Copper-Aluminum-Iron-Nickel Alloy (Aluminum Bronze) C95400

Chemical Composition

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

	Cu[1]	Pb	Fe	Ni (incl Co)	Al	Mn	Mg	Si	Zn	Sn	Other Named Elements
Min./Max.	83.0min.	–	3.0-5.0	1.5	10.0-11.5	.50	–	–	–	–	–
Nominal	83.2	–	4.0	–	10.8	–	–	–	–	–	–

1. Cu + Sum of Named Elements, 99.5% min.

Applicable Specifications

Process or Ingot	Specification	
Centrifugal	ASME	SB271
	ASTM	B 271
	SAE	J461, J462
Continuous	ASTM	B 505
	SAE	J461, J462
Ingot	ASTM	B 30
	INGOT	415C
Precision	MILITARY	MIL-C-11866
Sand	ASME	SB148
	ASTM	B 148, B 763
	SAE	J461, J462

Fabrication Practices

Joining Technique	Suitability
Soldering	Good
Brazing	Good
Oxyacetylene Welding	Not Recommended
Gas Shielded Arc Welding	Very Good
Coated Metal Arc Welding	Good

Machinability Rating: 60

(C36000, Free Cutting Brass = 100)

Typical Uses

Bearings and Bushings
Spur Gears
Gears
Pickling Hooks and Baskets
Worms
Valve Components

Casting Characteristics

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

Heat Treatment

Stress Relieving:
600 F (315 C) for 1h/in. of Section Thickness

Solution Anneal:
1600-1675 F (880-915 C) for 1h/WQ

Tempering:
1150-1225 F (620-665 C) for 1h/AC

This alloy may be sensitive to water-quench cracking in heavy casting sections. Oil quenching or forced-air cooling may be preferred.

Physical Properties

	US Customary	Metric
Melting Range, Liquidus	1900 F	1038 C
Solidus	1880 F	1027 C
Density	0.269 lb/in.^{3} at 68 F	7.45 g/cm^3 at 20 C
Specific Gravity	7.45	7.45
Electrical Resistivity	80.2 ohm•cmil/ft at 68 F	13.3 microhm-cm at 20 C
Coefficient of Thermal Expansion	9.0 10^{-6} per°F (68-572 F)	16.2 10^{-6} per°C (20-300 C)
Magnetic Permeability (F.S.=16kA/m)		
As Cast, (F.S.=16kA/m)	1.27	1.27
TQ 50 Temper, (F.S.=16kA/m)	1.20	1.20
Thermal Conductivity	33.9 Btu•ft/(hr•ft^2•°F) at 68	58.7 W/m•°K at 20 C
Electrical Conductivity	13 %IACS at 68 F	0.075 Siemens/cm at 20 C
Specific Heat Capacity	0.10 Btu/lb/°F at 68 F	419 J/kg•°K at 20 C
Modulus of Elasticity in Tension	15,500 ksi	107,000 MPa

Mechanical Properties*

M01 - AS SAND CAST		US Customary	Metric	Applicable Specifications
Tensile Strength	Minimum	75 ksi	517 MPa	ASME SB148; ASTM B 148, B 763
	Minimum	75 ksi	515 MPa	SAE J462-A
	Typical	85 ksi	586 MPa	
Yield Strength				
0.5% Ext. under load	Minimum	30 ksi	207 MPa	ASME SB148; ASTM B 148, B 763
	Minimum	30 ksi	205 MPa	SAE J462-A
	Typical	35 ksi	241 MPa	
Proportional Limit	Typical	17 ksi	117 MPa	
Elongation	Minimum	12 %, in 2 in.	12 %, in 51 mm	ASTM B 148, B 763; SAE J462-A
	Typical	18 %, in 2 in.	18 %, in 51 mm	
Brinell Hardness				
3000 kg load	Minimum	150	150	ASTM B 148, B 763
	Typical	170	170	
Shear Strength	Typical	47 ksi	324 MPa	
Compressive Strength				
0.1 in. set/in.	Typical	100 ksi	689 MPa	
Impact Strength				
Izod	Typical	16 ft-lb	22 J	
Charpy Un-notched	Typical	11 ft-lb	15 J	
Fatigue Strength				
at 10^8 cycles	Typical	28 ksi	193 MPa	
Creep Strength,				
0.1%/10^4 h				
at 450 F (232 C)	Typical	17 ksi	115 MPa	
at 600 F (316 C)	Typical	7 ksi	51 MPa	
at 700 F (371 C)	Typical	4 ksi	30 MPa	
at 800 F (427 C)	Typical	3 ksi	20 MPa	

Mechanical Properties*

M01/O10 AS SAND CAST & ANNEALED		US Customary	Metric	Applicable Specifications
Tensile Strength	Minimum	75 ksi	517 MPa	ASME SB148
Yield Strength				
0.5% Ext. under load	Minimum	30 ksi	207 MPa	ASME SB148

