

Dura-Bar 60-40-18 Continuously Cast Ductile Iron Bar Stock ASTM A536, 4018

Category : Metal , Ferrous Metal , Cast Iron , Alloy Cast Iron , Ductile Iron , Ferritic

Material Notes:

Continuously cast ductile iron bar stock is produced in a wide variety of sizes and shapes, including rounds, rectangles and special shape cross sections. It often is used as a direct replacement for plain carbon steel and can offer dramatic cost reductions for parts that require a lot of machining. The machinability rating of ductile iron bar stock will be similar to free machining carbon steel grades, such as 12L14, 11L17, 86L20, 1141 and 1144, and achievable machining speeds will be significantly higher. Ductile iron contains graphite in the form of very small, round nodules that give the material free machining properties without the addition of lead, bismuth, sulfur or phosphorus. The continuous casting process eliminates typical foundry defects, such as gas holes, hard spots, slag inclusions and inconsistent properties, that result from different molding methods. Bars are cast through a water-cooled graphite die mounted on the bottom of a large bar machine crucible. The ferrostatic head pressure created by the molten metal in the bar machine crucible forces iron into the die, producing a very fine-grained microstructure. The outer "rim" is the only part of the bar that is solid when it exits the die. The core is molten iron. Heat from the molten iron core reheats the rapidly chilled outer skin, producing a homogenized microstructure that is cooled to room temperature in still air. Ductile iron bar stock consists of a microstructure that is made up of graphite nodules in a solid metal matrix. The solid metal matrix will be similar to the matrix structure in carbon steel bars, and the amount of combined carbon determines the mechanical and physical properties of each grade. The 60-40-18 ductile iron grade has a ferritic matrix obtained by annealing (heat treating). The mechanical properties will be less than low carbon steels, and this grade is not recommended for sliding wear applications. All grades of ductile iron bar stock respond very well to conventional heat-treating methods. Composition: Typical chemical composition and ranges, actual values depend on cross section size. Information provided by Dura-Bar

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http://www.lookpolymers.com/polymer_Dura-Bar-60-40-18-Continuously-Cast-Ductile-Iron-Bar-Stock-ASTM-A536-4018.php

Physical Properties	Metric	English	Comments
Density	6.64 - 7.20 g/cc	0.240 - 0.260 lb/in ³	Approximately 10% lighter than carbon steel

Mechanical Properties	Metric	English	Comments
Hardness, Brinell	120 - 160	120 - 160	Depends on cast section size and location of test
Tensile Strength, Ultimate	>= 414 MPa	>= 60000 psi	Mid-radius
Tensile Strength, Yield	>= 276 MPa @Strain 0.200 %	>= 40000 psi @Strain 0.200 %	
Elongation at Break	>= 18 %	>= 18 %	
Reduction of Area	5.0 %	5.0 %	
Tensile Modulus	172 GPa	25000 ksi	Typical
Compressive Yield Strength	>= 331 MPa	>= 48000 psi	Compressive yield will be 1.2 times the tensile yield

Mechanical Properties	Metric	English	Comments
Shear Modulus	67.6 GPa	9800 ksi	calculated
Shear Strength	496 MPa	72000 psi	Shear strength is 90% of tensile strength for all ductile iron grades

Thermal Properties	Metric	English	Comments
CTE, linear	11.5 $\mu\text{m}/\text{m}\cdot\text{C}^\circ$	6.39 $\mu\text{in}/\text{in}\cdot\text{F}^\circ$	Mean
	@Temperature 21.0 - 100 $^\circ\text{C}$	@Temperature 69.8 - 212 $^\circ\text{F}$	
	12.2 $\mu\text{m}/\text{m}\cdot\text{C}^\circ$	6.78 $\mu\text{in}/\text{in}\cdot\text{F}^\circ$	Mean
	@Temperature 21.0 - 300 $^\circ\text{C}$	@Temperature 69.8 - 572 $^\circ\text{F}$	
Specific Heat Capacity	13.5 $\mu\text{m}/\text{m}\cdot\text{C}^\circ$	7.50 $\mu\text{in}/\text{in}\cdot\text{F}^\circ$	Mean
	@Temperature 21.0 - 500 $^\circ\text{C}$	@Temperature 69.8 - 932 $^\circ\text{F}$	
Thermal Conductivity	13.7 $\mu\text{m}/\text{m}\cdot\text{C}^\circ$	7.61 $\mu\text{in}/\text{in}\cdot\text{F}^\circ$	Mean
	@Temperature 21.0 - 900 $^\circ\text{C}$	@Temperature 69.8 - 1650 $^\circ\text{F}$	
Melting Point	0.460 - 0.602 J/g- $^\circ\text{C}$	0.110 - 0.144 BTU/lb- $^\circ\text{F}$	Eutectic temp
	@Temperature 22.2 - 699 $^\circ\text{C}$	@Temperature 72.0 - 1290 $^\circ\text{F}$	
Maximum Service Temperature, Air	649 $^\circ\text{C}$	1200 $^\circ\text{F}$	
Minimum Service Temperature, Air	-30.0 $^\circ\text{C}$	-22.0 $^\circ\text{F}$	

Component Elements Properties	Metric	English	Comments
Carbon, C	3.5 - 3.9 %	3.5 - 3.9 %	
Chromium, Cr	<= 0.050 %	<= 0.050 %	
Copper, Cu	0.020 - 0.50 %	0.020 - 0.50 %	
Iron, Fe	95 %	95 %	
Manganese, Mn	0.15 - 0.35 %	0.15 - 0.35 %	
Phosphorous, P	<= 0.050 %	<= 0.050 %	

Component Elements Properties	Metric	English	Comments
Sulfur, S	0.010 - 0.025 %	0.010 - 0.025 %	
Tin, Sn	0.010 - 0.050 %	0.010 - 0.050 %	

Electrical Properties	Metric	English	Comments
Volume Resistivity	0.0000050 ohm-cm	0.0000050 ohm-cm	
Magnetic Permeability	400 - 750	400 - 750	25 Oersted, Low hysteresis loss

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