



**Standard Properties of Typical
Brass, Bronze, & Aluminum Alloys**

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319.0
 356.0
 535.0

C83600 Red Brass

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

	Cu ¹	Al	Sb	Fe	Pb	Ni ²	P ³	Si	S	Sn	Zn
MIN./MAX.	84.0-86.0	.005	.25	.30	4.0-6.0	1.0	.05	.005	.08	4.0-6.0	4.0-6.0
Nominal	85.0				5.0					5.0	5.0

TYPICAL USES

Architecture: Ornamental Fixtures

Builders Hardware: Hardware

Building: Lightning Protection, Heating Equipment, Cooling Equipment, Trowels for Cement Working

Electrical: Electrical Hardware, Switches, Electrical Equipment Fasteners Large Hold Down Screws

Industrial: Handles for Dental Equipment, Air Actuators, Valve Bodies, Valves, Bushings, Pump Parts, Pumps, Valve Bodies, Impellers, Pump Fixtures, Couplings, Valves, Transducer Housings, Valve Bodies for the Water Meter Industry, Valves for the Water Meter Industry, Pumps, Low Pressure Valves, Small Gears, Bearings, Bearing Segments for Steel Industry, Pressure Blocks for Steel Industry, Rings, Printing Presses, Furnaces

Marine: Marine Products, Parts for Boats

Plumbing: Faucets, Fixtures, Pipe Fittings

APPLICABLE SPECIFICATIONS

Product	Specification
Sand	AMS 4855; ASME SB62, ASTM B584; B62, SAE J461, J462

FABRICATION PROPERTIES

Joining Technique	Suitability
Machinability Rating	84

MECHANICAL PROPERTIES (measured at room temperature, 68° F (20° C))

As Sand Cast

TEMPER	SECTION SIZE	COLD WORK	TYP/ MIN	TEMP	TENSILE STRENGTH	YIELD STRENGTH (0.5% EXT. UNDER LOAD)	YIELD STRENGTH (0.2% OFFSET)	YIELD STRENGTH (0.05% OFFSET)	EL	ROCKWELL HARDNESS				VICKENS HARD.	BRINELL HARD.		SHEAR STRENGTH	FATIGUE STRENGTH*	IZOD IMPACT STRENGTH
										B	C	F	30T		500	3000			
	in.	%		F	ksi	ksi	ksi	ksi	%						500	3000	ksi	ksi	ft-lb
	mm.		C	MPa	MPa	MPa	MPa										MPa	MPa	J
M01	0.0	0	TYP	68	37				30						60			11	10.0
	0.0			20	255	117			30						60			76	14.0

BRASS & BRONZE ALLOYS

C86200 Manganese Bronze

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

	Cu ¹	Al	Fe	Pb	Mn	Ni ²	Sn	Zn
Min./Max	60.0-66.0	3.0-4.9	2.0-4.0	.20	2.5-5.0	1.0	.20	22.0-28.0
Nominal	63.0	4.0	3.0		3.7			25.0

- In determining Cu min., Cu may be calculated as Cu + Ni.
- Ni value includes Co.

Note: Cu + Sum of Named Elements, 99.0% min

TYPICAL USES

Builders Hardware: Structural Parts, Brackets

Fasteners: Screw Down Nuts

Industrial: Pressing Dies for Wood Pulp, Wear Rings for Pressing Dies for Wood Pulp Industry, Cams, Bushings, Valve Stems, Worm Gears, Gears, Frames, Shafts, Hooks, High Strength Machine Parts, Struts, Marine Racing Propellers

Marine: Clamps, Marine Castings, Boat Parts, Rudders

Ordnance: Gun Mounts

APPLICABLE SPECIFICATIONS

Product	Specification
Sand	ASTM B763, B584 SAE J461, J462

FABRICATION PROPERTIES

Joining Technique	Suitability
Machinability Rating	30

MECHANICAL PROPERTIES (measured at room temperature, 68° F (20° C))

As Sand Cast

TEMPER	SECTION SIZE	COLD WORK	TYP/ MIN	TEMP	TENSILE STRENGTH	YIELD STRENGTH (0.5% EXT. UNDER LOAD)	YIELD STRENGTH (0.2% OFFSET)	YIELD STRENGTH (0.05% OFFSET)	EL	ROCKWELL HARDNESS				VICKENS HARD.	BRINELL HARD.		SHEAR STRENGTH	FATIGUE STRENGTH*	IZOD IMPACT STRENGTH
										B	C	F	30T						
	in.	%		F	ksi	ksi	ksi	ksi	%						500	3000	ksi	ksi	ft-lb
	mm.		C	MPa	MPa	MPa	MPa										MPa	MPa	J
M01	0.0	0	TYP	68	95	48			20							180			12.0
	0.0			20	655	331			20							180			16.0

C86300 Manganese Bronze

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

	Cu ¹	Al	Fe	Pb	Mn	Ni ²	Sn	Zn
Min./Max	60.0-66.0	5.0-7.5	2.0-4.0	.20	2.5-5.0	1.0	.20	22.0-28.0
Nominal	63.0	6.2	3.0		3.7			25.0

- In determining Cu min., Cu may be calculated as Cu + Ni.
- Ni value includes Co.

