C86500

Material Notes: Casting methods recommended for this alloy: Centrifugal, Investment, Plaster, and Sand.

Applications: Machinery parts requiring strength and toughness, lever arm, valve stems, gears.

Classified under: Manganese and leaded manganese bronze alloys. ASTM B584; formerly ASTM B147-8A

As cast values below are for sand casting. Alloy does not respond to heat treating.

Key Words: Manganese Bronze, ASTM B584; ASTM B147-8A

Physical Properties	Metric	English	Comments
Density	8.30 g/cc	0.300 lb/in³	

Mechanical Properties	Metric	English	Comments
Hardness, Brinell	130	130	
	80 @Load 500 kg, Temperature 230 °C	80 @Load 1100 lb, Temperature 446 °F	
	88 @Load 500 kg, Temperature 170 °C	88 @Load 1100 lb, Temperature 338 °F	
	97 @Load 500 kg, Temperature -35.0 °C	97 @Load 1100 lb, Temperature -31.0 °F	
	98 @Load 500 kg, Temperature 20.0 °C	98 @Load 1100 lb, Temperature 68.0 °F	
Tensile Strength, Ultimate	490 MPa	71100 psi	
	315 MPa @Temperature 225 °C	45700 psi @Temperature 437 °F	
	370 MPa @Temperature 175 °C	53700 psi @Temperature 347 °F	
	485 MPa @Temperature 20.0 °C	70300 psi @Temperature 68.0 °F	
	500 MPa @Temperature -35.0 °C	72500 psi @Temperature -31.0 °F	
Tensile Strength, Yield	195 MPa	28300 psi	
	175 MPa @Strain 0.200 %, Temperature 20.0 °C	25400 psi @Strain 0.200 %, Temperature 68.0 °F	
	180 MPa	26100 psi	

	@Strain 0.200 %, Temperature 175 °C	@Strain 0.200 %, Temperature 347 °F	
	180 MPa @Strain 0.200 %, Temperature 230 °C	26100 psi @Strain 0.200 %, Temperature 446 °F	
	185 MPa @Strain 0.200 %, Temperature -40.0 °C	26800 psi @Strain 0.200 %, Temperature -40.0 °F	
	195 MPa @Strain 0.500 %, Temperature 20.0 °C	28300 psi @Strain 0.500 %, Temperature 68.0 °F	
	195 MPa @Strain 0.500 %, Temperature 175 °C	28300 psi @Strain 0.500 %, Temperature 347 °F	
	195 MPa @Strain 0.500 %, Temperature 230 °C	28300 psi @Strain 0.500 %, Temperature 446 °F	
	200 MPa @Strain 0.500 %, Temperature -40.0 °C	29000 psi @Strain 0.500 %, Temperature -40.0 °F	
Elongation at Break	30 %	30 %	in 50 mm
	31 % @Temperature -35.0 °C	31 % @Temperature -31.0 °F	
	39 % @Temperature 20.0 °C	39 % @Temperature 68.0 °F	
	54 % @Temperature 225 °C	54 % @Temperature 437 °F	
	59 % @Temperature 175 °C	59 % @Temperature 347 °F	
Reduction of Area	26 % @Temperature -35.0 °C	26 % @Temperature -31.0 °F	
	39 % @Temperature 20.0 °C	39 % @Temperature 68.0 °F	
	62 % @Temperature 225 °C	62 % @Temperature 437 °F	
	69 % @Temperature 175 °C	69 % @Temperature 347 °F	
Creep Strength	12.0 MPa	1740 psi	for 0.1% creep in 10,000 h, at 230°C
	43.0 MPa	6240 psi	for 0.1% creep in 10,000 h, at 175°C
	190 MPa	27600 psi	for 0.1% creep in 10,000 h, at 120°C
Rupture Strength	85.0 MPa @Temperature 230 °C, Time 2.88e+6 sec	12300 psi @Temperature 446 °F, Time 800 hour	
	250 MPa @Temperature 230 °C, Time 32400 sec	36300 psi @Temperature 446 °F, Time 9.00 hour	
	265 MPa @Temperature 175 °C, Time 2.88e+6 sec	38400 psi @Temperature 347 °F, Time 800 hour	
	300 MPa @Temperature 175 °C, Time 1.08e+6 sec	43500 psi @Temperature 347 °F, Time 300 hour	
	380 MPa @Temperature 175 °C, Time 140000 sec	55100 psi @Temperature 347 °F, Time 39.0 hour	

