SAE Aerospace
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AEROSPACE MATERIAL SPECIFICATION

SAE® MAM 2251B

Issued JAN 1983
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Noncurrent MAR 2003

Superseding MAM 2251A

Tolerances, Metric
Low-Alloy Steel Bars

NONCURRENCY NOTICE

This specification has been declared "NONCURRENT" by the Aerospace Materials Division, SAE, as of March, 2003. It is recommended, therefore, that this specification not be specified for new designs.

AMS 2251 covers the same requirements.

"NONCURRENT" refers to those materials which have been widely used and which may be required on some existing designs in the future. The Aerospace Materials Division, however, does not recommend these as standard materials for future use in new designs.

"NONCURRENT" specifications are available from SAE.

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1. SCOPE:

This specification covers established metric manufacturing tolerances applicable to low-alloy steel bars ordered to metric dimensions. These tolerances apply to all conditions, unless otherwise noted. The term "exclusive" is used to apply to the higher figure of the specified range.

1.1 No clear cut demarcation is available to differentiate between bar and wire products, so no definitions of these products are included.

1.2 AMS 2251 is the inch/pound version of this MAM.

2. DIAMETER OR THICKNESS:

2.1 Cold Finished:

2.1.1 Cold Drawn: Table 1 includes tolerances for bars that have been annealed, spheroidize annealed, normalized, normalized and tempered, or quenched and tempered before cold finishing. This table does not include tolerances for bars that are spheroidize annealed, normalized, normalized and tempered, or quenched and tempered after cold finishing.

2.1.1.1 Width governs the tolerances for both width and thickness of flats. For example, when the maximum of carbon range is up to 0.28, inclusive, for a flat 50.00 millimeters wide and 25.00 millimeters thick, the width tolerance is 0.15 millimeter and the thickness tolerance is the same, namely, 0.15 millimeter.

TABLE 1 - Tolerances, Millimeter, Minus Only; Maximum of Carbon Range, %

Specified Diameter of Thickness Millimeters	Up to 0.28 Carbon, incl	Over 0.28 to 0.55 Carbon, incl	Up to 0.55 Carbon, incl, Stress Relieved or Annealed After Cold Finishing	Over 0.55, Carbon, With or Without Stress Relieving or Annealing After Cold Finishing, and All Carbons Quenched and Tempered or Normalized and Tempered Before Cold Finishing
ROUNDS				
Up to 25.00, incl, in coils	0.05	0.08	0.10	0.12
Up to 37.50, incl	0.08	0.10	0.15	0.18
Over 37.50 to 62.50, incl	0.10	0.12	0.15	0.18
Over 62.50 to 100.00, incl	0.12	0.15	0.18	0.20
HEXAGONS				
Up to 18.75, incl	0.08	0.10	0.12	0.18
Over 18.75 to 37.50, incl	0.10	0.12	0.15	0.20
Over 37.50 to 62.50, incl	0.12	0.15	0.18	0.22
Over 62.50 to 78.00, incl	0.15	0.18	0.20	0.25
Over 78.00 to 100.00, incl	0.15	-	-	-
SQUARES				
Up to 18.75, incl	0.08	0.12	0.15	0.20
Over 18.75 to 37.50, incl	0.10	0.15	0.18	0.22
Over 37.50 to 62.50, incl	0.12	0.18	0.20	0.25
Over 62.50 to 100.00, incl	0.18	0.22	0.25	0.30
Over 100.00 to 125.00, incl	0.28	-	-	-
FLATS				
Specified Width, Millimeters				
Up to 18.75, incl	0.10	0.12	0.18	0.22
Over 18.75 to 37.50, incl	0.12	0.15	0.22	0.28
Over 37.50 to 75.00, incl	0.15	0.18	0.28	0.32
Over 75.00 to 100.00, incl	0.18	0.22	0.30	0.42
Over 100.00 to 150.00, incl	0.22	0.28	0.32	0.52
Over 150.00	0.35	-	-	-

2.1.1.2 When rough turned round bars are permitted, the tolerances of Table 1 shall be doubled.

2.1.1.3 The tolerances for flats apply to both width and thickness.

2.1.1.4 Tolerances in the column headed "Over 0.28 to 0.55 carbon, inclusive" also apply to all carbons up to 0.55 maximum, annealed or normalized before cold finishing.

2.1.2 Machined Bars: Tolerances for machined bars 9.50 millimeters and over in specified diameter or thickness are shown in Table 2. Bars up to 9.50 millimeters, exclusive, in specified diameter or thickness are supplied centerless ground.