Note: Cu + Sum of Named Elements, 99.0% min

TYPICAL USES

Builders Hardware: Brackets

Electrical: Electrical Components, Switches

Fasteners: Screw Down Nuts

Industrial: Wear Rings for Forming Dies for Wood Pulp Industry, Large Valve Stems, Hydraulic Cylinder Parts, Propellers, Bridge Pins, Forming Dies for Wood Pulp Industry, Cams, Gib, Gears, Hydraulic Cylinder Parts, Slow Speed, Heavy Load Bearings, Bushings, High Strength Machine Parts, Hooks, Frames, Struts

Marine: Marine Hardware, Rudders, Covers for Marine Hardware, Clamps, Boat Parts

APPLICABLE SPECIFICATIONS

Product	Specification
Sand	AMS 4862 ASTM B763, B584, B22 SAE J462, J461

FABRICATION PROPERTIES

Joining Technique	Suitability
Machinability Rating	8

MECHANICAL PROPERTIES (measured at room temperature, 68° F (20° C))

As Sand Cast

TEMPER	SECTION SIZE	COLD WORK	TYP/ MIN	TEMP	TENSILE STRENGTH	YIELD STRENGTH (0.5% EXT. UNDER LOAD)	YIELD STRENGTH (0.2% OFFSET)	YIELD STRENGTH (0.05% OFFSET)	EL	ROCKWELL HARDNESS				VICKENS HARD.	BRINELL HARD.		SHEAR STRENGTH	FATIGUE STRENGTH*	IZOD IMPACT STRENGTH
										B	C	F	30T						
	in.	%		F	ksi	ksi	ksi	ksi	%						500	3000	ksi	ksi	ft-lb
	mm.		C	MPa	MPa	MPa	MPa										MPa	MPa	J
M01	0.0	0	TYP	68	119	62			18							225		25	15.0
	0.0			20	821	427			18							225		172	20.0

C86500 Manganese Bronze

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

	Cu ¹	Al	Fe	Pb	Mn	Ni ²	Sn	Zn
Min./Max.	55.0-60.0	.50-1.5	.40-2.0	.40	.10-1.5	1.0	1.0	36.0-42.0
Nominal	58.0	1.0	1.2		.8		.5	39.0

- In determining Cu min., Cu may be calculated as Cu + Ni.
- Ni value includes Co.

Note: Cu + Sum of Named Elements, 99.0% min.

TYPICAL USES

Automotive: Weld Guns

Builders Hardware: Brackets

Electrical: Electrical Hardware

Industrial: Machinery Parts (Substituted for Steel and Malleable Iron), Pressing Dies for Wood Pulp, Gears, Machinery Parts requiring High Strength, Frames, Hooks, Wear Rings for Pressing Dies for Wood Pulp Industry, Forming Dies for Wood Pulp Industry, Compressors, Lever Arms, Machinery, Struts

Marine: Boat Parts, Covers for Marine Hardware, Rudders, Clamps, Propellers for salt and fresh water

APPLICABLE SPECIFICATIONS

Product	Specification
Sand	AMS 4860 ASTM B584, B763 SAE J461, J462

FABRICATION PROPERTIES

Joining Technique	Suitability
Machinability Rating	26

MECHANICAL PROPERTIES (measured at room temperature, 68° F (20° C))

As Sand Cast

TEMPER	SECTION SIZE	COLD WORK	TYP/ MIN	TEMP	TENSILE STRENGTH	YIELD STRENGTH (0.5% EXT. UNDER LOAD)	YIELD STRENGTH (0.2% OFF-SET)	YIELD STRENGTH (0.05% OFFSET)	EL	ROCKWELL HARDNESS				VICKENS HARD.	BRINELL HARD.		SHEAR STRENGTH	FATIGUE STRENGTH*	IZOD IMPACT STRENGTH
										B	C	F	30T						
	in.	%		F	ksi	ksi	ksi	ksi	%						500	3000	ksi	ksi	ft-lb
	mm.		C	MPa	MPa	MPa	MPa										MPa	MPa	J
M01	0.0	0	TYP	68	71	29			30						100	130		20	0.0
	0.0			20	490	200			30						100	130		138	0.0

C87500 Copper Silicon

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

	Cu	Al	Pb	Si	Zn
Min./Max.	79.0 min	.50	.09	3.0-5.0	12.0-16.0
Nominal	82.0			4.0	14.0

Note: Cu + Sum of Named Elements, 99.5% min.

TYPICAL USES

Builders Hardware: Window Hardware

Industrial: Levers, Fittings, Impellers, Gears, Pump Fixtures, Valve Bodies, Bearings

Marine: Small Boat Propellers, Boat Parts

Plumbing: Fixtures

APPLICABLE SPECIFICATIONS

Product	Specification
Sand	ASTM B584, B763

FABRICATION PROPERTIES

Joining Technique	Suitability
Machinability Rating	50

MECHANICAL PROPERTIES (measured at room temperature, 68° F (20° C))

As Sand Cast

TEMPER	SECTION SIZE	COLD WORK	TYP/ MIN	TEMP	TENSILE STRENGTH	YIELD STRENGTH (0.5% EXT. UNDER LOAD)	YIELD STRENGTH (0.2% OFF-SET)	YIELD STRENGTH (0.05% OFFSET)	EL	ROCKWELL HARDNESS				VICKENS HARD.	BRINELL HARD.		SHEAR STRENGTH	FATIGUE STRENGTH*	IZOD IMPACT STRENGTH
										B	C	F	30T						
	in.	%		F	ksi	ksi	ksi	ksi	%						500	3000	ksi	ksi	ft-lb
	mm.		C	MPa	MPa	MPa	MPa										MPa	MPa	J
M01	0.0	0	TYP	68	67	30			21						115	134		22	0.0
	0.0			20	462	207			21						115	134		152	0.0

BRASS & BRONZE ALLOYS

C87600 Copper Silicon

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

	Cu	Fe	Pb	Si	Zn
Min./Max.	88.0 min	.20	.25	3.5-5.5	4.0-7.0
Nominal	89.0			4.5	5.5

Note: Cu + Sum of Named Elements, 99.5% min.

