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400 COMMONWEALTH DRIVE WARRENDALE, PA 15096

AEROSPACE MATERIAL SPECIFICATION

AMS 2231G
Superseding AMS 2231F

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TOLERANCES
Carbon Steel Bars

1. SCOPE: This specification covers established inch/pound manufacturing tolerances applicable to carbon steel bars ordered to inch/pound 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, so no definitions of these products are included.

2. DIAMETER OR THICKNESS:

2.1 Cold Finished:

2.1.1 Cold Drawn: Table I 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 of carbon range is up to 0.28, incl., for a flat 2.000 in. wide and 1.000 in. thick, the width tolerance is 0.005 in. and the thickness tolerance is the same, namely, 0.005 inch.

REAFFIRMED
4-92

TABLE I

Specified Diameter or Thickness Inches	Tolerance, Inch, Minus Only, Maximum of Carbon Range, %			
	Up to 0.28, incl	Over 0.28 to 0.55, incl	Up to 0.55, incl, Stress Relieved or Annealed After Cold Finishing	Over 0.55, 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 1.500, incl	0.002	0.003	0.004	0.005
Over 1.500 to 2.500, incl	0.003	0.004	0.005	0.006
Over 2.500 to 4.000, incl	0.004	0.005	0.006	0.007
HEXAGONS				
Up to 0.750, incl	0.002	0.003	0.004	0.006
Over 0.750 to 1.500, incl	0.003	0.004	0.005	0.007
Over 1.500 to 2.500, incl	0.004	0.005	0.006	0.008
Over 2.500 to 3.125, incl	0.005	0.006	0.007	0.009
SQUARES				
Up to 0.750, incl	0.002	0.004	0.005	0.007
Over 0.750 to 1.500, incl	0.003	0.005	0.006	0.008
Over 1.500 to 2.500, incl	0.004	0.006	0.007	0.009
Over 2.500 to 4.000, incl	0.006	0.008	0.009	0.011
FLATS				
Specified Width Inches				
Up to 0.750, incl	0.003	0.004	0.006	0.008
Over 0.750 to 1.500, incl	0.004	0.005	0.008	0.010
Over 1.500 to 3.000, incl	0.005	0.006	0.010	0.012
Over 3.000 to 4.000, incl	0.006	0.008	0.011	0.016
Over 4.000 to 6.000, incl	0.008	0.010	0.012	0.020
Over 6.000	0.013	0.015	--	--

2.1.2 Turned and Polished Rounds: Table II 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 II

Specified Diameter Inches	Tolerance, Inch, Minus Only Maximum of Carbon Range, %			
	Up to 0.28, incl	Over 0.28 to 0.55, incl	Up to 0.55, incl, Stress Relieved or Annealed After Cold Finishing	Over 0.55, 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 1.500, incl	0.002	0.003	0.004	0.005
Over 1.500 to 2.500, incl	0.003	0.004	0.005	0.006
Over 2.500 to 4.000, incl	0.004	0.005	0.006	0.007
Over 4.000 to 6.000, incl	0.005	0.006	0.007	0.008
Over 6.000 to 8.000, incl	0.006	0.007	0.008	0.009
Over 8.000 to 9.000, incl	0.007	0.008	0.009	0.010
Over 9.000	0.008	0.009	0.010	0.011

2.1.3 Cold Drawn, Ground, and Polished Rounds:

TABLE III

Specified Diameter Inches	Tolerance, Inch Minus Only
Up to 1.500, incl	0.001
Over 1.500 to 2.500, excl	0.0015
2.500 to 3.000, incl	0.002
Over 3.000 to 4.000, incl	0.003

2.1.4 Turned, Ground, and Polished Rounds:

TABLE IV

Specified Diameter Inches	Tolerance, Inch Minus Only
Up to 1.500, incl	0.001
Over 1.500 to 2.500, incl	0.0015
2.500 to 3.000, incl	0.002
Over 3.000 to 4.000, incl	0.003
Over 4.000 to 6.000, incl	0.004 (See 2.1.4.1)
Over 6.000	0.005 (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 4.000 in. in specified diameter are increased by 0.001 inch.

2.2 Hot Finished:

2.2.1 Rounds and Squares: 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.

TABLE V

Specified Diameter or Thickness Inches	Tolerance, Inch Plus	Tolerance, Inch Minus	Out-of-Round or Out-of-Square Inch
Up to 0.3125, incl	0.005	0.005	0.008
Over 0.3125 to 0.4375, incl	0.006	0.006	0.009
Over 0.4375 to 0.625, incl	0.007	0.007	0.010
Over 0.625 to 0.875, incl	0.008	0.008	0.012
Over 0.875 to 1.000, incl	0.009	0.009	0.013
Over 1.000 to 1.125, incl	0.010	0.010	0.015
Over 1.125 to 1.250, incl	0.011	0.011	0.016
Over 1.250 to 1.375, incl	0.012	0.012	0.018
Over 1.375 to 1.500, incl	0.014	0.014	0.021
Over 1.500 to 2.000, incl	0.016	0.016	0.023
Over 2.000 to 2.500, incl	0.031	0	0.023
Over 2.500 to 3.500, incl	0.047	0	0.035
Over 3.500 to 4.500, incl	0.063	0	0.046
Over 4.500 to 5.500, incl	0.078	0	0.058
Over 5.500 to 6.500, incl	0.125	0	0.070
Over 6.500 to 8.250, incl	0.156	0	0.085
Over 8.250 to 9.500, incl	0.188	0	0.100
Over 9.500 to 10.000, incl	0.250	0	0.120