



Castle Metals®



Cold Finished Carbon Steel Bars

*Your foremost provider
of specialty products,
services and solutions*

Quirk Guide



Cold Finished Carbon Steel Bars

| TYPE | GRADE | MACHINABILITY RATING% BASED ON 1212 AS 100% | DESCRIPTION |
|---|---|---|---|
| LOW CARBON COLD DRAWN OR TURNED & POLISHED | 1018 | 78 | A general purpose low carbon steel with good case hardening qualities. Especially suited to cold forming, bending and welding operations. |
| | 1117 | 91 | A resulphurized steel offering higher strength and better machinability than 1018. Good for applications requiring carburization. |
| | 11L17 | 104 | A leaded and resulphurized steel. The lead addition augments the effect of the sulphur, reducing friction and permitting increased machine speed and better finish. |
| MEDIUM CARBON COLD DRAWN OR TURNED & POLISHED | 1045 | 65 | A higher strength alternative to 1018, as a result of the higher carbon content. |
| | 1141 | 70 | A resulphurized, heat treatable grade with better machining characteristics than 1045 |
| | 11L41 | 79 | A leaded and resulphurized heat treatable steel. Machines even better than 1141. |
| | 1144 | 76 | A medium carbon, resulphurized steel with free-machining qualities. Higher carbon than 1141 or 1045 results in better heat treatability. |
| | 1144/ASTMA 311 CLASS B STRESSPROOF®(2) | 83 | This grade offers an exceptional combination of machinability and high strength without heat treatment. 1144 modified chemistry. Pretested for machinability. Guaranteed 100,000 PSI minimum yield strength. |
| | Oversized 1144/ASTMA 311 CLASS B STRESSPROOF®(2) | 83 | Slightly oversized material ordered to permit finishing by grinding to the nominal diameter. |
| | FATIGUE-PROOF®(1) | 80 | FATIGUE-PROOF®(2) has the high strength properties usually associated only with heat treated steels. Features excellent machining characteristics. 1144 modified chemistry. Pretested for machinability. |
| SCREW MACHINE STOCK COLD DRAWN OR TURNED & POLISHED | 12L5 | 136 | The basic rephosphorized and resulphurized screw machine grade. |
| | 12L14 | 180 | The most widely used leaded, rephosphorized and resulphurized screw machine grade. |
| | ProCut™(1) 12L14 | 200 | Restricted chemistry and melting practice provides 12L14 at the best and most consistent levels of machining within the grade. |
| | Oversized 12L14 | 180 | Slightly oversized cold drawn 12L14 ordered to permit finishing at nominal diameters. |
| | 12L14 with Te or Se | 250 | The addition of Tellurium or Selenium to 12L14 produces further improvements in machining performance. These trace elements promote the formation of desirable globular sulphide inclusions, which enhance machinability. |
| | INCUT 100®(3) 12L5BIZ | 200 | Features high sulphur plus bismuth to ensure excellent machinability. |
| GROUND SHAFTING TURNED OR DRAWN GROUND & POLISHED | 1018 | 71 | Turned, ground and polished or drawn, ground and polished bars offer high dimensional accuracy and superior surface finish. Minimizes decarburization, seams and slivers. Ground and polished bars are generally used in shafting applications. |
| | 1045 | 53 | |
| | 1141 | 67 | |
| | 1144/ASTMA 311 CLASS B STRESSPROOF®(2) | 70 | |
| ACCURACY STOCK COLD DRAWN GROUND & POLISHED | 1215 | 136 | Special accuracy stock suitable for precision requirements. Features a highly polished finish and close dimensional tolerance of ± 0.0005 . |
| | 1141 | 70 | |

(1) Procut™ are trademarks of A. M. Castle & Co.