TYPICAL USES

Architecture: Artistry Components

Electrical: Electrical Components

Industrial: Valve Stems, Valve Bodies, Bearings, Engineering Applications

APPLICABLE SPECIFICATIONS

Product	Specification
Sand	ASTM B584, B763

FABRICATION PROPERTIES

Joining Technique	Suitability
Machinability Rating	40

MECHANICAL PROPERTIES (measured at room temperature, 68° F (20° C))

As Sand Cast

TEMPER	SECTION SIZE	COLD WORK	TYP/ MIN	TEMP	TENSILE STRENGTH	YIELD STRENGTH (0.5% EXT. UNDER LOAD)	YIELD STRENGTH (0.2% OFF-SET)	YIELD STRENGTH (0.05% OFFSET)	EL	ROCKWELL HARDNESS				VICKENS HARD.	BRINELL HARD.		SHEAR STRENGTH	FATIGUE STRENGTH*	IZOD IMPACT STRENGTH
										B	C	F	30T		500	3000			
	in.	%		F	ksi	ksi	ksi	ksi	%										
	mm.		C	MPa	MPa	MPa	MPa									MPa	MPa	J	
M01	0.0	0	TYP	68	66	32			20	76					110	135			0.0
	0.0			20	455	221			20	76					110	135			0.0

C90300 Tin Bronze

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

	Cu(1)	Al	Sb	Fe	Pb	Ni(2)	P(3)	Si	S	Sn	Zn
Min./Max.	86.0-89.0	.005	.20	.20	.30	1.0	.05	.005	.05	7.5-9.0	3.0-5.0
Nominal	87.5									8.3	4.0

Note: Cu + Sum of Named Elements, 99.5% min.

TYPICAL USES

Building: Heavy Construction Equipment

Fasteners: Swivel

Industrial: Pump Impellers, Piston Rings, Valve Bodies, Valves, Gears, Bushings, Bearings, Pump Bodies, Gear Blanks

Plumbing: Steam Fittings

APPLICABLE SPECIFICATIONS

Product	Specification
Sand	ASTM B763, B584 SAE J461, J462

FABRICATION PROPERTIES

Joining Technique	Suitability
Machinability Rating	30

MECHANICAL PROPERTIES (measured at room temperature, 68° F (20° C))

As Sand Cast

TEMPER	SECTION SIZE	COLD WORK	TYP/ MIN	TEMP	TENSILE STRENGTH	YIELD STRENGTH (0.5% EXT. UNDER LOAD)	YIELD STRENGTH (0.2% OFF-SET)	YIELD STRENGTH (0.05% OFFSET)	EL	ROCKWELL HARDNESS				VICKENS HARD.	BRINELL HARD.		SHEAR STRENGTH	FATIGUE STRENGTH*	IZOD IMPACT STRENGTH
										B	C	F	30T		500	3000			
	in.	%		F	ksi	ksi	ksi	ksi	%										
	mm.		C	MPa	MPa	MPa	MPa									MPa	MPa	J	
M01	0.0	0	TYP	68	45	21			30						70				0.0
	0.0			20	310	145			30						70				0.0

C90500 Gun Metal

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

	Cu(1)	Al	Sb	Fe	Pb	Ni(2)	P(3)	Si	S	Sn	Zn
Min./Max.	86.0-89.0	.005	.20	.20	.30	1.0	.05	.005	.05	9.0-11.0	1.0-3.0
Nominal	87.5									10.0	2.0

- In determining Cu min., Cu may be calculated as Cu + Ni.
- Ni value includes Co.
- For continuous castings, P shall be 1.5%, max.

Note: Cu + Sum of Named Elements, 99.7% min.

APPLICABLE SPECIFICATIONS

Product	Specification
Sand	AMS 4845; ASTM B763, B584, B22; SAE J462, J461

FABRICATION PROPERTIES

Joining Technique	Suitability
Machinability Rating	30

TYPICAL USES

Builders Hardware: Clamps

Building: Heavy Construction Equipment

Electrical: Connectors

Fasteners: Nuts

Industrial: Pump Bodies, Valves, Gears, Piston Rings, Pump Impellers, Bushings, Bearings, Worm Gears, Expansion Bearings, Gear Blanks, Finishing Dies for Wood Pulp Industry, Valve Bodies, Seal Rings

Plumbing: Water Conditioners, Steam Fittings

MECHANICAL PROPERTIES (measured at room temperature, 68° F (20° C))

As Sand Cast

TEMPER	SECTION SIZE	COLD WORK	TYP/ MIN	TEMP	TENSILE STRENGTH	YIELD STRENGTH (0.5% EXT. UNDER LOAD)	YIELD STRENGTH (0.2% OFFSET)	YIELD STRENGTH (0.05% OFFSET)	EL	ROCKWELL HARDNESS				VICKENS HARD.	BRINELL HARD.		SHEAR STRENGTH	FATIGUE STRENGTH*	IZOD IMPACT STRENGTH
										B	C	F	30T		500	3000			
	in.	%		F	ksi	ksi	ksi	ksi	%						500	3000	ksi	ksi	ft-lb
	mm.		C	MPa	MPa	MPa	MPa										MPa	MPa	J
M01	0.0	0	TYP	68	45	22			25						75			13	10.0
	0.0			20	310	152			25						75			90	13.0

C90700 Tin Bronze, 65

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

	Cu ¹	Al	Sb	Fe	Pb	Ni ²	P ³	Si	S	Sn	Zn
Min./Max.	88.0-90.0	.005	.20	.15	.50	.50	.30	.005	.05	10.0-12.0	.50
Nominal	89.0									11.0	

- In determining Cu min., Cu may be calculated as Cu + Ni.
- Ni value includes Co.
- For continuous castings, P shall be 1.5%, max.

