

Reference Guide



Reference Guide

Fifth edition

wieland
concast

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Manufactured in the United States of America

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Introduction

Since its inception almost 15 years ago, the Wieland Contact Reference Guide has become one of the industry's most trusted technical companions. This comprehensive resource is a living document that continues to capture the collective expertise of hundreds of dedicated professionals from across the industry, creating an indispensable reference that our customers, employees, and partners rely on daily.

The Wieland Concast Reference Guide is a comprehensive technical resource that provides detailed information about copper alloys. Organized into three primary sections – continuous cast, extruded or cast-and-drawn, and lead-free replacement products, the guide precisely identifies each alloy by its UNS number. In addition to its technical specifications, the manual offers insight into Wieland Concast, exploring our history, manufacturing philosophy, casting methods, inventory management, and quality standards. A dedicated section on product tolerances provides an in-depth look at manufacturing precision, and the complete catalog of standard-stocked product sizes ensures engineers and technical professionals have easy access to the information they need.

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Overview

Wieland Concast

As a premier manufacturer of specialty continuous-cast copper alloys, Wieland Concast leverages technology innovation, quality control, and superior customer care to maintain its reputation as a market leader and trusted partner across industries.

Rich history

Wieland Concast is the trusted single-source supplier for customers seeking precision-engineered copper alloys in bars, rods, tubes, rectangles, and custom sizes. Our legacy of innovation began in 1891 as Concast Metal Products Co., producing brass and bronze ingots in Pittsburgh, Pennsylvania. In 1960, we introduced continuous-cast manufacturing, and by 1990, we expanded into copper alloys. The 1995 acquisition of our Birmingham, Ohio, facility added aluminum bronze and manganese bronze to our portfolio. In 2024, we became part of Wieland, strengthening our commitment to quality and innovation.



Our facilities

Wieland Concast maintains the largest inventory of standard-stocked, continuous-cast copper alloys in North America. This inventory of more than 1,100 sizes serves a wide range of industries and end-use applications.

Our Birmingham, Ohio, distribution center is a modern, 70,000-sq.-ft., resource-efficient warehouse. It is located near the Ohio Turnpike and is open six days a week.

Our Birmingham location is also home to our horizontal continuous-casting production operation and our sales and marketing teams. Our Mars, Pennsylvania, plant houses our vertical continuous-casting operation and our administrative offices.

Our philosophy

Wieland Concast became a market leader by adopting a simple yet effective strategy – we listen to our customers. From initial inquiry to product delivery, our customer-centric approach has been at the heart of everything we do. Our team of metallurgists, chemists, engineers, sales professionals, and service specialists work closely together to address customer needs at every stage. Each account is personally managed by a qualified inside technical sales representative to ensure the highest level of service. Our on-site quality control lab ensures that every product meets or exceeds standards before it leaves our facility. When customers request custom alloys or sizes, we respond quickly, delivering solutions tailored to their exact specifications.

Our markets

Wieland Concast sells its products through major metal distributors across North America and Europe as well as original equipment manufacturers and contract machine shops. Our alloys are integral to a number of industries, including oil and gas, energy, aerospace and aviation, power transmission, transportation, military and defense, heavy equipment, plumbing and fluid management, and hydraulics.

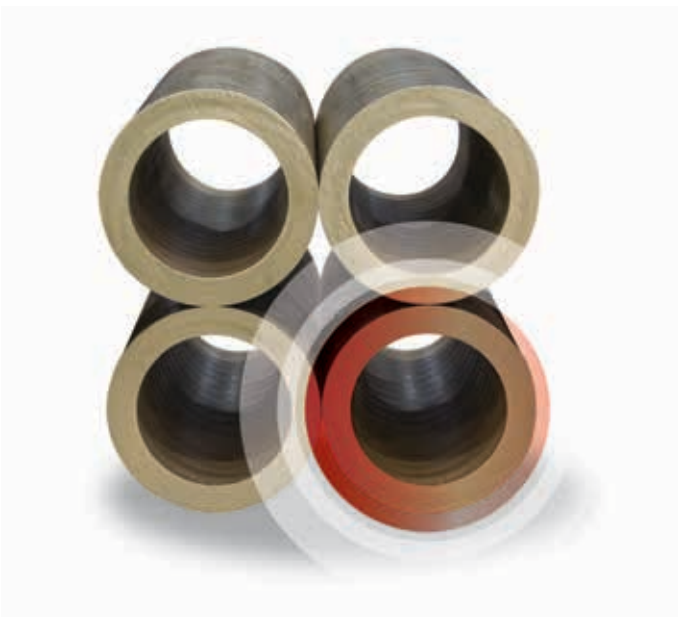
Quality

Our team of dedicated professionals at Wieland Concast is committed to delivering the highest-quality products at a fair value, consistently exceeding our customers' expectations. Our Quality Management System drives our commitment to excellence and continuous improvement.

Our Quality Policy – based on the criteria outlined in ISO 9001 and AS9100 industry standards – promotes and ensures the consistent delivery of superior products by enforcing strict adherence to these specifications.

Certifications

As an ISO 9001-certified manufacturer, we are recognized as the leading producer of continuous-cast copper alloys for customers who value quality as much as we do. We are also AS9100 certified to meet aerospace industry standards. Focused on staying ahead of market trends, we evolve to meet growing demands for product diversity, higher quality, and eco-friendly solutions. Our investments in cutting-edge equipment, advanced product engineering, and comprehensive before- and after-sales support ensure exceptional service.



Casting methods

Vertical continuous casting

Vertical continuous casting has been a cornerstone of Wieland Concast's production for over 30 years. In this process, molten metal flows into a water-cooled die at the bottom of the crucible, where it solidifies. The cast product then moves smoothly downward through rollers beneath the die. With precise temperature control, the rollers carefully withdraw the metal to maintain its grain structure and metallurgical properties.

Horizontal continuous casting

Horizontal continuous casting is ideal for aluminum bronzes, given the material's unique metallurgy. As a result, our Birmingham plant specializes heavily on aluminum bronze production. In this process, molten metal flows from the crucible into a water-cooled die, where it solidifies. Drive rollers then pull the bar along roller tables that support its weight during casting. With precise temperature control, we achieve the desired grain structure and metallurgical properties.

Standard-stocked alloys			
Continuous-cast		Extruded or cast and drawn	
C86300	C89835	C14500	C51000
C90300	C93200	C54400	C63000
C95400	C95500	C63020	C64200
C95510	C95900	C67300	C72900

Inventory

Wieland Concast offers a comprehensive range of stocked and custom-made continuous-cast, extruded, and cast-and-drawn copper alloy products to meet the diverse needs of our customers. Whether you require standard sizes or specialized alloys, we deliver tailored solutions that guarantee exceptional quality, performance, and reliability. (For detailed technical information, please refer to your specific requirement within our Reference Guide.)

In addition, we produce a full line of GreenAlloys™, many of which comply with key regulations, including the Federal Safe Drinking Water Act (SDWA), the Federal Reduction of Lead in Drinking Water Act (S. 3874), California AB1953, and Vermont Act 193. Several of our alloys are also NSF/ANSI/CAN 61-2022 compliant.



Our locations

Mars, Pennsylvania

Our Mars, Pennsylvania, location houses our vertical continuous casting production operation. This facility is located 30 miles north of Pittsburgh and contains our administrative offices.

P +1 724 538 4000 | sales.concast@wieland.com | concast.com



Birmingham, Ohio

Our production facility in Birmingham, Ohio, is located 30 miles west of Cleveland. This location is the site for our vertical continuous casting production as well as our shipping, receiving, and sales and marketing operations.

P +1 440 965 4455 | sales.concast@wieland.com | concast.com



Continuous-cast products

Continuous-cast products

Standard-stocked alloys include C86300, C89835, C90300, C93200, C95400, C95500, AMS 4880–95510, and C95900. When Concast customers request special alloys and special sizes, we respond with products designed to meet their exacting specifications.

We offer special alloys, shapes, and sizes in the ASTM B505, 800, and 900 series specifications. Almost any extruded shape profile can be produced using continuous-cast technology. Wieland Concast can also supply centrifugals up to 30". Custom tubes, rectangles, and unique shapes can be continuous cast to within .005" tolerance in sizes ranging from 0.5" to 16" and cut to custom lengths.

Wieland
Concast offers
a complete
line of
stocked and
custom-made
products.

Product descriptions

Leaded red brass

This group of alloys is typically found in plumbing applications. The most widely used alloy in this family is C84400 leaded semi-red brass is known for reasonable cost with good machining and casting properties. The lead content ensures pressure tightness. Red brass is also used for low-cost bearing materials under low loads.

C83600	C84200	C84800
C83800	C84400	C85700

Leaded tin bronze

The lead content in these alloys is between 7 percent and 15 percent. High-leaded tin bronzes are free cutting and retain favorable thermal conductivity and good lubricity due to the lead content. Alloy C93200 is considered this family's workhorse alloy and is widely used in many bearing applications.

C92200	C92700	C93200
C92300	C92800	

Manganese bronze

Manganese bronzes can operate under very high loads and speeds. Besides excellent mechanical qualities, these alloys have good corrosion resistance. The standard alloy in this group is high tensile C86300, which is comprised of copper, manganese, aluminum, and iron. This combination raises the tensile strength to over 110,000 ksi.

C86200	C86300	C86500
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Aluminum bronze

Aluminum bronze is the highest strength standard copper-based alloy. Wieland Concast produces C95400, C95500, AMS 4880-C95510, and C95900 aluminum bronze alloys as standard-stocked products in standard sizes of rounds, tubes, and rectangles. Aluminum, in conjunction with iron and nickel, acts as a strengthener in these alloys. All of the aluminum bronzes can be heat treated, further increasing tensile strengths.

C95200	C95500	C95900
C95300	C95510	
C95400	C95520HT	
C95410	C95800	

Product descriptions continued

High tin bronze

High tin bronze alloys are typically found in gear, high-strength bushing and bearing applications where high strength, low speeds, and heavy loads are present. Other high-strength applications for these alloys are pump impellers, piston rings, steam fittings, and valve bodies. High tin bronze castings are utilized in movable bridge components, turntables for bridges, and other structures for fixed and expansion bearings with slow or intermittent movement and heavy loads.

C90300	C90810	C91600
C90500	C91000	C91700
C90700	C91100	
C90800	C91300	

Nickel silver bronze

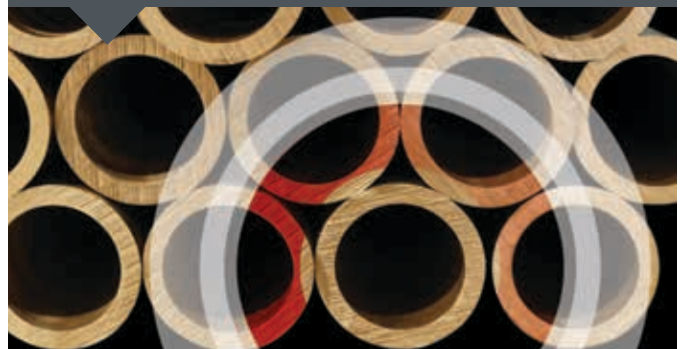
Nickel silvers are alloys that contain copper, nickel, and zinc. Also called nickel brasses, the silver refers to their attractive silver shine. The nickel silvers have moderately high strength and good corrosion resistance. Nickel silver bronze alloys consist of copper, tin, lead, zinc, and nickel. They have low to moderate strength and good corrosion resistance. They are used in food and beverage handling equipment, decorative hardware, electroplated tableware, optical and photographic equipment, and musical instruments. The alloys are UNS C97300 to C97800.

C97300	C97600	C97800
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Common continuous-cast alloys

- C83600
- C83800
- C84200
- C84400
- C84800
- C85700
- C86200
- C86300
- C86400
- C86500
- C86700
- C87850
- C89320
- C89325
- C89520
- C89831
- C89833
- C89835
- C89844
- C90300
- C90500
- C90700
- C90800
- C90810
- C91000
- C91100
- C91300
- C91600
- C91700
- C92200
- C92300
- C92500
- C92700
- C92800
- C92900
- C93200
- C93400
- C93500
- C93600
- C93700
- C93800
- C93900
- C94000
- C94100
- C94300
- C94700*
- C94800
- C95200
- C95300*
- C95400*
- C95410*
- C95500*
- C95510
- C95520HT
- C95600
- C95800
- C95900
- C96400
- C96900HT
- C97300
- C97600
- C97800
- C99500

*Also available in heat-treated condition.



Continuous-cast product list

Common continuous-cast products, product forms, and size ranges

Copper alloy UNS no.	Product description	Solid bar stock		Tubes		Rectangles	
		Avail.	Size range	Avail.	Size range	Avail.	Size range
C83600	Leaded red brass	X	1/2" to 13" O.D.	X	1" to 16" O.D.	X	Up to 20"
C83800	Leaded red brass	X	1/2" to 13" O.D.	X	1" to 16" O.D.	X	Up to 20"
C84200	Leaded semi-red brass	X	1/2" to 13" O.D.	X	1" to 16" O.D.	X	Up to 20"
C84400	Leaded semi-red brass	X	1/2" to 13" O.D.	X	1" to 16" O.D.	X	Up to 20"
C84800	Leaded semi-red brass	X	1/2" to 13" O.D.	X	1" to 16" O.D.	X	Up to 20"
C85700	Leaded yellow brass	X	1/2" to 13" O.D.	X	1-1/8" to 9" O.D.	X	Up to 15"
C86200	Manganese bronze	X	1/2" to 9" O.D.	X	1-1/8" to 9" O.D.	X	Up to 15"
C86300*	Manganese bronze	X	1/2" to 9" O.D.	X	1-1/8" to 9" O.D.	X	Up to 15"
C86400	Manganese bronze	X	1/2" to 9" O.D.	X	1-1/8" to 9" O.D.	X	Up to 15"
C86500	Manganese bronze	X	1/2" to 9" O.D.	X	1-1/8" to 9" O.D.	X	Up to 15"
C86700	Manganese bronze	X	1/2" to 9" O.D.	X	1-1/8" to 9" O.D.	X	Up to 15"
C87850	Silicon brass	X	Consult mill	X	Consult mill	X	Consult mill
C89320	Bismuth tin bronze	X	1/2" to 10" O.D.	X	1-1/8" to 9" O.D.	X	Up to 15"
C89325	Bismuth tin bronze	X	1/2" to 10" O.D.	X	1-1/8" to 9" O.D.	X	Up to 15"
C89520	Bismuth tin bronze	X	1/2" to 10" O.D.	X	1-1/8" to 9" O.D.	X	Up to 15"
C89831	Bismuth tin bronze	X	1/2" to 10" O.D.	X	1-1/8" to 9" O.D.	X	Up to 15"
C89833	Bismuth tin bronze	X	1/2" to 10" O.D.	X	1-1/8" to 9" O.D.	X	Up to 15"
C89835*	Bismuth tin bronze	X	1/2" to 10" O.D.	X	1-1/8" to 9" O.D.	X	Up to 15"
C89844	Bismuth tin bronze	X	1/2" to 10" O.D.	X	1-1/8" to 9" O.D.	X	Up to 15"
C90300*	Tin bronze	X	1/2" to 10" O.D.	X	1" to 16" O.D.	X	Up to 20"
C90500	Tin bronze	X	1/2" to 10" O.D.	X	1" to 16" O.D.	X	Up to 20"
C90700	Tin bronze	X	1/2" to 10" O.D.	X	1" to 16" O.D.	X	Up to 20"
C90800	Tin bronze	X	1" to 6" O.D.	X	1" to 6" O.D.	X	Up to 10"
C90810	High tin bronze	X	1" to 6" O.D.	X	1" to 6" O.D.	X	Up to 10"
C91000	Tin bronze	X	1" to 6" O.D.	X	1" to 6" O.D.	X	Up to 10"
C91100	High tin bronze	X	1" to 6" O.D.	X	1" to 6" O.D.	X	Up to 10"
C91300	Tin bronze	X	1" to 6" O.D.	X	1" to 6" O.D.	X	Up to 10"
C91600	High tin bronze	X	1" to 6" O.D.	X	1" to 6" O.D.	X	Up to 10"
C91700	High tin bronze	X	1" to 6" O.D.	X	1" to 6" O.D.	X	Up to 10"
C92200	Leaded tin bronze	X	1/2" to 13" O.D.	X	1" to 16" O.D.	X	Up to 20"
C92300	Leaded tin bronze	X	1/2" to 13" O.D.	X	1" to 16" O.D.	X	Up to 20"
C92500	Nickel-phosphor bronze	X	1/2" to 13" O.D.	X	1" to 16" O.D.	X	Up to 20"
C92700	Leaded tin bronze	X	1/2" to 13" O.D.	X	1" to 16" O.D.	X	Up to 20"
C92800	Leaded tin bronze	X	1/2" to 13" O.D.	X	1" to 16" O.D.	X	Up to 20"
C92900	Leaded nickel-tin bronze	X	1/2" to 13" O.D.	X	1" to 16" O.D.	X	Up to 20"
C93200*	Leaded tin bronze	X	1/2" to 13" O.D.	X	1" to 16" O.D.	X	Up to 20"
C93400	High-leaded tin bronze	X	1/2" to 13" O.D.	X	1" to 16" O.D.	X	Up to 20"

*Standard-stocked alloy.