(2) STRESSPROOF® and FATIGUE-PROOF® are registered trademarks of Niagara/LaSalle

(3) INCUT 100® is a registered trademark of Mittal Steel USA

Carbon Steel Bars Quik Guide



| CHEMISTRY | | | | | | TYPICAL MECHANICAL PROPERTIES ⁽³⁾ | | | | GRADE |
|-----------------------------|-----------|-----------|-----------|---------|-------------------------|--|-----------------|----------------|----------------|--|
| % Carb. | % Mang. | % Phos. | % Sul. | % Lead. | % Other | Tensile PSI | Yield PSI | % Elong. in 2" | % Red. of Area | |
| .15/.20 | .60/.90 | .040 Max. | .050 Max. | — | — | 65,000 | 55,000 | 16 | 40 | 1018 |
| .14/.20 | 1.00/1.30 | .040 Max. | .08/.13 | — | — | 70,000 | 60,000 | 15 | 40 | 1117 |
| .14/.20 | 1.00/1.30 | .040 Max. | .08/.13 | .15/.35 | — | 70,000 | 60,000 | 16 | 41 | 11L17 |
| .43/.50 | .60/.90 | .040 Max. | .050 Max. | — | — | 90,000 | 80,000 | 11 | 35 | 1045 |
| .37/.45 | 1.35/1.65 | .040 Max. | .08/.13 | — | — | 100,000 | 90,000 | 10 | 30 | 1141 |
| .37/.45 | 1.35/1.65 | .040 Max. | .08/.13 | .15/.35 | — | 100,000 | 90,000 | 10 | 30 | 11L41 |
| .40/.48 | 1.35/1.65 | .040 Max. | .24/.33 | — | — | 100,000 | 95,000 | 10 | 30 | 1144 |
| .40/.48 | 1.35/1.65 | .040 Max. | .24/.33 | — | Si .15/.30 | 130,000 | 100,000 Min. | 12 | 34 | 1144/ASTMA 311 CLASS B STRESSPROOF ^{®(2)} |
| .40/.48 | 1.35/1.65 | .040 Max. | .24/.33 | — | Si .15/.30 | 130,000 | 100,000 Min. | 12 | 34 | Overized 1144/ASTMA 311 CLASS B STRESSPROOF ^{®(2)} |
| .40/.48 | 1.35/1.65 | .040 Max. | .24/.33 | — | Si .15/.30 | 140,000 Min. | 125,000 Min. | 10 | 26 | FATIGUE-PROOF ^{®(1)} |
| .09 Max. | .75/1.05 | .04/.09 | .26/.35 | — | — | 78,000 | 60,000 | 15 to 20 | 35 | 1215 |
| .15 Max. | .85/1.15 | .04/.09 | .26/.35 | .15/.35 | — | 78,000 | 60,000 | 17 | 35 | 12L14 |
| separate bulletin available | | | | | | 78,000 | 60,000 | 17 | 35 | ProCut ^{TM(1)} 12L14 |
| .15 Max. | .85/1.15 | .04/.09 | .26/.35 | .15/.35 | — | 78,000 | 60,000 | 17 | 35 | Oversized 12L14 |
| .15 Max. | .85/1.15 | .04/.09 | .26/.35 | .15/.35 | Te or Se .035 Aim | 74,000 | 70,000 | 16 | 44 | 12L14 with Te or Se |
| .06/.09 | .95/1.20 | .04/.09 | .40 Min. | — | Bi .10 Mean | 65,000 | 60,000 | 11.5 | 40 | 1215 BIZ |
| .15/.20 | .60/.90 | .040 Max. | .050 Max. | — | — | 65,000 | 45,000 | 36 | 58 | 1018 |
| .43/.50 | .60/.90 | .040 Max. | .050 Max. | — | — | 90,000 | 59,000 | 24 | 45 | 1045 |
| .37/.45 | 1.35/1.65 | .040 Max. | .08/.13 | — | — | 99,000 | 61,000 | 25 | 51 | 1141 |
| .40/.48 | 1.35/1.65 | .040 Max. | .24/.33 | — | Si .15/.30 | 130,000 | 100,000 Min. | 10 | 30 | STRESSPROOF ^{®(2)} 1144/ASTMA 311 CLASS B |
| .09 Max. | .75/1.05 | .04/.09 | .26/.35 | — | — | 78,000 | 73,000 | 18 | 53 | 1215 |
| .37/.45 | 1.35/1.65 | .040 Max. | .08/.13 | — | — | 100,000 | 90,000 | 16 | 40 | 1141 |

(3) Nominal Values only. Mechanical properties are not guaranteed unless denoted "Minimum" or "Min."