Note: Cu + Sum of Named Elements, 99.4% min

APPLICABLE SPECIFICATIONS

Product	Specification
Sand	ASTM B427 SAE J461, J462

FABRICATION PROPERTIES

Joining Technique	Suitability
Machinability Rating	20

TYPICAL USES

Industrial: Bearings, Worm Wheels, Gears, Bearings for Heavy Loads and Relatively Low Speeds, Restaurant Equipment, Gear Boxes, Speed Reducers, Valve Bodies, Worm Gears

MECHANICAL PROPERTIES (measured at room temperature, 68° F (20° C))

As Sand Cast

TEMPER	SECTION SIZE	COLD WORK	TYP/ MIN	TEMP	TENSILE STRENGTH	YIELD STRENGTH (0.5% EXT. UNDER LOAD)	YIELD STRENGTH (0.2% OFFSET)	YIELD STRENGTH (0.05% OFFSET)	EL	ROCKWELL HARDNESS				VICKENS HARD.	BRINELL HARD.		SHEAR STRENGTH	FATIGUE STRENGTH*	IZOD IMPACT STRENGTH
										B	C	F	30T		500	3000			
	in.	%		F	ksi	ksi	ksi	ksi	%						500	3000	ksi	ksi	ft-lb
	mm.		C	MPa	MPa	MPa	MPa										MPa	MPa	J
M01	0.0	0	TYP	68	44	22			20						80			25	0.0
	0.0			20	303	152			20						80			172	0.0
M01	0.0	0	SMIN	68	35	17			10						65				0.0
	0.0			20	241	117			10						65				0.0

BRASS & BRONZE ALLOYS

C92200 Navy M Bronze

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

	Cu ¹	Al	Sb	Fe	Pb	Ni ²	P ³	Si	S	Sn	Zn
Min./Max.	86.0-90.0	.005	.25	.25	1.0-2.0	1.0	.05	.005	.05	5.5-6.5	3.0-5.0
Nominal	88.0				1.5					6.0	4.5

- In determining Cu min., Cu may be calculated as Cu + Ni.
- Ni value includes Co.
- For continuous castings, P shall be 1.5%, max.

Note: Cu + Sum of Named Elements, 99.3% min.

APPLICABLE SPECIFICATIONS

Product	Specification
Sand	ASME SB61, SB584; ASTM B61, B584; SAE J461, J462

FABRICATION PROPERTIES

Joining Technique	Suitability
Machinability Rating	42

TYPICAL USES

Architecture: Ornamental Castings

Building: Cooling Equipment, Heating Equipment

Fasteners: Nuts

Industrial: Fittings Used to 550 F, Gears, Bushings, Bearings, Pump Impellers, Pumps Used to 550 F, Cryogenic Valves, Valves for Water Meters, Medium Pressure Hydraulic Equipment, Piston Rings, Valve Components

Marine: Marine Castings

Plumbing: Medium Pressure Steam Equipment to 550° F

MECHANICAL PROPERTIES (measured at room temperature, 68° F (20° C))

As Sand Cast

TEMPER	SECTION SIZE	COLD WORK	TYP/ MIN	TEMP	TENSILE STRENGTH	YIELD STRENGTH (0.5% EXT. UNDER LOAD)	YIELD STRENGTH (0.2% OFFSET)	YIELD STRENGTH (0.05% OFFSET)	EL	ROCKWELL HARDNESS				VICKENS HARD.	BRINELL HARD.		SHEAR STRENGTH	FATIGUE STRENGTH*	IZOD IMPACT STRENGTH
										B	C	F	30T		500	3000			
	in.	%		F	ksi	ksi	ksi	ksi	%						500	3000	ksi	ksi	ft-lb
	mm.		C	MPa	MPa	MPa	MPa										MPa	MPa	J
M01	0.0	0	TYP	68	40	20			30						65			11	0.0
	0.0			20	276	138			30						65			76	0.0

C92700 Leaded Tin Bronze

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

	Cu ¹	Al	Sb	Fe	Pb	Ni ²	P ³	Si	S	Sn	Zn
Min./Max.	86.0-89.0	.005	.25	.20	1.0-2.5	1.0	.25	.005	.05	9.0-11.0	.7
Nominal	87.5				1.8					10.0	

- In determining Cu min., Cu may be calculated as Cu + Ni.
- Ni value includes Co.
- For continuous castings, P shall be 1.5%, max.

Note: Cu + Sum of Named Elements, 99.3% min.

APPLICABLE SPECIFICATIONS

Product	Specification
Sand	SAE J462, J461

FABRICATION PROPERTIES

Joining Technique	Suitability
Machinability Rating	45

TYPICAL USES

Fasteners: Lead Screw Nuts

Industrial: Pump Pistons, Steam Fittings, Bushings, Gears, Pump Impellers, Heavy Duty Bearings, Bearings

MECHANICAL PROPERTIES (measured at room temperature, 68° F (20° C))

As Sand Cast

TEMPER	SECTION SIZE	COLD WORK	TYP/ MIN	TEMP	TENSILE STRENGTH	YIELD STRENGTH (0.5% EXT. UNDER LOAD)	YIELD STRENGTH (0.2% OFFSET)	YIELD STRENGTH (0.05% OFFSET)	EL	ROCKWELL HARDNESS				VICKENS HARD.	BRINELL HARD.		SHEAR STRENGTH	FATIGUE STRENGTH*	IZOD IMPACT STRENGTH
										B	C	F	30T		500	3000			
	in.	%		F	ksi	ksi	ksi	ksi	%						500	3000	ksi	ksi	ft-lb
	mm.		C	MPa	MPa	MPa	MPa										MPa	MPa	J
M01	0.0	0	TYP	68	42	21			20						77				0.0
	0.0			20	290	145			20						77				0.0

C93200 Tin Bronze

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

	Cu(1)	Al	Sb	Fe	Pb	Ni(2)	P(3)	Si	S	Sn	Zn
Min./Max.	81.0-85.0	.005	.35	.20	6.0-8.0	1.0	.15	.005	.08	6.3-7.5	1.0-4.0
Nominal	83.0				7.0					6.9	2.5

- In determining Cu min., Cu may be calculated as Cu + Ni.
- Ni value includes Co.
- For continuous castings, P shall be 1.5%, max.

