



AEROSPACE MATERIAL SPECIFICATION

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AMS 2231D

Superseding AMS 2231C

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TOLERANCES Carbon Steel Bars

1. PURPOSE: To publish established manufacturing tolerances.
2. APPLICATION: Tolerances shown herein apply, unless otherwise agreed upon by purchaser and vendor. These tolerances apply to all conditions, unless otherwise noted.
3. DIAMETER OR THICKNESS:
 - 3.1 Cold Finished:
 - 3.1.1 Cold Drawn:

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TABLE I (See Note 1)

Tolerance, Inch, Minus Only
Maximum of Carbon Range, %

Nominal Diameter or Thickness Inches				
	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, 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	0.006
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

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TABLE I (See Note 1) - Continued

<u>Tolerance, Inch, Minus Only</u>				
<u>Maximum of Carbon Range, %</u>				
Nominal Diameter or Thickness Inches	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, and All Carbons Quenched and Tempered or Normalized and Tempered Before Cold Finishing
Nominal Width, Inches (See Note 2)		FLATS		
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	--	--

3.1.2 Turned and Polished Rounds:

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TABLE II (See Note 1)

		<u>Tolerance, Inch, Minus Only</u>			<u>Maximum of Carbon Range, %</u>
Nominal Diameter Inches	Up to 0.28, incl	Over 0.28 to 0.55, incl	Up to 0.55, incl, Stresses Relieved or Annealed After Cold Finishing	Over 0.55, and All Carbons Quenched and Tempered or Normalized and Tempered Before Cold Finishing	
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	

3.1.3 Cold Drawn, Ground, and Polished Rounds:

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TABLE III

Nominal 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

3.1.4 Turned, Ground, and Polished Rounds:

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TABLE IV

Nominal 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
Over 4.000 to 6.000, incl	0.004 (See Note 3)
Over 6.000	0.005 (See Note 3)

3.2 Hot Finished:

3.2.1 Rounds and Squares:

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TABLE V

Nominal Diameter or Thickness Inches	<u>Tolerance, Inch</u>		Out-of-Round or Out-of-Square Inch (See Note 4)
	Plus	Minus	
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

3.2.2 Square-Edge and Round-Edge Flats:

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TABLE VI

Thickness Tolerance, Inch, Plus and Minus

Nominal Width Inches	Thickness Ranges, Inch						Width Tolerance Inch	
	Thickness Ranges, Inch						Plus	Minus
	0.203 to 0.230, excl	0.230 to 0.250, excl	0.250 to 0.500, incl	0.500 to 1.000, incl	Over 1.000 to 2.000, incl	Over 2.000 to 3.000, incl		
Up to 1.000, incl	0.007	0.007	0.008	0.010	--	--	0.016	0.016
Over 1.000 to 2.000, incl	0.007	0.007	0.012	0.015	0.031	--	0.031	0.031
Over 2.000 to 4.000, incl	0.008	0.008	0.015	0.020	0.031	0.047	0.063	0.031
Over 4.000 to 6.000, incl	0.009	0.009	0.015	0.020	0.031	0.047	0.094	0.063
Over 6.000 to 8.000, incl	(See Note 5)	0.015	0.016	0.025	0.031	0.047	0.125	0.094
							(See Note 6)	(See Note 6)

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Note 5)(See
Note 6)(See
Note 6)