

C92200

Material



Notes: Casting methods recommended for this alloy: Centrifugal, Continuous, Investment, Permanent Mold, Plaster, and Sand.

Applications: Valves, fittings, and pressure containing parts for use up to 550°F.

Classified under: Leaded tin bronzes. ASTM B61; ASTM B584; formerly ASTM B143-2A

Data typical for sand-cast test bars. Alloy does not respond to heat treating. Casting shrinkage allowance is 1.5%




Key Words: Leaded tin bronze, valve bronze, navy m bronze, steam bronze, ASTM B61; ASTM B584; ASTM B143-2A

Physical Properties	Metric	English	Comments
Density	8.64 g/cc	0.312 lb/in ³	
Mechanical Properties	Metric	English	Comments
Hardness, Brinell	65	65	500 kg
	57 @Load 500 kg, Temperature 285 °C	57 @Load 1100 lb, Temperature 545 °F	
	58 @Load 500 kg, Temperature 120 °C	58 @Load 1100 lb, Temperature 248 °F	
	64 @Load 500 kg, Temperature 20.0 °C	64 @Load 1100 lb, Temperature 68.0 °F	
	71 @Load 500 kg, Temperature -35.0 °C	71 @Load 1100 lb, Temperature -31.0 °F	
Tensile Strength, Ultimate	275 MPa	39900 psi	
	190 MPa @Temperature 285 °C	27600 psi @Temperature 545 °F	
	270 MPa @Temperature 120 °C	39200 psi @Temperature 248 °F	
	280 MPa @Temperature 20.0 °C	40600 psi @Temperature 68.0 °F	
	295 MPa @Temperature -35.0 °C	42800 psi @Temperature -31.0 °F	
Tensile Strength, Yield	140 MPa @Strain 0.500 %	20300 psi @Strain 0.500 %	



	80.0 MPa @Strain 0.200 %, Temperature 285 °C	11600 psi @Strain 0.200 %, Temperature 545 °F	
	85.0 MPa @Strain 0.200 %, Temperature 120 °C	12300 psi @Strain 0.200 %, Temperature 248 °F	
	90.0 MPa @Strain 0.500 %, Temperature 285 °C	13100 psi @Strain 0.500 %, Temperature 545 °F	
	100 MPa @Strain 0.500 %, Temperature 120 °C	14500 psi @Strain 0.500 %, Temperature 248 °F	
	110 MPa @Strain 0.200 %, Temperature 20.0 °C	16000 psi @Strain 0.200 %, Temperature 68.0 °F	
	120 MPa @Strain 0.500 %, Temperature 20.0 °C	17400 psi @Strain 0.500 %, Temperature 68.0 °F	
	125 MPa @Strain 0.200 %, Temperature -35.0 °C	18100 psi @Strain 0.200 %, Temperature -31.0 °F	
	135 MPa @Strain 0.500 %, Temperature -35.0 °C	19600 psi @Strain 0.500 %, Temperature -31.0 °F	
Elongation at Break	30 %	30 %	in 50 mm
	20 % @Temperature 285 °C	20 % @Temperature 545 °F	
	44 % @Temperature 120 °C	44 % @Temperature 248 °F	
	46 % @Temperature -35.0 °C	46 % @Temperature -31.0 °F	
	47 % @Temperature 20.0 °C	47 % @Temperature 68.0 °F	
Reduction of Area	30 % @Temperature 285 °C	30 % @Temperature 545 °F	
	37 % @Temperature -35.0 °C	37 % @Temperature -31.0 °F	
	40 % @Temperature 20.0 °C	40 % @Temperature 68.0 °F	
	44 % @Temperature 120 °C	44 % @Temperature 248 °F	
Creep Strength	43.0 MPa	6240 psi	for 10E-5%/h, at 288°C
	77.2 MPa	11200 psi	for 10E-5%/h, at 232°C
	110 MPa	16000 psi	for 10E-5%/h, at 177°C
Rupture Strength	80.0 MPa @Temperature 290 °C, Time 3.42e+6 sec	11600 psi @Temperature 554 °F, Time 950 hour	
	105 MPa @Temperature 290 °C, Time 216000 sec	15200 psi @Temperature 554 °F, Time 60.0 hour	
	140 MPa @Temperature 290 °C, Time 10800 sec	20300 psi @Temperature 554 °F, Time 3.00 hour	
Modulus of	97.0 GPa	14100 ksi	