	420 MPa @Temperature 120 °C, Time 1.01e+6 sec	60900 psi @Temperature 248 °F, Time 280 hour	
	440 MPa @Temperature 175 °C, Time 18000 sec	63800 psi @Temperature 347 °F, Time 5.00 hour	
	500 MPa @Temperature 120 °C, Time 27000 sec	72500 psi @Temperature 248 °F, Time 7.50 hour	
Modulus of Elasticity	105 GPa	15200 ksi	
	92.0 GPa @Temperature 225 °C	13300 ksi @Temperature 437 °F	
	99.0 GPa @Temperature 170 °C	14400 ksi @Temperature 338 °F	
	101 GPa @Temperature -35.0 °C	14600 ksi @Temperature -31.0 °F	
	106 GPa @Temperature 20.0 °C	15400 ksi @Temperature 68.0 °F	
Compressive Strength	165 MPa	23900 psi	at permanent set of 0.1%
	240 MPa	34800 psi	at permanent set of 1%
	545 MPa	79000 psi	at permanent set of 10%
	150 MPa @Temperature 25.0 °C	21800 psi @Temperature 77.0 °F	0.1% set
	170 MPa @Temperature 175 °C	24700 psi @Temperature 347 °F	0.1% set
	170 MPa @Temperature -35.0 °C	24700 psi @Temperature -31.0 °F	0.1% set
	175 MPa @Temperature 230 °C	25400 psi @Temperature 446 °F	0.1% set
	205 MPa @Temperature 230 °C	29700 psi @Temperature 446 °F	1% set
	245 MPa @Temperature 25.0 °C	35500 psi @Temperature 77.0 °F	1% set
	245 MPa @Temperature 175 °C	35500 psi @Temperature 347 °F	1% set
	255 MPa @Temperature -35.0 °C	37000 psi @Temperature -31.0 °F	1% set
	400 MPa @Temperature 230 °C	58000 psi @Temperature 446 °F	10% set
	430 MPa @Temperature 175 °C	62400 psi @Temperature 347 °F	10% set
	550 MPa @Temperature 25.0 °C	79800 psi @Temperature 77.0 °F	10% set
	605 MPa @Temperature -35.0 °C	87700 psi @Temperature -31.0 °F	10% set
Fatigue Strength	130 - 150 MPa @# of Cycles 1.00e+8	18900 - 21800 psi @# of Cycles 1.00e+8	
	145 MPa @# of Cycles 1.00e+8	21000 psi @# of Cycles 1.00e+8	
	140 - 160 MPa @# of Cycles 1.00e+7	20300 - 23200 psi @# of Cycles 1.00e+7	
	170 - 200 MPa	24700 - 29000 psi	

	@# of Cycles 1.00e+6	@# of Cycles 1.00e+6	
	240 - 265 MPa @# of Cycles 100000	34800 - 38400 psi @# of Cycles 100000	
Machinability	26 %	26 %	UNS C36000 (free-cutting brass) = 100%
Charpy Impact	42.0 J	31.0 ft-lb	
	27.0 J @Temperature 230 °C	19.9 ft-lb @Temperature 446 °F	
	33.0 J @Temperature 175 °C	24.3 ft-lb @Temperature 347 °F	
	43.0 J @Temperature 20.0 °C	31.7 ft-lb @Temperature 68.0 °F	
	47.0 J @Temperature -35.0 °C	34.7 ft-lb @Temperature -31.0 °F	