Please consult mill for minimum I.D., minimum thickness, and minimum wall thickness.

Continuous-cast product list continued

Copper alloy UNS no.	Product description	Solid bar stock		Tubes		Rectangles	
		Avail.	Size range	Avail.	Size range	Avail.	Size range
C93500	High-leaded tin bronze	X	1/2" to 13" O.D.	X	1" to 16" O.D.	X	Up to 20"
C93600	High-leaded tin bronze	X	1/2" to 13" O.D.	X	1" to 16" O.D.	X	Up to 20"
C93700	High-leaded tin bronze	X	1/2" to 10" O.D.	X	1" to 16" O.D.	X	Up to 20"
C93800	High-leaded tin bronze	X	1/2" to 10" O.D.	X	1" to 16" O.D.	X	Up to 20"
C93900	High-leaded tin bronze	X	1/2" to 10" O.D.	X	1" to 16" O.D.	X	Up to 20"
C94000	High-leaded tin bronze	X	1/2" to 10" O.D.	X	1" to 16" O.D.	X	Up to 10"
C94100	High-leaded tin bronze	X	1/2" to 10" O.D.	X	1" to 16" O.D.	X	Up to 10"
C94300	High-leaded tin bronze	X	1/2" to 10" O.D.	X	1" to 16" O.D.	X	Up to 10"
C94700	Nickel-tin bronze	X	1/2" to 10" O.D.	X	1" to 16" O.D.	X	Up to 20"
C94700HT	Nickel-tin bronze	X	1/2" to 10" O.D.	X	1" to 16" O.D.	X	Up to 20"
C94800	Leaded nickel-tin bronze	X	1/2" to 10" O.D.	X	1" to 16" O.D.	X	Up to 20"
C95200	Aluminum bronze	X	1/2" to 9" O.D.	X	1-1/8" to 9" O.D.	X	Up to 15"
C95300	Aluminum bronze	X	1/2" to 9" O.D.	X	1-1/8" to 9" O.D.	X	Up to 15"
C95300HT	Aluminum bronze	X	1/2" to 9" O.D.	X	1-1/8" to 9" O.D.	X	Up to 15"
C95400*	Aluminum bronze	X	1/2" to 9" O.D.	X	1-1/8" to 9" O.D.	X	Up to 15"
C95400HT	Aluminum bronze	X	1/2" to 9" O.D.	X	1-1/8" to 9" O.D.	X	Up to 15"
C95410	Aluminum bronze	X	1/2" to 9" O.D.	X	1-1/8" to 9" O.D.	X	Up to 15"
C95410HT	Aluminum bronze	X	1/2" to 9" O.D.	X	1-1/8" to 9" O.D.	X	Up to 15"
C95500*	Nickel-aluminum bronze	X	1/2" to 9" O.D.	X	1-1/8" to 9" O.D.	X	Up to 15"
C95500HT	Nickel-aluminum bronze	X	1/2" to 9" O.D.	X	1-1/8" to 9" O.D.	X	Up to 15"
C95510*	Nickel-aluminum bronze	X	1/2" to 9" O.D.	X	1-1/8" to 13" O.D.	X	Up to 15"
C95520HT	Nickel-aluminum bronze	X	1/2" to 9" O.D.	X	1-1/8" to 9" O.D.	X	Up to 15"
C95600	Nickel-aluminum bronze	X	1/2" to 9" O.D.	X	1-1/8" to 9" O.D.	X	Up to 15"
C95800	Nickel-aluminum bronze	X	1/2" to 9" O.D.	X	1-1/8" to 9" O.D.	X	Up to 15"
C95900*	Aluminum bronze	X	1" to 5" O.D.		Consult mill	X	Up to 7"
CONCAST380	Aluminum bronze	X	1" to 5" O.D.			X	Up to 10"
C96400	Copper-nickel	X	1/2" to 9" O.D.	X	1-1/8" to 9" O.D.	X	Up to 15"
C96900HT	Copper-nickel	X	1/2" to 9" O.D.	X	1-1/8" to 9" O.D.	X	Up to 15"
C97300	Nickel silver bronze	X	3/4" to 9" O.D.	X	1-1/8" to 9" O.D.	X	Up to 14"
C97600	Nickel silver bronze	X	3/4" to 9" O.D.	X	1-1/8" to 9" O.D.	X	Up to 14"
C97800	Nickel silver bronze	X	3/4" to 9" O.D.	X	1-1/8" to 9" O.D.	X	Up to 14"
C99500	Special alloy	X	1/2" to 9" O.D.	X	1-1/8" to 9" O.D.	X	Up to 14"

*Standard-stocked alloy.

Please consult mill for minimum I.D., minimum thickness, and minimum wall thickness.

All alloys also available as near-net shape, solid hex bar, and hex tube except Concast380 which is not available as hex tube.

C83600

Continuous cast

Product description	Leaded red brass
Solids	1/2" to 13" O.D.
Tubes	1" to 16" O.D.
Rectangles	Up to 20"
Standard lengths	144"
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar

Typical uses

Architecture

Ornamental fixtures

Builders hardware

Hardware

Building

Cooling equipment, heating equipment, lightning protection, trowels for cement working

Electrical

Electrical equipment, electrical hardware, switches

Fasteners

Large hold-down screws

Industrial

Air actuators, bearing segments for steel industry, bearings, bushings, couplings, furnaces, handles for dental equipment, impellers, low pressure valves, pressure blocks for steel industry, printing presses, pump fixtures, pump parts, pumps, rings, small gears, transducer housings, valve bodies, valve bodies for the water meter industry, valves, valves for the water meter industry

Marine

Marine products, parts for boats

Plumbing

Faucets, fixtures, pipe fittings

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C83600	B505 B505M B271 B271M B62	J461 J462	4855	WW-P-460 WW-U-516	MIL-C-11866 MIL-V-18436	Ounce metal

Chemical composition

Cu (%) ¹	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%)	Ni (%) ^{1,2}	Al (%)	S (%)	Sb (%)	Si (%)
84.00-86.00	4.00-6.00	4.00-6.00	4.00-6.00	0.30	1.50	1.00	0.005	0.08	0.25	0.005

Chemical composition according to ASTM B505/B505M-23

¹In determining Cu min., Cu may be calculated as Cu + Ni.
Note: Single values represent maximums.

²Ni value includes Co.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 °F)
C83600	84	0.318

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
36	248	19	131	15	60	

Mechanical properties according to ASTM B505/B505M-23

Physical properties

	US customary	Metric
Melting point – liquidus	1850 °F	1010 °C
Melting point – solidus	1570 °F	854 °C
Density	0.318 lb/in ³ at 68 °F	8.83 gm/cm ³ at 20 °C
Specific gravity	8.83	8.83
Electrical conductivity	15% IACS at 68 °F	0.087 MegaSiemens/cm at 20 °C
Thermal conductivity	41.6 Btu/sq ft/ft hr/°F at 68 °F	72 W/m at 20 °C
Coefficient of thermal expansion 68-392	10 · 10 ⁻⁶ per °F (68-392 °F)	17.3 · 10 ⁻⁶ per °C (20-200 °C)
Specific heat capacity	0.090 Btu/lb/°F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	13500 ksi	93100 MPa
Magnetic permeability	1	1

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Excellent
Brazing*	Good
Oxyacetylene welding	Not recommended
Gas shielded arc welding	Not recommended
Coated metal arc welding	Fair
Machinability rating	84

Fabrication properties provided by CDA

*Since brazing is performed within the hot-short range, strain must be avoided during brazing and cooling.

Casting characteristics

Casting attribute	Level
Casting yield	High
Drossing	Low
Effect of section size	High
Fluidity	Medium
Gassing	Medium
Patternmakers shrinkage (inches per foot)	3/16
Shrinkage in solidification	Medium
Shrinkage during freezing	Medium

Casting characteristics provided by CDA

C83800

Continuous cast

Product description	Leaded red brass
Solids	1/2" to 13" O.D.
Tubes	1" to 16" O.D.
Rectangles	Up to 20"
Standard lengths	144"
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar

Typical uses

Builders hardware

Hardware

Electrical

Electrical components, switches

Industrial

Air/gas/water fittings, bushings, pump fixtures, railroad catenary fittings, valves

Plumbing

Plumbing fixtures

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C83800	B505 B505M B271 B271M B584	J461 J462		WW-U-516		Hydraulic bronze

Chemical composition

Cu (%) ¹	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%)	Ni (%) ^{1,2}	Al (%)	S (%)	Sb (%)	Si (%)
82.00-83.80	5.00-7.00	3.30-4.20	5.00-8.00	0.30	1.50	1.00	0.005	0.08	0.25	0.005

Chemical composition according to ASTM B505/B505M-23

¹In determining Cu min., Cu may be calculated as Cu + Ni.
Note: Single values represent maximums.

²Ni value includes Co.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 ° F)
C83800	90	0.312

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
30	207	15	97	16	60	

Mechanical properties according to ASTM B505/B505M-23

Physical properties

	US customary	Metric
Melting point – liquidus	1840 °F	1004 °C
Melting point – solidus	1550 °F	843 °C
Density	0.312 lb/in ³ at 68 °F	8.64 gm/cm ³ at 20 °C
Specific gravity	8.64	8.64
Electrical conductivity	15% IACS at 68 °F	0.087 MegaSiemens/cm at 20 °C
Thermal conductivity	41.8 Btu/sq ft/ft hr/°F at 68 °F	72.4 W/m at 20 °C
Coefficient of thermal expansion 68-392	10 · 10 ⁻⁶ per °F (68-392 °F)	17.3 · 10 ⁻⁶ per °C (20-200 °C)
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	13300 ksi	91700 MPa
Magnetic permeability	1	1

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Excellent
Brazing	Good
Oxyacetylene welding	Not recommended
Gas shielded arc welding	Not recommended
Coated metal arc welding	Fair
Machinability rating	90

Fabrication properties provided by CDA

Casting characteristics

Casting attribute	Level
Casting yield	High
Drossing	Low
Effect of section size	High
Fluidity	Medium
Gassing	Medium
Patternmakers shrinkage (inches per foot)	3/16
Shrinkage in solidification	Medium

Casting characteristics provided by CDA

C84200

Continuous cast

Product description	Leaded semi-red brass
Solids	1/2" to 13" O.D.
Tubes	1" to 16" O.D.
Rectangles	Up to 20"
Standard lengths	144"
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar

Typical uses

Builders hardware

General hardware

Industrial

Bushings, fittings for oil lines, low-pressure valves, small gears, small pump castings, plumbing

Plumbing

Couplings, elbows, pipe fittings, plugs, tees, unions

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C84200	B505 B505M			WW-P-460		

Chemical composition

Cu (%) ¹	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%)	Ni (%) ^{1,2}	Al (%)	S (%)	Sb (%)	Si (%)
78.00-82.00	2.00-3.00	4.00-6.00	10.00-16.00	0.40	1.50	0.80	0.005	0.08	0.25	0.005

Chemical composition according to ASTM B505/B505M-23

¹In determining Cu min., Cu may be calculated as Cu + Ni.
Note: Single values represent maximums.

²Ni value includes Co.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 ° F)
C84200	80	0.311

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
32	221	16	110	13	60	

Mechanical properties according to ASTM B505/B505M-23

Physical properties

	US customary	Metric
Melting point – liquidus	1820 °F	993 °C
Melting point – solidus	1540 °F	838 °C
Density	0.311 lb/in ³ at 68 °F	8.61 gm/cm ³ at 20 °C
Specific gravity	8.61	8.61
Electrical conductivity	16.4% IACS at 68 °F	0.095 MegaSiemens/cm at 20 °C
Thermal conductivity	41.8 Btu/sq ft/ft hr/°F at 68 °F	72.4 W/m at 20 °C
Coefficient of thermal expansion 68-392	10 · 10 ⁻⁶ per °F (68-392 °F)	17.3 · 10 ⁻⁶ per °C (20-200 °C)
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	14000 ksi	96500 MPa

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Excellent
Brazing*	Good
Oxyacetylene welding	Not recommended
Gas shielded arc welding	Not recommended
Coated metal arc welding	Fair
Machinability rating	80

Fabrication properties provided by CDA

*Since brazing is performed within the hot-short range, strain must be avoided during brazing and cooling.

Casting characteristics

Casting attribute	Level
Casting yield	High
Drossing	Low
Effect of section size	High
Fluidity	Medium
Gassing	Medium
Patternmakers shrinkage (inches per foot)	3/16
Shrinkage in solidification	Low

Casting characteristics provided by CDA

C84400

Continuous cast

Product description	Leaded semi-red brass
Solids	1/2" to 13" O.D.
Tubes	1" to 16" O.D.
Rectangles	Up to 20"
Standard lengths	144"
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar

Typical uses

Architecture

Ornamental fixtures

Builders hardware

Cases for dead bolt locks, dead bolt locks, door hardware for prisons, hardware

Building

Cooling equipment, heating equipment

Consumer

Musical instruments

Electrical

Electrical equipment

Industrial

Low-pressure fittings, pump fixtures, valve bodies for the water industry, valve seat, valves, valves for water meters

Marine

Boat parts, marine hardware, nuts for transducers

Plumbing

Fixtures, pipe fittings

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C84400	B505 B505M B271 B271M B584			WW-U-516		Valve metal

Chemical composition

Cu (%) ¹	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%)	Ni (%) ^{1,2}	Al (%)	S (%)	Sb (%)	Si (%)
78.00-82.00	6.00-8.00	2.30-3.50	7.00-10.00	0.40	1.50	1.00	0.005	0.08	0.25	0.005

Chemical composition according to ASTM B505/B505M-23

¹In determining Cu min., Cu may be calculated as Cu + Ni.
Note: Single values represent maximums.

²Ni value includes Co.

C84400 continued

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 °F)
C84400	90	0.314

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
30	207	15	103	16	55	

Mechanical properties according to ASTM B505/B505M-23

Physical properties

	US customary	Metric
Melting point – liquidus	1840 °F	1004 °C
Melting point – solidus	1549 °F	843 °C
Density	0.314 lb/in ³ at 68 °F	8.69 gm/cm ³ at 20 °C
Specific gravity	8.69	8.69
Electrical conductivity	16.4% IACS at 68 °F	0.095 MegaSiemens/cm at 20 °C
Thermal conductivity	41.8 Btu/sq ft/ft hr/ °F at 68 °F	72.4 W/m at 20 °C
Coefficient of thermal expansion 68-572	10 · 10 ⁻⁶ per °F (68-392 °F)	17.3 · 10 ⁻⁶ per °C (20-200 °C)
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	13000 ksi	89600 MPa
Magnetic permeability	1	1

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Excellent
Brazing*	Good
Oxyacetylene welding	Not recommended
Gas shielded arc welding	Not recommended
Coated metal arc welding	Fair
Machinability rating	90

Fabrication properties provided by CDA

*Since brazing is performed within the hot-short range, strain must be avoided during brazing and cooling.

Casting characteristics

Casting attribute	Level
Casting yield	High
Drossing	Medium
Effect of section size	High
Fluidity	Medium
Gassing	Medium
Patternmakers shrinkage (inches per foot)	3/16
Shrinkage in solidification	Medium

Casting characteristics provided by CDA

C84800

Continuous cast

Product description	Leaded semi-red brass
Solids	1/2" to 13" O.D.
Tubes	1" to 16" O.D.
Rectangles	Up to 20"
Standard lengths	144"
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar

Typical uses

Builders hardware

General hardware, hardware, stops, washers

Industrial

Air line fittings, fittings, gas line fittings, low-pressure valves

Plumbing

Cocks, faucets, plumbing fittings, plumbing fixtures

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C84800	B505 B505M B271 B271M					Plumbing goods brass

Chemical composition

Cu (%) ¹	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%)	Ni (%) ^{1,2}	Al (%)	S (%)	Sb (%)	Si (%)
75.00-77.00	5.50-7.00	2.00-3.00	13.00-17.00	0.40	1.50	1.00	0.005	0.08	0.25	0.005

Chemical composition according to ASTM B505/B505M-23

¹In determining Cu min., Cu may be calculated as Cu + Ni.
Note: Single values represent maximums.

