS ① in.	AREA sq. in.	TENSILE STRENGTH—ksi				ELONGATION percent min. in 2 in. or 4D ②
			ULTIMATE		YIELD		
			min.	max.	min.	max.	
<b>5083</b>							
5083-O	All	Up thru 32	39.0	51.0	16.0	..	14
5083-H111	All	Up thru 32	40.0	..	24.0	..	12
5083-H112	All	Up thru 32	39.0	..	16.0	..	12
<b>5086</b>							
5086-O	All	Up thru 32	35.0	46.0	14.0	..	14
5086-H111	All	Up thru 32	36.0	..	21.0	..	12
5086-H112	All	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	All	Up thru 32	31.0	41.0	12.0	..	14
5454-H111	All	Up thru 32	33.0	..	19.0	..	12
5454-H112	All	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
<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 ④ and T4511 ④	All	All	26.0	..	16.0	..	16
6061-T42 ③ ⑤	All	All	26.0	..	12.0	..	16
6061-T51	Up thru 0.625	All	35.0	..	30.0	..	8
6061-T6, T62 ③ ⑤, T6510 ④ and T6511 ④	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	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 ③ ⑤	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 ⑦	Up thru 1.000	All	22.0	30.0	16.0	25.0	8
6063-T6 and T62 ③ ⑤	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 ④, and T4511 ④	All	All	40.0	..	25.0	..	14
6066-T42 ③ ⑤	All	All	40.0	..	24.0	..	14
6066-T6, T6510 ④ and T6511 ④	All	All	50.0	..	45.0	..	8
6066-T62 ③ ⑤	All	All	50.0	..	42.0	..	8
<b>6070</b>							
6070-T6 and T62 ③ ⑤	Up thru 2.999	Up thru 32	48.0	..	45.0	..	6

For all numbered footnotes, see page 12-5.

**TABLE 12.1 Mechanical Property Limits—Extruded Tube (concluded)**

ALLOY AND TEMPER	SPECIFIED WALL THICKNESS ① in.	AREA sq. in.	TENSILE STRENGTH—ksi				ELONGATION percent min. in 2 in. or 4D ②
			ULTIMATE		YIELD		
			min.	max.	min.	max.	
<b>6082</b>							
6082-T6	0.200–1.000	All	45.0	..	38.0	..	8
<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 ④ and T5511 ④	Up thru 1.000	All	37.0	..	34.0	..	7
6162-T6, T6510 ④ and T6511 ④	Up thru 0.249 0.250–0.499	All	38.0	..	35.0	..	8
		All	38.0	..	35.0	..	10
<b>6262</b>							
6262-T6, T62 ③ ⑤, T6510 ④ and T6511 ④	All	All	38.0	..	35.0	..	10
<b>6351</b>							
6351-T4 6351-T6	Up thru 0.749 Up thru 0.124 0.125–0.749	All	32.0	..	19.0	..	16
		All	42.0	..	37.0	..	8
		All	42.0	..	37.0	..	10
<b>7075</b>							
7075-O	All	All	..	40.0	..	24.0	10
7075-T6, T62 ③ ⑤, T6510 ④ and T6511 ④	Up thru 0.249 0.250–0.499 0.500–1.499 1.500–2.999	All	78.0	..	70.0	..	7
		All	81.0	..	73.0	..	7
		All	81.0	..	72.0	..	7
		All	81.0	..	72.0	..	7
7075-T73 ⑥, T73510 ④ ⑥ and T73511 ④ ⑥	0.062–0.249 0.250–1.499 1.500–2.999	All	68.0	..	58.0	..	7
		Up thru 25 Up thru 25	70.0	..	61.0	..	8
			69.0	..	59.0	..	8

**Footnotes for Table 12.1**

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 D represents specimen diameter.

③ 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 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.

④ 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.

⑤ This temper is not available from the material producer.

⑥ 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.

⑦ 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.