AERONAUTICAL MATERIAL SPECIFICATION

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TOLERANCES
Magnesium Alloy ZK60A Extrusions

1. PURPOSE: To publish established manufacturing tolerances.

2. APPLICATION: Tolerances shown herein apply, unless otherwise agreed upon by purchaser and vendor. These tolerances apply to all conditions, unless otherwise noted. The term "excl" is used to apply only to the higher figur of the specified range.

3. DIAMETER OR THICKNESS:

3.1 Rods, Bars, Solid Shapes, and Shapes where none of the nominal dimension is space:

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TABLE I

Nominal Dimension Inches	Tolerance, Inch, Plus and Minus Width/Thickness Ratio (1)		
	20.0 and under	Over 20.0 to 40.0, incl	Over 40.0
Under 0.125	0.006	0.010	0.016
0.125 to 0.250, excl	0.007	0.010	0.016
0.250 to 0.500, excl	0.008	0.010	0.016
0.500 to 0.750, excl	0.009	0.010	0.016
0.750 to 1.000, excl	0.010	0.010	0.016
1.000 to 1.500, excl	0.012	0.012	0.016
1.500 to 2.000, excl	0.016	0.016	0.016
2.000 to 4.000, excl	0.024	0.024	0.024
4.000 to 6.000, excl	0.034	0.034	0.034
6.000 to 8.000, excl	0.044	0.044	0.044
8.000 to 10.000, excl	0.054	0.054	0.054
10.000 to 12.000, excl	0.064	0.064	0.064
12.000 to 14.000, excl	0.074	0.074	0.074
14.000 to 15.000, excl	0.080	0.080	0.080

Note. (1) See Figure 2.

ø 3.2 Shapes where any of the nominal dimension is space:

3.2.1 Where specified dimension is less than 0.250 in. thick and has Width/Thickness Ratio greater than 8.0 (1):

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TABLE II

Nominal Dimension (4) Inches	Tolerance, Inch, Plus and Minus When specified dimension is at following distance in inches from base of cantilevered leg (Z) (3)			
	0.25 to 0.625, excl	0.625 to 1.25, excl	1.25 to 2.50, excl	2.50 and over
Under 0.125	0.014			
0.125 to 0.250, excl	0.015	0.023		
0.250 to 0.500, excl	0.016	0.024	0.040	
0.500 to 0.750, excl	0.017	0.025	0.041	
0.750 to 1.000, excl	0.018	0.026	0.042	
1.000 to 1.500, excl	0.020	0.028	0.044	0.066
1.500 to 2.000, excl	0.024	0.032	0.048	0.070
2.000 to 4.000, excl	0.032	0.040	0.056	0.076

Notes. (1) See Figure 2.

(2) Where the space is completely enclosed, use Table I for dimensions which can be taken completely over solid metal. For dimensions partly over space, use Section 7 or 12, as applicable.

(3) For dimensions at points less than .0.25 in. from base of leg, use Table I, column headed "20.0 and under".

(4) Where nominal dimension is 4.000 to 15.000 in., excl, use Table III.

3.2.2 Where specified dimension is other than in 3.2.1:

TABLE III

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Nominal Dimension Inches	Tolerance, Inch, Plus and Minus When specified dimension is at following distance in inches from base of cantilevered leg (1) (2)			
	0.250 to 0.625, excl	0.625 to 1.25, excl	1.25 to 2.50, excl	2.50 and over
Under 0.125	0.010	0.012	0.014	0.016
0.125 to 0.250, excl	0.012	0.014	0.016	0.020
0.250 to 0.500, excl	0.014	0.016	0.018	0.022
0.500 to 0.750, excl	0.016	0.018	0.020	0.026
0.750 to 1.000, excl	0.018	0.020	0.022	0.030
1.000 to 1.500, excl	0.020	0.022	0.026	0.034
1.500 to 2.000, excl	0.024	0.028	0.034	0.050
2.000 to 4.000, excl	0.032	0.036	0.048	0.064
4.000 to 6.000, excl	0.042	0.050	0.064	0.088
6.000 to 8.000, excl	0.054	0.062	0.082	0.112
8.000 to 10.000, excl	0.064	0.074	0.100	0.136
10.000 to 12.000, excl	0.074	0.088	0.116	0.160
12.000 to 14.000, excl	0.084	0.100	0.134	0.184
14.000 to 15.000, excl	0.090	0.106	0.142	0.196

Notes. (1) Where the space is completely enclosed, use Table I for dimensions which can be taken completely over solid metal. For dimensions partly over space, use Section 7 or 12, as applicable.

(2) For dimensions at points less than 0.25 in. from base of leg, us Table I, column headed "20.0 and under".

3.3 Round Tubing:

TABLE IV

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Nominal OD Inches	Tolerance, Inch, Plus and Minus	
	Mean Diameter (1)	Diameter at Any Point (2)
Under 1.00	0.010	0.020
1.00 to 2.00, excl	0.012	0.025
2.00 to 4.00, excl	0.015	0.030
4.00 to 6.00, excl	0.025	0.050
6.00 to 8.00, excl	0.035	0.075
8.00 to 10.00, excl	0.045	0.100

Notes. (1) Mean diameter is the average of two measurements taken at right angles to each other.

(2) Not applicable to tubing having wall thickness less than 2.5% of OD.

