C93700

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

Applications: Bearings for high speed and heavy pressures, pumps, impellers, corrosion-resistant applications, pressure tight castings.

Classified under: High-leaded tin bronzes. ASTM B22; ASTM B584; formerly ASTM B22-C; ASTM B144-3A

Typical data for sand cast test bars. Alloy does not respond to heat treating.

Key Words: High lead tin bronze, ASTM B22, ASTM B584, ASTM B22-C, ASTM B144-3A

Physical Properties	Metric	English	Comments
Density	8.95 g/cc	0.323 lb/in³	

Mechanical Properties	Metric	English	Comments
Hardness, Brinell	60	60	
Tensile Strength, Ultimate	240 MPa	34800 psi	
	210 MPa @Temperature 230 °C	30500 psi @Temperature 446 °F	
	230 MPa @Temperature 120 °C	33400 psi @Temperature 248 °F	
	270 MPa @Temperature 25.0 °C	39200 psi @Temperature 77.0 °F	
	295 MPa @Temperature -40.0 °C	42800 psi @Temperature -40.0 °F	
Tensile Strength, Yield	125 MPa @Strain 0.500 %	18100 psi @Strain 0.500 %	
	95.0 MPa @Strain 0.200 %, Temperature 120 °C	13800 psi @Strain 0.200 %, Temperature 248 °F	
	95.0 MPa @Strain 0.200 %, Temperature 230 °C	13800 psi @Strain 0.200 %, Temperature 446 °F	
	105 MPa @Strain 0.500 %, Temperature 120 °C	15200 psi @Strain 0.500 %, Temperature 248 °F	
	105 MPa @Strain 0.500 %, Temperature 230 °C	15200 psi @Strain 0.500 %, Temperature 446 °F	
	115 MPa @Strain 0.200 %, Temperature 25.0 °C	16700 psi @Strain 0.200 %, Temperature 77.0 °F	

	125 MPa @Strain 0.500 %, Temperature 25.0 °C	18100 psi @Strain 0.500 %, Temperature 77.0 °F	
	135 MPa @Strain 0.200 %, Temperature -40.0 °C	19600 psi @Strain 0.200 %, Temperature -40.0 °F	
	145 MPa @Strain 0.500 %, Temperature -40.0 °C	21000 psi @Strain 0.500 %, Temperature -40.0 °F	
Elongation at Break	20 %	20 %	in 50 mm
	16 % @Temperature 230 °C	16 % @Temperature 446 °F	
	22 % @Temperature 120 °C	22 % @Temperature 248 °F	
	28 % @Temperature -40.0 °C	28 % @Temperature -40.0 °F	
	30 % @Temperature 25.0 °C	30 % @Temperature 77.0 °F	
Reduction of Area	20 % @Temperature 230 °C	20 % @Temperature 446 °F	
	24 % @Temperature 25.0 °C	24 % @Temperature 77.0 °F	
	26 % @Temperature -40.0 °C	26 % @Temperature -40.0 °F	
	27 % @Temperature 120 °C	27 % @Temperature 248 °F	
Creep Strength	12.0 MPa	1740 psi	for 10E-5%/h, at 288°C
	51.0 MPa	7400 psi	for 10E-5%/h, at 232°C
	71.7 MPa	10400 psi	for 10E-5%/h, at 177°C
Rupture Strength	120 MPa @Temperature 230 °C, Time 2.70e+6 sec	17400 psi @Temperature 446 °F, Time 750 hour	
	135 MPa @Temperature 230 °C, Time 1.08e+6 sec	19600 psi @Temperature 446 °F, Time 300 hour	
	150 MPa @Temperature 230 °C, Time 234000 sec	21800 psi @Temperature 446 °F, Time 65.0 hour	
	210 MPa @Temperature 175 °C, Time 86400 sec	30500 psi @Temperature 347 °F, Time 24.0 hour	
Tensile Modulus	45.0 GPa @Temperature 230 °C	6530 ksi @Temperature 446 °F	
	68.0 GPa @Temperature 120 °C	9860 ksi @Temperature 248 °F	
	82.0 GPa @Temperature 25.0 °C	11900 ksi @Temperature 77.0 °F	
	93.0 GPa @Temperature -40.0 °C	13500 ksi @Temperature -40.0 °F	
Compressive Strength	90.0 MPa	13100 psi	at permanent set of 0.1%
	325 MPa	47100 psi	at permanent set of 10%
	95.0 MPa @Temperature 120 °C	13800 psi @Temperature 248 °F	0.1% set
	100 MPa	14500 psi	0.1% set

	@Temperature 240 °C	@Temperature 464 °F	
	105 MPa @Temperature 25.0 °C	15200 psi @Temperature 77.0 °F	0.1% set
	120 MPa @Temperature 120 °C	17400 psi @Temperature 248 °F	1% set
	120 MPa @Temperature 240 °C	17400 psi @Temperature 464 °F	1% set
	140 MPa @Temperature -40.0 °C	20300 psi @Temperature -40.0 °F	0.1% set
	150 MPa @Temperature 25.0 °C	21800 psi @Temperature 77.0 °F	1% set
	175 MPa @Temperature -40.0 °C	25400 psi @Temperature -40.0 °F	1% set
	215 MPa @Temperature 25.0 °C	31200 psi @Temperature 77.0 °F	10% set
	270 MPa @Temperature 120 °C	39200 psi @Temperature 248 °F	10% set
	275 MPa @Temperature 240 °C	39900 psi @Temperature 464 °F	10% set
	350 MPa @Temperature -40.0 °C	50800 psi @Temperature -40.0 °F	10% set
Fatigue Strength	90.0 MPa @# of Cycles 1.00e+8	13100 psi @# of Cycles 1.00e+8	
Machinability	80 %	80 %	UNS C36000 (free-cutting brass) = 100%
Izod Impact	7.00 J	5.16 ft-lb	
Charpy Impact	15.0 J	11.1 ft-lb	V-notch