Tolerance Tables for Cold Finished Carbon Steel Bars

| ASTM A108 Straightness Tolerances For Cold Finished Carbon Steel Bars For Automatic Screw Machine Use | | |
|--|--------------------|--|
| Size, in inch | Length, in feet | Straightness tolerance, in inch ⁽⁴⁾ (maximum deviation from straight- ness in any 10-foot portion of the bar) |
| ROUNDS: Maximum of Carbon Range 0.28 Per Cent or Less | | |
| Less than 5/8 | Less than 15 | 1/8 |
| Less than 5/8 | 15 and over | 1/8 |
| 5/8 and over | Less than 15 | 1/16 |
| 5/8 and over | 15 and over | 1/8 |
| ROUNDS: Maximum of Carbon Range over 0.28 Per Cent and all Grades Heat Treated⁽⁵⁾ | | |
| Less than 5/8 | Less than 15 | 3/16 |
| Less than 5/8 | 15 and over | 5/16 |
| 5/8 and over | Less than 15 | 1/8 |
| 5/8 and over | 15 and over | 3/16 |
| SQUARES, HEXAGONS: Maximum of Carbon Range 0.28 Per Cent or Less | | |
| Less than 5/8 | Less than 15 | 3/16 |
| Less than 5/8 | 15 and over | 5/16 |
| 5/8 and over | Less than 15 | 1/8 |
| 5/8 and over | 15 and over | 3/16 |
| SQUARES, HEXAGONS: Maximum of Carbon Range Over 0.28 Per Cent and all Grades Heat Treated⁽⁵⁾ | | |
| Less than 5/8 | Less than 15 | 1/4 |
| Less than 5/8 | 15 and over | 3/8 |
| 5/8 and over | Less than 15 | 3/16 |
| 5/8 and over | 15 and over | 1/4 |

(4) The tolerance is based on the following method of measuring straightness. Deviation from straightness is measured by placing the bar on a level table so that the arc or deviation from straightness is horizontal, and the depth of the arc is measured with a steel scale and a straight edge.

(5) All grades quenched and tempered or normalized and tempered before cold finishing, and all grades stress relieved or annealed after cold finishing.

NOTE: It should be recognized that straightness is a perishable quality and may be altered by mishandling. The preservation of straightness in cold finished bars requires the utmost care in subsequent handling.

| ASTM A108 Size Tolerances for Cold Finished Round Bars Cold Drawn, Ground and Polished or Turned, Ground and Polished | | |
|--|--------------------------------|---|
| Size, in. Cold Drawn Ground and Polished | Turned, Ground and Polished | Tolerances from Specified Size, Minus Only, in. |
| To 1-1/2 incl. | To: 1-1/2, incl. | 0.001 |
| Over 1-1/2 to 2-1/2 excl. | Over 1-1/2, to 2-1/2, excl. | 0.0015 |
| 2-1/2 to 3, incl. | 2-1/2 to 3, incl. | 0.002 |
| Over 3 to 4, incl. | Over 3 to 4, incl. | 0.003 |
| — | Over 4 to 6 incl. | 0.004 ⁽⁶⁾ |
| — | Over 6 | 0.005 ⁽⁶⁾ |

(6) For non-resulphurized steels (steels specified to maximum sulphur limits under 0.08%), or for steels thermally treated, the tolerance is increased by 0.001 in.

| ASTM A108 Size Tolerances for Cold Finished Carbon Steel Bars, Cold Drawn or Turned and Polished ⁽⁷⁾ | | | | |
|---|---|---|---|--|
| Size, inch ⁽¹⁰⁾ | Maximum of Carbon Range 0.28% or less | Maximum of Carbon Range Over 0.28% to 0.55%, incl. | Maximum of Carbon | Maximum of Carbon Range |
| | | | Range to 0.55%, incl. Stress Relieved or Annealed after Cold Finishing ⁽⁸⁾ | Over 0.55% or All Grades Quenched and Tempered or Normalized and Tempered Before Cold Finishing |
| All Tolerances are in inches and are minus | | | | |
| Rounds — Cold Drawn (to 6 in.) or Turned and Polished | | | | |
| To 1-1/2, incl. | 0.002 | 0.003 | 0.004 | 0.005 |
| Over 1-1/2 to 2-1/2, incl. | 0.003 | 0.004 | 0.005 | 0.006 |
| Over 2-1/2 to 4, incl. | 0.004 | 0.005 | 0.006 | 0.007 |
| Over 4 to 6, incl. | 0.005 | 0.006 | 0.007 | 0.008 |
| Over 6 to 8, incl. | 0.006 | 0.007 | 0.008 | 0.009 |
| Over 8 to 9, incl. | 0.007 | 0.008 | 0.009 | 0.010 |
| Hexagons | | | | |
| To 3/4, incl. | 0.002 | 0.003 | 0.004 | 0.006 |
| Over 3/4 to 1-1/2, Incl | 0.003 | 0.004 | 0.005 | 0.007 |
| Over 1-1/2 to 2-1/2, incl. | 0.004 | 0.005 | 0.006 | 0.008 |
| Over 2-1/2 to 3-1/8, incl. | 0.005 | 0.006 | 0.007 | 0.009 |
| Over 3-1/8 to 4, incl. | 0.005 | 0.006 | — | — |
| Squares | | | | |
| To 3/4, incl. | 0.002 | 0.004 | 0.005 | 0.007 |
| Over 3/4 to 1-1/2, incl. | 0.003 | 0.005 | 0.006 | 0.008 |
| Over 1-1/2 to 2-1/2, incl. | 0.004 | 0.006 | 0.007 | 0.009 |
| Over 2-1/2 to 4, incl. | 0.006 | 0.008 | 0.009 | 0.011 |
| Over 4 to 5, incl. | 0.010 | — | — | — |
| Over 5 to 6, incl. | 0.014 | — | — | — |
| Flats ⁽⁹⁾ | | | | |
| Width, ⁽¹⁰⁾ in. | | | | |
| To 3/4 incl. | 0.003 | 0.004 | 0.006 | 0.008 |
| Over 3/4 to 1-1/2, incl. | 0.004 | 0.005 | 0.008 | 0.010 |
| Over 1-1/2 to 3, incl. | 0.005 | 0.006 | 0.010 | 0.012 |
| Over 3 to 4, incl. | 0.006 | 0.008 | 0.011 | 0.016 |
| Over 4 to 6, incl. | 0.008 | 0.010 | 0.012 | 0.020 |
| Over 6 | 0.013 | 0.015 | — | — |