²Ni value includes Co.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 ° F)
C84800	90	0.310

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
30	207	15	103	16	655	

Mechanical properties according to ASTM B505/B505M-23

Physical properties

	US customary	Metric
Melting point – liquidus	1750 °F	954 °C
Melting point – solidus	1530 °F	832 °C
Density	0.31 lb/in ³ at 68 °F	8.58 gm/cm ³ at 20 °C
Specific gravity	8.58	8.58
Electrical conductivity	16.4% IACS at 68 °F	0.095 MegaSiemens/cm at 20 °C
Thermal conductivity	41.6 Btu/sq ft/ft hr/°F at 68 °F	72 W/m at 20 °C
Coefficient of thermal expansion 68-392	10 · 10 ⁻⁶ per °F (68-392 °F)	17.3 · 10 ⁻⁶ per °C (20-200 °C)
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	15000 ksi	103400 MPa
Magnetic permeability	1	1

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Excellent
Brazing*	Good
Oxyacetylene welding	Not recommended
Gas shielded arc welding	Not recommended
Coated metal arc welding	Fair
Machinability rating	90

Fabrication properties provided by CDA

*Since brazing is performed within the hot-short range, strain must be avoided during brazing and cooling.

Casting characteristics

Casting attribute	Level
Casting yield	High
Drossing	Medium
Effect of section size	Medium
Fluidity	Medium
Gassing	Medium
Patternmakers shrinkage (inches per foot)	3/16
Shrinkage in solidification	Medium

Casting characteristics provided by CDA

C85700

Continuous cast

Product description	Leaded yellow brass
Solids	1/2" to 13" O.D.
Tubes	1 1/8" to 9" O.D.
Rectangles	Up to 15"
Standard lengths	144"
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar

Typical uses

Builders hardware

Door hardware for prisons, ornamental hardware, window hardware

Consumer

Musical instruments

Industrial

Mechanical components where aesthetics are important

Marine

Marine hardware, ship trim

Plumbing

Fittings, flanges

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C85700	B505 B505M B271 B271M B176					

Chemical composition

Cu (%) ¹	Pb (%)	Sn (%)	Zn (%)	Fe (%)	Ni (%) ^{1,2}	Al (%)	Si (%)
58.00-64.00	0.80-1.50	0.50-1.50	32.00-40.00	0.70	1.00	0.80	0.05

Chemical composition according to ASTM B505/B505M-23

¹In determining Cu min., Cu may be calculated as Cu + Ni.
Note: Single values represent maximums.

²Ni value includes Co.

C85700 continued

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 °F)
C85700	80	0.304

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
40	276	14	97	15	75	

Mechanical properties according to ASTM B505/B505M-23

Physical properties

	US customary	Metric
Melting point – liquidus	1725 °F	941 °C
Melting point – solidus	1675 °F	913 °C
Density	0.304 lb/in ³ at 68 °F	8.41 gm/cm ³ at 20 °C
Specific gravity	8.41	8.41
Electrical conductivity	22% IACS at 68 °F	0.128 MegaSiemens/cm at 20 °C
Thermal conductivity	48.5 Btu/sq ft/ft hr/°F at 68 °F	83.9 W/m at 20 °C
Coefficient of thermal expansion 68-572	12 · 10 ⁻⁶ per °F (68-572 °F)	20.7 · 10 ⁻⁶ per °C (20-300 °C)
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	14000 ksi	87000 MPa
Magnetic permeability	1	1

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Good
Brazing	Fair
Oxyacetylene welding	Not recommended
Gas shielded arc welding	Not recommended
Coated metal arc welding	Not recommended
Machinability rating	80

Fabrication properties provided by CDA

Casting characteristics

Casting attribute	Level
Casting yield	Medium
Drossing	High
Effect of section size	Low
Fluidity	Medium
Gassing	Low
Patternmakers shrinkage (inches per foot)	3/16
Shrinkage in solidification	Medium

Casting characteristics provided by CDA

C86200

Continuous cast

Product description	Manganese bronze
Solids	1/2" to 9" O.D.
Tubes	1 1/8" to 9" O.D.
Rectangles	Up to 15"
Standard lengths	144"
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar

Typical uses

Builders hardware

Brackets, structural parts

Fasteners

Screw down nuts

Industrial

Bushings, cams, frames, gears, high-strength machine parts, hooks, marine racing propellers, press dies, shafts, struts, valve stems, wear rings for pressing dies for wood pulp industry, worm gears

Marine

Boat parts, clamps, marine castings, rudders

Ordnance

Gun mounts

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C86200	B505 B505M B271 B271M	J461 J462		QQ-C-523	MIL-C-11866	

Chemical composition

Cu (%) ¹	Pb (%)	Sn (%)	Zn (%)	Fe (%)	Ni (%) ^{1,2}	Al (%)	Mn (%)
60.00-66.00	0.20	0.20	22.00-28.00	2.00-4.00	1.00	3.00-4.90	2.50-5.00

Chemical composition according to ASTM B505/B505M-23

¹In determining Cu min., Cu may be calculated as Cu + Ni.
Note: Single values represent maximums.

²Ni value includes Co.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 °F)
C86200	30	0.288

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (3000 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
90	621	45	310	18	180	

Mechanical properties according to ASTM B505/B505M-23

Physical properties

	US customary	Metric
Melting point – liquidus	1725 °F	941 °C
Melting point – solidus	1650 °F	899 °C
Density	0.288 lb/in ³ at 68 °F	7.97 gm/cm ³ at 20 °C
Specific gravity	7.97	7.97
Electrical conductivity	8% IACS at 68 °F	0.044 MegaSiemens/cm at 20 °C
Thermal conductivity	20.5 Btu/sq ft/ft hr/°F at 68 °F	35.5 W/m at 20 °C
Coefficient of thermal expansion 68-572	12 · 10 ⁻⁶ per °F (68-572 °F)	20.7 · 10 ⁻⁶ per °C (20-300 °C)
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	15000 ksi	103400 MPa
Magnetic permeability*	1.24	1.24

Physical properties provided by CDA

*Field strength 16 kA/m

Fabrication properties

Technique	Suitability
Soldering	Poor
Brazing	Poor
Oxyacetylene welding	Good
Gas shielded arc welding	Fair
Coated metal arc welding	Good
Machinability rating	30

Fabrication properties provided by CDA

Casting characteristics

Casting attribute	Level
Casting yield	Low
Drossing	High
Effect of section size	Low
Fluidity	Medium
Gassing	Low
Patternmakers shrinkage (inches per foot)	1/4
Shrinkage in solidification	High

Casting characteristics provided by CDA

C86300

Standard-stocked product*	Continuous cast
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Product description	Manganese bronze
Solids	1/2" to 9" O.D.
Tubes	1 1/8" to 9" O.D.
Rectangles	Up to 15"
Standard lengths	144" *Solids and tubes are standard stocked
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/ rectangular bar

Typical uses

Builders hardware

Brackets

Electrical

Electrical components, switches

Fasteners

Screw down nuts

Industrial

Bridge pins, bushings, cams, forming dies for wood pulp industry, frames, gears, gib, high-strength machine parts, hooks, hydraulic cylinder parts, large valve stems, propellers, slow-speed/ heavy-load bearings, struts, wear rings for forming dies for wood pulp industry

Marine

Boat parts, clamps, covers for marine hardware, marine hardware, rudders

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C86300	B505 B505M B271 B271M	J461 J462		QQ-C-523	MIL-C-11866	

Chemical composition

Cu (%) ¹	Pb (%)	Sn (%)	Zn (%)	Fe (%)	Ni (%) ^{1,2}	Al (%)	Mn (%)
60.00-66.00	0.20	0.20	22.00-28.00	2.00-4.00	1.00	5.00-7.50	2.50-5.00

Chemical composition according to ASTM B505/B505M-23

¹In determining Cu min., Cu may be calculated as Cu + Ni.
Note: Single values represent maximums.

²Ni value includes Co.

C86300 continued

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 °F)
C86300	8	0.283

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (3000 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
110	758	62	427	14	223	

Mechanical properties according to ASTM B505/B505M-23

Note: Compression Deformation Limit min 55 ksi/380 MPa

Physical properties

	US customary	Metric
Melting point – liquidus	1693 °F	923 °C
Melting point – solidus	1625 °F	885 °C
Density	0.283 lb/in ³ at 68 °F	7.83 gm/cm ³ at 20 °C
Specific gravity	7.83	7.83
Electrical conductivity	8% IACS at 68 °F	0.046 MegaSiemens/cm at 20 °C
Thermal conductivity	20.5 Btu/sq ft/ft hr/°F at 68 °F	35.5 W/m at 20 °C
Coefficient of thermal expansion 68-572	12 · 10 ⁻⁶ per °F (68-572 °F)	20.7 · 10 ⁻⁶ per °C (20-300 °C)
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	14200 ksi	97900 MPa
Magnetic permeability*	1.09	1.09

Physical properties provided by CDA

*Field strength 16 kA/m

Fabrication properties

Technique	Suitability
Soldering	Poor
Brazing	Poor
Oxyacetylene welding	Poor
Gas shielded arc welding	Poor
Coated metal arc welding	Good
Machinability rating	8

Fabrication properties provided by CDA

Casting characteristics

Casting attribute	Level
Casting yield	Low
Drossing	High
Effect of section size	Low
Fluidity	Medium
Gassing	Low
Patternmakers shrinkage (inches per foot)	1/4
Shrinkage in solidification	High

Casting characteristics provided by CDA

C86400

Continuous cast

Product description	Manganese bronze
Solids	1/2" to 9" O.D.
Tubes	1" to 9" O.D.
Rectangles	Up to 15"
Standard lengths	144"
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar

Typical uses

Builders hardware

Door hardware for prisons, window hardware

Consumer

Musical instruments, piano keys

Electrical

Electrical components, electrical equipment, switches

Fasteners

Screw down nuts

Industrial

Bearing cage blanks, bearings, brackets, bushings, cams, fittings, lever arms, light-duty gears, machinery parts, propellers, pump fixtures, roller bearings, valve stems

Plumbing

Fixtures

Chemical composition

Cu (%) ¹	Pb (%)	Sn (%)	Zn (%)	Fe (%)	Ni (%) ²	Al (%)	Mn (%)
56.00-62.00	0.50-1.50	0.50-1.50	34.00-42.00	0.40-2.00	1.00	0.50-1.50	0.10-1.50

Chemical composition according to ASTM B505/B505M-23

¹In determining Cu min., Cu may be calculated as Cu + Ni.
Note: Single values represent maximums.

²Ni value includes Co.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 ° F)
C86400	65	0.301

Mechanical properties

Tensile strength, typ		Yield strength, at 0.5% extension under load, typ		Elongation, in 2 in. or 50 mm, typ	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
65	448	25	172	20	90	

Mechanical properties according to ASTM B505/B505M-23

Physical properties

	US customary	Metric
Melting point – liquidus	1616 °F	880 °C
Melting point – solidus	1583 °F	862 °C
Density	0.301 lb/in ³ at 68 °F	8.33 gm/cm ³ at 20 °C
Specific gravity	8.33	8.33
Electrical conductivity	19% IACS at 68 °F	0.110 MegaSiemens/cm at 20 °C
Thermal conductivity	51 Btu/sq ft/ft hr/°F at 68 °F	88.3 W/m at 20 °C
Coefficient of thermal expansion 68-392	11 · 10 ⁻⁶ per °F (68-392 °F)	19 · 10 ⁻⁶ per °C (20-300 °C)
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	14000 ksi	96527 MPa

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Fair
Brazing	Fair
Oxyacetylene welding	Poor
Gas shielded arc welding	Poor
Coated metal arc welding	Poor
Machinability rating	65

Fabrication properties provided by CDA

Casting characteristics

Casting attribute	Level
Casting yield	Low
Drossing	High
Effect of section size	Low
Fluidity	Medium
Gassing	Low
Patternmakers shrinkage (inches per foot)	1/4
Shrinkage in solidification	High

Casting characteristics provided by CDA

C86500

Continuous cast

Product description	Manganese bronze
Solids	1/2" to 9" O.D.
Tubes	1 1/8" to 9" O.D.
Rectangles	Up to 15"
Standard lengths	144"
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar

Typical uses

Automotive

Weld guns

Builders hardware

Brackets

Electrical

Electrical hardware

Industrial

Compressors, forming dies for wood pulp industry, frames, gears, hooks, lever arms, machinery, machinery parts (substituted for steel and malleable iron), machinery parts requiring high strength, pressing dies for wood pulp, struts, wear rings for pressing dies for wood pulp industry

Marine

Boat parts, clamps, covers for marine hardware, propellers for salt and fresh water, rudders

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C86500	B505 B505M	J461 J462	4860	QQ-C-390, C3 QQ-B-726, Class A	MIL-C-22229, Comp 7	

Chemical composition

Cu (%) ¹	Pb (%)	Sn (%)	Zn (%)	Fe (%)	Ni (%) ^{1,2}	Al (%)	Mn (%)
55.00-60.00	0.40	1.00	36.00-42.00	0.40-2.00	1.00	0.50-1.50	0.10-1.50

Chemical composition according to ASTM B505/B505M-23

¹In determining Cu min., Cu may be calculated as Cu + Ni. ²Ni value includes Co.
Note: Cu + sum of named elements, 99.0% min. Single values represent maximums.

C86500 continued

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 °F)
C86500	26	0.301

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (3000 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
70	483	25	172	25	130	

Mechanical properties according to ASTM B505/B505M-23

Physical properties

	US customary	Metric
Melting point – liquidus	1616 °F	880 °C
Melting point – solidus	1583 °F	862 °C
Density	0.301 lb/in ³ at 68 °F	8.33 gm/cm ³ at 20 °C
Specific gravity	8.33	8.33
Electrical conductivity	22% IACS at 68 °F	0.128 MegaSiemens/cm at 20 °C
Thermal conductivity	49.6 Btu/sq ft/ft hr/°F at 68 °F	85.8 W/m at 20 °C
Coefficient of thermal expansion 68-212	11.3 · 10 ⁻⁶ per °F (68-212 °F)	19.5 · 10 ⁻⁶ per °C (20-100 °C)
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	15000 ksi	103400 MPa
Magnetic permeability*	1.09	1.09

Physical properties provided by CDA

*Field strength 16 kA/m

Fabrication properties

Technique	Suitability
Soldering	Fair
Brazing	Fair
Oxyacetylene welding	Poor
Gas shielded arc welding	Poor
Coated metal arc welding	Poor
Machinability rating	26

Fabrication properties provided by CDA

Casting characteristics

Casting attribute	Level
Casting yield	Low
Drossing	High
Effect of section size	Low
Fluidity	Medium
Gassing	Low
Patternmakers shrinkage (inches per foot)	1/4
Shrinkage in solidification	High

Casting characteristics provided by CDA

C86700

Continuous cast

Product description	Manganese bronze
Solids	1/2" to 13" O.D.
Tubes	1 1/8" to 16" O.D.
Rectangles	Up to 20"
Standard lengths	144"
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar

Typical uses

Builders hardware

Brackets

Fasteners

Screw down nuts

Industrial

Bearings, cams, fittings, lever arms, machinery parts, moderate-duty gears, propellers, valve stems

Plumbing

Marine hardware, propellers

Chemical composition

Cu (%) ¹	Pb (%)	Sn (%)	Zn (%)	Fe (%)	Ni (%) ²	Al (%)	Mn (%)
55.00-60.00	0.50-1.50	1.50	30.00-38.00	1.00-3.00	1.00	1.00-3.00	0.10-3.50

Chemical composition provided by CDA

¹In determining Cu min., Cu may be calculated as Cu + Ni. ²Ni value includes Co.
Note: Cu + sum of named elements, 99.0% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 ° F)
C86700	55	0.301

Mechanical properties

Tensile strength, typ		Yield strength, at 0.5% extension under load, typ		Elongation, in 2 in. or 50 mm, typ	Brinell hardness (3000 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
85	586	42	290	20	155	

Mechanical properties provided by CDA

Physical properties

	US customary	Metric
Melting point – liquidus	1616 °F	880 °C
Melting point – solidus	1583 °F	862 °C
Density	0.301 lb/in ³ at 68 °F	8.33 gm/cm ³ at 20 °C
Specific gravity	8.33	8.33
Electrical conductivity	17% IACS at 68 °F	0.097 MegaSiemens/cm at 20 °C
Coefficient of thermal expansion 68-392	11 · 10 ⁻⁶ per °F (68-392 °F)	19 · 10 ⁻⁶ per °C (20-200 °C)
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	15000 ksi	103422 MPa

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Fair
Brazing	Fair
Oxyacetylene welding	Poor
Gas shielded arc welding	Poor
Coated metal arc welding	Poor
Machinability rating	55

Fabrication properties provided by CDA

Casting characteristics

Casting attribute	Level
Casting yield	Low
Drossing	High
Effect of section size	Low
Fluidity	Medium
Gassing	Low
Patternmakers shrinkage (inches per foot)	1/4
Shrinkage in solidification	High

Casting characteristics provided by CDA

C87850

Continuous cast	GreenAlloys™
Product description	Silicon brass
Solids	Consult mill for sizes
Tubes	Consult mill for sizes
Rectangles	Consult mill for sizes
Standard lengths	144"
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar
Compliance	C87850 is compliant with key legislation including (1) Federal Safe Drinking Water Act - SDWA, (2) S. 3874 Federal Reduction of Lead in Drinking Water Act, (3) California AB1953, and (4) Vermont Act 193

Typical uses

Industrial

Valve bodies for water

Marine

Marine products

Plumbing

Faucets, plumbing fittings, water meter cases

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C87850	B505 B505M					

Chemical composition

Cu (%)	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P	Ni (%) ¹	Mn (%)	Sb (%)	Si (%)
75.00-78.00	0.02*-0.09	0.30	remain.	0.10	0.05-0.20	0.20	0.10	0.10	2.70-3.40

Chemical composition according to ASTM B505/B505M-23

*Pb content is greater than 0.02%.