Elasticity

Tensile Modulus 	66.0 GPa @Temperature 285 °C	9570 ksi @Temperature 545 °F	
	74.0 GPa @Temperature 120 °C	10700 ksi @Temperature 248 °F	
	86.0 GPa @Temperature -35.0 °C	12500 ksi @Temperature -31.0 °F	
	89.0 GPa @Temperature 20.0 °C	12900 ksi @Temperature 68.0 °F	
Compressive Strength	105 MPa	15200 psi	at permanent set of 10%
	260 MPa	37700 psi	at permanent set of 0.1%
	70.0 MPa @Temperature 285 °C	10200 psi @Temperature 545 °F	0.1% set
	75.0 MPa @Temperature 120 °C	10900 psi @Temperature 248 °F	0.1% set
	90.0 MPa @Temperature 285 °C	13100 psi @Temperature 545 °F	1% set
	95.0 MPa @Temperature 120 °C	13800 psi @Temperature 248 °F	1% set
	95.0 MPa @Temperature 20.0 °C	13800 psi @Temperature 68.0 °F	0.1% set
	110 MPa @Temperature 20.0 °C	16000 psi @Temperature 68.0 °F	1% set
	110 MPa @Temperature -35.0 °C	16000 psi @Temperature -31.0 °F	0.1% set
	140 MPa @Temperature -35.0 °C	20300 psi @Temperature -31.0 °F	1% set
	210 MPa @Temperature 285 °C	30500 psi @Temperature 545 °F	10% set
	225 MPa @Temperature 120 °C	32600 psi @Temperature 248 °F	10% set
	260 MPa @Temperature 20.0 °C	37700 psi @Temperature 68.0 °F	10% set
	290 MPa @Temperature -35.0 °C	42100 psi @Temperature -31.0 °F	10% set
Fatigue Strength 	75.0 MPa @# of Cycles 5.00e+7 - 3.00e+8	10900 psi @# of Cycles 5.00e+7 - 3.00e+8	
	76.0 MPa @# of Cycles 1.00e+8	11000 psi @# of Cycles 1.00e+8	rotating beam
	90.0 MPa @# of Cycles 4.00e+6 - 2.50e+7	13100 psi @# of Cycles 4.00e+6 - 2.50e+7	
	105 MPa @# of Cycles 1.00e+6 - 1.00e+7	15200 psi @# of Cycles 1.00e+6 - 1.00e+7	
	140 MPa @# of Cycles 200000 - 700000	20300 psi @# of Cycles 200000 - 700000	
	175 MPa @# of Cycles 60000 - 100000	25400 psi @# of Cycles 60000 - 100000	
Machinability	42 %	42 %	UNS C36000 (free-cutting brass) = 100%

