

HARD ALLOY TUBE & PIPE



DRAWN SEAMLESS ALUMINUM TUBE CAPABILITIES

STANDARD ALLOYS & TEMPER								
2024	3003	5052	6061	6063	7050	7068	7075	K749A
O	O	O	O	T6	O	O	O	T6
T3	H12	H32	T4	T831	T6	T6	T6	
	H14	H34	T6	T832	T76		T76	
							T73	

STANDARD ALLOYS & SPECIFICATIONS*								
2024	3003	5052	6061	6063	7050	7068	7075	K749A
AMS 4086	ASTM B210	AMS 4069	AMS 4079	ASTM B483			ASTM B 210	
AMS 4087	AMS-T-700/2	AMS4070	AMS 4080	ASTM B241			AMS-T-700/7	
AMS 4088	AMS4065	AMS4071	AMS4081	MIL-P-25995				
AMS-T-700/3	AMS4067	ASTM B 210	AMS 4082					
ASTM B210	ASME SB234	ASME SB210	AMS 4083					
		ASTM B 234	ASME SB210					
		ASTM B 483	ASTM B 210					
		AMS-T-700/4	ASTM B 234					
			ASTM B 241					
			ASTM B 483					
			AMS-T-700/6					
			MIL-P25995					
			AMS-T-7081					

DIMENSIONAL RANGES					
		Wall			
Inches	Millimeters	Inches	Millimeters	Feet	Meters
0.125 - 3.00	3.18 - 76.20	0.018 - .250	0.46 - 6.35	0.50 - 20.00	0.15 - 8.00

Notes

Some specifications are no longer available but are provided for reference.

Press minimums vary from 500 - 3,000 lbs. Call for availability.

HARD ALLOY TUBE & PIPE



EXTRUDED SEAMLESS ALUMINUM TUBE CAPABILITIES

STANDARD ALLOYS & TEMPER					
2024	5052	7005	7046	7050	7075
O	O	F	O	F	O
T3					T6
T3511					T6511

STANDARD ALLOYS & SPECIFICATIONS					
2024	5052	7005	7046	7050	7075
ASTM B241	ASTM B241	ASTM B221			ASTM B241
ASTM B221	ASTM B221				ASTM B221
AMS 4152	ASME SB241				AMS 4154
ASME SB221					AMS-QQ-A-200/11
AMS-QQ-A-200/3					

DIMENSIONAL RANGES - ALLOYS 2024, 5052, 7050, 7075				
Wall Thickness (in.)	Outside Diameter (in.)			
	1.625/2.249	2.250/2.999	3.000/3.999	4.000/4.500
0.110 - 0.180	This area identifies available Extruded Seamless Aluminum Tube dimensional ranges.			
0.181 - 0.280				
0.281 - 0.374				
0.375 - 0.499				

DIMENSIONAL RANGES - ALLOYS 7005, 7046				
Wall Thickness (in.)	Outside Diameter (in.)			
	1.050/1.500	1.501/1.999	2.000/2.999	3.000/3.999
0.088 - 0.129	This area identifies available Extruded Seamless Aluminum Tube dimensional ranges.			
0.130 - 0.180				
0.181 - 0.218				
0.219 - 0.280				
0.281 - 0.374				
0.375 - 0.499				
0.500 - 0.749				

Notes

Press minimums vary from 500 - 3,000 lbs. Call for availability.