¹Ni value includes Co.

Note: Cu + sum of named elements, 99.5% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 ° F)
C87850	70	0.3

Mechanical properties

Mechanical properties according to ASTM B505/B505M-19

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	minimum BHN	
65	448	25	172	8	103	

Physical properties

	US customary	Metric
Melting point – liquidus	1616 °F	880 °C
Melting point – solidus	1571 °F	855 °C
Density	0.3 lb/in ³ at 68 °F	8.3 gm/cm ³ at 20 °C
Electrical conductivity	8% IACS at 68 °F	0.046 MegaSiemens/cm at 20 °C
Thermal conductivity	21.8 Btu/sq ft/ft hr/°F at 68 °F	37.8 W/m at 20 °C
Coefficient of thermal expansion 68-212	10.3 · 10 ⁻⁶ per °F (68-212 °F)	17.8 · 10 ⁻⁶ per °C (20-100 °C)
Coefficient of thermal expansion 68-392	10.3 · 10 ⁻⁶ per °F (68-392 °F)	17.8 · 10 ⁻⁶ per °C (20-200 °C)
Coefficient of thermal expansion 68-572	10.4 · 10 ⁻⁶ per °F (68-572 °F)	18 · 10 ⁻⁶ per °C (20-300 °C)
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	15200 ksi	104801 MPa

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Excellent
Brazing	Excellent
Oxyacetylene welding	Good
Spot weld	Good
Seam weld	Good
Butt weld	Good
Capacity for being cold worked	Poor
Capacity for being hot formed	Excellent
Machinability rating	70

Fabrication properties provided by CDA

Casting characteristics

Casting attribute	Level
Casting yield	Medium
Drossing	Low
Effect of section size	Medium
Fluidity	High
Gassing	Low
Patternmakers shrinkage (inches per foot)	3/16
Shrinkage in solidification	Medium

Casting characteristics provided by CDA

C89320

Continuous cast	GreenAlloys™
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Product description	Bismuth tin bronze
Solids	1/2" to 10" O.D.
Tubes	1 1/8" to 9" O.D.
Rectangles	Up to 15"
Standard lengths	144"
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/ rectangular bar
Compliance	C89320 is compliant with key legislation including (1) Federal Safe Drinking Water Act - SDWA, 2) S. 3874 Federal Reduction of Lead in Drinking Water Act, (3) California AB1953, and (4) Vermont Act 193

Typical uses

Fasteners

Washers

Industrial

Backs for lined bearings, cam bushings for diesel engines, crankshaft main bearings, deep well pump bowl bushings, deep well pump line shaft bearings, electric motor bearings, general utility bearings, guide bushings for piston rods, guide bushings for valves, hydraulic gland seals, main bearings for presses, piston pin bearings, pump sleeves, rod bushings, rolling mill bearings, seals, sleeve bushings, spacer bushings, wrist pin bushings

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C89320	B505 B505M					

Chemical composition

Cu (%)	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%)	Ni (%) ¹	Al (%)	Bi (%)	S (%)	Sb (%)	Si (%)
87.00-91.00	0.09	5.00-7.00	1.00	0.20	0.30	1.00	0.005	4.00-6.00	0.08	0.35	0.005

Chemical composition according to ASTM B505/B505M-23

¹Ni value includes Co.

Note: Cu + sum of named elements, 99.5% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 ° F)
C89320	80	0.318

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
35	241	18	124	15	70	

Mechanical properties according to ASTM B505/B505M-23

Physical properties

	US customary	Metric
Melting point – liquidus	1913 °F	1045 °C
Melting point – solidus	1702 °F	928 °C
Density	0.318 lb/in ³ at 68 °F	8.8 gm/cm ³ at 20 °C
Electrical conductivity	14.7% IACS at 68 °F	0.082 MegaSiemens/cm at 20 °C
Thermal conductivity	32.4 Btu/sq ft/ft hr/°F at 68 °F	56.1 W/m at 20 °C
Modulus of elasticity in tension	13900 ksi	95827 MPa

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Excellent
Brazing	Good
Oxyacetylene welding	Not recommended
Gas shielded arc welding	Not recommended
Coated metal arc welding	Not recommended
Machinability rating	80

Fabrication properties provided by CDA

Casting characteristics

Casting attribute	Level
Casting yield	High
Drossing	Low
Effect of section size	Medium
Fluidity	Medium
Gassing	Medium
Shrinkage in solidification	Low

Casting characteristics provided by CDA

C89325 Lead-free replacement for C937

Continuous cast	GreenAlloys™
Product description	Bismuth tin bronze
Solids	1/2" to 10" O.D.
Tubes	1 1/8" to 9" O.D.
Rectangles	Up to 15"
Standard lengths	144"
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar
Compliance	C89325 is compliant with key legislation including (1) Federal Safe Drinking Water Act - SDWA, (2) S. 3874 Federal Reduction of Lead in Drinking Water Act, (3) California AB1953, and (4) Vermont Act 193

Typical uses

Industrial

Bushings, high-speed/high-pressure bearings

Chemical composition

Cu (%) ¹	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%)	Ni (%) ²	Al (%)	Bi (%)	S (%)	Sb (%)	Si (%)
84.00-88.00	0.10	9.00-11.00	1.00	0.15	0.10	1.00	0.005	2.70-3.70	0.08	0.50	0.005

Chemical composition provided by CDA

¹0.01 - 2.0% as any single or combination of Ce La or other rare earth(x) elements as agreed upon. (x)ASM International definition: one of the group of chemically similar metals with atomic numbers 57 through 71 commonly referred to as lanthanides. ²Ni value includes Co.
Note: Cu + sum of named elements, 99.0% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 ° F)
C89325	80	0.323

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
30	207	12	83	4	73	

Physical properties

	US customary	Metric
Melting point – liquidus	1805 °F	985 °C
Melting point – solidus	1432 °F	777 °C
Density	0.323 lb/in ³ at 68 °F	8.94 gm/cm ³ at 20 °C
Specific gravity	8.94	8.94
Electrical conductivity	10.8% IACS at 68 °F	0.062 MegaSiemens/cm at 20 °C
Thermal conductivity	29 Btu/sq ft/ft hr/°F at 68 °F	50.2 W/m at 20 °C
Coefficient of thermal expansion 68-392	10.3 · 10 ⁻⁶ per °F (68-392 °F)	17.8 · 10 ⁻⁶ per °C (20-200 °C)
Specific heat capacity	0.089 Btu/lb/°F at 68 °F	372.9 J/kg at 20 °C
Modulus of elasticity in tension	16400 ksi	113074 MPa

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Good
Brazing	Good
Oxyacetylene welding	Not recommended
Gas shielded arc welding	Not recommended
Coated metal arc welding	Not recommended
Machinability rating	80

Fabrication properties provided by CDA

Casting characteristics

Casting attribute	Level
Casting yield	High
Drossing	Low
Effect of section size	Low
Fluidity	Medium
Gassing	Medium
Patternmakers shrinkage (inches per foot)	3/32
Shrinkage in solidification	Low

Casting characteristics provided by CDA

C89520 EnviroBrass II

	Continuous cast	GreenAlloys™
Product description	Bismuth tin bronze	
Solids	1/2" to 9" O.D.	
Tubes	1 1/8" to 9" O.D.	
Rectangles	Up to 15"	
Standard lengths	144"	
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/ rectangular bar	
Compliance	C89520 is compliant with key legislation including (1) Federal Safe Drinking Water Act - SDWA, 2) S. 3874 Federal Reduction of Lead in Drinking Water Act, (3) California AB1953, and (4) Vermont Act 193	

Typical uses

Plumbing

Plumbing castings

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C89520	B584					

Chemical composition

Cu (%)	Pb (%)	Sn (%)	Zn (%)	Fe (%)	Ni (%) ¹	Al (%)	Bi (%) ²	S (%)	Sb (%)	Se (%) ²
85.00-87.00	0.09	5.00-6.00	4.00-6.00	0.20	1.00	0.005	1.60-2.20	0.08	0.25	0.80-1.10

Chemical composition according to ASTM B505/B505M-23

¹Ni value includes Co.

²Bi:Se >= 2:1

Note: Cu + sum of named elements, 99.5% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 ° F)
C89520	85	0.318

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
25	172	18	124	6	54	

Physical properties

	US customary	Metric
Melting point – liquidus	1842 °F	1006 °C
Melting point – solidus	353 °F	178 °C

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Excellent
Brazing	Good
Oxyacetylene welding	Not recommended
Gas shielded arc welding	Not recommended
Coated metal arc welding	Not recommended
Machinability rating	85

Fabrication properties provided by CDA

Casting characteristics

Casting attribute	Level
Casting yield	High
Drossing	Medium
Effect of section size	Low
Fluidity	Medium
Gassing	Medium
Shrinkage in solidification	Medium

Casting characteristics provided by CDA

C89831 Lead-free replacement for C844

	Continuous cast	GreenAlloys™
Product description	Bismuth tin bronze	
Solids	1/2" to 10" O.D.	
Tubes	1 1/8" to 9" O.D.	
Rectangles	Up to 15"	
Standard lengths	144"	
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar	
Compliance	C89831 is compliant with key legislation including (1) Federal Safe Drinking Water Act - SDWA, (2) S. 3874 Federal Reduction of Lead in Drinking Water Act, (3) California AB1953, and (4) Vermont Act 193	

Typical uses

Industrial

Bushings, high-speed/high-pressure bearings

Chemical composition

Cu (%) ¹	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%)	Ni (%) ²	Al (%)	Bi (%)	S (%)	Sb (%)	Si (%)
87.00-91.00	0.10	2.70-3.70	2.00-4.00	0.30	0.05	1.00	0.005	2.70-3.70	0.08	0.25	0.005

Chemical composition provided by CDA

¹0.01 - 2.0% as any single or combination of Ce La or other rare earth(x) elements as agreed upon. (x)ASM International definition: one of the group of chemically similar metals with atomic numbers 57 through 71 commonly referred to as lanthanides. ²Ni value includes Co.
Note: Cu + sum of named elements, 99.0% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 ° F)
C89831	85	0.318

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
29	200	13	90	5	55	

Physical properties

	US customary	Metric
Melting point – liquidus	1893 °F	1033 °C
Melting point – solidus	1518 °F	825 °C
Density	0.318 lb/in ³ at 68 °F	8.81 gm/cm ³ at 20 °C
Specific gravity	8.81	8.81
Electrical conductivity	20.38% IACS at 68 °F	0.117 MegaSiemens/cm at 20 °C
Thermal conductivity	50 Btu/sq ft/ft hr/°F at 68 °F	86.6 W/m at 20 °C
Coefficient of thermal expansion 68-392	10 · 10 ⁻⁶ per °F (68-392 °F)	17.3 · 10 ⁻⁶ per °C (20-200 °C)
Specific heat capacity	0.092 Btu/lb/°F at 68 °F	385.4 J/kg at 20 °C
Modulus of elasticity in tension	13700 ksi	94458 MPa

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Excellent
Brazing	Good
Oxyacetylene welding	Not recommended
Gas shielded arc welding	Not recommended
Coated metal arc welding	Poor
Machinability rating	85

Fabrication properties provided by CDA

Casting characteristics

Casting attribute	Level
Casting yield	High
Drossing	Low
Effect of section size	Low
Fluidity	Medium
Gassing	Medium
Patternmakers shrinkage (inches per foot)	5/32
Shrinkage in solidification	Low

Casting characteristics provided by CDA

C89833 Lead-free replacement for C836

	Continuous cast	GreenAlloys™
Product description	Bismuth tin bronze	
Solids	1/2" to 10" O.D.	
Tubes	1 1/8" to 9" O.D.	
Rectangles	Up to 15"	
Standard lengths	144"	
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar	
Compliance	C89833 is compliant with key legislation including (1) Federal Safe Drinking Water Act - SDWA, (2) S. 3874 Federal Reduction of Lead in Drinking Water Act, (3) California AB1953, (4) Vermont Act 193, and is NSF/ANSI/CAN 61-2022 compliant	

Typical uses

Industrial

Corrosion-resistant/
pressure-tight castings,
impellers, pumps

Chemical composition

Cu (%)	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%)	Ni (%) ¹	Al (%)	Bi (%)	S (%)	Sb (%)	Si (%)
86.00-91.00	0.09	4.00-6.00	2.00-6.00	0.30	0.05	1.00	0.005	1.70-2.70	0.08	0.25	0.005

Chemical composition provided by CDA

¹Ni value includes Co.

Note: Cu + sum of named elements, 99.3% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68° F)
C89833	81	0.317

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
30	207	14	97	6	60	

Physical properties

	US customary	Metric
Melting point – liquidus	1877 °F	1025 °C
Melting point – solidus	1454 °F	790 °C
Density	0.317 lb/in ³ at 68 °F	8.78 gm/cm ³ at 20 °C
Specific gravity	8.78	8.78
Electrical conductivity	17.8% IACS at 68 °F	0.103 MegaSiemens/cm at 20 °C
Thermal conductivity	41 Btu/sq ft/ft hr/°F at 68 °F	71 W/m at 20 °C
Coefficient of thermal expansion 68-392	13 · 10 ⁻⁶ per °F (68-392 °F)	22.5 · 10 ⁻⁶ per °C (20-200 °C)
Specific heat capacity	0.085 Btu/lb/°F at 68 °F	356.1 J/kg at 20 °C
Modulus of elasticity in tension	15500 ksi	106869 MPa

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Excellent
Brazing	Good
Oxyacetylene welding	Not recommended
Gas shielded arc welding	Not recommended
Coated metal arc welding	Poor
Machinability rating	81

Fabrication properties provided by CDA

Casting characteristics

Casting attribute	Level
Casting yield	High
Drossing	Low
Effect of section size	Low
Fluidity	Medium
Gassing	Medium
Patternmakers shrinkage (inches per foot)	11/64
Shrinkage in solidification	Low

Casting characteristics provided by CDA

C89835 Lead-free replacement for C932, C836, C844

Standard-stocked product*	Continuous cast	GreenAlloys™
Product description	Bismuth tin bronze	
Solids	1/2" to 8" O.D.	
Tubes	1 1/8" to 14" O.D.**	
Rectangles	Up to 15"	
Standard lengths	105" *Solids and tubes are standard stocked **Consult mill for wall thickness	
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/ rectangular bar	
Compliance	C89835 is compliant with key legislation including (1) Federal Safe Drinking Water Act - SDWA, (2) S. 3874 Federal Reduction of Lead in Drinking Water Act, (3) California AB1953, (4) Vermont Act 193, and is NSF/ANSI/CAN 61-2022 compliant	

Typical uses

Industrial

Housing, small gears

Industrial

Faucets, pipe fittings, plumbing goods, pump components, water pump impellers

Chemical composition											
Cu (%)	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%)	Ni (%) ¹	Al (%)	Bi (%)	S (%)	Sb (%)	Si (%)
85.00-89.00	0.09	6.00-7.50	2.00-4.00	0.20	0.10	1.00	0.005	1.70-2.70	0.08	0.35	0.005

Chemical composition provided by CDA

¹Ni value includes Co.
Note: Cu + sum of named elements, 99.3% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68° F)
C89835	70	0.321

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
30	207	14	97	6	65	

Physical properties

	US customary	Metric
Melting point – liquidus	1855 °F	1012 °C
Melting point – solidus	1445 °F	785 °C
Density	0.321 lb/in ³ at 68 °F	8.89 gm/cm ³ at 20 °C
Specific gravity	8.89	8.89
Electrical conductivity	14.5% IACS at 68 °F	0.084 MegaSiemens/cm at 20 °C
Thermal conductivity	38 Btu/sq ft/ft hr/°F at 68 °F	65.8 W/m at 20 °C
Coefficient of thermal expansion 68-392	10 · 10 ⁻⁶ per °F (68-392 °F)	17.3 · 10 ⁻⁶ per °C (20-200 °C)
Specific heat capacity	0.093 Btu/lb/°F at 68 °F	389.6 J/kg at 20 °C
Modulus of elasticity in tension	16900 ksi	116522 MPa

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Excellent
Brazing	Good
Oxyacetylene welding	Not recommended
Gas shielded arc welding	Not recommended
Coated metal arc welding	Not recommended
Machinability rating	70

Fabrication properties provided by CDA

Casting characteristics

Casting attribute	Level
Casting yield	High
Drossing	Low
Effect of section size	Low
Fluidity	Medium
Gassing	Medium
Patternmakers shrinkage (inches per foot)	1/8
Shrinkage in solidification	Low

Casting characteristics provided by CDA

C89844 Lead-free replacement for C844

	Continuous cast	GreenAlloys™
Product description	Bismuth tin bronze	
Solids	1/2" to 10" O.D.	
Tubes	1 1/8" to 9" O.D.	
Rectangles	Up to 15"	
Standard lengths	144"	
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar	
Compliance	C89844 is compliant with key legislation including (1) Federal Safe Drinking Water Act - SDWA, (2) S. 3874 Federal Reduction of Lead in Drinking Water Act, (3) California AB1953, and (4) Vermont Act 193	

Typical uses

Plumbing

Fittings/valves for potable water

Chemical composition

Cu (%)	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%)	Ni (%) ¹	Al (%)	Bi (%)	S (%)	Sb (%)	Si (%)
83.00-86.00	0.20	3.00-5.00	7.00-10.00	0.30	0.05	1.00	0.005	2.00-4.00	0.08	0.25	0.005

Chemical composition provided by CDA

¹Ni value includes Co.