Note: Cu + Sum of Named Elements, 99.0% min

APPLICABLE SPECIFICATIONS

Product	Specification
Sand	ASTM B584, B763, B66 SAE J462, J461

FABRICATION PROPERTIES

Joining Technique	Suitability
Machinability Rating	70

TYPICAL USES

Automotive: Automotive Fittings

Fasteners: Washers

Industrial: Bearings for Cranes, Trunion Bearings, Roll Neck Bearings, Rolling Mill Bearings, Linkage Bushings for Presses, Fuel Pump Bushings, Water Pump Bushings, Diesel Engine Wrist Pin Bushings, Forging Press Toggle Lever Bearings, Hydraulic Press Stuffing Box, Hydraulic Press Main Lining, Insert Bearings, Bearings, Thrust Washers, Pumps, Bushings, Machine Parts, Pump Impellers, General Purpose Bushings, Fittings, Pump Fixtures, Main Spindle Bearings, Machine Tool Bearings

MECHANICAL PROPERTIES (measured at room temperature, 68° F (20° C))

As Sand Cast

TEMPER	SECTION SIZE	COLD WORK	TYP/ MIN	TEMP	TENSILE STRENGTH	YIELD STRENGTH (0.5% EXT. UNDER LOAD)	YIELD STRENGTH (0.2% OFFSET)	YIELD STRENGTH (0.05% OFFSET)	EL	ROCKWELL HARDNESS				VICKENS HARD.	BRINELL HARD.		SHEAR STRENGTH	FATIGUE STRENGTH*	IZOD IMPACT STRENGTH
										B	C	F	30T						
	in.	%		F	ksi	ksi	ksi	ksi	%						500	3000	ksi	ksi	ft-lb
	mm.		C	MPa	MPa	MPa	MPa										MPa	MPa	J
M01	0.0	0	TYP	68	35	18			20						65			16	6.0
	0.0			20	241	124			20						65			110	8.0

C93700 Bearing Bronze

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

	Cu	Al	Sb	Fe ¹	Pb	Ni ²	P ³	Si	S	Sn	Zn
Min./Max.	78.0-82.0	.005	.50	.7	8.0-11.0	.50	.10	.005	.08	9.0-11.0	.8
Nominal	80.0				9.5					10.0	

- Fe shall be .35% max., when used for steel-backed
- Ni value includes Co.
- For continuous castings, P shall be 1.5%, max.

Note: Cu + Sum of Named Elements, 99.0% min.

APPLICABLE SPECIFICATIONS

Product	Specification
Sand	AMS 4842 ASME SB584 ASTM B763, B66, B584, B22 SAE J461, J462

FABRICATION PROPERTIES

Joining Technique	Suitability
Machinability Rating	80

TYPICAL USES

Builders Hardware: Brackets

Fasteners: Washers for Engines, Nuts

Industrial: Crank Shafts, Bushings, Machine Parts, High Speed, Heavy Load Bearings, Pumps, Pressure Tight Castings, Impellers, Corrosion Resistant Castings, Bushings for high speed and heavy pressure, Applications Requiring Acid Resistance to Sulphite Fluids, Bearings, Bearing Plates, Parts for Steel Mill Maintenance, Slide Guides for Steel Mills

Marine: Large Bearings for Ships

MECHANICAL PROPERTIES (measured at room temperature, 68° F (20° C))

As Sand Cast

TEMPER	SECTION SIZE	COLD WORK	TYP/ MIN	TEMP	TENSILE STRENGTH	YIELD STRENGTH (0.5% EXT. UNDER LOAD)	YIELD STRENGTH (0.2% OFFSET)	YIELD STRENGTH (0.05% OFFSET)	EL	ROCKWELL HARDNESS				VICKENS HARD.	BRINELL HARD.		SHEAR STRENGTH	FATIGUE STRENGTH*	IZOD IMPACT STRENGTH	
										B	C	F	30T							ksi
	in.	%		F	ksi	ksi	ksi	ksi	%						500	3000	ksi	ksi	ft-lb	
	mm.		C	MPa	MPa	MPa	MPa										MPa	MPa	J	
M01	0.0	0	TYP	68	35	18	16		20						60			18	13	5.0
	0.0			20	241	124	110		20						60			124	90	7.0

BRASS & BRONZE ALLOYS

C95200 Aluminum Bronze

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

	Cu	Al	Fe
Min./Max.	86.0 min	8.5-9.5	2.5-4.0
Nominal	87.7	9.0	3.3

Note: Cu + Sum of Named Elements, 99.0% min

TYPICAL USES

Electrical: Electrical Hardware

Fasteners: Nuts

Industrial: Pickling Tanks, Mild Alkali Applications, Large Gear Parts, Hydrant Parts, Valve Seats, Hot Mill Guides, Welding Jaws, Pickling Equipment, Worm Wheels, Worms, Valve Bodies, Wear Plates, Thrust Pads, Bearing Liners, Pump Parts, Valves, High Strength Clamps, Acid Resistant Pumps, Bearings, Bushings, Gears, Plungers, Pump Rods

Marine: Marine Hardware, Covers for Marine Hardware, Propellers, Marine Engines

Ordnance: Gun Mountings, Gun Slides

APPLICABLE SPECIFICATIONS

Product	Specification
Sand	ASME SB148 ASTM B763, B148 SAE J461, J462

FABRICATION PROPERTIES

Joining Technique	Suitability
Machinability Rating	20

MECHANICAL PROPERTIES (measured at room temperature, 68° F (20° C))

As Sand Cast

TEMPER	SECTION SIZE	COLD WORK	TYP/ MIN	TEMP	TENSILE STRENGTH	YIELD STRENGTH (0.5% EXT. UNDER LOAD)	YIELD STRENGTH (0.2% OFFSET)	YIELD STRENGTH (0.05% OFFSET)	EL	ROCKWELL HARDNESS				VICKENS HARD.	BRINELL HARD.		SHEAR STRENGTH	FATIGUE STRENGTH*	IZOD IMPACT STRENGTH
										B	C	F	30T		500	3000			
	in.	%		F	ksi	ksi	ksi	ksi	%						500	3000	ksi	ksi	ft-lb
	mm.		C	MPa	MPa	MPa	MPa										MPa	MPa	J
M01	0.0	0	TYP	68	80	27			35						125	40	22	22	30.0
	0.0			20	552	186			35						125	276	152	152	41.0