Electrical Properties	**Metric**	**English**	**Comments**
Electrical Resistivity	0.0000170 ohm-cm	0.0000170 ohm-cm	
	0.0000171 ohm-cm @Temperature 25.0 °C	0.0000171 ohm-cm @Temperature 77.0 °F	
	0.00001776 ohm-cm @Temperature 65.0 °C	0.00001776 ohm-cm @Temperature 149 °F	
	0.000018125 ohm-cm @Temperature 90.0 °C	0.000018125 ohm-cm @Temperature 194 °F	
	0.00001851 ohm-cm @Temperature 120 °C	0.00001851 ohm-cm @Temperature 248 °F	
	0.00001891 ohm-cm @Temperature 150 °C	0.00001891 ohm-cm @Temperature 302 °F	
	0.00001933 ohm-cm @Temperature 175 °C	0.00001933 ohm-cm @Temperature 347 °F	
	0.00001977 ohm-cm @Temperature 210 °C	0.00001977 ohm-cm @Temperature 410 °F	
	0.0000200 ohm-cm @Temperature 235 °C	0.0000200 ohm-cm @Temperature 455 °F	

Thermal Properties	**Metric**	**English**	**Comments**
CTE, linear	17.8 µm/m-°C @Temperature 100 °C	9.89 µin/in-°F @Temperature 212 °F	
	18.0 µm/m-°C	10.0 µin/in-°F	

	@Temperature 130 °C	@Temperature 266 °F	
	18.2 µm/m-°C @Temperature 165 °C	10.1 µin/in-°F @Temperature 329 °F	
	18.3 µm/m-°C @Temperature 185 °C	10.2 µin/in-°F @Temperature 365 °F	
	18.4 µm/m-°C @Temperature 215 °C	10.2 µin/in-°F @Temperature 419 °F	
	18.5 µm/m-°C @Temperature 20.0 - 200 °C	10.3 µin/in-°F @Temperature 68.0 - 392 °F	
	18.6 µm/m-°C @Temperature 235 °C	10.3 µin/in-°F @Temperature 455 °F	
	18.7 µm/m-°C @Temperature 270 °C	10.4 µin/in-°F @Temperature 518 °F	
Specific Heat Capacity	0.376 J/g-°C	0.0899 BTU/lb-°F	
Thermal Conductivity 	46.9 W/m-K @Temperature 20.0 °C	325 BTU-in/hr-ft²-°F @Temperature 68.0 °F	
	47.0 W/m-K @Temperature 20.0 °C	326 BTU-in/hr-ft²-°F @Temperature 68.0 °F	
	48.0 W/m-K @Temperature 40.0 °C	333 BTU-in/hr-ft²-°F @Temperature 104 °F	
	50.0 W/m-K @Temperature 70.0 °C	347 BTU-in/hr-ft²-°F @Temperature 158 °F	
	51.0 W/m-K @Temperature 95.0 °C	354 BTU-in/hr-ft²-°F @Temperature 203 °F	
	52.0 W/m-K @Temperature 125 °C	361 BTU-in/hr-ft²-°F @Temperature 257 °F	
	54.0 W/m-K @Temperature 160 °C	375 BTU-in/hr-ft²-°F @Temperature 320 °F	
	56.0 W/m-K @Temperature 175 °C	389 BTU-in/hr-ft²-°F @Temperature 347 °F	
	59.0 W/m-K @Temperature 205 °C	409 BTU-in/hr-ft²-°F @Temperature 401 °F	
	62.0 W/m-K @Temperature 230 °C	430 BTU-in/hr-ft²-°F @Temperature 446 °F	
Melting Point	762 - 930 °C	1400 - 1710 °F	
Solidus	762 °C	1400 °F	
Liquidus	930 °C	1710 °F	

Processing Properties	**Metric**	**English**	**Comments**
Annealing Temperature	260 °C	500 °F	Stress-Relieving Temperature

Component Elements Properties	**Metric**	**English**	**Comments**
Aluminum, Al	<= 0.0050 %	<= 0.0050 %	
Antimony, Sb	<= 0.50 %	<= 0.50 %	
Copper, Cu	78 - 82 %	78 - 82 %	
Iron, Fe	<= 0.15 %	<= 0.15 %	
Lead, Pb	8.0 - 11 %	8.0 - 11 %	

Nickel, Ni	<= 0.70 %	<= 0.70 %
Phosphorous, P	<= 0.050 %	<= 0.050 %
Silicon, Si	<= 0.0030 %	<= 0.0030 %
Sulfur, S	<= 0.080 %	<= 0.080 %
Tin, Sn	9.0 - 11 %	9.0 - 11 %
Zinc, Zn	<= 0.70 %	<= 0.70 %