Note: Cu + sum of named elements, 99.3% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 ° F)
C89844	70	0.31

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
28	193	13	90	5	55	

Physical properties

	US customary	Metric
Melting point – liquidus	1850 °F	1010 °C
Melting point – solidus	1550 °F	853 °C
Density	0.31 lb/in ³ at 68 °F	8.58 gm/cm ³ at 20 °C
Specific gravity	8.58	8.58
Electrical conductivity	16.8% IACS at 68 °F	0.095 MegaSiemens/cm at 20 °C
Thermal conductivity	46.7 Btu/sq ft/ft hr/°F at 68 °F	80.9 W/m at 20 °C
Coefficient of thermal expansion 68-392	10 · 10 ⁻⁶ per °F (68-392 °F)	17.3 · 10 ⁻⁶ per °C (20-200 °C)
Specific heat capacity	0.08 Btu/lb/°F at 68 °F	335.2 J/kg at 20 °C
Modulus of elasticity in tension	13000 ksi	89622 MPa

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Excellent
Brazing*	Good
Oxyacetylene welding	Not recommended
Gas shielded arc welding	Not recommended
Coated metal arc welding	Not recommended
Machinability rating	70

Fabrication properties provided by CDA

*Since brazing is performed within the hot-short range, strain must be avoided during brazing and cooling.

Casting characteristics

Casting attribute	Level
Casting yield	High
Drossing	Medium
Effect of section size	High
Fluidity	Medium
Gassing	Medium
Patternmakers shrinkage (inches per foot)	3/16
Shrinkage in solidification	Medium

Casting characteristics provided by CDA

C90300

Standard-stocked product*	Continuous cast	GreenAlloys™
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Product description	Tin bronze
Solids	1/2" to 10" O.D.
Tubes	1" to 16" O.D.
Rectangles	Up to 20"
Standard lengths	144" *Solids is standard stocked
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/ rectangular bar

Typical uses

Building

Heavy construction equipment

Fasteners

Swivel

Industrial

Bearings, bushings, gear blanks, gears, piston rings, pump bodies, pump impellers, valve bodies, valves

Plumbing

Steam fittings

Chemical composition

Cu (%) ¹	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%)	Ni (%) ^{1,2}	Al (%)	S (%)	Sb (%)	Si (%)
86.00-89.00	0.30	7.50-9.00	3.00-5.00	0.20	1.50	1.00	0.005	0.05	0.20	0.005

Chemical composition according to ASTM B505/B505M-23

¹In determining Cu min., Cu may be calculated as Cu + Ni. ²Ni value includes Co.
Note: Cu + sum of named elements, 99.4% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 ° F)
C90300	30	0.318

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
44	303	22	152	18	70	

Physical properties

	US customary	Metric
Melting point – liquidus	1832 °F	1000 °C
Melting point – solidus	1570 °F	854 °C
Density	0.318 lb/in ³ at 68 °F	8.8 gm/cm ³ at 20 °C
Specific gravity	8.8	8.8
Electrical conductivity	12% IACS at 68 °F	0.069 MegaSiemens/cm at 20 °C
Thermal conductivity	43.2 Btu/sq ft/ft hr/°F at 68 °F	74.8 W/m at 20 °C
Coefficient of thermal expansion 68-392	10 · 10 ⁻⁶ per °F (68-392 °F)	17.3 · 10 ⁻⁶ per °C (20-200 °C)
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	14000 ksi	96527 MPa
Magnetic permeability	1	1

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Excellent
Brazing*	Good
Oxyacetylene welding	Fair
Gas shielded arc welding	Fair
Coated metal arc welding	Fair
Machinability rating	30

Fabrication properties provided by CDA

*Since brazing is performed within the hot-short range, strain must be avoided during brazing and cooling.

Casting characteristics

Casting attribute	Level
Casting yield	Medium
Drossing	Low
Effect of section size	High
Fluidity	Medium
Gassing	Medium
Patternmakers shrinkage (inches per foot)	3/16
Shrinkage in solidification	Medium

Casting characteristics provided by CDA

C90500

Continuous cast	GreenAlloys™
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Product description	Tin bronze
Solids	1/2" to 10" O.D.
Tubes	1" to 16" O.D.
Rectangles	Up to 20"
Standard lengths	144"
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar

Typical uses

Builders hardware

Clamps

Building

Heavy construction equipment

Electrical

Connectors

Fasteners

Nuts

Industrial

Bearings, bushings, expansion bearings, finishing dies for wood pulp industry, gear blanks, gears, piston rings, pump bodies, pump impellers, seal rings, valve bodies, valves, worm gears

Plumbing

Steam fittings, water conditioners

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C90500	B505 B505M B22 B22M B143-IA	62 J461 J462	4845	QQ-C-390, D6 QQ-B-1005, Comp 16	MIL-B-11553, Comp 16	Gun metal

Chemical composition

Cu (%) ¹	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%)	Ni (%) ^{1,2}	Al (%)	S (%)	Sb (%)	Si (%)
86.00-89.00	0.30	9.00-11.00	1.00-3.00	0.20	1.50	1.00	0.005	0.05	0.20	0.005

Chemical composition according to ASTM B505/B505M-23

¹In determining Cu min., Cu may be calculated as Cu + Ni. ²Ni value includes Co.
Note: Cu + sum of named elements, 99.7% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 °F)
C90500	30	0.315

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
44	303	25	172	10	75	

Mechanical properties according to ASTM B505/B505M-23

Physical properties

	US customary	Metric
Melting point – liquidus	1830 °F	999 °C
Melting point – solidus	1570 °F	854 °C
Density	0.315 lb/in ³ at 68 °F	8.72 gm/cm ³ at 20 °C
Specific gravity	8.72	8.72
Electrical conductivity	11% IACS at 68 °F	0.064 MegaSiemens/cm at 20 °C
Thermal conductivity	43.2 Btu/sq ft/ft hr/°F at 68 °F	74.8 W/m at 20 °C
Coefficient of thermal expansion 68-572	11 · 10 ⁻⁶ per °F (68-212 °F)	19.8 · 10 ⁻⁶ per °C (20-300 °C)
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	15000 ksi	103400 MPa
Magnetic permeability	1	1

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Excellent
Brazing*	Good
Oxyacetylene welding	Fair
Gas shielded arc welding	Fair
Coated metal arc welding	Fair
Machinability rating	30

Fabrication properties provided by CDA

*Since brazing is performed within the hot-short range, strain must be avoided during brazing and cooling.

Casting characteristics

Casting attribute	Level
Casting yield	Medium
Drossing	Low
Effect of section size	High
Fluidity	Medium
Gassing	Medium
Patternmakers shrinkage (inches per foot)	3/16
Shrinkage in solidification	Medium

Casting characteristics provided by CDA

C90700

Continuous cast	GreenAlloys™
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Product description	Tin bronze
Solids	1/2" to 10" O.D.
Tubes	1" to 16" O.D.
Rectangles	Up to 20"
Standard lengths	144"
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar

Typical uses

Industrial

Bearings, bearings for heavy loads and relatively low speeds, gear boxes, gears, restaurant equipment, speed reducers, valve bodies, worm gears, worm wheels

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C90700	B505 B505M	65 J461 J462				Tin bronze, 65

Chemical composition

Cu (%) ¹	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%)	Ni (%) ^{1,2}	Al (%)	S (%)	Sb (%)	Si (%)
88.00-90.00	0.50	10.00-12.00	0.50	0.15	1.50	0.50	0.005	0.05	0.20	0.005

Chemical composition according to ASTM B505/B505M-23

¹In determining Cu min., Cu may be calculated as Cu + Ni. ²Ni value includes Co.
Note: Cu + sum of named elements, 99.4% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 °F)
C90700	20	0.317

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
40	276	25	172	10	102	

Mechanical properties according to ASTM B505/B505M-23

Physical properties

	US customary	Metric
Melting point – liquidus	1830 °F	999 °C
Melting point – solidus	1528 °F	831 °C
Density	0.317 lb/in ³ at 68 °F	8.77 gm/cm ³ at 20 °C
Specific gravity	8.77	8.77
Electrical conductivity	10% IACS at 68 °F	0.056 MegaSiemens/cm at 20 °C
Thermal conductivity	40.8 Btu/sq ft/ft hr/°F at 68 °F	70.6 W/m at 20 °C
Coefficient of thermal expansion 68-392	10.2 · 10 ⁻⁶ per °F (68-392 °F)	18.4 · 10 ⁻⁶ per °C (20-200 °C)
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	15000 ksi	103400 MPa
Magnetic permeability	1	1

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Excellent
Brazing*	Good
Oxyacetylene welding	Fair
Gas shielded arc welding	Fair
Coated metal arc welding	Fair
Machinability rating	20

Fabrication properties provided by CDA

*Since brazing is performed within the hot-short range, strain must be avoided during brazing and cooling.

Casting characteristics

Casting attribute	Level
Casting yield	Medium
Drossing	Low
Effect of section size	High
Fluidity	High
Gassing	Medium-high
Patternmakers shrinkage (inches per foot)	3/16
Shrinkage in solidification	Low

Casting characteristics provided by CDA

C90800

	Continuous cast	GreenAlloys™
Product description	Tin bronze	
Solids	1" to 6" O.D.	
Tubes	1" to 6" O.D.	
Rectangles	Up to 10"	
Standard lengths	144"	
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar	
Compliance	C90800 is compliant with key legislation including (1) Federal Safe Drinking Water Act - SDWA, (2) S. 3874 Federal Reduction of Lead in Drinking Water Act, (3) California AB1953, and (4) Vermont Act 193	

Typical uses

Industrial

Speed reducers, worm gears

Chemical composition

Cu (%) ¹	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%) ²	Ni (%) ³	Al (%)	S (%)	Sb (%)	Si (%)
85.00-89.00	0.25	11.00-13.00	0.25	0.15	0.30	0.50	0.005	0.05	0.20	0.005

Chemical composition according to ASTM B505/B505M-23

¹In determining Cu min., Cu may be calculated as Cu + Ni.

²For continuous castings, P shall be 1.5% max.

³Ni value includes Co.

Note: Cu + sum of named elements, 99.4% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 °F)
C90800		0.317

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
35	241	17	117	10	65	

C90810

	Continuous cast	GreenAlloys™
Product description	High tin bronze	
Solids	1" to 6" O.D.	
Tubes	1" to 6" O.D.	
Rectangles	Up to 10"	
Standard lengths	144"	
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar	
Compliance	C90810 is compliant with key legislation including (1) Federal Safe Drinking Water Act - SDWA, (2) S. 3874 Federal Reduction of Lead in Drinking Water Act, (3) California AB1953, and (4) Vermont Act 193	

Typical uses

Industrial

Bearings, gears, shafts, worm gears

Chemical composition

Cu (%) ¹	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%) ²	Ni (%) ³	Al (%)	S (%)	Sb (%)	Si (%)
remain.	0.25	11.00-13.00	0.30	0.15	0.15-0.80	0.50	0.005	0.05	0.20	0.005

Chemical composition provided by CDA

¹In determining Cu min., Cu may be calculated as Cu + Ni.

²For continuous castings, P shall be 1.5% max.

³Ni value includes Co.

Note: Cu + sum of named elements, 99.4% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68° F)
C90810	20	0.323

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
					95	

C91000

Continuous cast		GreenAlloys™
Product description	Tin bronze	
Solids	1" to 6" O.D.	
Tubes	1" to 6" O.D.	
Rectangles	Up to 10"	
Standard lengths	144"	
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar	
Compliance	C91000 is compliant with key legislation including (1) Federal Safe Drinking Water Act - SDWA, (2) S. 3874 Federal Reduction of Lead in Drinking Water Act, (3) California AB1953, and (4) Vermont Act 193	

Typical uses

Industrial

Bearings, piston rings

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C91000	B505 B505M			QQ-C-390, D2 QQ-B-1005, Comp 9	MIL-B-16262, Grade III	Tin bronze, 65

Chemical composition

Cu (%) ¹	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%)	Ni (%) ²	Al (%)	S (%)	Sb (%)	Si (%)
84.00-86.00	0.20	14.00-16.00	1.50	0.10	1.50	0.80	0.005	0.05	0.20	0.005

Chemical composition according to ASTM B505/B505M-23

¹In determining Cu min., Cu may be calculated as Cu + Ni. ²Ni value includes Co.
Note: Cu + sum of named elements, 99.4% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68° F)
C91000	20	0.317

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
30	207				105	

Mechanical properties according to ASTM B505/B505M-23

Physical properties

	US customary	Metric
Melting point – liquidus	1760 °F	960 °C
Melting point – solidus	1505 °F	818 °C
Electrical conductivity	9% IACS at 68 °F	0.054 MegaSiemens/cm at 20 °C
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	16000 ksi	110000 MPa

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Excellent
Brazing*	Good
Oxyacetylene welding	Fair
Gas shielded arc welding	Fair
Coated metal arc welding	Fair
Machinability rating	20

Fabrication properties provided by CDA

*Since brazing is performed within the hot-short range, strain must be avoided during brazing and cooling.

Casting characteristics

Casting attribute	Level
Casting yield	Medium
Drossing	Low
Effect of section size	High
Fluidity	High
Gassing	Medium
Patternmakers shrinkage (inches per foot)	3/16
Shrinkage in solidification	Low

Casting characteristics provided by CDA

C91100

Continuous cast

Product description	High tin bronze
Solids	1" to 6" O.D.
Tubes	1" to 6" O.D.
Rectangles	Up to 10"
Standard lengths	144"
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar

Typical uses

Electrical

Hollow conductors

Industrial

Bearings, bushings, piston rings

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C91100	B22 B22M					

Chemical composition

Cu (%) ¹	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%) ²	Ni (%) ³	Al (%)	S (%)	Sb (%)	Si (%)
82.00-85.00	0.25	15.00-17.00	0.25	0.25	1.00	0.50	0.005	0.05	0.20	0.005

Chemical composition according to ASTM B22/B22M-17

¹In determining Cu min., Cu may be calculated as Cu + Ni.

²For continuous castings, P shall be 1.5% max.

³Ni value includes Co.

Note: Cu + sum of named elements, 99.4% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 ° F)
C91100	10	0.318

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (3000 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
					135	

Physical properties

	US customary	Metric
Melting point – liquidus	1742 °F	950 °C
Melting point – solidus	1505 °F	818 °C
Electrical conductivity	8% IACS at 68 °F	0.049 MegaSiemens/cm at 20 °C
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	15000 ksi	103400 MPa

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Excellent
Brazing*	Good
Oxyacetylene welding	Fair
Gas shielded arc welding	Fair
Coated metal arc welding	Fair
Machinability rating	10

Fabrication properties provided by CDA

*Since brazing is performed within the hot-short range, strain must be avoided during brazing and cooling.