(7) This table 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 annealed, spheroidize annealed, normalized, normalized and tempered, or quenched and tempered after cold finishing; the producer should be consulted for tolerances for such bars.

(8) STRESSPROOF[®] (2) and FATIGUE-PROOF[®] (2) have separate tolerances.

(9) Width governs the tolerances for both width and thickness of flats. For example, when the maximum of carbon range is 0.28% or less, for a flat 2 in. wide and 1 in. thick, the width tolerance is 0.005 in. and the thickness tolerance is the same, namely, 0.005 in.

(10) Tolerances may be ordered all plus, or distributed plus minus with the sum equivalent to the tolerances listed.

| AISI Recommended Stock Removal | | |
|--------------------------------|--|--|
| Size Range | Material | |
| | Non-Resulphurized Grades Maximum Clean Up Cut | Resulphurized Grades Maximum Clean Up Cut |
| Thru 5/8" | 0.010" Per Side | 0.015" Per Side |
| Over 5/8" | .001" Per Side For Each 1/16" of Diameter | 0.0015" Per Side For Each 1/16" of Diameter |

Note: STRESSPROOF[®] (2) and FATIGUE-PROOF[®] (2) are resulphurized grades but have a recommended stock removal of .001" per side for each 1/16" of diameter for all sizes.

Theoretical Weights of Round, Square, Flat⁽¹¹⁾ and Hexagon Steel Bars

Theoretical weight per cubic inch + 0.2836

| Thickness or Diameter, In. | Round Weight Lbs. Per Ft. | Square Weight Lbs. Per Ft. | Hexagon Weight Lbs. Per Ft. |
|----------------------------|---------------------------|----------------------------|-----------------------------|
| 1/32 | 0.0025 | 0.0033 | 0.0028 |
| 1/16 | 0.0104 | 0.0133 | 0.0115 |
| 3/32 | 0.0235 | 0.0299 | 0.0259 |
| 1/8 | 0.0417 | 0.0532 | 0.0460 |
| 5/32 | 0.0653 | 0.0831 | 0.0720 |
| 3/16 | 0.0940 | 0.1196 | 0.1036 |
| 7/32 | 0.1279 | 0.1629 | 0.1410 |
| 1/4 | 0.1671 | 0.2127 | 0.1842 |
| 9/32 | 0.2114 | 0.2692 | 0.2331 |
| 5/16 | 0.2611 | 0.3324 | 0.2878 |
| 11/32 | 0.3158 | 0.4022 | 0.3483 |
| 3/8 | 0.3759 | 0.4786 | 0.4154 |
| 13/32 | 0.4412 | 0.5617 | 0.4865 |
| 7/16 | 0.5116 | 0.6515 | 0.5642 |
| 15/32 | 0.5873 | 0.7479 | 0.6477 |
| 1/2 | 0.6683 | 0.8509 | 0.7369 |
| 17/32 | 0.7544 | 0.9606 | 0.8319 |
| 9/16 | 0.8458 | 1.077 | 0.9327 |
| 19/32 | 0.9424 | 1.200 | 1.039 |
| 5/8 | 1.044 | 1.329 | 1.151 |
| 21/32 | 1.151 | 1.466 | 1.269 |
| 11/16 | 1.263 | 1.609 | 1.393 |
| 23/32 | 1.381 | 1.758 | 1.523 |
| 3/4 | 1.504 | 1.915 | 1.658 |
| 25/32 | 1.632 | 2.077 | 1.799 |
| 13/16 | 1.765 | 2.247 | 1.946 |
| 27/32 | 1.903 | 2.424 | 2.098 |
| 7/8 | 2.046 | 2.606 | 2.256 |
| 29/32 | 2.195 | 2.795 | 2.421 |
| 15/16 | 2.349 | 2.991 | 2.591 |
| 31/32 | 2.509 | 3.194 | 2.766 |
| 1 | 2.673 | 3.404 | 2.947 |
| 1-1/16 | 3.018 | 3.842 | 3.328 |
| 1-1/8 | 3.384 | 4.308 | 3.731 |
| 1-3/16 | 3.770 | 4.800 | 4.156 |
| 1-1/4 | 4.176 | 5.319 | 4.606 |
| 1-5/16 | 4.605 | 5.863 | 5.077 |
| 1-3/8 | 5.054 | 6.435 | 5.573 |
| 1-7/16 | 5.524 | 7.033 | 6.091 |
| 1-1/2 | 6.014 | 7.658 | 6.632 |
| 1-9/16 | 6.526 | 8.310 | 7.197 |
| 1-5/8 | 7.058 | 8.988 | 7.783 |

