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INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE MATERIAL SPECIFICATION

SAE MAM 2221B

Issued JUL 1982
Revised JAN 1994
Reaffirmed OCT 1999

Submitted for recognition as an American National Standard

Superseding MAM 2221A

Tolerances, Metric
Copper and Copper Alloy Bars and Rods

1. SCOPE:

This specification covers established metric manufacturing tolerances applicable to bars and rods of copper and copper alloys ordered to metric 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 0.02 mm to obtain the permissible tolerance.

1.2 AMS 2221 is the inch/pound version of this MAM.

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.

2.3 Hot Finished Rounds:

See Table 6.

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3. WIDTH:

See 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 bar.

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 12.5 mm in any 1800 mm or 2.0 mm x length in 300 mm 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.

8. NOTES:

8.1 The change bar (**I**) 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.

8.2 Similar Specifications:

FED-STD-146 is listed for information only and shall not be construed as an acceptable alternate unless all requirements of this MAM are met.

8.3 Tolerances meeting the requirements of this specification have been classified under Federal Supply Classification (FSC) 95GP.

TABLE 1 - Diameter or Thickness Tolerances, Cold Finished Rods

Specified Diameter or Distance Between Parallel Surfaces mm	Tolerance, mm Plus and Minus Nonrefractory Round	Tolerance, mm Plus and Minus Nonrefractory Hexagonal Octagonal	Tolerance, mm Plus and Minus Refractory Round	Tolerance, mm Plus and Minus Refractory Hexagonal Octagonal
Up to 3.8, incl	0.035	0.06	0.050	--
Over 3.8 to 12, incl	0.04	0.08	0.05	0.10
Over 12 to 25, incl	0.05	0.10	0.08	0.13
Over 25 to 50, incl	0.06	0.13	0.10	0.15
Over 50	0.15%	0.30%	0.20%	0.40%

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

Specified Thickness mm	Thickness Tolerance mm Plus and Minus Width Ranges mm Up to 12, incl	Thickness Tolerance mm Plus and Minus Width Ranges mm Over 12 to 30, incl	Thickness Tolerance Inch Plus and Minus Width Ranges mm Over 30 to 50, incl	Thickness Tolerance mm Plus and Minus Width Ranges mm Over 50 to 100, incl	Thickness Tolerance mm Plus and Minus Width Ranges mm Over 100 to 200, incl	Thickness Tolerance mm Plus and Minus Width Ranges mm Over 200 to 300, incl
Over 4.8 to 12, incl	0.08	0.08	0.09	0.10	0.11	0.13
Over 12 to 25, incl	--	0.10	0.10	0.11	0.13	0.15
Over 25 to 50, incl	--	0.11	0.11	0.13	0.15	--
Over 50 to 100, incl	--	--	--	0.30%	--	--

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

Specified Thickness mm	Thickness Tolerance mm Plus and Minus Width Ranges mm Up to 12, incl	Thickness Tolerance mm Plus and Minus Width Ranges mm Over 12 to 30, incl	Thickness Tolerance mm Plus and Minus Width Ranges mm Over 30 to 50, incl	Thickness Tolerance mm Plus and Minus Width Ranges mm Over 50 to 100, incl	Thickness Tolerance mm Plus and Minus Width Ranges mm Over 100 to 200, incl	Thickness Tolerance mm Plus and Minus Width Ranges mm Over 200 to 300, incl
Over 4.8 to 12, incl	0.9	0.10	0.11	0.11	0.13	0.20
Over 12 to 25, incl	--	0.11	0.13	0.13	0.18	0.23
Over 25 to 50, incl	--	0.13	0.13	0.15	0.20	--
Over 50 to 100, incl	--	--	--	0.30%	--	--

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

Specified Thickness mm	Thickness Tolerance mm Plus and Minus Width Ranges mm Up to 12, incl	Thickness Tolerance mm Plus and Minus Width Ranges mm Over 12 to 30, incl	Thickness Tolerance mm Plus and Minus Width Ranges mm Over 30 to 50, incl	Thickness Tolerance mm Plus and Minus Width Ranges mm Over 50 to 100, incl	Thickness Tolerance mm Plus and Minus Width Ranges mm Over 100 to 200, incl	Thickness Tolerance mm Plus and Minus Width Ranges mm Over 200 to 300, incl
Over 4.8 to 12, incl	0.13	0.13	0.15	0.18	0.23	0.30
Over 12 to 25, incl	--	0.15	0.18	0.20	0.25	0.33
Over 25 to 50, incl	--	0.15	0.18	0.23	0.28	--
Over 50 to 100, incl	--	--	--	0.50%		--

TABLE 5 - Diameter or Thickness Tolerances, Extruded Round, Hexagonal, Octagonal, Square, and Rectangular Shapes

Specified Diameter or Distance Between Parallel Surfaces mm	Tolerance, mm Plus and Minus Nonrefractory	Tolerance, mm Plus and Minus Refractory
Up to 25, incl	0.25	0.50
Over 25 to 50, incl	0.38	0.75
Over 50 to 75, incl	0.65	1.3
Over 75 to 90, incl	0.90	1.8
Over 90 to 100, incl	1.5	3.0

TABLE 6 - Diameter Tolerances, Hot Finished Rounds

Specified Diameter mm	Tolerance mm Plus	Tolerance mm Minus
6.35	0.50	0.25
Over 6.35 to 20, incl	0.38	0.38
Over 20 to 30, incl	0.50	0.50
Over 30 to 38, incl	0.75	0.75
Over 38 to 75, incl	1.6	1.6
Over 75	3.2	3.2