Casting characteristics

Casting attribute	Level
Casting yield	Medium
Drossing	Low
Effect of section size	Medium
Fluidity	High
Gassing	Medium-high
Patternmakers shrinkage (inches per foot)	3/16
Shrinkage in solidification	Low

Casting characteristics provided by CDA

C91300

Continuous cast		GreenAlloys™
Product description	Tin bronze	
Solids	1" to 6" O.D.	
Tubes	1" to 6" O.D.	
Rectangles	Up to 10"	
Standard lengths	144"	
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar	
Compliance	C91300 is compliant with key legislation including (1) Federal Safe Drinking Water Act - SDWA, (2) S. 3874 Federal Reduction of Lead in Drinking Water Act, (3) California AB1953, and (4) Vermont Act 193	

Typical uses

Consumer

Bells

Industrial

Bearings, bushings, piston rings, valve bodies

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C91300	B505 B505M B22 B22M		7322	QQ-C-390, D1		

Chemical composition

Cu (%) ¹	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%)	Ni (%) ^{1,2}	Al (%)	S (%)	Sb (%)	Si (%)
79.00-82.00	0.25	18.00-20.00	0.25	0.25	1.50	0.50	0.005	0.05	0.20	0.005

Chemical composition according to ASTM B505/B505M-23

¹In determining Cu min., Cu may be calculated as Cu + Ni. ²Ni value includes Co.
Note: Cu + sum of named elements, 99.4% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 ° F)
C91300	10	0.318

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (3000 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
					160	

Mechanical properties according to ASTM B505/B505M-23

Physical properties

	US customary	Metric
Melting point – liquidus	1632 °F	889 °C
Melting point – solidus	1505 °F	818 °C
Electrical conductivity	7% IACS at 68 °F	0.04 MegaSiemens/cm at 20 °C
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	16000 ksi	110000 MPa

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Excellent
Brazing*	Good
Oxyacetylene welding	Fair
Gas shielded arc welding	Fair
Coated metal arc welding	Fair
Machinability rating	10

Fabrication properties provided by CDA

*Since brazing is performed within the hot-short range, strain must be avoided during brazing and cooling.

Casting characteristics

Casting attribute	Level
Casting yield	Medium
Drossing	Low
Effect of section size	Medium
Fluidity	High
Gassing	Medium-high
Patternmakers shrinkage (inches per foot)	3/16
Shrinkage in solidification	Low

Casting characteristics provided by CDA

C91600

Continuous cast

Product description	High tin bronze
Solids	1" to 6" O.D.
Tubes	1" to 6" O.D.
Rectangles	Up to 10"
Standard lengths	144"
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar

Typical uses

Fasteners

Nuts

Industrial

Bearings, bushings, fittings, gears, piston rings, pump impellers, steam castings

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C91600	B427			QQ-C-390, F1		

Chemical composition

Cu (%) ¹	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%)	Ni (%) ²	Al (%)	S (%)	Sb (%)	Si (%)
86.00-89.00	0.25	9.70-10.80	0.25	0.20	0.30	1.20-2.00	0.005	0.05	0.20	0.005

Chemical composition according to ASTM B427-21

¹In determining Cu min., Cu may be calculated as Cu + Ni. ²Ni value includes Co.
Note: Cu + sum of named elements, 99.4% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68° F)
C91600	20	0.32

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
45	310	25	172	10	85	

Mechanical properties according to ASTM B427-21

Physical properties

	US customary	Metric
Melting point – liquidus	1887 °F	1031 °C
Melting point – solidus	1575 °F	857 °C
Density	0.32 lb/in ³ at 68 °F	8.86 gm/cm ³ at 20 °C
Specific gravity	8.86	8.86
Electrical conductivity	10% IACS at 68 °F	0.058 MegaSiemens/cm at 20 °C
Thermal conductivity	40.8 Btu/sq ft/ft hr/ °F at 68 °F	70.6 W/m at 20 °C
Coefficient of thermal expansion 68-392	9 · 10 ⁻⁶ per °F (68-392 °F)	15.5 · 10 ⁻⁶ per °C (20-200 °C)
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	16000 ksi	110000 MPa

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Excellent
Brazing*	Good
Oxyacetylene welding	Fair
Gas shielded arc welding	Fair
Coated metal arc welding	Fair
Machinability rating	20

Fabrication properties provided by CDA

*Since brazing is performed within the hot-short range, strain must be avoided during brazing and cooling.

C91700

Continuous cast

Product description	High tin bronze
Solids	1" to 6" O.D.
Tubes	1" to 6" O.D.
Rectangles	Up to 10"
Standard lengths	144"
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar

Typical uses

Industrial

Gears, heavy load/relatively low-speed bearings, worm gears, worm wheels

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C91700	B427					Nickel gear bronze

Chemical composition

Cu (%) ¹	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%)	Ni (%) ²	Al (%)	S (%)	Sb (%)	Si (%)
84.00-87.00	0.25	11.30-12.50	0.25	0.20	0.30	1.20-2.00	0.005	0.05	0.20	0.005

Chemical composition according to ASTM B427-21

¹In determining Cu min., Cu may be calculated as Cu + Ni. ²Ni value includes Co.
Note: Cu + sum of named elements, 99.4% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68° F)
C91700	20	0.316

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
35	241	17	117	10	65	

Mechanical properties according to ASTM B427-21

Physical properties

	US customary	Metric
Melting point – liquidus	1859 °F	1015 °C
Melting point – solidus	1563 °F	851 °C
Density	0.316 lb/in ³ at 68 °F	8.75 gm/cm ³ at 20 °C
Specific gravity	8.75	8.75
Electrical conductivity	10% IACS at 68 °F	0.058 MegaSiemens/cm at 20 °C
Thermal conductivity	40.8 Btu/sq ft/ft hr/ °F at 68 °F	70.6 W/m at 20 °C
Coefficient of thermal expansion 68-392	9 · 10 ⁻⁶ per °F (68-392 °F)	15.5 · 10 ⁻⁶ per °C (20-200 °C)
Specific heat capacity	0.09 Btu/lb/ °F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	15000 ksi	103400 MPa
Magnetic Permeability	1	1

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Excellent
Brazing*	Good
Oxyacetylene welding	Fair
Gas shielded arc welding	Fair
Coated metal arc welding	Fair
Machinability rating	20

Fabrication properties provided by CDA

*Since brazing is performed within the hot-short range, strain must be avoided during brazing and cooling.

C92200

Continuous cast

Product description	Leaded tin bronze
Solids	1/2" to 13" O.D.
Tubes	1" to 16" O.D.
Rectangles	Up to 20"
Standard lengths	144"
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar

Typical uses

Architecture

Ornamental castings

Building

Cooling equipment, heating equipment

Fasteners

Nuts

Industrial

Bearings, bushings, cryogenic valves, fittings used to 550 °F, gears, medium-pressure hydraulic equipment, piston rings, pump impellers, pumps used to 550 °F, valve components, valves for water meters

Marine

Marine castings

Plumbing

Medium-pressure steam equipment to 550 °F

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C92200	B505 B505M B61 B143-2A	622 J461 J462		QQ-C-390, D4 QQ-B-1005, Comp 1	MIL-B-11553, Comp 1 MIL-B-16541	Navy M bronze

Chemical composition

Cu (%) ¹	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%)	Ni (%) ^{1,2}	Al (%)	S (%)	Sb (%)	Si (%)
86.00-90.00	1.00-2.00	5.50-6.50	3.00-5.00	0.25	1.50	1.00	0.005	0.05	0.25	0.005

Chemical composition according to ASTM B505/B505M-23

¹In determining Cu min., Cu may be calculated as Cu + Ni. ²Ni value includes Co.
Note: Cu + sum of named elements, 99.3% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 °F)
C92200	42	0.312

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
38	262	19	131	18	65	

Mechanical properties according to ASTM B505/B505M-23

Physical properties

	US customary	Metric
Melting point – liquidus	1810 °F	988 °C
Melting point – solidus	1518 °F	826 °C
Density	0.312 lb/in ³ at 68 °F	8.64 gm/cm ³ at 20 °C
Specific gravity	8.64	8.64
Electrical conductivity	14% IACS at 68 °F	0.083 MegaSiemens/cm at 20 °C
Thermal conductivity	40.2 Btu/sq ft/ft hr/°F at 68 °F	69.6 W/m at 20 °C
Coefficient of thermal expansion 68-572	10 · 10 ⁻⁶ per °F (68-572 °F)	17.3 · 10 ⁻⁶ per °C (20-300 °C)
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	14000 ksi	96500 MPa
Incipient melting	600 °F	316 °C
Magnetic permeability	1	1

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Excellent
Brazing*	Excellent
Oxyacetylene welding	Not recommended
Gas shielded arc welding	Not recommended
Coated metal arc welding	Not recommended
Machinability rating	42

Fabrication properties provided by CDA

*Since brazing is performed within the hot-short range, strain must be avoided during brazing and cooling.

Casting characteristics

Casting attribute	Level
Casting yield	Medium
Drossing	Low
Effect of section size	High
Fluidity	Medium
Gassing	Medium
Patternmakers shrinkage (inches per foot)	3/16
Shrinkage in solidification	Low

Casting characteristics provided by CDA

C92300

Continuous cast

Product description	Leaded tin bronze
Solids	1/2" to 13" O.D.
Tubes	1" to 16" O.D.
Rectangles	Up to 20"
Standard lengths	144"
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar

Typical uses

Builders hardware

Structural castings

Fasteners

Nuts

Industrial

Bearings, bushings, gears, high pressure hydraulic equipment, piston rings, pump impellers, pump parts, valve bodies

Plumbing

High-pressure steam equipment

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C92300	B505 B505M B143-2B	621 J461 J462		QQ-C-390, D3 QQ-B-1005, Comp 6	MIL-B-11553, Comp 6	

Chemical composition

Cu (%) ¹	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%)	Ni (%) ^{1,2}	Al (%)	S (%)	Sb (%)	Si (%)
85.00-89.00	0.30-1.00	7.50-9.00	2.50-5.00	0.25	1.50	1.00	0.005	0.05	0.25	0.005

Chemical composition according to ASTM B505/B505M-23

¹In determining Cu min., Cu may be calculated as Cu + Ni. ²Ni value includes Co.
Note: Cu + sum of named elements, 99.3% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 °F)
C92300	42	0.317

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
40	276	19	131	16	70	

Mechanical properties according to ASTM B505/B505M-23

Physical properties

	US customary	Metric
Melting point – liquidus	1830 °F	999 °C
Melting point – solidus	1570 °F	854 °C
Density	0.317 lb/in ³ at 68 °F	8.77 gm/cm ³ at 20 °C
Specific gravity	8.77	8.77
Electrical conductivity	12% IACS at 68 °F	0.07 MegaSiemens/cm at 20 °C
Thermal conductivity	43.2 Btu/sq ft/ft hr/°F at 68 °F	74.8 W/m at 20 °C
Coefficient of thermal expansion 68-392	10 · 10 ⁻⁶ per °F (68-392 °F)	17.3 · 10 ⁻⁶ per °C (20-200 °C)
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	14000 ksi	96500 MPa
Incipient melting	600 °F	316 °C

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Excellent
Brazing*	Good
Oxyacetylene welding	Not recommended
Gas shielded arc welding	Not recommended
Coated metal arc welding	Not recommended
Machinability rating	42

Fabrication properties provided by CDA

*Since brazing is performed within the hot-short range, strain must be avoided during brazing and cooling.

Casting characteristics

Casting attribute	Level
Casting yield	Medium
Drossing	Low
Effect of section size	High
Fluidity	Medium
Gassing	Medium
Patternmakers shrinkage (inches per foot)	3/16
Shrinkage in solidification	Low

Casting characteristics provided by CDA

C92500

Continuous cast

Product description	Nickel-phosphor bronze
Solids	1/2" to 13" O.D.
Tubes	1" to 16" O.D.
Rectangles	Up to 20"
Standard lengths	144"
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar

Typical uses

Automotive

Automotive synchronizer rings

Industrial

Gears

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C92500	B505 B505M	J461 J462				

Chemical composition

Cu (%) ¹	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%)	Ni (%) ^{1,2}	Al (%)	S (%)	Sb (%)	Si (%)
85.00-88.00	1.00-1.50	10.00-12.00	0.50	0.30	1.50	0.80-1.50	0.005	0.05	0.25	0.005

Chemical composition according to ASTM B505/B505M-23

¹In determining Cu min., Cu may be calculated as Cu + Ni. ²Ni value includes Co.
Note: Cu + sum of named elements, 99.3% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 ° F)
C92500	30	0.317

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
40	276	24	165	10	80	

Mechanical properties according to ASTM B505/B505M-23

Physical properties

	US customary	Metric
Density	0.317 lb/in ³ at 68 °F	8.7 gm/cm ³ at 20 °C
Specific gravity	8.7	8.7
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	16000 ksi	110000 MPa
Incipient Melting	600 °F	316 °C

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Excellent
Brazing*	Good
Oxyacetylene welding	Not recommended
Gas shielded arc welding	Not recommended
Coated metal arc welding	Not recommended
Machinability rating	30

Fabrication properties provided by CDA

*Since brazing is performed within the hot-short range, strain must be avoided during brazing and cooling.

Casting characteristics

Casting attribute	Level
Casting yield	Medium
Drossing	Low
Effect of section size	High
Fluidity	Medium
Gassing	Medium-high
Patternmakers shrinkage (inches per foot)	3/16
Shrinkage in solidification	Low

Casting characteristics provided by CDA

C92700

Continuous cast

Product description	Leaded tin bronze
Solids	1/2" to 13" O.D.
Tubes	1" to 16" O.D.
Rectangles	Up to 20"
Standard lengths	144"
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar

Typical uses

Fasteners

Lead screw nuts

Industrial

Bearings, bushings, gears, heavy-duty bearings, pump impellers, pump pistons, steam fittings

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C92700	B505 B505M	63 J461 J462				

Chemical composition

Cu (%) ¹	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%)	Ni (%) ^{1,2}	Al (%)	S (%)	Sb (%)	Si (%)
86.00-89.00	1.00-2.50	9.00-11.00	0.70	0.20	1.50	1.00	0.005	0.05	0.25	0.005

Chemical composition according to ASTM B505/B505M-23

¹In determining Cu min., Cu may be calculated as Cu + Ni. ²Ni value includes Co.
Note: Cu + sum of named elements, 99.3% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 ° F)
C92700	45	0.317

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
38	252	20	138	8	77	

Mechanical properties according to ASTM B505/B505M-23

Physical properties

	US customary	Metric
Melting point – liquidus	1800 °F	982 °C
Melting point – solidus	1550 °F	843 °C
Density	0.317 lb/in ³ at 68 °F	8.78 gm/cm ³ at 20 °C
Specific gravity	8.78	8.78
Electrical conductivity	11% IACS at 68 °F	0.064 MegaSiemens/cm at 20 °C
Thermal conductivity	27.2 Btu/sq ft/ft hr/°F at 68 °F	47 W/m at 20 °C
Coefficient of thermal expansion 68-392	10 · 10 ⁻⁶ per °F (68-392 °F)	17.3 · 10 ⁻⁶ per °C (20-200 °C)
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	16000 ksi	110000 MPa
Incipient melting	600 °F	316 °C

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Excellent
Brazing*	Good
Oxyacetylene welding	Not recommended
Gas shielded arc welding	Not recommended
Coated metal arc welding	Not recommended
Machinability rating	45

Fabrication properties provided by CDA

*Since brazing is performed within the hot-short range, strain must be avoided during brazing and cooling.

Casting characteristics

Casting attribute	Level
Casting yield	Medium
Drossing	Low
Effect of section size	High
Fluidity	Medium
Gassing	Medium
Patternmakers shrinkage (inches per foot)	3/16
Shrinkage in solidification	Low

Casting characteristics provided by CDA

C92800

Continuous cast

Product description	Leaded tin bronze
Solids	1/2" to 13" O.D.
Tubes	1" to 16" O.D.
Rectangles	Up to 20"
Standard lengths	144"
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar

Typical uses

Industrial

Bushings, corrosion-resistant castings, piston rings

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C92800	B505 B505M		7320			

Chemical composition

Cu (%) ¹	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%)	Ni (%) ^{1,2}	Al (%)	S (%)	Sb (%)	Si (%)
78.00-82.00	4.00-6.00	15.00-17.00	0.80	0.20	1.50	0.80	0.005	0.05	0.25	0.005

Chemical composition according to ASTM B505/B505M-23

¹In determining Cu min., Cu may be calculated as Cu + Ni. ²Ni value includes Co.
Note: Cu + sum of named elements, 99.3% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68° F)
C92800	70	0.317

Physical properties

	US customary	Metric
Melting point – liquidus	1751 °F	955 °C
Melting point – solidus	1505 °F	818 °C
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	16000 ksi	110000 MPa

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Excellent
Brazing*	Good
Oxyacetylene welding	Not recommended
Gas shielded arc welding	Not recommended
Coated metal arc welding	Not recommended
Machinability rating	70

Fabrication properties provided by CDA

*Since brazing is performed within the hot-short range, strain must be avoided during brazing and cooling.