Electrical Properties	**Metric**	**English**	**Comments**
Electrical Resistivity	0.00000840 ohm-cm @Temperature 20.0 °C	0.00000840 ohm-cm @Temperature 68.0 °F	
	0.00000841 ohm-cm @Temperature 20.0 °C	0.00000841 ohm-cm @Temperature 68.0 °F	Calculated from 20.5% IACS
	0.00000890 ohm-cm @Temperature 65.0 °C	0.00000890 ohm-cm @Temperature 149 °F	
	0.00000930 ohm-cm @Temperature 90.0 °C	0.00000930 ohm-cm @Temperature 194 °F	
	0.00000970 ohm-cm @Temperature 120 °C	0.00000970 ohm-cm @Temperature 248 °F	
	0.0000102 ohm-cm @Temperature 145 °C	0.0000102 ohm-cm @Temperature 293 °F	
	0.0000106 ohm-cm @Temperature 175 °C	0.0000106 ohm-cm @Temperature 347 °F	
	0.0000109 ohm-cm @Temperature 205 °C	0.0000109 ohm-cm @Temperature 401 °F	
	0.0000113 ohm-cm @Temperature 235 °C	0.0000113 ohm-cm @Temperature 455 °F	
Magnetic Permeability	1.09	1.09	16 kA/m field strength

Thermal Properties	**Metric**	**English**	**Comments**
CTE, linear	18.0 µm/m-°C @Temperature 105 °C	10.0 µin/in-°F @Temperature 221 °F	
	18.4 µm/m-°C @Temperature 130 °C	10.2 µin/in-°F @Temperature 266 °F	
	18.8 µm/m-°C @Temperature 160 °C	10.4 µin/in-°F @Temperature 320 °F	
	19.2 µm/m-°C @Temperature 185 °C	10.7 µin/in-°F @Temperature 365 °F	
	19.6 µm/m-°C @Temperature 215 °C	10.9 µin/in-°F @Temperature 419 °F	
	20.0 µm/m-°C @Temperature 240 °C	11.1 µin/in-°F @Temperature 464 °F	
	20.3 µm/m-°C @Temperature 21.0 - 93.0 °C	11.3 µin/in-°F @Temperature 69.8 - 199 °F	

	20.4 µm/m-°C @Temperature 275 °C	11.3 µin/in-°F @Temperature 527 °F	
Specific Heat Capacity	0.373 J/g-°C	0.0891 BTU/lb-°F	
Thermal Conductivity	87.0 W/m-K @Temperature 20.0 °C	604 BTU-in/hr-ft²-°F @Temperature 68.0 °F	
	87.0 W/m-K @Temperature 20.0 °C	604 BTU-in/hr-ft²-°F @Temperature 68.0 °F	
	92.0 W/m-K @Temperature 40.0 °C	638 BTU-in/hr-ft²-°F @Temperature 104 °F	
	95.0 W/m-K @Temperature 70.0 °C	659 BTU-in/hr-ft²-°F @Temperature 158 °F	
	98.0 W/m-K @Temperature 95.0 °C	680 BTU-in/hr-ft²-°F @Temperature 203 °F	
	102 W/m-K @Temperature 125 °C	708 BTU-in/hr-ft²-°F @Temperature 257 °F	
	105 W/m-K @Temperature 140 °C	729 BTU-in/hr-ft²-°F @Temperature 284 °F	
	106 W/m-K @Temperature 175 °C	736 BTU-in/hr-ft²-°F @Temperature 347 °F	
	109 W/m-K @Temperature 210 °C	756 BTU-in/hr-ft²-°F @Temperature 410 °F	
	112 W/m-K @Temperature 235 °C	777 BTU-in/hr-ft²-°F @Temperature 455 °F	
Melting Point	862 - 880 °C	1580 - 1620 °F	
Solidus	862 °C	1580 °F	
Liquidus	880 °C	1620 °F	

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

Component Elements Properties	**Metric**	**English**	**Comments**
Aluminum, Al	0.50 - 1.5 %	0.50 - 1.5 %	
Copper, Cu	55 - 60 %	55 - 60 %	
Iron, Fe	0.40 - 2.0 %	0.40 - 2.0 %	
Lead, Pb	<= 0.40 %	<= 0.40 %	
Manganese, Mn	<= 1.5 %	<= 1.5 %	
Nickel, Ni	<= 1.0 %	<= 1.0 %	
Tin, Sn	<= 1.0 %	<= 1.0 %	
Zinc, Zn	39 %	39 %	