Mechanical Property Limits—Hard Alloy—Drawn Seamless Aluminum Tube

ALLOY AND TEMPER	WALL THICKNESS		TENSILE STRENGTH								Elongation % Min. Full Section Specimen
			ULTIMATE				YIELD				
			KSI		MPa		KSI		MPa		
			inches	mm	min.	max.	min.	max.	min.	max.		min.	max.
2024											
2024-O	0.018-0.250	0.46-6.35	..	32.0	..	221	..	15.0	..	103	
2024-T3	0.018-0.024	0.48-0.61	64	..	441	..	42.0	..	290	..	10
	0.025-0.049	0.64-1.24	64	..	441	..	42.0	..	290	..	12
	0.050-0.250	1.27-6.35	64	..	441	..	42.0	..	290	..	14
3003											
3003-O	0.018-0.024	0.48-0.61	14.0	19.0	96	130	5.0	..	34	..	..
	0.025-0.049	0.64-1.24	14.0	19.0	96	130	5.0	..	34	..	30
	0.050-0.250	1.27-6.35	14.0	19.0	96	130	5.0	..	34	..	35
3003-H12	0.018-0.250	0.48-6.35	17	..	117	..	12.0	..	83	..	..
3003-H14	0.018-0.024	1.27-6.35	20.0	..	138	..	17.0	..	117	..	3
	0.025-0.049	.64-1.24	20.0	..	138	..	17.0	..	117	..	5
	0.050-0.250	1.27-6.35	20.0	..	138	..	17.0	..	117	..	8
5052											
5052-O	0.018-0.250	0.48-6.35	25.0	35.0	172	241	6.0	41	..	..	..
5052-H32	0.018-0.250	0.48-6.35	31.0	..	213	..	23.0	..	159	..	..
5052-H34	0.018-0.250	0.48-6.35	34.0	..	234	..	26.0	..	179	..	..
6061											
6061-O	0.018-0.250	0.48-6.35	..	22.0	..	152	..	14.0	..	97	15
6061-T4	0.025-0.049	0.64-1.24	30.0	..	207	..	16.0	..	110	..	16
	0.050-0.250	1.27-6.35	30.0	..	207	..	16.0	..	110	..	18
6061-T6	0.025-0.049	0.64-1.24	42.0	..	290	..	35.0	..	241	..	10
	0.050-0.250	1.27-6.35	42.0	..	290	..	35.0	..	241	..	12
6063											
6063-T6	0.025-0.049	0.64-1.24	33.0	..	228	..	28.0	..	193	..	12
	0.050-0.250	1.27-6.35	33.0	..	228	..	28.0	..	193	..	14
6063-T831	0.025-0.250	0.64-6.35	28.0	..	193	..	25.0	..	172	..	5
6063-T832	0.025-0.049	0.64-1.24	41.0	..	283	..	36.0	..	248	..	8
	0.050-0.250	1.27-6.35	40.0	..	276	..	35.0	..	241	..	8
7050											
7050-O	0.025-0.250	0.64-6.35	..	40.0	..	276	..	21.0	..	145	8
7050-T6	0.025-0.250	0.64-6.35	85.0	..	586	..	74.0	..	510	..	5
7050-T76	0.025-0.250	0.64-6.35	80.0	..	552	..	69.0	..	476	..	5
7068											
7068-O	0.025-0.250	0.64-6.35	..	40.0	..	276	..	21.0	..	145	8
7068-T6	0.025-0.250	0.64-6.35	88.0	..	607	..	84.0	..	579	..	5
7075											
7075-O	0.025-0.049	0.64-1.24	..	40.0	..	276	..	21.0	..	145	10
	0.050-0.250	1.27-6.35	..	40.0	..	276	..	21.0	..	145	12
7075-T6	0.025-0.250	0.64-6.35	77.0	..	455	..	66.0	..	530	..	8
7075-T76	0.025-0.250	0.64-6.35	77.0	..	455	..	64.0	..	441	..	8
7075-T73	0.025-0.250	0.64-6.35	66.0	..	530	..	56.0	..	386	..	10
K749A											
K749A-T6	0.025-0.250	0.64-6.35	95.0	..	655	..	91.0	..	627	..	7

Mechanical Property Limits—Hard Alloy—Extruded Seamless Aluminum Tube

ALLOY AND TEMPER	WALL THICKNESS		TENSILE STRENGTH								Elongation % Min. Full Section Specimen
			ULTIMATE				YIELD				
			KSI		MPa		KSI		MPa		
			inches	mm	min.	max.	min.	max.	min.	max.	
2024											
2024-O	All	All	..	35.0	..	241	..	19.0	..	131	12
2024-T3	0.110-0.249	2.8-6.32	57.0	..	393	..	42.0	..	290	..	10
2024-T3511	0.250-0.500	6.35-12.7	60.0	..	414	..	44.0	..	303	..	10
5052											
5052-O	All	All	25.0	35.0	172	241	10	..	69	..	..
7005											
7005-F	All	All	..	..	..	..	..	..	..	..	..
7046											
7046-O	All	All	..	35.0	..	241	..	28.0	..	193	10
7050											
7050-F	All	All	..	..	..	..	..	..	..	..	..
7075											
7075-O	All	All	..	40.0	..	276	..	24.0	..	165	10
7075-T6	0.110-0.249	2.79-6.32	78.0	..	538	..	70.0	..	483	..	7
7075-T6511	0.250-0.499	6.35-12.7	81.0	..	558	..	73.0	..	503	..	7