Theoretical weight per cubic inch + 0.2836

| Thickness or Diameter, In. | Round Weight Lbs. Per Ft. | Square Weight Lbs. Per Ft. | Hexagon Weight Lbs. Per Ft. |
|----------------------------|---------------------------|----------------------------|-----------------------------|
| 1-11/16 | 7.612 | 9.692 | 8.394 |
| 1-3/4 | 8.187 | 10.42 | 9.028 |
| 1-13/16 | 8.782 | 11.18 | 9.680 |
| 1-7/8 | 9.398 | 11.96 | 10.36 |
| 1-15/16 | 10.03 | 12.77 | 11.06 |
| 2 | 10.69 | 13.61 | 11.79 |
| 2-1/16 | 11.37 | 14.48 | 12.54 |
| 2-1/8 | 12.07 | 15.37 | 13.31 |
| 2-3/16 | 12.79 | 16.29 | 14.10 |
| 2-1/4 | 13.53 | 17.23 | 14.93 |
| 2-5/16 | 14.29 | 18.20 | 15.77 |
| 2-3/8 | 15.08 | 19.20 | 16.63 |
| 2-7/16 | 15.89 | 20.22 | 17.51 |
| 2-1/2 | 16.71 | 21.27 | 18.42 |
| 2-5/8 | 18.42 | 23.45 | 20.31 |
| 2-3/4 | 20.21 | 25.74 | 22.29 |
| 2-7/8 | 22.09 | 28.13 | 24.37 |
| 3 | 24.05 | 30.63 | 26.53 |
| 3-1/8 | 26.11 | 33.24 | 28.78 |
| 3-1/4 | 28.24 | 35.95 | 31.13 |
| 3-3/8 | 30.45 | 38.77 | 33.58 |
| 3-1/2 | 32.74 | 41.69 | 36.11 |
| 3-5/8 | 35.13 | 44.73 | 38.73 |
| 3-3/4 | 37.59 | 47.86 | 41.45 |
| 3-7/8 | 40.14 | 51.10 | 44.26 |
| 4 | 42.77 | 54.46 | 47.16 |
| 4-1/8 | 45.49 | 57.91 | 50.15 |
| 4-1/4 | 48.28 | 61.48 | 53.24 |
| 4-3/8 | 51.16 | 65.15 | 56.42 |
| 4-1/2 | 54.13 | 68.92 | 59.69 |
| 4-5/8 | 57.18 | 72.81 | 63.05 |
| 4-3/4 | 60.13 | 76.79 | 66.51 |
| 4-7/8 | 63.53 | 80.89 | 70.05 |
| 5 | 66.83 | 85.09 | 73.69 |
| 5-1/8 | 70.21 | 89.39 | 77.42 |
| 5-1/4 | 73.68 | 93.81 | 81.25 |
| 5-3/8 | 77.23 | 98.33 | 85.16 |
| 5-1/2 | 80.87 | 103.0 | 89.16 |
| 5-5/8 | 84.58 | 107.7 | 93.26 |
| 5-3/4 | 88.38 | 112.5 | 97.45 |
| 5-7/8 | 92.27 | 117.5 | 102.7 |
| 6 | 96.23 | 122.5 | 106.1 |

(11) Flats. To determine the theoretical weight in pounds per linear foot, multiply the width in inches times the thickness in inches times 3.404

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