C95400 Aluminum Bronze

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

	Cu	Al	Fe	Mn	Ni ¹
Min./Max.	83.0 min	10.0-11.5	3.0-5.0	.50	1.5
Nominal	83.2	10.8	4.0		

1. Ni value includes Co.

Note: Cu + Sum of Named Elements, 99.5% min

TYPICAL USES

Automotive: Weld Guns

Fasteners: Nuts, Large Hold Down Screws

Industrial: Pickling Hooks, Bearings, Pawl, Worm Gears, Machine Parts, Spur Gears, Heavily Loaded Worm Gears, Pump Parts, Landing Gear Parts, Valve Bodies, Valve Guides, Valve Seats, Bearing Segments for the Steel Industry, Pressure Blocks for the Steel Industry, High Strength Clamps, Bushings, Valves, Gears

Marine: Ship Building, Covers for Marine Hardware

Ordnance: Government Fittings

APPLICABLE SPECIFICATIONS

Product	Specification
Sand	ASME SB148 ASTM B66, B148, B763 SAE J461, J462

FABRICATION PROPERTIES

Joining Technique	Suitability
Machinability Rating	60

MECHANICAL PROPERTIES (measured at room temperature, 68° F (20° C))

As Sand Cast

TEMPER	SECTION SIZE	COLD WORK	TYP/ MIN	TEMP	TENSILE STRENGTH	YIELD STRENGTH (0.5% EXT. UNDER LOAD)	YIELD STRENGTH (0.2% OFFSET)	YIELD STRENGTH (0.05% OFFSET)	EL	ROCKWELL HARDNESS				VICKENS HARD.	BRINELL HARD.		SHEAR STRENGTH	FATIGUE STRENGTH*	IZOD IMPACT STRENGTH
										B	C	F	30T		500	3000			
	in.	%		F	ksi	ksi	ksi	ksi	%						500	3000	ksi	ksi	ft-lb
	mm.		C	MPa	MPa	MPa	MPa										MPa	MPa	J
M01	0.0	0	TYP	68	85	35			18						170	47	28	28	16.0
	0.0			20	586	241			18						170	324	193	193	22.0

C95500 Aluminum Bronze

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

	Cu	Al	Fe	Mn	Ni ¹
Min./Max	78.0min	10.0-11.5	3.0-5.0	3.5	3.0-5.5
Nominal	80.0	11.0	4.0		4.3

1. Ni value includes Co.

Note: Cu + Sum of Named Elements, 99.5% min.

APPLICABLE SPECIFICATIONS

Product	Specification
Sand	ASTM B148, B763 SAE J461, J462

FABRICATION PROPERTIES

Joining Technique	Suitability
Machinability Rating	50

TYPICAL USES

Builders Hardware: Window Hardware

Consumer: Piano Keys, Musical Instruments

Electrical: Electrical Hardware

Fasteners: Stuffing Box Nuts

Industrial: Pickling Equipment, Valve Guides, Piston Guides, Valve Seats, Pump Fluid Ends, Glands, Worms, Worms Wheels, Hot Mill Guides, Hand Gun Recoil Mechanisms, Landing Gear Parts, Air Craft Components, Wear Plates, Welding Jaws, Landing Gear Parts, Glass Molds, Machine Parts, Sewage Treatment Applications, Valve Components, Bearings, Bushings, Valve Bodies, Gears Marine Marine Applications, Covers for Marine Hardware, Ship Building, Marine Hardware

Ordinance: Government Fittings

MECHANICAL PROPERTIES (measured at room temperature, 68° F (20° C))

As Sand Cast

TEMPER	SECTION SIZE	COLD WORK	TYP/ MIN	TEMP	TENSILE STRENGTH	YIELD STRENGTH (0.5% EXT. UNDER LOAD)	YIELD STRENGTH (0.2% OFFSET)	YIELD STRENGTH (0.05% OFFSET)	EL	ROCKWELL HARDNESS				VICKENS HARD.	BRINELL HARD.		SHEAR STRENGTH	FATIGUE STRENGTH*	IZOD IMPACT STRENGTH
										B	C	F	30T		500	3000			
	in.	%		F	ksi	ksi	ksi	ksi	%								ksi	ksi	ft-lb
	mm.		C	MPa	MPa	MPa	MPa										MPa	MPa	J
M01	0.0	0	TYP	68	100	44			12	87						195	48	31	13.0
	0.0			20	689	303			12	87						195	331	214	18.0

C95800 Aluminum Bronze

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

	Cu	Al	Fe ¹	Pb	Mn	Ni ²	Si
Min./Max.	79.0 min	8.5-9.5	3.5-4.5	.03	.8-1.5	4.0-5.0	.10
Nominal	81.0	9.0	4.0		1.0	4.5	

1. Fe content shall not exceed Ni content.

2. Fe content shall not exceed Ni content. Ni value

Note: Cu + Sum of Named Elements, 99.5% min.

APPLICABLE SPECIFICATIONS

Product	Specification
Sand	ASTM B148, B763 MILITARY ML-B-24480 SAE J461, J462

FABRICATION PROPERTIES

Joining Technique	Suitability
Machinability Rating	20

TYPICAL USES

Fasteners: Nuts

Industrial: Shafts, Machinery, Valve Bodies, Propeller Hub, Worm Wheels, Propeller Blades, Pickling Equipment, Worms, Wear Plates, Gears, Bushings

Marine: Marine Hardware, Valves in contact with sea water, Covers for Marine Hardware, Ship Building

Plumbing: Elbows

MECHANICAL PROPERTIES (measured at room temperature, 68° F (20° C))

As Sand Cast

TEMPER	SECTION SIZE	COLD WORK	TYP/ MIN	TEMP	TENSILE STRENGTH	YIELD STRENGTH (0.5% EXT. UNDER LOAD)	YIELD STRENGTH (0.2% OFFSET)	YIELD STRENGTH (0.05% OFFSET)	EL	ROCKWELL HARDNESS				VICKENS HARD.	BRINELL HARD.		SHEAR STRENGTH	FATIGUE STRENGTH*	IZOD IMPACT STRENGTH
										B	C	F	30T		500	3000			
	in.	%		F	ksi	ksi	ksi	ksi	%								ksi	ksi	ft-lb
	mm.		C	MPa	MPa	MPa	MPa										MPa	MPa	J
M01	0.0	0	TYP	68	95	38			25							159	58	31	20.0
	0.0			20	655	262			25							159	400	214	27.0