Mechanical Property Limits—Hard Alloy—Extruded Seamless Aluminum Shapes

2024											
2024-O	All	All	..	35.0	..	241	..	19.0	..	131	12
2024-T3	0.110-0.249	2.8-6.32	57.0	..	393	..	42.0	..	290	..	12
2024-T3511	0.250-0.500	6.35-12.7	60.0	..	414	..	44.0	..	303	..	12
7075											
7075-O	All	All	..	40.0	..	276	..	24.0	..	165	10
7075-T6	0.110-0.249	2.79-6.32	78.0	..	538	..	70.0	..	483	..	7
7075-T6511	0.250-0.499	6.35-12.7	81.0	..	558	..	73.0	..	503	..	7

TABLE 12.20 Diameter—Drawn Round Tube

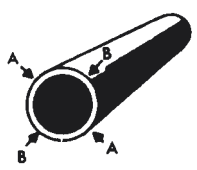
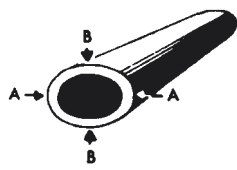
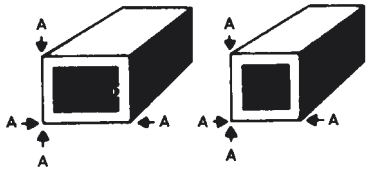

SPECIFIED DIAMETER in.	TOLERANCE ②—in. plus and minus			
	ALLOWABLE DEVIATION OF MEAN DIAMETER ③ FROM SPECIFIED DIAMETER (Size)  Difference between ½ (AA + BB) and specified diameter	ALLOWABLE DEVIATION OF DIAMETER AT ANY POINT FROM SPECIFIED DIAMETER ④  Difference between AA or BB and specified diameter		
		NON-ANNEALED AND NON-HEAT-TREATED TUBE	HEAT-TREATED TUBE ⑤	ANNEALED TUBE
Col. 1	Col. 2	Col. 3	Col. 4	Col. 5
Up thru 0.500	.003	.003	.006	.018
0.501–1.000	.004	.004	.008	.024
1.001–2.000	.005	.005	.010	.030
2.001–3.000	.006	.006	.012	.036
3.001–5.000	.008	.008	.016	.048
5.001–6.000	.010	.010	.020	.060
6.001–8.000	.015	.015	.030	.090
8.001–10.000	.020	.020	.040	.120
10.001–12.000	.025	.025	.050	.150

TABLE 12.21 Width and Depth—Drawn Square, Rectangular, Hexagonal and Octagonal Tube

SPECIFIED WIDTH OR DEPTH ① in.	TOLERANCE ②—in. plus and minus		
	ALLOWABLE DEVIATION OF WIDTH OR DEPTH AT CORNERS FROM SPECIFIED WIDTH OR DEPTH  Difference between AA and specified width or depth	ALLOWABLE DEVIATION OF WIDTH OR DEPTH NOT AT CORNERS FROM SPECIFIED WIDTH OR DEPTH ④ ⑦  Difference between AA and specified width, depth, or distance across flats	
		SQUARE, RECTANGULAR	SQUARE, HEXAGONAL, OCTAGONAL	RECTANGULAR
Col. 1	Col. 2	Col. 3	Col. 4
Up thru 0.500	.003	.006	The tolerance for the width is the value in Col. 3 for the dimension equal to the depth, and conversely, but in no case is the tolerance less than at the corners. ⑥
0.501–1.000	.004	.008	
1.001–2.000	.005	.010	
2.001–3.000	.006	.012	
3.001–5.000	.008	.016	
5.001–6.000	.010	.020	
6.001–8.000	.015	.030	
8.001–10.000	.020	.040	
10.001–12.000	.025	.050	

Footnotes for Tables 12.20 and 12.21

- ① When outside diameter, inside diameter, and wall thickness (or their equivalent dimensions in other than round tube) are all specified, standard tolerances are applicable to any two of these dimensions, but not to all three. When both outside and inside diameters or inside diameter and wall thickness are specified, the tolerance applicable to the specified or calculated O.D. dimension shall also apply to the I.D. dimension.
- ② 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 of the dimension under consideration.
- ③ Mean diameter is the average of two diameter measurements taken at right angles to each other at the same longitudinal location on the tube.

