



AEROSPACE MATERIAL SPECIFICATION	AMS2221™	REV. H
	Issued 1945-07 Reaffirmed 2017-09 Revised 2023-01	
Superseding AMS2221G		
Tolerances Copper and Copper Alloy Bars and Rods		

RATIONALE

AMS2221H results from a Five-Year Review and update of this specification with changes to update applicable documents (Section 2).

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. APPLICABLE DOCUMENTS

The issue of the following documents in effect on the date of the purchase order forms a part of this specification to the extent specified herein. The supplier may work to a subsequent revision of a document unless a specific document issue is specified. When the referenced document has been cancelled and no superseding document has been specified, the last published issue of that document shall apply.

2.1 SAE Publication

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AS7766 Terms Used in Aerospace Metals Specifications

2.2 Definitions

Terms used in AMS are defined in AS7766.

3. DIAMETER OR THICKNESS

3.1 Cold Finished

3.1.1 Rods; Rounds, Hexagons, and Octagons

See Table 1.

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3.1.2 Bars; Squares, and Rectangles

Shall be as follows:

3.1.2.1 Copper

See Table 2.

3.1.2.2 Nonrefractory Alloys

See Table 3.

3.1.2.3 Refractory Alloys

See Table 4.

3.2 Extruded Round, Hexagonal, Octagonal, Square, and Rectangular Shapes

See Table 5.

3.3 Hot Finished Rounds

See Table 6.

4. WIDTH

4.1 Rectangles, Not Including Squares

See Table 7.

5. LENGTH

Shall be as shown in Table 8, 5.1, and 5.2.

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

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

6. STRAIGHTNESS

6.1 Cold Finished Rods; Hexagons, Octagons

See Table 9.

6.2 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 than 0.50 inch in any 6 feet or length, or 0.083 inch x length in feet for shorter lengths.

7. FLATNESS

No requirements specified.

8. SPECIAL TOLERANCES

- 8.1 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.
- 8.2 If tolerances specified herein are all plus and if all minus are desired, use the same values specified.
- 8.3 If tolerances specified herein are all plus and if plus and minus are desired, halve the values specified.

9. NOTES

9.1 Revision Indicator

A 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 document. An (R) symbol to the left of the document title indicates a complete revision of the document, including technical revisions. Change bars and (R) are not used in original publications, nor in documents that contain editorial changes only.

Table 1 - Diameter or thickness tolerances, cold finished rods

Specified Diameter or Distance Between Parallel Surfaces Inches	Tolerance Inches Plus and Minus Nonrefractory	Tolerance Inches Plus and Minus Nonrefractory Hexagonal Octagonal	Tolerance Inches Plus and Minus Refractory Round	Tolerance Inches Plus and Minus Refractory Hexagonal Octagonal
	Round	Octagonal	Round	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 Inches Plus and Minus Width Ranges Inches					
	Up to 0.500, Incl	Over 0.500 to 1.250, Incl	Over 1.250 to 2.00, Incl	Over 2.00 to 4.00, Incl	Over 4.00 to 8.00, Incl	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 Inches Plus and Minus Width Ranges Inches					
	Up to 0.500, Incl	Over 0.500 to 1.250, Incl	Over 1.250 to 2.00, Incl	Over 2.00 to 4.00, Incl	Over 4.00 to 8.00, Incl	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 Inches	Thickness Tolerance Inches	Thickness Tolerance Inches	Thickness Tolerance Inches	Thickness Tolerance Inches	Thickness Tolerance Inches	Thickness Tolerance Inches
	Plus and Minus Width Ranges Inches					
	Up to 0.500, Incl	Over 0.500 to 1.250, Incl	Over 1.250 to 2.00, Incl	Over 2.00 to 4.00, Incl	Over 4.00 to 8.00, Incl	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%	--	--

Table 5 - Diameter or thickness tolerances, extruded round, hexagonal, octagonal, square, and rectangular shapes

Specified Diameter or Distance Between Parallel Surfaces Inches	Tolerance Inches	Tolerance Inches
	Plus and Minus Nonrefractory	Plus and Minus Refractory
Up to 1.00, incl	0.010	0.020
Over 1.00 to 2.00, incl	0.015	0.030
Over 2.00 to 3.00, incl	0.025	0.050
Over 3.00 to 3.50, incl	0.035	0.070
Over 3.50 to 4.00, incl	0.060	0.120

Table 6 - Diameter tolerances, hot finished rounds

Specified Diameter Inches	Tolerance Inches	Tolerance Inches
	Plus	Minus
0.250	0.020	0.010
Over 0.250 to 0.750, incl	0.015	0.015
Over 0.750 to 1.25, incl	0.020	0.020
Over 1.25 to 1.50, incl	0.030	0.030
Over 1.50 to 3.00, incl	0.0625	0.0625
Over 3.0	0.125	0.125

Table 7 - Width tolerances, rectangles

Specified Width Inches	Tolerance Inches	Tolerance Inches
	Plus and Minus Copper and Nonrefractory	Plus and Minus Refractory
Over 0.188 to 0.500, incl	0.0035	0.005
Over 0.500 to 1.25, incl	0.005	0.007
Over 1.25 to 2.00, incl	0.008	0.010
Over 2.00 to 4.00, incl	0.012	0.015
Over 4.00 to 12.00, incl	0.30%	0.50%