M01 / TQ50 - AS SAND CAST, QUENCH HARDENED & TEMPER ANNEALED		US Customary	Metric	Applicable Specifications
Tensile Strength	Minimum	90 ksi	621 MPa	ASTM B 148, B 763
	Minimum	90 ksi	620 MPa	SAE J462-C
	Typical	105 ksi	724 MPa	
Yield Strength				
0.5% Ext. under load	Minimum	45 ksi	310 MPa	ASTM B 148, B 763; SAE J462-C
	Typical	54 ksi	372 MPa	
Proportional Limit	Typical	28 ksi	193 MPa	
Elongation	Minimum	6 %, in 2 in.	6 %, in 51 mm	ASTM B 148, B 763; SAE J462-C
	Typical	8 %, in 2 in.	8 %, in 51 mm	
Brinell Hardness				
3000 kg load	Minimum	190	190	ASTM B 148, B 763
	Typical	195	195	
Shear Strength	Typical	50 ksi	345 MPa	
Compressive Strength				
0.1 in. set/in.	Typical	120 ksi	827 MPa	
Impact Strength				
Izod	Typical	11 ft-lb	15 J	
Charpy V-Notch	Typical	7 ft-lb	9 J	
Fatigue Strength				
at 10^8 cycles	Typical	35 ksi	241 MPa	

M02 - AS CENTRIFUGAL CAST		US Customary	Metric	Applicable Specifications
Tensile Strength	Minimum	75 ksi	517 MPa	ASME SB271
	Minimum	75 ksi	515 MPa	ASTM B 271; SAE J462-A
Yield Strength				
0.5% Ext. under load	Minimum	30 ksi	207 MPa	ASME SB271
	Minimum	30 ksi	205 MPa	ASTM B 271; SAE J462-A
Elongation	Minimum	12 %, in 2 in.	12 %, in 51 mm	ASTM B 271; SAE J462-A
Brinell Hardness				
3000 kg load	Minimum	150	150	ASTM B 271

Mechanical Properties*

M02 / TQ50 CENTRIFUGAL CAST, QUENCH HARDENED & TEMPER ANNEALED		US Customary	Metric	Applicable Specifications
Tensile Strength	Minimum	90 ksi	620 MPa	ASTM B 271; SAE J462-C
Yield Strength				
0.5% Ext. under load	Minimum	45 ksi	310 MPa	ASTM B 271; SAE J462-C
Elongation	Minimum	6 %, in 2 in.	6 %, in 51 mm	ASTM B 271; SAE J462-C
Brinell Hardness				
3000 kg load	Minimum	190	190	ASTM B 271

M05 - AS PERMANENT MOLD CAST		US Customary	Metric	Applicable Specifications
Tensile Strength	Minimum	100 ksi	690 MPa	ASTM B 806
	Typical	105 ksi	725 MPa	
Yield Strength	Minimum	40 ksi	275 MPa	ASTM B 806
0.5% Ext. under load	Typical	46 ksi	320 MPa	
Elongation	Minimum	10 %, in 2 in.	10 %, in 51 mm	ASTM B 806
	Typical	11 %, in 2 in.	11 %, in 51 mm	
Rockwell Hardness				
B scale	Typical	88	88	

M07 - AS CONTINUOUS CAST		US Customary	Metric	Applicable Specifications
Tensile Strength	Minimum	85 ksi	586 MPa	ASTM B 505
	Minimum	85 ksi	585 MPa	SAE J462-B
Yield Strength				
0.5% Ext. under load	Minimum	32 ksi	221 MPa	ASTM B 505
	Minimum	32 ksi	220 MPa	SAE J462-B
Elongation	Minimum	12 %, in 2 in.	12 %, in 51 mm	ASTM B 505; SAE J462-B

M07 - TQ50 AS CONTINUOUS CAST, QUENCH HARDENED & TEMPER ANNEALED		US Customary	Metric	Applicable Specifications
Tensile Strength	Minimum	95 ksi	655 MPa	ASTM B 505; SAE J462-D
Yield Strength				
0.5% Ext. under load	Minimum	45 ksi	310 MPa	ASTM B 505; SAE J462-D
Elongation	Minimum	10 %, in 2 in.	10 %, in 51 mm	ASTM B 505; SAE J462-D

* 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.

ASME Boiler and Pressure Code

Specification No.	SB-148	SB-271
Product Form	Castings	Castings
Temper and Casting Method	M01 As Sand Cast	M02 As Centrifugal Cast
P-No.	35	35
Tensile Strength ksi., min.	75	75
Yield Strength ksi., min.	30	30
Section I	Not Permitted	Not Permitted
Section III	Class 3 only; 450 F, max.	Class 3 only; 450 F, max.
Section VIII-I	600 F, max.	Not Permitted
External Pressure	NFC-4	–

For Metal Temperatures Not Exceeding	**Maximum Allowable Stress (ksi)**	
-20 to 100 F	18.9	18.9
150 F	18.9	18.9
200 F	18.7	18.7
250 F	18.7	18.7
300 F	18.7	18.7
350 F	18.1	18.1
400 F	17.4	17.4
450 F	16.0	16.0
500 F	13.9	–
550 F	11.0	–
600 F	8.5	–