- ④ Not applicable to coiled tube or tube having a wall thickness less than 2½ percent of the specified outside diameter. The tolerance for tube with wall thickness less than 2½ percent of the specified outside diameter is determined by multiplying the applicable tolerance in columns 3 thru 5 as follows:
2% to 2½% exclusive—1.5 × tolerance
1½% to 2% exclusive—2.0 × tolerance
1% to 1½% exclusive—3.0 × tolerance
½% to 1% exclusive—4.0 × tolerance
- ⑤ For the T8 tempers of 6063 the tolerance in Column 3 apply.
- ⑥ Example: The width tolerance of 1 × 3 inch rectangular tube is plus and minus 0.008 inch, and the depth tolerance is plus and minus 0.012 in.
- ⑦ Not applicable to annealed (O temper) tube.

TABLE 12.22 Diameter—Drawn Oval, Elliptical and Streamline Tube



EQUIVALENT ROUND DIAMETER ^⑤ in.	TOLERANCE ^{① ②} —in.			
	LENGTH OF MAJOR AXIS, in.		LENGTH OF MAJOR AXIS, in.	
				
	Difference between AA and specified length		Difference between AA and specified length	
Col. 1	Col. 2		Col. 3	
Up thru 2.500	+0.040	-.025	+0.025	-.015
2.501-4.250	+0.050	-.035	+0.035	-.025
4.251-6.000	+0.070	-.050	+0.055	-.040
6.001-8.000	+0.100	-.085	+0.080	-.060
8.001-10.000	+0.160	-.140	+0.115	-.085

TABLE 12.23 Corner Radii—Drawn Tube

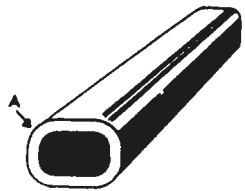
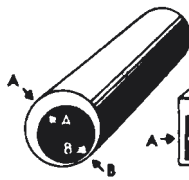
SPECIFIED ^⑦ RADIUS in.	TOLERANCE ^② —in.
	ALLOWABLE DEVIATION FROM SPECIFIED RADIUS
	
	Difference between radius A and specified radius
Sharp Corners	+1/64
0.016-0.187	±1/64
0.188 and over	±10%

TABLE 12.24 Wall Thickness—Drawn Round and Other-Than-Round Tube

SPECIFIED THICKNESS ^④ in.	TOLERANCE ^{① ②} —in. plus and minus		
	ALLOWABLE DEVIATION OF MEAN WALL THICKNESS ^③ FROM SPECIFIED WALL THICKNESS	ALLOWABLE DEVIATION OF WALL THICKNESS AT ANY POINT FROM SPECIFIED WALL THICKNESS (Eccentricity)	
	 Difference between 1/2(AA+BB) and specified wall thickness	ROUND, NON-HEAT-TREATABLE ALLOYS ^⑥	ROUND, HEAT-TREATABLE ALLOYS AND OTHER THAN ROUND, ALL ALLOYS
Col. 1	Col. 2	Col. 3	Col. 4
0.010-0.035	.002	.002	Plus and minus 10% of specified wall thickness, min ±0.003
0.036-0.049	.003	.003	
0.050-0.083	.004	.004	
0.084-0.120	.005	.006	
0.121-0.203	.006	.008	
0.204-0.300	.008	.012	
0.301-0.375	.015	.020	
0.376-0.500	.020	.030	

Footnotes for Tables 12.22 through 12.24

① When outside diameter, inside diameter, and wall thickness (or their equivalent dimensions in other-than-round tube) are all specified, standard tolerances are applicable to any two of these dimensions, but not to all three. When both outside and inside diameters or inside diameter and wall thickness are specified, the tolerance applicable to the specified or calculated O.D. dimension shall also apply to the I.D. dimension.

② 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.