Casting characteristics

Casting attribute	Level
Casting yield	Medium
Drossing	Low
Effect of section size	Medium
Fluidity	Medium
Gassing	Medium
Patternmakers shrinkage (inches per foot)	3/16
Shrinkage in solidification	Low

Casting characteristics provided by CDA

C92900

Continuous cast

Product description	Leaded nickel-tin bronze
Solids	1/2" to 13" O.D.
Tubes	1" to 16" O.D.
Rectangles	Up to 20"
Standard lengths	144"
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar

Typical uses

Industrial

Cams, gears, general-service bearings, impellers for mine water, pump bodies, wear plates, worm gears

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C92900	B505 B505M					

Chemical composition

Cu (%) ¹	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%)	Ni (%) ^{1,2}	Al (%)	S (%)	Sb (%)	Si (%)
82.00-86.00	2.00-3.20	9.00-11.00	0.25	0.20	1.50	2.80-4.00	0.005	0.05	0.25	0.005

Chemical composition according to ASTM B505/B505M-23

¹In determining Cu min., Cu may be calculated as Cu + Ni. ²Ni value includes Co.
Note: Cu + sum of named elements, 99.3% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68° F)
C92900	40	0.32

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
45	310	25	172	8	75	

Mechanical properties according to ASTM B505/B505M-23

Physical properties

	US customary	Metric
Melting point – liquidus	1887 °F	1031 °C
Melting point – solidus	1575 °F	857 °C
Density	0.32 lb/in ³ at 68 °F	8.86 gm/cm ³ at 20 °C
Specific gravity	8.86	8.86
Electrical conductivity	9% IACS at 68 °F	0.053 MegaSiemens/cm at 20 °C
Thermal conductivity	33.6 Btu/sq ft/ft hr/°F at 68 °F	58.2 W/m at 20 °C
Coefficient of thermal expansion 68-392	9.5 · 10 ⁻⁶ per °F (68-392 °F)	16.4 · 10 ⁻⁶ per °C (20-200 °C)
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	14000 ksi	96500 MPa
Incipient melting	600 °F	316 °C

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Excellent
Brazing*	Good
Oxyacetylene welding	Not recommended
Gas shielded arc welding	Not recommended
Coated metal arc welding	Not recommended
Machinability rating	40

Fabrication properties provided by CDA

*Since brazing is performed within the hot-short range, strain must be avoided during brazing and cooling.

Casting characteristics

Casting attribute	Level
Casting yield	Medium
Drossing	Low
Effect of section size	High
Fluidity	High
Gassing	Medium
Patternmakers shrinkage (inches per foot)	3/16
Shrinkage in solidification	Low

Casting characteristics provided by CDA

C93200

Standard-stocked product	Continuous cast
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Product description	Leaded tin bronze
Solids	3/8" to 13" O.D.
Tubes	1" to 16" O.D.*
Rectangles	Up to 20"
Standard lengths	105" *Consult mill for wall thickness
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar

Typical uses

Automotive

Automotive fittings

Fasteners

Washers

Industrial

Bearings, bearings for cranes, bushings, diesel engine wrist pin bushings, fittings, forging press toggle lever bearings, fuel pump bushings, general purpose bushings, hydraulic press main lining, hydraulic press stuffing box, insert bearings, linkage bushings for presses, machine parts, machine tool bearings, main spindle bearings, pump fixtures, pump impellers, pumps, roll neck bearings, rolling mill bearings, thrust washers, trunion bearings, water pump bushings

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C93200	B505 B505M	J461 J462		QQ-C-390, E7 QQ-B-1005, Comp 12	MIL-B-11553, Comp 12	Bearing bronze

Chemical composition

Cu (%) ¹	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%)	Ni (%) ^{1,2}	Al (%)	S (%)	Sb (%)	Si (%)
81.00-85.00	6.00-8.00	6.30-7.50	2.00-4.00	0.20	1.50	1.00	0.005	0.08	0.35	0.005

Chemical composition according to ASTM B505/B505M-23

¹In determining Cu min., Cu may be calculated as Cu + Ni. ²Ni value includes Co.
Note: Cu + sum of named elements, 99.0% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 ° F)
C93200	70	0.322

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
35	241	20	138	10	65	

Mechanical properties according to ASTM B505/B505M-23

Physical properties

	US customary	Metric
Melting point – liquidus	1790 °F	977 °C
Melting point – solidus	1570 °F	854 °C
Density	0.322 lb/in ³ at 68 °F	8.91 gm/cm ³ at 20 °C
Specific gravity	8.91	8.91
Electrical conductivity	12% IACS at 68 °F	0.07 MegaSiemens/cm at 20 °C
Thermal conductivity	33.6 Btu/sq ft/ft hr/°F at 68 °F	58.2 W/m at 20 °C
Coefficient of thermal expansion 68-212	10 · 10 ⁻⁶ per °F (68-212 °F)	17.3 · 10 ⁻⁶ per °C (20-100 °C)
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	14500 ksi	100000 MPa

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Excellent
Brazing*	Good
Oxyacetylene welding	Not recommended
Gas shielded arc welding	Not recommended
Coated metal arc welding	Not recommended
Machinability rating	70

Fabrication properties provided by CDA

*Since brazing is performed within the hot-short range, strain must be avoided during brazing and cooling.

Casting characteristics

Casting attribute	Level
Casting yield	High
Drossing	Low
Effect of section size	Medium
Fluidity	Medium
Gassing	Medium
Patternmakers shrinkage (inches per foot)	7/32
Shrinkage in solidification	Low

Casting characteristics provided by CDA

C93400

Continuous cast

Product description	High-leaded tin bronze
Solids	1/2" to 13" O.D.
Tubes	1" to 16" O.D.
Rectangles	Up to 20"
Standard lengths	144"
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar

Typical uses

Fasteners

Washers

Industrial

Bearings, bushings, corrosion-resistant castings, pump impellers, slide bars, thrust bearings

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C93400	B505 B505M	J461 J462		QQ-C-390, E8 QQ-B-1005, Comp 8	MIL-B-11553, Comp 8	

Chemical composition

Cu (%) ¹	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%)	Ni (%) ^{1,2}	Al (%)	S (%)	Sb (%)	Si (%)
82.00-85.00	7.00-9.00	7.00-9.00	0.80	0.20	1.50	1.00	0.005	0.08	0.50	0.005

Chemical composition according to ASTM B505/B505M-23

¹In determining Cu min., Cu may be calculated as Cu + Ni. ²Ni value includes Co.
Note: Cu + sum of named elements, 99.0% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68° F)
C93400	70	0.32

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
34	234	20	138	8	60	

Mechanical properties according to ASTM B505/B505M-23

Physical properties

	US customary	Metric
Density	0.32 lb/in ³ at 68 °F	8.86 gm/cm ³ at 20 °C
Specific gravity	8.86	8.86
Electrical conductivity	12% IACS at 68 °F	0.07 MegaSiemens/cm at 20 °C
Thermal conductivity	33.6 Btu/sq ft/ft hr/°F at 68 °F	58.2 W/m at 20 °C
Coefficient of thermal expansion 68-392	10 · 10 ⁻⁶ per °F (68-392 °F)	17.3 · 10 ⁻⁶ per °C (20-200 °C)
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	11000 ksi	75800 MPa

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Good
Brazing*	Good
Oxyacetylene welding	Not recommended
Gas shielded arc welding	Not recommended
Coated metal arc welding	Not recommended
Machinability rating	70

Fabrication properties provided by CDA

*Since brazing is performed within the hot-short range, strain must be avoided during brazing and cooling.

Casting characteristics

Casting attribute	Level
Casting yield	High
Drossing	Low
Effect of section size	Medium
Fluidity	High
Gassing	Medium
Patternmakers shrinkage (inches per foot)	3/16
Shrinkage in solidification	Low

Casting characteristics provided by CDA

C93500

Continuous cast

Product description	High-leaded tin bronze
Solids	1/2" to 13" O.D.
Tubes	1" to 16" O.D.
Rectangles	Up to 20"
Standard lengths	144"
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar

Typical uses

Automotive

Backing for babbitt-lined bearings

Industrial

Bearings, corrosion-resistant castings, high-speed/light-load bushings, mild acidic applications, pump impellers

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C93500	B505 B505M B144-3C	66 J461 J462		QQ-C-390, E9 QQ-B-1005, Comp 14	MIL-B-11553, Comp 14	

Chemical composition

Cu (%) ¹	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%)	Ni (%) ^{1,2}	Al (%)	S (%)	Sb (%)	Si (%)
83.00-86.00	8.00-10.00	4.30-6.00	2.00	0.20	1.50	1.00	0.005	0.08	0.30	0.005

Chemical composition according to ASTM B505/B505M-23

¹In determining Cu min., Cu may be calculated as Cu + Ni. ²Ni value includes Co.
Note: Cu + sum of named elements, 99.0% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 ° F)
C93500	70	0.32

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
30	207	16	110	12	60	

Mechanical properties according to ASTM B505/B505M-23

Physical properties

	US customary	Metric
Melting point – liquidus	1830 °F	999 °C
Melting point – solidus	1570 °F	854 °C
Density	0.32 lb/in ³ at 68 °F	8.86 gm/cm ³ at 20 °C
Specific gravity	8.86	8.86
Electrical conductivity	15% IACS at 68 °F	0.088 MegaSiemens/cm at 20 °C
Thermal conductivity	40.7 Btu/sq ft/ft hr/°F at 68 °F	70.4 W/m at 20 °C
Coefficient of thermal expansion 68-392	9.9 · 10 ⁻⁶ per °F (68-392 °F)	17.1 · 10 ⁻⁶ per °C (20-200 °C)
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	14500 ksi	100000 MPa
Incipient melting	600 °F	316 °C
Magnetic permeability	1	1

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Good
Brazing*	Good
Oxyacetylene welding	Not recommended
Gas shielded arc welding	Not recommended
Coated metal arc welding	Not recommended
Machinability rating	70

Fabrication properties provided by CDA

*Since brazing is performed within the hot-short range, strain must be avoided during brazing and cooling.

C93600

Continuous cast

Product description	High-leaded tin bronze
Solids	1/2" to 13" O.D.
Tubes	1" to 16" O.D.
Rectangles	Up to 20"
Standard lengths	144"
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar

Typical uses

Industrial

Backs for lined bearings, bushings for corrosion/lubrication/pressure, cam bushings for diesel engines, crankshaft main bearings, deep well pump line shaft bearings, electric motor bearings, flow monitor valves, guide bushings for piston rods, guide bushings for valves, hydraulic gland seals, locomotive bearing parts, main bearings for presses, piston pin bearings, pump sleeves, rod bushings, rolling mill bearings, seals, sleeve bushings (for cranes, etc.), spacer bushings (for pumps, etc.), steel mill bushings, wrist pin bushings

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C93600	B505 B505M					

Chemical composition

Cu (%)	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%)	Ni (%) ¹	Al (%)	S (%)	Sb (%)	Si (%)
79.00-83.00	11.00-13.00	6.00-8.00	1.00	0.20	1.50	1.00	0.005	0.08	0.55	0.005

Chemical composition according to ASTM B505/B505M-23

¹Ni value includes Co.

Note: Cu + sum of named elements, 99.3% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 °F)
C93600	80	0.325

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
33	227	20	138	10	65	

Mechanical properties according to ASTM B505/B505M-23

Physical properties

	US customary	Metric
Melting point – liquidus	1720 °F	938 °C
Melting point – solidus	1550 °F	843 °C
Density	0.325 lb/in ³ at 68 °F	9 gm/cm ³ at 20 °C
Specific gravity	9	9
Electrical conductivity	11% IACS at 68 °F	0.064 MegaSiemens/cm at 20 °C
Thermal conductivity	28.5 Btu/sq ft/ft hr/°F at 68 °F	49.36 W/m at 20 °C
Coefficient of thermal expansion 68-392	10.3 · 10 ⁻⁶ per °F (68-392 °F)	17.8 · 10 ⁻⁶ per °C (20-200 °C)
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	14000 ksi	96516 MPa

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Good
Brazing*	Good
Oxyacetylene welding	Not recommended
Gas shielded arc welding	Not recommended
Coated metal arc welding	Not recommended
Machinability rating	80

Fabrication properties provided by CDA

*Since brazing is performed within the hot-short range, strain must be avoided during brazing and cooling.

Casting characteristics

Casting attribute	Level
Casting yield	High
Drossing	Low
Effect of section size	Low
Fluidity	High
Gassing	Medium
Patternmakers shrinkage (inches per foot)	1/8
Shrinkage in solidification	Low

Casting characteristics provided by CDA

C93700

Continuous cast

Product description	High-leaded tin bronze
Solids	1/2" to 13" O.D.
Tubes	1" to 16" O.D.
Rectangles	Up to 20"
Standard lengths	144"
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar

Typical uses

Builders hardware

Brackets

Fasteners

Nuts, washers for engines

Industrial

Applications requiring acid resistance to sulphite fluids, bearing plates, bearings, bushings, bushings for high speed and heavy pressure, corrosion-resistant castings, crank shafts, high speed/heavy load bearings, impellers, machine parts, parts for steel mill maintenance, pressure-tight castings, pumps, slide guides for steel mills

Marine

Large bearings for ships

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C93700	B505 B505M	J461 J462		QQ-C-390, E10	MIL-B-11553, Comp 23	Bearing bronze 80-10-10 bronze

Chemical composition

Cu (%)	Pb (%)	Sn (%)	Zn (%)	Fe (%) ¹	P (%)	Ni (%) ²	Al (%)	S (%)	Sb (%)	Si (%)
78.00-82.00	8.00-11.00	9.00-11.00	0.80	0.70	1.50	0.50	0.005	0.08	0.50	0.005

Chemical composition according to ASTM B505/B505M-23

¹Fe shall be 0.35% max, when used for steel-backed bearings. ²Ni value includes Co.
Note: Cu + sum of named elements, 99.0% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 °F)
C93700	80	0.32

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
35	241	20	138	6	60	

Mechanical properties according to ASTM B505/B505M-23

Physical properties

	US customary	Metric
Melting point – liquidus	1705 °F	929 °C
Melting point – solidus	1403 °F	762 °C
Density	0.32 lb/in ³ at 68 °F	8.86 gm/cm ³ at 20 °C
Specific gravity	8.86	8.86
Electrical conductivity	10% IACS at 68 °F	0.059 MegaSiemens/cm at 20 °C
Thermal conductivity	27.1 Btu/sq ft/ft hr/°F at 68 °F	46.9 W/m at 20 °C
Coefficient of thermal expansion 68-392	10.3 · 10 ⁻⁶ per °F (68-392 °F)	17.8 · 10 ⁻⁶ per °C (20-200 °C)
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	11000 ksi	75800 MPa
Incipient melting	600 °F	316 °C
Magnetic permeability	1	1

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Good
Brazing*	Good
Oxyacetylene welding	Not recommended
Gas shielded arc welding	Not recommended
Coated metal arc welding	Not recommended
Machinability rating	80

Fabrication properties provided by CDA

*Since brazing is performed within the hot-short range, strain must be avoided during brazing and cooling.

C93800

Continuous cast

Product description	High-leaded tin bronze
Solids	1/2" to 13" O.D.
Tubes	1" to 16" O.D.
Rectangles	Up to 20"
Standard lengths	144"
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar

Typical uses

Industrial

Acid resisting applications, backs for lined journal bearings for locomotives, backs for lined journal bearings for passenger cars, bearings, freight car bearings, general service bearings for moderate pressure, industrial centrifuges, low-friction/moderate pressure bushings, machine parts, pump bodies for acid mine water, pump impellers for acid mine water, pumps, railroad applications, railroad engine casings, wearing material for rod bushings, wearing material for shoes, wearing material for wedges

Marine

Large bearings for ships

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C93800	B505 B505M	J461 J462		QQ-C-390, E6 QQ-B-1005, Comp 19	MIL-B-11553, Comp 19	Anti-acid metal SAE 67

Chemical composition

Cu (%)	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%)	Ni (%) ¹	Al (%)	S (%)	Sb (%)	Si (%)
75.00-79.00	13.00-16.00	6.30-7.50	0.80	0.15	1.50	1.00	0.005	0.08	0.80	0.005

Chemical composition according to ASTM B505/B505M-23

¹Ni value includes Co.