BRASS & BRONZE ALLOYS

C97600 Nickel Silver

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

	Cu	Al	Sb	Fe	Pb	Mn	Ni ¹	P	Si	S	Sn	Zn
Min./Max.	63.0-67.0	.005	.25	1.5	3.0-5.0	1.0	19.0-21.5	.05	.15	.08	3.5-4.5	3.0-9.0
Nominal	65.0				4.0		20.3				4.0	6.0

1. Ni value includes Co.

Note: Cu + Sum of Named Elements, 99.7% min

TYPICAL USES

Architecture: Ornamental Castings

Builders Hardware: Window Hardware, Door Hardware for Prison Doors, Hardware

Consumer: Piano Keys

Industrial: Valves, Pumps

Marine: Marine Furniture

Plumbing: Sanitary Fittings

APPLICABLE SPECIFICATIONS

Product	Specification
Sand	ASME SB584 ASTM B584, B763

FABRICATION PROPERTIES

Joining Technique	Suitability
Machinability Rating	70

MECHANICAL PROPERTIES (measured at room temperature, 68° F (20° C))

As Sand Cast

TEMPER	SECTION SIZE	COLD WORK	TYP/ MIN	TEMP	TENSILE STRENGTH	YIELD STRENGTH (0.5% EXT. UNDER LOAD)	YIELD STRENGTH (0.2% OFFSET)	YIELD STRENGTH (0.05% OFFSET)	EL	ROCKWELL HARDNESS				VICKENS HARD.	BRINELL HARD.		SHEAR STRENGTH	FATIGUE STRENGTH*	IZOD IMPACT STRENGTH
										B	C	F	30T		500	3000			
	in.	%		F	ksi	ksi	ksi	ksi	%						500	3000	ksi	ksi	ft-lb
	mm.		C	MPa	MPa	MPa	MPa										MPa	MPa	J
M01	0.0	0	TYP	68	45	24			20						80			16	0.0
	0.0			20	310	165			20						80			107	0.0

C99500 NDZ-S

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

	Cu	Al	Fe	Pb	Mn	Ni	Si	Zn
Min./Max.	Rem.	.50-2.0	3.0-5.0	.09	.50	3.5-5.5	.50-2.0	.50-2.0
Nominal	88.9	1.3	4.0			4.5	1.3	1.3

Note: Cu + Sum of Named Elements, 99.7% min.

TYPICAL USES

Electrical: Electrical Parts

Industrial: Valve Stems, Gears for Mining Equipment, Propeller Wheels

Marine: Outboard Marine Components

APPLICABLE SPECIFICATIONS

Product	Specification
Sand	ASTM B763

FABRICATION PROPERTIES

Joining Technique	Suitability
Machinability Rating	50

MECHANICAL PROPERTIES (measured at room temperature, 68° F (20° C))

As Sand Cast

TEMPER	SECTION SIZE	COLD WORK	TYP/ MIN	TEMP	TENSILE STRENGTH	YIELD STRENGTH (0.5% EXT. UNDER LOAD)	YIELD STRENGTH (0.2% OFFSET)	YIELD STRENGTH (0.05% OFFSET)	EL	ROCKWELL HARDNESS				VICKENS HARD.	BRINELL HARD.		SHEAR STRENGTH	FATIGUE STRENGTH*	IZOD IMPACT STRENGTH
										B	C	F	30T		500	3000			
	in.	%		F	ksi	ksi	ksi	ksi	%						500	3000	ksi	ksi	ft-lb
	mm.		C	MPa	MPa	MPa	MPa										MPa	MPa	J
M01	0.0	0	TYP	68											145	50			0.0
	0.0			20											145	50			0.0
TF00	0.0	0	TYP	68	86	62			8						196				0.0
	0.0			20	593	427			8						196				0.0
M01	0.0	0	S MIN	68	70	40			12										0.0
	0.0			20	483	276			12										0.0

C89520 SeBiLOY II – EnviroBrass II

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

	Cu	Al	Sb	Bi ¹	Fe	Pb	Ni ²	P	Se ³	Si	S	Sn	Zn
Min./Max.	85.0-87.0	.005	.25	1.6-2.2	.20	.09	1.0	.05	.8-1.1	.005	.08	5.0-6.0	4.0-6.0
Nominal	86.0			1.9					.95			5.5	5.0

1. Bi:Se >= 2:1
2. Ni value includes Co.
3. Bi:Se >= 2:1

Note: Cu + Sum of Named Elements, 99.5% min.

TYPICAL USES

Plumbing: Plumbing Castings

APPLICABLE SPECIFICATIONS

Product	Specification
Sand	ASTM B584

FABRICATION PROPERTIES

Joining Technique	Suitability
Machinability Rating	85

MECHANICAL PROPERTIES (measured at room temperature, 68° F (20° C))

As Sand Cast

TEMPER	SECTION SIZE	COLD WORK	TYP/ MIN	TEMP	TENSILE STRENGTH	YIELD STRENGTH (0.5% EXT. UNDER LOAD)	YIELD STRENGTH (0.2% OFFSET)	YIELD STRENGTH (0.05% OFFSET)	EL	ROCKWELL HARDNESS				VICKENS HARD.	BRINELL HARD.		SHEAR STRENGTH	FATIGUE STRENGTH*	IZOD IMPACT STRENGTH
										B	C	F	30T						
	in.	%		F	ksi	ksi	ksi	ksi	%						500	3000	ksi	ksi	ft-lb
	mm.		C	MPa	MPa	MPa	MPa										MPa	MPa	J
M01	0.0	0	TYP	68	31	21			10						54				0.0
	0.0			20	210	140			10						54				0.0

C89833 Federalloy

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

	Cu	Al	Sb	Bi	Fe	Pb	Ni ¹	P	Si	S	Sn	Zn
Min./Max.	86.0-91.0	.005	.25	1.7-2.7	.30	.09	1.0	.050	.005	.08	4.0-6.0	2.0-6.0
Nominal	89.0			2.2							5.0	3.0

- 1.Ni value includes Co.