Electrical Properties

	Metric	English	Comments
Electrical Resistivity	0.0000120 ohm-cm	0.0000120 ohm-cm	

Magnetic Permeability	1.0	1.0
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Thermal Properties	Metric	English	Comments	
CTE, linear 	16.7 $\mu\text{m}/\text{m}\cdot\text{C}$ @Temperature 100 °C	9.28 $\mu\text{in}/\text{in}\cdot\text{F}$ @Temperature 212 °F		
	17.0 $\mu\text{m}/\text{m}\cdot\text{C}$ @Temperature 130 °C	9.44 $\mu\text{in}/\text{in}\cdot\text{F}$ @Temperature 266 °F		
	17.3 $\mu\text{m}/\text{m}\cdot\text{C}$ @Temperature 160 °C	9.61 $\mu\text{in}/\text{in}\cdot\text{F}$ @Temperature 320 °F		
	17.6 $\mu\text{m}/\text{m}\cdot\text{C}$ @Temperature 190 °C	9.78 $\mu\text{in}/\text{in}\cdot\text{F}$ @Temperature 374 °F		
	17.7 $\mu\text{m}/\text{m}\cdot\text{C}$ @Temperature 215 °C	9.83 $\mu\text{in}/\text{in}\cdot\text{F}$ @Temperature 419 °F		
	17.9 $\mu\text{m}/\text{m}\cdot\text{C}$ @Temperature 240 °C	9.94 $\mu\text{in}/\text{in}\cdot\text{F}$ @Temperature 464 °F		
	18.0 $\mu\text{m}/\text{m}\cdot\text{C}$ @Temperature 450 °C	10.0 $\mu\text{in}/\text{in}\cdot\text{F}$ @Temperature 842 °F		
	18.2 $\mu\text{m}/\text{m}\cdot\text{C}$ @Temperature 270 °C	10.1 $\mu\text{in}/\text{in}\cdot\text{F}$ @Temperature 518 °F		
	18.3 $\mu\text{m}/\text{m}\cdot\text{C}$ @Temperature 295 °C	10.2 $\mu\text{in}/\text{in}\cdot\text{F}$ @Temperature 563 °F		
	18.5 $\mu\text{m}/\text{m}\cdot\text{C}$ @Temperature 325 °C	10.3 $\mu\text{in}/\text{in}\cdot\text{F}$ @Temperature 617 °F		
	Specific Heat Capacity	0.376 J/g·°C	0.0899 BTU/lb·°F	
	Thermal Conductivity 	69.0 W/m-K @Temperature 15.0 °C	479 BTU-in/hr-ft ² ·°F @Temperature 59.0 °F	
70.0 W/m-K @Temperature 20.0 °C		486 BTU-in/hr-ft ² ·°F @Temperature 68.0 °F		
71.0 W/m-K @Temperature 30.0 °C		493 BTU-in/hr-ft ² ·°F @Temperature 86.0 °F		
72.0 W/m-K @Temperature 65.0 °C		500 BTU-in/hr-ft ² ·°F @Temperature 149 °F		
74.0 W/m-K @Temperature 95.0 °C		514 BTU-in/hr-ft ² ·°F @Temperature 203 °F		
77.0 W/m-K @Temperature 125 °C		534 BTU-in/hr-ft ² ·°F @Temperature 257 °F		
79.0 W/m-K @Temperature 150 °C		548 BTU-in/hr-ft ² ·°F @Temperature 302 °F		
82.0 W/m-K @Temperature 175 °C		569 BTU-in/hr-ft ² ·°F @Temperature 347 °F		
86.0 W/m-K @Temperature 205 °C		597 BTU-in/hr-ft ² ·°F @Temperature 401 °F		
87.0 W/m-K @Temperature 235 °C		604 BTU-in/hr-ft ² ·°F @Temperature 455 °F		
Melting Point	825 - 990 °C	1520 - 1810 °F		
Solidus	825 °C	1520 °F		
Liquidus	990 °C	1810 °F		

Processing	Metric	English	Comments
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Properties

Melt Temperature	315 °C	599 °F	Incipient
Annealing Temperature	260 °C	500 °F	Stress-Relieving Temperature

Component Elements Properties	Metric	English	Comments
Antimony, Sb	<= 0.25 %	<= 0.25 %	
Copper, Cu	86 - 90 %	86 - 90 %	
Iron, Fe	<= 0.25 %	<= 0.25 %	
Lead, Pb	1.0 - 2.0 %	1.0 - 2.0 %	
Nickel, Ni	<= 1.0 %	<= 1.0 %	
Phosphorous, P	<= 0.050 %	<= 0.050 %	
Silicon, Si	<= 0.0050 %	<= 0.0050 %	
Sulfur, S	<= 0.050 %	<= 0.050 %	
Tin, Sn	5.5 - 6.5 %	5.5 - 6.5 %	
Zinc, Zn	3.0 - 5.0 %	3.0 - 5.0 %	