TABLE 2 - Tolerances, Machined Bars

Specified Diameter or Thickness Millimeters	Tolerance plus only Millimeter	Out of Round Millimeter
9.50 to 50.00, excl	0.40	0.20
50.00 to 75.00, incl	0.80	0.40
Over 75.00	0.80	0.40

2.1.3 Centerless Ground Bars: Tolerances for centerless-ground bars 3.00 to 105.00 millimeters, inclusive, in specified diameter are shown in Table 3. Bars over 105.00 millimeters in specified diameter are supplied machined.

TABLE 3 - Tolerances, Centerless-Ground Bars

Specified Diameter Millimeters	Tolerance plus or minus Millimeter	Out of Round Millimeter
3.00 to 6.25, excl	0.025	0.025
6.25 to 15.75, excl	0.04	0.04
15.75 to 78.00, excl	0.05	0.05
78.00 to 105.00, incl	0.08	0.08

2.1.4 Ground and Polished Rounds: See Table 4.

TABLE 4 - Tolerances, Ground and Polished Rounds

Specified Diameter Millimeters	Tolerance Millimeter Minus only
Up to 37.50, incl	0.02
Over 37.50 to 62.50, excl	0.038
62.50 to 75.00, incl	0.05
Over 75.00 to 100.00, incl	0.08

2.2 Hot Finished:

2.2.1 Rounds and Squares: See Table 5.

2.2.1.1 Out-of-round is the difference between the maximum and minimum diameters of the bar, measured at the same cross-section. Out-of-square is the difference in the two dimensions at the same cross-section of a square bar between opposite faces.

TABLE 5 - Tolerances, Hot Finished Rounds and Squares

Specified Diameter or Thickness Millimeters	Tolerance Millimeters Plus	Tolerance Millimeter Minus	Out-of-Round or Out-of-Square Millimeters
Up to 7.80, incl	0.12	0.12	0.20
Over 7.80 to 11.00, incl	0.15	0.15	0.23
Over 11.00 to 15.50, incl	0.18	0.18	0.25
Over 15.50 to 22.00, incl	0.20	0.20	0.30
Over 22.00 to 25.00, incl	0.22	0.22	0.32
Over 25.00 to 28.00, incl	0.25	0.25	0.38
Over 28.00 to 31.25, incl	0.28	0.28	0.41
Over 31.25 to 34.50, incl	0.30	0.30	0.45
Over 34.50 to 37.50, incl	0.35	0.35	0.57
Over 37.50 to 50.00, incl	0.40	0.40	0.58
Over 50.00 to 62.50, incl	0.78	0	0.58
Over 62.50 to 87.50, incl	1.18	0	0.88
Over 87.50 to 115.00, incl	1.58	0	1.15
Over 115.00 to 137.50, incl	1.95	0	1.47
Over 137.50 to 165.00, incl	3.12	0	1.75
Over 165.00 to 205.00, incl	3.90	0	2.12
Over 205.00 to 235.00, incl	4.70	0	2.50
Over 235.00 to 250.00, incl	6.25	0	3.00

2.2.2 Hexagons and Octagons: See Table 6.

TABLE 6 - Tolerances, Hot Finished Hexagons and Octagons

Specified Distance Between Parallel Sides Millimeters	Tolerance Millimeters Plus	Tolerance Millimeters Minus	Maximum Difference, Millimeters, 3 Measurements, For Hexagons Only
Up to 12.50, incl	0.18	0.18	0.28
Over 12.50 to 25.00, incl	0.25	0.25	0.38
Over 25.00 to 37.50, incl	0.52	0.32	0.62
Over 37.50 to 50.00, incl	0.78	0.40	0.78
Over 50.00 to 62.50, incl	1.18	0.40	1.18
Over 62.50 to 87.50, incl	1.58	0.40	1.58

2.2.3 Square-Edged and Round-Edged Flats: See Table 7.

2.2.3.1 Flats over 150 to 200 millimeters, inclusive, in specified width are not available as hot rolled alloy steel bars in thicknesses under 5.75 millimeters.

2.2.3.2 Tolerances shall be negotiated for flats over 150 to 200 millimeters, inclusive, in specified width and over 75.00 millimeters in specified thickness.

