Copper-Tin Alloy (Tin Bronze) C90500

Chemical Composition

(% max., unless shown as range or min.)

	Cu[1] [2]	Sn	Pb	Zn	Fe	Sb	Ni (incl Co)	S	P[3]	Al	Si	Mn
Min./Max.	86.0-89.0	9.0-11.0	.30	1.0-3.0	.20	.20	1.0	.05	.05	.005	.005	–
Nominal	87.5	10.1	–	2.0	–	–	–	–	–	–	–	–

1. Cu + Sum of Named Elements, 99.7% min.
2. In determining Cu min., Cu may be calculated as Cu + Ni.
3. For continuous castings, P shall be 1.5% max.

Applicable Specifications

Process or Ingot	Specification	
Centrifugal	AMS	4845
	ASTM	B 271
	SAE	J461, J462
Continuous	ASTM	B 505
	SAE	J461, J462
Ingot	ASTM	B 30
	INGOT	210
Sand	AMS	4845
	ASTM	B 22, B 584, B 763
	SAE	J461, J462

Casting Characteristics

Characteristic	Value
Effect of Section Size	Large
Patternmakers Shrinkage	3/16 in./ft
Drossing	Low
Gassing	Medium
Fluidity	Medium
Shrinkage	Medium
Casting Yield	Medium

Fabrication Practices

Joining Technique	Suitability
Soldering	Excellent
Brazing	Good
Oxyacetylene Welding	Fair
Gas Shielded Arc Welding	Fair
Coated Metal Arc Welding	Fair

Machinability Rating: 30

(C36000, Free Cutting Brass = 100)

Typical Uses

Bearings and Bushings
Nuts
Seal Rings
Worm Gears
Bridge Parts and Expansion Bearings
Gears
Piston Rings
Pump Impellers
Steam Fittings
Valve Components

Heat Treatment

Stress Relieving:
500 F (260 C) for 1h/in. of Section Thickness
Cannot be Strengthened by Heat Treatment

Physical Properties

	US Customary	Metric
Melting Range, Liquidus	1830 F	999 C
Solidus	1570 F	854 C
Density	0.315 lb/in.^{3} at 68 F	8.72 g/cm^3 at 20 C
Specific Gravity	8.72	8.72
Electrical Resistivity	94.0 ohm•cmil/ft at 68 F	15.6 microhm-cm at 20 C
Coefficient of Thermal Expansion	11.0 10^{-6} per°F (68-572 F)	19.8 10^{-6} per°C (20-300 C)
Magnetic Permeability (F.S.=16kA/m)	1.00	1.00
Thermal Conductivity	43.2 Btu•ft/(hr•ft^2•°F) at 68 F	74.8 W/m•°K at 20 C
Electrical Conductivity	11 %IACS at 68 F	0.064 Siemens/cm at 20 C
Specific Heat Capacity	0.09 Btu/lb/°F at 68 F	377 J/kg•°K at 20 C
Modulus of Elasticity in Tension	15,000 ksi	103,400 MPa

Mechanical Properties*

M01 - AS SAND CAST		US Customary	Metric	Applicable Specifications
Tensile Strength	Minimum	40 ksi	275 MPa	ASTM B 22
	Minimum	40 ksi	276 MPa	ASTM B 584, B 763
	Minimum	40 ksi	275 MPa	SAE J462-A
	Typical	45 ksi	310 MPa	
Yield Strength				
0.5% Ext. under load	Minimum	18 ksi	125 MPa	ASTM B 22
	Minimum	18 ksi	124 MPa	ASTM B 584, B 763
	Minimum	18 ksi	125 MPa	SAE J462-A
	Typical	22 ksi	152 MPa	
Elongation	Minimum	20 %, in 2 in.	20 %, in 51 mm	ASTM B 22, B 584, B 763; SAE J462-A
	Typical	25 %, in 2 in.	25 %, in 51 mm	
Brinell Hardness				
500 kg load	Typical	75	75	
Compressive Strength				
0.01 in. set/in.	Typical	40 ksi	276 MPa	
Impact Strength				
Izod	Typical	10 ft-lb	13 J	
Fatigue Strength				
at 10^8 cycles	Typical	13 ksi	90 MPa	

Mechanical Properties*

M02 - AS CENTRIFUGAL CAST		US Customary	Metric	Applicable Specifications
Tensile Strength	Minimum	40 ksi	276 MPa	ASTM B 271
	Minimum	40 ksi	275 MPa	SAE J462-A
	Typical	45 ksi	310 MPa	
Yield Strength				
0.5% Ext. under load	Minimum	18 ksi	124 MPa	ASTM B 271
	Minimum	18 ksi	125 MPa	SAE J462-A
	Typical	22 ksi	152 MPa	
Elongation	Minimum	20 %, in 2 in.	20 %, in 51 mm	ASTM B 271; SAE J462-A
	Typical	25 %, in 2 in.	25 %, in 51 mm	
Brinell Hardness				
500 kg load	Typical	75	75	
Compressive Strength				
0.01 in. set/in.	Typical	40 ksi	276 MPa	
Impact Strength				
Izod	Typical	10 ft-lb	13 J	
Fatigue Strength				
at 10^8 cycles	Typical	13 ksi	90 MPa	

M07 - AS CONTINUOUS CAST		US Customary	Metric	Applicable Specifications
Tensile Strength	Minimum	44 ksi	303 MPa	ASTM B 505
	Minimum	44 ksi	305 MPa	SAE J462-B
Yield Strength				
0.5% Ext. under load	Minimum	25 ksi	172 MPa	ASTM B 505
	Minimum	25 ksi	170 MPa	SAE J462-B
Elongation	Minimum	10 %, in 2 in.	10 %, in 51 mm	ASTM B 505; SAE J462-B

* For alloys listed under SAE J462, suffix symbols are to distinguish between two or more sets of mechanicals properties, heat treatments, conditions, etc., as applicable. See Society of Automotive Engineers Inc., SAE Handbook, Vol. 1 Materials, 1989, Warrendale, PA 15096.