SAE Aerospace
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AEROSPACE MATERIAL SPECIFICATION

SAE AMS 2221 | REV. G

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Superseding AMS 2221F

Tolerances
Copper and Copper Alloy Bars and Rods

RATIONALE

This document has been reaffirmed to comply with the SAE five-year review policy.

1. SCOPE:

This specification covers established inch/pound manufacturing tolerances applicable to bars and rods of copper and copper alloys ordered to inch/pound dimensions. These tolerances apply to all conditions, unless otherwise noted. The term “exclusive” is used to apply only to the higher figure of a specified range.

1.1 If the tolerance is expressed as a percentage of a specified dimension, the tolerance so calculated shall be rounded to the nearest 0.001 inch to obtain the permissible tolerance.

2. DIAMETER OR THICKNESS:

2.1 Cold Finished:

2.1.1 Rods; Rounds, Hexagons, and Octagons: See Table 1.

2.1.2 Bars; Squares, and Rectangles: Shall be as follows

2.1.2.1 Copper: See Table 2.

2.1.2.2 Nonrefractory Alloys: See Table 3.

2.1.2.3 Refractory Alloys: See Table 4.

2.2 Extruded Round, Hexagonal, Octagonal, Square, and Rectangular Shapes:

See Table 5.

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2.3 Hot Finished Rounds:

See Table 6.

3. WIDTH:

Rectangles, Not Including Squares: See Table 7.

4. LENGTH:

Shall be as shown in Table 8, 4.1, and 4.2.

4.1 Full length pieces specific and stock lengths with or without ends.

4.2 No length tolerances are established for extruded and hot rolled rod.

5. STRAIGHTNESS:

5.1 Cold Finished Rods; Hexagons, Octagons:

See Table 9.

5.2 Bars; Squares and Rectangles:

When supplied in straight lengths, in rolls, or on bucks, shall be of such straightness that the maximum edgewise curvature (depth of arc) shall be not greater then 0.50 inch in any 6 feet or length, or 0.083 inch × length in feet for shorter lengths.

6. FLATNESS:

No requirements specified.

7. SPECIAL TOLERANCES:

7.1 If tolerances specified herein are plus and minus and if all plus or all minus are desired, use the sum of the plus and minus values specified, neglecting the signs.

7.2 If tolerances specified herein are all plus and if all minus are desired, use the same values specified.

7.3 If tolerances specified herein are all plus and if plus and minus are desired, halve the values specified.

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8. NOTES:

8.1 A change bar (|) located in the left margin is for the convenience of the user in locating areas where technical revisions, not editorial changes, have been made to the previous issue of this specification. An (R) symbol to the left of the document title indicates a complete revision of the specification, including technical revisions. Change bars and (R) are not used in original publications, nor in specifications that contain editorial changes only.

8.2 Terms used in AMS are clarified in ARP1917.

8.3 Dimensions and properties in inch/pound units and Fahrenheit temperatures are primary; dimensions and properties in SI units and Celsius temperatures are shown as the approximate equivalents of the primary units and are presented only for information.

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TABLE 1 - Diameter or Thickness Tolerances, Cold Finished Rods

Specified Diameter or Distance Between Parallel Surfaces Inch	Tolerance, Inch Plus and Minus Nonrefractory Round	Tolerance, Inch Plus and Minus Nonrefractory Hexagonal Octagonal	Tolerance, Inch Plus and Minus Refractory Round	Tolerance, Inch Plus and Minus Refractory Hexagonal Octagonal
Up to 0.150, incl	0.0013	0.0025	0.002	--
Over 0.150 to 0.500, incl	0.0015	0.003	0.002	0.004
Over 0.500 to 1.00, incl	0.002	0.004	0.003	0.005
Over 1.00 to 2.00, incl	0.0025	0.005	0.004	0.006
Over 2.00	0.15%	0.30%	0.20%	0.40%

TABLE 2 - Thickness Tolerances, Copper, Square and Rectangle Bars

Specified Thickness Inches	Thickness Tolerance Inch Plus and Minus Width Ranges Inch Up to 0.500, incl	Thickness Tolerance Inch Plus and Minus Width Ranges Inches Over 0.500 to 1.250, incl	Thickness Tolerance Inch Plus and Minus Width Ranges Inches Over 1.250 to 2.00, incl	Thickness Tolerance Inch Plus and Minus Width Ranges Inches Over 2.00 to 4.00, incl	Thickness Tolerance Inch Plus and Minus Width Ranges Inches Over 4.00 to 8.00, incl	Thickness Tolerance Inch Plus and Minus Width Ranges Inches Over 8.00 to 12.00, incl
Over 0.188 to 0.500, incl	0.003	0.003	0.0035	0.004	0.0045	0.0055
Over 0.500 to 1.00, incl	--	0.004	0.004	0.0045	0.005	0.006
Over 1.00 to 2.00, incl	--	0.0045	0.0045	0.005	0.006	--
Over 2.00 to 4.00, incl	--	--	--	0.30%	--	--

TABLE 3 - Thickness Tolerances, Nonrefractory Alloys, Square and Rectangle Bars

Specified Thickness Inches	Thickness Tolerance Inch Plus and Minus Width Ranges Inches Up to 0.500, incl	Thickness Tolerance Inch Plus and Minus Width Ranges Inches Over 0.500 to 1.250, incl	Thickness Tolerance Inch Plus and Minus Width Ranges Inches Over 1.250 to 2.00, incl	Thickness Tolerance Inch Plus and Minus Width Ranges Inches Over 2.00 to 4.00, incl	Thickness Tolerance Inch Plus and Minus Width Ranges Inches Over 4.00 to 8.00, incl	Thickness Tolerance Inch Plus and Minus Width Ranges Inches Over 8.00 to 12.00, incl
Over 0.188 to 0.500, incl	0.0035	0.004	0.0045	0.0045	0.006	0.008
Over 0.500 to 1.00, incl	--	0.0045	0.005	0.005	0.007	0.009
Over 1.00 to 2.00, incl	--	0.005	0.005	0.006	0.008	--
Over 2.00 to 4.00, incl	--	--	--	0.30%	--	--

TABLE 4 - Thickness Tolerances, Refractory Alloys, Square and Rectangle Bars

Specified Thickness Inch	Thickness Tolerance Inch Plus and Minus Width Ranges Inch Up to 0.500, incl	Thickness Tolerance Inch Plus and Minus Width Ranges Inches Over 0.500 to 1.250, incl	Thickness Tolerance Inch Plus and Minus Width Ranges Inches Over 1.250 to 2.00, incl	Thickness Tolerance Inch Plus and Minus Width Ranges Inches Over 2.00 to 4.00, incl	Thickness Tolerance Inch Plus and Minus Width Ranges Inches Over 4.00 to 8.00, incl	Thickness Tolerance Inch Plus and Minus Width Ranges Inches Over 8.00 to 12.00, incl
Over 0.188 to 0.500, incl	0.005	0.005	0.006	0.007	0.009	0.012
Over 0.500 to 1.00, incl	--	0.006	0.007	0.008	0.010	0.013
Over 1.00 to 2.00, incl	--	0.006	0.007	0.009	0.011	--
Over 2.00 to 4.00, incl	--	--	--	0.50%	--	--

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