

Dura-Bar 65-45-12 Continuously Cast Ductile Iron Bar Stock ASTM A536

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 65-45-12 ductile iron grade has a mostly ferritic matrix with approximately 25% (max) pearlite. The mechanical properties of 65-45-12 will be similar to low carbon steels that contain up to 0.25% carbon including 1010, 1018, 11L17, 12L14 and 1020. 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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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	130 - 217	130 - 217	Depends on cast section size and location of test
Tensile Strength, Ultimate	496 MPa	72000 psi	Typical
Tensile Strength, Yield	345 MPa	50000 psi	Typical
Elongation at Break	18 %	18 %	Typical
Reduction of Area	5.0 %	5.0 %	
Tensile Modulus	172 GPa	25000 ksi	Typical
Compressive Yield Strength	>= 372 MPa	>= 54000 psi	Compressive yield will be 1.2 times the tensile yield
Poissons Ratio	0.275	0.275	Generally accepted value

Mechanical Properties	Metric ^{SI}	English ^{SI}	Comments
Fatigue Strength	@# of Cycles 1.00e+8	@# of Cycles 1.00e+8	Rotating beam
Shear Modulus	67.6 GPa	9800 ksi	calculated
Shear Strength	372 MPa	54000 psi	Shear strength is 90% of tensile strength for all ductile iron grades
Charpy Impact	13.6 J @Temperature 23.0 °C	10.0 ft-lb @Temperature 73.4 °F	

Thermal Properties	Metric	English	Comments
CTE, linear	11.5 µm/m-°C @Temperature 21.0 - 100 °C	6.39 µin/in-°F @Temperature 69.8 - 212 °F	Mean
	12.2 µm/m-°C @Temperature 21.0 - 300 °C	6.78 µin/in-°F @Temperature 69.8 - 572 °F	Mean
	13.5 µm/m-°C @Temperature 21.0 - 500 °C	7.50 µin/in-°F @Temperature 69.8 - 932 °F	Mean
	13.7 µm/m-°C @Temperature 21.0 - 900 °C	7.61 µin/in-°F @Temperature 69.8 - 1650 °F	Mean
Specific Heat Capacity	0.460 - 0.602 J/g-°C @Temperature 22.2 - 699 °C	0.110 - 0.144 BTU/lb-°F @Temperature 72.0 - 1290 °F	
Thermal Conductivity	32.301 W/m-K	224.16 BTU-in/hr-ft ² -°F	
Melting Point	1120 °C	2050 °F	Eutectic temp
Maximum Service Temperature, Air	649 °C	1200 °F	
Minimum Service Temperature, Air	-30.0 °C	-22.0 °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 Component Elements Properties	95 % Metric	95 % English	Comments
Manganese, Mn	0.15 - 0.35 %	0.15 - 0.35 %	
Phosphorous, P	<= 0.050 %	<= 0.050 %	
Silicon, Si	2.25 - 2.75 %	2.25 - 2.75 %	
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	At 2.50% Silicon
Magnetic Permeability	400 - 750	400 - 750	25 Oersteds, Low hysteresis loss

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