Ø 3.4 Square, Rectangular, Hexagonal, and Octagonal Tubing:

3.4.1 Dimensions at Corners:
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TABLE V

Nominal Distance B tween Parallel Sides Inches	Tolerance, Inch Plus and Minus
0.50 to 0.75, excl	0.012
0.75 to 1.00, excl	0.014
1.00 to 2.00, excl	0.018
2.00 to 4.00, excl	0.025
4.00 to 5.00, incl	0.035

Ø 3.4.2 Dimensions Not at Corners:

3.4.2.1 Rectangular:
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TABLE VI

Nominal Dimension at Right Angles to the One Being Measured Inches	Tolerance, Inch Plus and Minus (Applies to measured dimension)
0.50 to 1.00, excl	0.020 (1)
1.00 to 2.00, excl	0.025 (1)
2.00 to 4.00, excl	0.035 (1)
4.00 to 5.00, incl	0.045 (1)

Note. (1) Or value in Table V for measured dimension, whichever is greater.

3.4.2.2 Square, Hexagonal, and Octagonal:
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TABLE VII

Nominal Distance Between Parallel Sides Inches	Tolerance, Inch Plus and Minus
0.50 to 1.00, excl	0.020
1.00 to 2.00, excl	0.025
2.00 to 4.00, excl	0.035
4.00 to 5.00, incl	0.045

Ø 4. WALL THICKNESS:

Ø 4.1 Shapes with Completely Enclosed Space:

4.1.1 Toleranc for hollow extrusions having a hole area of 0.11 sq in. and ov r is plus and minus 10% of the nominal wall thickness with a maximum of plus and minus 0.060 in. and a minimum of plus and minus 0.010 inch.
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4.1.2 Tolerance for hollow extrusions having a hole area less than 0.11 sq in. shall be as agreed upon by purchaser and vendor.

4.2 Round Tubing:

TABLE VIII

Nominal Wall Thickness Inches	Mean Wall Thickness Tolerance, Inch, Plus and Minus OD Ranges, Inches		
	Under 3.00	3.00 to 5.00, excl	5.00 and over
Under 0.062	0.007	0.008	0.010
0.062 to 0.125, excl	0.008	0.010	0.015
0.125 to 0.250, excl	0.009	0.013	0.020
0.250 to 0.375, excl	0.011	0.016	0.025
0.375 to 0.500, excl	0.015	0.021	0.035
0.500 to 0.750, excl	0.020	0.028	0.045
0.750 to 1.000, excl	---	0.035	0.055
1.000 to 1.500, excl	---	0.045	0.065

Notes. (1) Mean wall thickness is the average of two measurements taken opposite each other.

(2) Wall thickness at any point shall not deviate from the mean wall thickness by more than plus or minus 10% of the mean wall thickness, except that the allowable deviation shall be not less than 0.010 in. nor more than 0.060 inch.

4.3 Square, Rectangular, Hexagonal, and Octagonal Tubing: Wall thickness at any point shall not deviate from the specified wall thickness by more than plus or minus 10% of the specified wall thickness, except that the allowable deviation shall be not less than 0.010 in. nor more than 0.060 inch.

5. LENGTH: None.

6. STRAIGHTNESS:

6.1 Rods, Bars, and Shapes:

TABLE IX

Circumscribed Circle Diameter (1) Inches	Minimum Thickness Inch	Max Curvature (Depth of Arc) (2) Inch per foot
Under 1.5	0.094 and under	0.0500
Under 1.5	Over 0.094	0.0125 (3)
1.5 and over	---	0.0125 (3)

Notes. (1) The circumscribed circle diameter is the diameter of the smallest circle that will completely enclose the extrusion.

(2) Extrusions shall be measured from a flat surface with the weight of the section minimizing the arc.

(3) Th maximum curvature (depth of arc) shall b measured over any 5 ft of length.

6.2 Round, Square, Rectangular, Hexagonal, and Octagonal Tubing:

TABLE X

Nominal Diameter or Greatest Distance Between Parallel Sides Inches	Max Curvature (Depth of Arc) Inch per foot
Under 6	0.010
6 and over	0.020

7. FLATNESS: The deviation from flat shall not exceed 0.005 in. for widths 1 in. and under and 0.005 in. per in. of width for widths over 1 inch.

8. ANGLES:

8.1 Square, Rectangular, Hexagonal, and Octagonal Tubing: Allowable deviation from nominal angle: ± 3 degrees.

8.2 Shap s and Bars:

TABLE XI

Thickness of Thinnest Leg Inch	Angular Tolerance, Degrees Plus and Minus
Under 0.188	2.0
0.188 to 0.750, excl	1.5
0.750 and over (to solid metal)	1.0

9. TWIST:

TABLE XII

Circumscribed Circle Diameter Inches	Tolerance, Degrees per foot
Under 1.5	1
1.5 to 3.0, excl	1/2, not over 5° in total length
3.0 and over	1/4, not over 3° in total length

10. SURFACE ROUGHNESS:

TABLE XIII

Section Thickness Inch	Maximum Depth of Defeat (1) Inch
Under 0.064	0.0015
0.064 to 0.126, excl	0.002
0.126 to 0.189, excl	0.0025
0.189 to 0.251, excl	0.003
0.251 and over	0.004

Note. (1) Including die marks, handling marks, polishing marks and similar groov s.