TABLE 7 - Thickness Tolerances, Inch, Plus and Minus; Thickness Ranges, Millimeters

Specified Width Millimeters	5.00 to 5.75, excl	5.75 to 6.25, excl	6.25 to 12.50, incl	Over 12.50 to 25.00, incl	Over 25.00 to 50.00, incl	Over 50.00 to 75.00, incl	Over 75.00	Width Tolerance Millimeters Plus	Width Tolerance Millimeters Minus
Up to 25.00, incl	0.18	0.18	0.20	0.25	-	-	-	0.40	0.40
Over 25.00 to 50.00, incl	0.18	0.18	0.30	0.38	0.78	-	-	0.78	0.78
Over 50.00 to 100.00, incl	0.20	0.20	0.38	0.50	0.78	1.18	1.18	1.58	0.78
Over 100.00 to 150.00, incl	0.22	0.22	0.38	0.50	0.78	1.18	1.18	2.35	1.60
Over 150.00 to 200.00, incl	-	0.38	0.40	0.62	0.78	1.18	-	3.12	2.35

3. WIDTH:

Included in Section 2.

4. LENGTH:

4.1 Cold Finished:

No requirements specified.

4.2 Hot Finished:

4.2.1 Hot Sheared:

4.2.1.1 Rounds, Squares, Hexagons, and Octagons: See Table 8.

TABLE 8 - Tolerances, Millimeters, Plus Only; Length Ranges, Millimeters

Specified Diameter or Distance Between Parallel Sides Millimeters	1500 to 3000, excl	3000 to 6000, excl	6000 to 9000, excl	9000 to 12000, excl	12000 to 18000, excl
Up to 25.00, incl	12.50	18.75	31.25	43.75	56.25
Over 25.00 to 50.00, incl	15.60	25.00	17.50	50.00	62.50
Over 50.00 to 125.00, incl	25.00	37.50	43.75	56.25	68.75
Over 125.00 to 240.00, incl	50.00	67.50	68.75	75.00	81.25

4.2.1.2 Round-Edged and Square-Edged Flats: See Table 9.

TABLE 9 - Tolerances, Millimeters Plus Only; Length Ranges, Millimeters

Specified Dimensions Millimeters Width	Specified Dimensions Millimeters Thickness	1500 to 3000, excl	3000 to 6000, excl	6000 to 9000, excl	9000 to 12000 excl	12000 to 18000, excl
Up to 75.00,	Up to 25.00, incl	12.50	19.00	31.75	43.25	56.25
	Over 25.00	15.60	25.00	37.50	50.00	62.50
Over 75.00 to 150.00, incl	Up to 25.00, incl	15.60	25.00	37.50	50.00	56.25
	Over 25.00	25.00	37.50	43.25	56.25	68.75
Over 150.00 to 200.00, incl	Up to 25.00, incl	19.00	31.75	43.25	87.50	100.00
	Over 25.00 to 75.00, incl	31.25	43.75	50.00	87.50	100.00

4.2.2 Hot Sawn:

4.2.2.1 Rounds, Squares, Hexagons, and Octagons: See Table 10.

TABLE 10 - Tolerances, Millimeters, Plus Only; Length Ranges, Millimeters

Specified Diameter or Distance Between Parallel Sides Millimeters	3000 to 6000, excl	6000 to 9000, excl	9000 to 12000, excl	12000 to 18000, excl
50.00 to 125.00, incl	37.50	43.75	56.25	68.75
Over 125.00 to 240.00, incl	62.50	68.75	75.00	81.25

4.2.2.2 Round-Edged and Square-Edged Flats: See Table 11.

TABLE 11 - Tolerances, Millimeters, Plus Only; Length Ranges, Millimeters

Specified Dimensions Millimeters Width	Specified Dimension Millimeters Thickness	3000 to 6000, excl	6000 to 9000, excl	9000 to 12000, excl	12000 to 18000, excl
75.00 and over	25.00 and over	37.50	42.75	56.25	68.75

4.2.3 Special Straightened and Machine Cut on Both Ends: See Table 12.

TABLE 12 - Tolerances, Millimeters; Length Ranges, Millimeters

Specified Diameter of Rounds Thickness of Hexagons and Squares Width of Flats Millimeters	Up to 3000, incl Plus	Up to 3000, incl Minus	Over 3000 to 7500 Plus	Over 3000 to 7500 Minus
Up to 75.00, incl	4.70	1.55	6.25	1.55
Over 75.00 to 150.00, incl	6.25	1.55	9.40	1.55
Over 150.00 to 200.00, incl	9.40	1.55	12.50	1.55
Over 200.00 to 240.00, incl	12.50	1.55	15.60	1.55

4.2.3.1 If bars are ordered with tolerances all plus or all minus, the unilateral tolerance shall be the arithmetic sum of the plus and minus tolerances of Table 12.