③ The mean wall thickness of round tube is the average of two measurements taken opposite each other. The mean wall thickness of other-than-round tube is the average of two measurements taken opposite each other at approximate center line of tube and perpendicular to the longitudinal axis of the cross section.

④ When dimensions specified are outside and inside, rather than wall thickness itself, allowable deviation at any point (eccentricity) is plus and minus 10 percent of the mean wall thickness but not less than ±0.003 inch.

⑤ Equivalent round diameter is the diameter of the circle having a circumference equal to the perimeter of the tube.

⑥ For coiled tube, values in Column 4 apply.

⑦ If unspecified, the radius shall be 1/2 in. maximum including tolerances.

TABLE 12.25 Straightness—Drawn Tube


SPECIFIED OUTSIDE DIAMETER OR WIDTH in.	TOLERANCE ① ②—in.	
	ALLOWABLE DEVIATION FROM STRAIGHT	
	 D(max) IN TOTAL LENGTH OR IN ANY MEASURED SEGMENT OF ONE FT. OR MORE OF TOTAL LENGTH	
Up thru 0.374	.500 × Measured length, ft.	
0.375–5.999	.010 × Measured length, ft.	
6.000 and over	.020 × Measured length, ft.	

TABLE 12.26 Twist ④—Drawn Tube

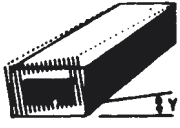
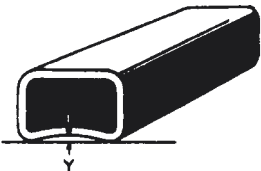
SPECIFIED WIDTH in.	TOLERANCE ① ②—Degree	
	ALLOWABLE DEVIATION FROM STRAIGHT	
	 Y (max) in degrees IN TOTAL LENGTH OR IN ANY MEASURED SEGMENT OF ONE FT. OR MORE OF TOTAL LENGTH	
	MAXIMUM FOR TOTAL LENGTH	
Up thru 1.499	1 × Measured length, ft.	7
1.500–2.999	½ × Measured length, ft.	5
3.000 and over	¼ × Measured length, ft.	3

TABLE 12.27 Length—Drawn Tube

SPECIFIED OUTSIDE DIAMETER OR WIDTH in.	TOLERANCE—in. plus except as noted							
	ALLOWABLE DEVIATION FROM SPECIFIED LENGTH							
	STRAIGHT				COILED			
	SPECIFIED LENGTH—ft.							
	Up thru 12	Over 12 thru 30	Over 30 thru 50	Over 50	Up thru 100	Over 100 to 250	250 to 500	500 and over
Up thru 0.249	¼	⅜	½	..	+5%, -0%	±10%	±15%	±20%
0.250–1.249	⅓	¼	⅜	1	+5%, -0%	±10%	±15%	±20%
1.250–2.999	⅛	¼	⅜	1	..	..	..	..
3.000–7.999	⅜	¼	⅜	1	..	..	..	..
8.000 and over	¼	⅜	½	1	..	..	..	..

TABLE 12.28 Flatness (Flat Surfaces)—Other-Than-Round Drawn Tube

SPECIFIED WIDTH OR DEPTH in.	TOLERANCE ③—in.	
	ALLOWABLE DEVIATION FROM FLAT	
	 Maximum allowable distance Y	
Up thru 0.500	.003	
0.501–1.000	.004	
1.001–2.000	.005	
2.001–3.000	.006	
3.001–5.000	.008	
5.001–6.000	.010	
6.001–8.000	.015	
8.001–10.000	.020	
10.001–12.000	.025	

Footnotes for Tables 12.25 through 12.28

- ① Tolerance is applicable when weight of tube on flat surface minimizes deviation.
- ② Not applicable to annealed (O temper) tube.
- ③ Not applicable to annealed (O temper) tube, coiled tube, or tube having a wall thickness less than 0.020 inch or less than 2½% of the equivalent round diameter. Equivalent round diameter is the diameter of a circle having a circumference equal to the perimeter of the tube.
- ④ Twist is normally measured by placing the drawn tube on a flat surface and at any point along its length measuring the maximum distance between the bottom surface of the drawn tube and the flat surface. From this measurement, the actual deviation from straightness of the drawn tube 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