Note: Cu + Sum of Named Elements, 99.3% min.

TYPICAL USES

Industrial: Pumps, Corrosion Resistant, Pressure Tight Castings, Impellers

FABRICATION PROPERTIES

Joining Technique	Suitability
Machinability Rating	81

MECHANICAL PROPERTIES (measured at room temperature, 68° F (20° C))

As Sand Cast

TEMPER	SECTION SIZE	COLD WORK	TYP/ MIN	TEMP	TENSILE STRENGTH	YIELD STRENGTH (0.5% EXT. UNDER LOAD)	YIELD STRENGTH (0.2% OFFSET)	YIELD STRENGTH (0.05% OFFSET)	EL	ROCKWELL HARDNESS				VICKENS HARD.	BRINELL HARD.		SHEAR STRENGTH	FATIGUE STRENGTH*	IZOD IMPACT STRENGTH
										B	C	F	30T						
	in.	%		F	ksi	ksi	ksi	ksi	%						500	3000	ksi	ksi	ft-lb
	mm.		C	MPa	MPa	MPa	MPa										MPa	MPa	J
M01	0.0	0	TYP	68	37	17			28						60				12.0
	0.0			20	258	119			28						60				16.4

BRASS & BRONZE ALLOYS

C87850 Silicon Brass

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

	Cu ¹	Sb	Fe	Pb	Mn	Ni ²	P	Si	Sn	Zn
Min./Max.	75.0-78.0	.10	.10	.09	.10	.20	.05-.20	2.7-3.4	.30	Rem.
Nominal	76.0						.12	3.0		20.9

1. Cu value includes Ag.

2. Ni value includes Co.

Note: Cu + Sum of Named Elements, 99.5% min.

TYPICAL USES

Industrial: Valve Bodies for Water

Marine: Marine Products

Plumbing: Plumbing Fittings, Faucets, Water Meter Cases

APPLICABLE SPECIFICATIONS

Product	Specification
Sand	ASTM 584

FABRICATION PROPERTIES

Joining Technique	Suitability
Machinability Rating	70

MECHANICAL PROPERTIES (measured at room temperature, 68° F (20° C))

As Sand Cast

TEMPER	SECTION SIZE	COLD WORK	TYP/ MIN	TEMP	TENSILE STRENGTH	YIELD STRENGTH (0.5% EXT. UNDER LOAD)	YIELD STRENGTH (0.2% OFFSET)	YIELD STRENGTH (0.05% OFFSET)	EL	ROCKWELL HARDNESS				VICKENS HARD.	BRINELL HARD.		SHEAR STRENGTH	FATIGUE STRENGTH*	IZOD IMPACT STRENGTH
										B	C	F	30T		500	3000			
	in.	%		F	ksi	ksi	ksi	ksi	%						500	3000	ksi	ksi	ft-lb
	mm.		C	MPa	MPa	MPa	MPa										MPa	MPa	J
M01	0.0	0	TYP	68	63	26			25	78									0.0
	0.0			20	434	179			25	78									0.0

319.0

formerly 319, Allcast

NOMINAL CHEMICAL COMPOSITION

Cu	Si	Mg	Zn
3.5	6.0	.10	1.0

MECHANICAL PROPERTIES (measured at room temperature, 68° F (20° C))

TEMPER	ULTIMATE TENSILE (KSI)	YIELD STRENGTH (KSI)	ELONGATION % IN 2 IN	COMPRESSIVE YIELD (KSI)	BRINELL HARDNESS 10MM 500KG	SHEARING STRENGTH (KSI)	ENDURANCE LIMIT (KSI)
T62	41	32	2.0	34	90	33	8.0
T7	39	26	6.0		65		
F	27	18	2.0	19	70	22	10.0

CHARACTERISTICS

PRESSURE	TIGHTNESS STRENGTH AT ELEVATED TEMP	CORROSION RESISTANCE
2	3	3

356.0

formerly 356

NOMINAL CHEMICAL COMPOSITION

Cu	Si	Mg	Zn
.25	7.0	.3	.35

MECHANICAL PROPERTIES (measured at room temperature, 68° F (20° C))

TEMPER	ULTIMATE TENSILE (KSI)	YIELD STRENGTH (KSI)	ELONGATION % IN 2 IN	COMPRESSIVE YIELD (KSI)	BRINELL HARDNESS 10MM 500KG	SHEARING STRENGTH (KSI)	ENDURANCE LIMIT (KSI)
T51	25	20	2.0	21	60	20	7.5
T6	33	24	3.5	25	70	26	8.5
T7	34	30	2.0	31	75	24	9.0

CHARACTERISTICS

PRESSURE	TIGHTNESS STRENGTH AT ELEVATED TEMP	CORROSION RESISTANCE
1	3	2

535.0

formerly Almag 35

NOMINAL CHEMICAL COMPOSITION

Cu	Si	Mg	Zn	Be
.05	.15	6.9		.005

MECHANICAL PROPERTIES (measured at room temperature, 68° F (20° C))

TEMPER	ULTIMATE TENSILE (KSI)	YIELD STRENGTH (KSI)	ELONGATION % IN 2 IN	COMPRESSIVE YIELD (KSI)	BRINELL HARDNESS 10MM 500KG	SHEARING STRENGTH (KSI)	ENDURANCE LIMIT (KSI)
F	40	20	13	35	70	27	10

CHARACTERISTICS

PRESSURE	TIGHTNESS STRENGTH AT ELEVATED TEMP	CORROSION RESISTANCE
5	3	1



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