

**AEROSPACE
MATERIAL
SPECIFICATION**

MAM 2231C

Issued JUL 1980
Noncurrent MAR 2003
Cancelled JUL 2007

Superseded by AMS 2231

Tolerances, Metric
Carbon Steel Bars

RATIONALE

MAM 2231B has been designated Cancelled and Superseded because equivalent technical requirements are provided by AMS 2231.

CANCELLATION NOTICE

This specification has been declared "CANCELLED" by the Aerospace Materials Division, SAE, as of July, 2007, and has been superseded by AMS 2231. The requirements of the latest issue of AMS 2231 shall be fulfilled whenever reference is made to the cancelled MAM 2231B. By this action, this document will remain listed in the Numerical Section of the Index of Aerospace Material Specifications noting that it is superseded by AMS 2231.

Cancelled specifications are available from SAE.

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AEROSPACE MATERIAL SPECIFICATION



MAM 2231B

Issued JAN 1993
Noncurrent MAR 2003

Superseding MAM 2231A

Tolerances, Metric
Carbon 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 2231 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 carbon steel bars ordered to metric dimensions. These tolerances apply to all conditions, unless otherwise noted. The term "excl" is used to apply only to the higher figure of the specified range.

1.1 No clear cut demarcation is available to differentiate between bar and wire products, therefore definitions of these products are not included.

1.2 AMS 2231 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, before cold finishing, 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, after cold finishing, are spheroidize annealed, normalized, normalized and tempered, or quenched and tempered.

2.1.1.1 Width governs the tolerances for both width and thickness of flats. For example, when the maximum carbon range is up to 0.28%, inclusive, for a flat 50.00 mm wide and 25.00 mm thick, the width tolerance is 0.12 mm and the thickness tolerance is the same, namely, 0.12 mm.

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TABLE 1 - Diameter, Thickness, or Width Tolerances, Millimeter, Minus Only
for Maximum of Carbon Range, %

TABLE 1A - Rounds

Specified Diameter 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
Up to 37.50, incl	0.05	0.08	0.10	0.12
Over 37.50 to 62.50, incl	0.08	0.10	0.12	0.15
Over 62.50 to 100.00, incl	0.10	0.12	0.15	0.18

TABLE 1B - Hexagons

Specified 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
Up to 18.75, incl	0.05	0.08	0.10	0.15
Over 18.75 to 37.50, incl	0.08	0.10	0.12	0.18
Over 37.50 to 62.50, incl	0.10	0.12	0.15	0.20
Over 62.50 to 80.00, incl	0.12	0.15	0.18	0.22

TABLE 1C - Squares

Specified 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
Up to 18.75, incl	0.05	0.10	0.12	0.18
Over 18.75 to 37.50, incl	0.08	0.12	0.15	0.20
Over 37.50 to 62.50, incl	0.10	0.15	0.18	0.22
Over 62.50 to 100.00, incl	0.15	0.20	0.22	0.28

TABLE 1D - Flats

Specified Width 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
Up to 18.75, incl	0.08	0.10	0.15	0.20
Over 18.75 to 37.50, incl	0.10	0.12	0.20	0.25
Over 37.50 to 75.00, incl	0.12	0.15	0.25	0.30
Over 75.00 to 100.00, incl	0.15	0.20	0.28	0.40
Over 100.00 to 150.00, incl	0.20	0.25	0.30	0.50
Over 150.00	0.32	0.38	--	--

2.1.2 Turned and Polished Rounds: Table 2 includes tolerances for bars that, before cold finishing, have been annealed, spheroidize annealed, normalized, normalized and tempered, or quenched and tempered. This table does not include tolerances for bars that, after cold finishing, are spheroidize annealed, normalized, normalized and tempered, or quenched and tempered.

TABLE 2 - Diameter Tolerances, Millimeter, Minus Only
for Maximum of Carbon Range, %

Specified Diameter 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
Up to 37.50, incl	0.05	0.08	0.10	0.12
Over 37.50 to 62.50, incl	0.08	0.10	0.12	0.15
Over 62.50 to 100.00, incl	0.10	0.12	0.15	0.18
Over 100.00 to 150.00, incl	0.12	0.15	0.18	0.20
Over 150.00 to 200.00, incl	0.15	0.18	0.20	0.22
Over 200.00 to 225.00, incl	0.18	0.20	0.22	0.25
Over 225.00	0.20	0.22	0.25	0.28

2.1.3 Cold Drawn, Ground, and Polished Rounds: See Table 3.

TABLE 3 - Diameter Tolerances

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

2.1.4 Turned, Ground, and Polished Rounds: See Table 4.
(R)

TABLE 4 - Diameter Tolerances

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
Over 100.00 to 150.00, incl	0.10 (See 2.1.4.1)
Over 150.00	0.12 (See 2.1.4.1)

2.1.4.1 For nonresulfurized steels (steels specified to maximum sulfur limits under 0.08%) or for steels thermally treated, the tolerances for sizes over 100.00 mm in specified diameter are increased by 0.02 mm.

2.2 Hot Finished:

2.2.1 Rounds and Squares: See Table 5. Out-of-round is the difference between maximum and minimum diameters of the bar, measured at the same cross section. Out-of-square section is the difference in the two dimensions at the same cross section of a square bar between opposite faces.