Note: Cu + sum of named elements, 99.0% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 °F)
C93800	80	0.334

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
25	172	16	110	5	55	

Mechanical properties according to ASTM B505/B505M-23

Physical properties

	US customary	Metric
Melting point – liquidus	1730 °F	943 °C
Melting point – solidus	1570 °F	854 °C
Density	0.334 lb/in ³ at 68 °F	9.25 gm/cm ³ at 20 °C
Specific gravity	9.25	9.25
Electrical conductivity	11% IACS at 68 °F	0.066 MegaSiemens/cm at 20 °C
Thermal conductivity	30.2 Btu/sq ft/ft hr/°F at 68 °F	52.3 W/m at 20 °C
Coefficient of thermal expansion 68-392	10.3 · 10 ⁻⁶ per °F (68-392 °F)	17.8 · 10 ⁻⁶ per °C (20-200 °C)
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	10500 ksi	72400 MPa
Incipient melting	600 °F	316 °C
Magnetic permeability	1	1

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Good
Brazing*	Poor
Oxyacetylene welding	Not recommended
Gas shielded arc welding	Not recommended
Coated metal arc welding	Not recommended
Machinability rating	80

Fabrication properties provided by CDA

*Since brazing is performed within the hot-short range, strain must be avoided during brazing and cooling.

Casting characteristics

Casting attribute	Level
Casting yield	High
Drossing	Low
Effect of section size	Low
Fluidity	High
Gassing	Medium
Patternmakers shrinkage (inches per foot)	1/8
Shrinkage in solidification	Low

Casting characteristics provided by CDA

C93900

Continuous cast

Product description	High-leaded tin bronze
Solids	1/2" to 10" O.D.
Tubes	1" to 16" O.D.
Rectangles	Up to 20"
Standard lengths	144"
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar

Typical uses

Industrial

Bearings, pump bodies, pump impellers for mine water

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C93900	B505 B505M	67 J461 J462		QQ-C-390, E5		79-6-15

Chemical composition

Cu (%)	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%)	Ni (%) ¹	Al (%)	S (%)	Sb (%)	Si (%)
76.50-79.50	14.00-18.00	5.00-7.00	1.50	0.40	1.50	0.80	0.005	0.08	0.50	0.005

Chemical composition according to ASTM B505/B505M-23

¹Ni value includes Co.

Note: Cu + sum of named elements, 98.9% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 ° F)
C93900	80	0.334

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
25	172	16	110	5	63	

Mechanical properties according to ASTM B505/B505M-23

Physical properties

	US customary	Metric
Melting point – liquidus	1730 °F	943 °C
Melting point – solidus	1570 °F	854 °C
Density	0.334 lb/in ³ at 68 °F	9.25 gm/cm ³ at 20 °C
Specific gravity	9.25	9.25
Electrical conductivity	11% IACS at 68 °F	0.066 MegaSiemens/cm at 20 °C
Thermal conductivity	30.2 Btu/sq ft/ft hr/°F at 68 °F	52.3 W/m at 20 °C
Coefficient of thermal expansion 68-392	10.3 · 10 ⁻⁶ per °F (68-392 °F)	17.8 · 10 ⁻⁶ per °C (20-200 °C)
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	11000 ksi	75800 MPa
Incipient melting	600 °F	316 °C
Magnetic permeability	1	1

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Good
Brazing*	Poor
Oxyacetylene welding	Not recommended
Gas shielded arc welding	Not recommended
Coated metal arc welding	Not recommended
Machinability rating	80

Fabrication properties provided by CDA

*Since brazing is performed within the hot-short range, strain must be avoided during brazing and cooling.

Casting characteristics

Casting attribute	Level
Casting yield	High
Drossing	Low
Effect of section size	Low
Fluidity	High
Gassing	Medium
Patternmakers shrinkage (inches per foot)	1/8
Shrinkage in solidification	Low

Casting characteristics provided by CDA

C94000

Continuous cast

Product description	High-leaded tin bronze
Solids	1/2" to 10" O.D.
Tubes	1" to 16" O.D.
Rectangles	Up to 10"
Standard lengths	144"
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar

Typical uses

Industrial

High-speed bearings for light loads, high-speed/light-to-medium-pressure bushings, soft bushings, railroad applications, soft metal applications

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C94000	B505 B505M	J461 J462		QQ-C-390, E2 QQ-B-1005, Comp 13	MIL-B-11553, Comp 13	

Chemical composition

Cu (%)	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%)	Ni (%) ¹	Al (%)	S (%) ²	Sb (%)	Si (%)
69.00-72.00	14.00-16.00	12.00-14.00	0.50	0.25	1.50	0.50-1.00	0.005	0.25	0.50	0.005

Chemical composition according to ASTM B505/B505M-23

¹Ni value includes Co. ²For continuous castings, S shall be 0.25% max.
Note: Cu + sum of named elements, 98.7% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68° F)
C94000	80	0.334

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
					80	

Mechanical properties according to ASTM B505/B505M-23

C94100

Continuous cast

Product description	High-leaded tin bronze
Solids	1/2" to 10" O.D.
Tubes	1" to 16" O.D.
Rectangles	Up to 10"
Standard lengths	144"
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar

Typical uses

Industrial
Thrust block

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C94100	B505 B505M			QQ-C-390, E5	MIL-B-16261, Grade X	

Chemical composition

Cu (%)	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%)	Ni (%) ¹	Al (%)	S (%) ²	Sb (%)	Si (%)
72.00-79.00	18.00-22.00	4.50-6.50	1.00	0.25	1.50	1.00	0.005	0.25	0.80	0.005

Chemical composition according to ASTM B505/B505M-23

¹Ni value includes Co. ²For continuous castings, S shall be 0.25% max.
Note: Cu + sum of named elements, 98.7% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68° F)
C94100	80	0.336

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
25	172	17	117	7	50	

Mechanical properties according to ASTM B505/B505M-23

C94300

Continuous cast

Product description	High-leaded tin bronze
Solids	1/2" to 10" O.D.
Tubes	1" to 16" O.D.
Rectangles	Up to 10"
Standard lengths	144"
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar

Typical uses

Industrial

High-speed bearings for light loads, high-speed/light-to-medium pressure bushings, railroad applications, soft bushings, soft metal applications

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C94300	B505 B505M	J461 J462		QQ-C-390, E1 QQ-B-1005, Comp 18	MIL-B-16261, Grade V	Soft bronze

Chemical composition

Cu (%)	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%)	Ni (%) ¹	Al (%)	S (%) ²	Sb (%)	Si (%)
67.00-72.00	23.00-27.00	4.50-6.00	0.80	0.15	1.50	1.00	0.005	0.25	0.80	0.005

Chemical composition according to ASTM B505/B505M-23

¹Ni value includes Co. ²For continuous castings, S shall be 0.25% max.
Note: Cu + sum of named elements, 99.0% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68° F)
C94300	80	0.336

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
21	145	15	103	7	45	

Mechanical properties according to ASTM B505/B505M-23

Physical properties

	US customary	Metric
Density	0.336 lb/in ³ at 68 °F	9.3 gm/cm ³ at 20 °C
Specific gravity	9.3	9.3
Electrical conductivity	9% IACS at 68 °F	0.053 MegaSiemens/cm at 20 °C
Thermal conductivity	36.2 Btu/sq ft/ft hr/°F at 68 °F	62.7 W/m at 20 °C
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	10500 ksi	72400 MPa
Incipient melting	600 °F	316 °C
Magnetic permeability	1	1

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Good
Brazing*	Poor
Oxyacetylene welding	Not recommended
Gas shielded arc welding	Not recommended
Coated metal arc welding	Not recommended
Machinability rating	80

Fabrication properties provided by CDA

*Since brazing is performed within the hot-short range, strain must be avoided during brazing and cooling.

Casting characteristics

Casting attribute	Level
Casting yield	High
Drossing	Low
Effect of section size	Low
Fluidity	High
Gassing	Medium
Patternmakers shrinkage (inches per foot)	1/8
Shrinkage in solidification	Low

Casting characteristics provided by CDA

C94700

Continuous cast

Product description	Nickel-tin bronze
Solids	1/2" to 10" O.D.
Tubes	1" to 16" O.D.
Rectangles	Up to 20"
Standard lengths	144"
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar

Typical uses

Electrical

Circuit breaker parts

Industrial

Bearings, feeding mechanisms, gears, nozzles, piston cylinders, shift forks, valve components, wear guides

Note: Also available in a heat-treated condition.

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C94700	B505 B505M B947 B292-A	J461 J462		QQ-C-390, F2		Cast nickel-tin bronze

Chemical composition

Cu (%)	Pb (%) ¹	Sn (%)	Zn (%)	Fe (%)	P (%)	Ni (%) ²	Al (%)	Mn (%)	S (%)	Sb (%)	Si (%)
85.00-90.00	0.09	4.50-6.00	1.00-2.50	0.25	0.05	4.50-6.00	0.005	0.20	0.05	0.15	0.005

Chemical composition according to ASTM B505/B505M-23

¹It is possible that the mechanical requirements of Copper Alloy UNS No. C94700 in the heat-treated condition will not be attained if the lead content exceeds 0.01%.

²Ni value includes Co.

Note: Cu + sum of named elements, 98.7% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 ° F)
C94700	30	0.32

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
45	310	20	138	25	85	

Mechanical properties according to ASTM B505/B505M-23

Physical properties

	US customary	Metric
Melting point – liquidus	1880 °F	1027 °C
Melting point – solidus	1660 °F	904 °C
Density	0.32 lb/in ³ at 68 °F	8.86 gm/cm ³ at 20 °C
Specific gravity	8.86	8.86
Electrical conductivity	12% IACS at 68 °F	0.07 MegaSiemens/cm at 20 °C
Thermal conductivity	31.2 Btu/sq ft/ft hr/°F at 68 °F	54 W/m at 20 °C
Coefficient of thermal expansion 68-392	10.9 · 10 ⁻⁶ per °F (68-392 °F)	18.8 · 10 ⁻⁶ per °C (20-200 °C)
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	15000 ksi	103400 MPa

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Excellent
Brazing*	Excellent
Oxyacetylene welding	Fair
Gas shielded arc welding	Good
Coated metal arc welding	Good
Machinability rating	30

Fabrication properties provided by CDA

*Since brazing is performed within the hot-short range, strain must be avoided during brazing and cooling.

Casting characteristics

Casting attribute	Level
Casting yield	Medium
Drossing	Low
Effect of section size	Medium
Fluidity	Medium
Gassing	Medium
Patternmakers shrinkage (inches per foot)	3/16
Shrinkage in solidification	Medium

Casting characteristics provided by CDA

C94700HT

Continuous cast

Product description	Nickel-tin bronze
Solids	1/2" to 10" O.D.
Tubes	1" to 16" O.D.
Rectangles	Up to 20"
Standard lengths	24"*
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/ rectangular bar *Consult mill for other lengths

Typical uses

Electrical

Circuit breaker parts

Industrial

Bearings, feeding mechanisms, gears, nozzles, piston cylinders, shift forks, valve components, wear guides

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C94700	B505 B505M B947 B292-A	J461 J462		QQ-C-390, F2		Cast nickel-tin bronze

Chemical composition

Cu (%)	Pb (%) ¹	Sn (%)	Zn (%)	Fe (%)	P (%)	Ni (%) ²	Al (%)	Mn (%)	S (%)	Sb (%)	Si (%)
85.00-90.00	0.09	4.50-6.00	1.00-2.50	0.25	0.05	4.50-6.00	0.005	0.20	0.05	0.15	0.005

Chemical composition according to ASTM B505/B505M-23

¹It is possible that the mechanical requirements of Copper Alloy UNS No. C94700 in the heat-treated condition will not be attained if the lead content exceeds 0.01%.

²Ni value includes Co.

Note: Cu + sum of named elements, 98.7% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 ° F)
C94700HT	30	0.32

Note: HT = heat treated.

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (3000 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
75	517	50	345	5	180	Heat treated

Mechanical properties according to ASTM B505/B505M-23

C94800

Continuous cast

Product description	Leaded nickel-tin bronze
Solids	1/2" to 10" O.D.
Tubes	1" to 16" O.D.
Rectangles	Up to 20"
Standard lengths	144"
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar

Typical uses

Builders hardware

Structural castings

Industrial

Bearings, gear components, machinery parts, motion translation devices

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C94800	B505 B505M B948 B292-B			QQ-C-390, F3		

Chemical composition

Cu (%)	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%)	Ni (%) ¹	Al (%)	Mn (%)	S (%)	Sb (%)	Si (%)
84.00-89.00	0.30-1.00	4.50-6.00	1.00-2.50	0.25	0.05	4.50-6.00	0.005	0.20	0.05	0.15	0.005

Chemical composition according to ASTM B505/B505M-23

¹Ni value includes Co.

Note: Cu + sum of named elements, 98.7% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68° F)
C94800	50	0.32

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
40	276	20	138	20	80	

Mechanical properties according to ASTM B505/B505M-23

Physical properties

	US customary	Metric
Melting point – liquidus	1880 °F	1027 °C
Melting point – solidus	1660 °F	904 °C
Density	0.32 lb/in ³ at 68 °F	8.86 gm/cm ³ at 20 °C
Specific gravity	8.86	8.86
Electrical conductivity	12% IACS at 68 °F	0.07 MegaSiemens/cm at 20 °C
Thermal conductivity	22.3 Btu/sq ft/ft hr/°F at 68 °F	38.6 W/m at 20 °C
Coefficient of thermal expansion 68-572	10.9 · 10 ⁻⁶ per °F (68-572 °F)	18.8 · 10 ⁻⁶ per °C (20-300 °C)
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	15000 ksi	103400 MPa

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Excellent
Brazing*	Good
Oxyacetylene welding	Not recommended
Gas shielded arc welding	Not recommended
Coated metal arc welding	Not recommended
Machinability rating	50

Fabrication properties provided by CDA

*Since brazing is performed within the hot-short range, strain must be avoided during brazing and cooling.

Casting characteristics

Casting attribute	Level
Casting yield	Medium
Drossing	Low
Effect of section size	Medium
Fluidity	Medium
Gassing	Medium
Patternmakers shrinkage (inches per foot)	3/16
Shrinkage in solidification	Medium

Casting characteristics provided by CDA

C95200

Continuous cast

Product description	Aluminum bronze
Solids	1/2" to 9" O.D.
Tubes	1 1/8" to 9" O.D.
Rectangles	Up to 15"
Standard lengths	144"
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar

Typical uses

Electrical

Electrical hardware

Fasteners

Nuts

Industrial

Acid-resistant pumps, bearing liners, bearings, bushings, gears, high-strength clamps, hot mill guides, hydrant parts, large gear parts, mild alkali applications, pickling equipment, pickling tanks, plungers, pump parts, pump rods, thrust pads, valve bodies, valve seats, valves, wear plates, welding jaws, worm wheels, worms

Marine

Covers for marine hardware, marine engines, marine hardware, propellers

Ordnance

Gun mountings, gun slides

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C95200	B505 B505M	68A J461 J462		QQ-C-390, G6 QQ-B-671, Class 1	MIL-B-16033, Class 1	Aluminum bronze 9A

Chemical composition

Cu (%)	Fe (%)	Al (%)
86.00 min	2.50-4.00	8.50-9.50

Chemical composition according to ASTM B505/B505M-23

Note: Cu + sum of named elements, 99.0% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 °F)
C95200	20	0.276

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (3000 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
68	469	26	179	20	125	

Mechanical properties according to ASTM B505/B505M-23

Physical properties

	US customary	Metric
Melting point – liquidus	1913 °F	1045 °C
Melting point – solidus	1907 °F	1042 °C
Density	0.276 lb/in ³ at 68 °F	7.64 gm/cm ³ at 20 °C
Specific gravity	7.64	7.64
Electrical conductivity	11% IACS at 68 °F	0.064 MegaSiemens/cm at 20 °C
Thermal conductivity	29.1 Btu/sq ft/ft hr/°F at 68 °F	50.4 W/m at 20 °C
Coefficient of thermal expansion 68-572	9 · 10 ⁻⁶ per °F (68-572 °F)	15.5 · 10 ⁻⁶ per °C (20-300 °C)
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	15000 ksi	103400 MPa
Magnetic permeability*	1.1	1.1
Poisson's ratio	0.31	0.31

Physical properties provided by CDA

*Field strength 16000 A/m (200 Oersted)

Fabrication properties

Technique	Suitability
Soldering	Good
Brazing	Good
Oxyacetylene welding	Not recommended
Gas shielded arc welding	Excellent
Coated metal arc welding	Good
Machinability rating	20

Fabrication properties provided by CDA.

Casting characteristics

Casting attribute	Level
Casting yield	Low
Drossing	High
Effect of section size	Low
Fluidity	Medium
Gassing	Medium
Patternmakers shrinkage (inches per foot)	1/4
Shrinkage in solidification	High
Shrinkage during freezing	High

Casting characteristics provided by CDA

C95300

Continuous cast

Product description	Aluminum bronze
Solids	1/2" to 9" O.D.
Tubes	1 1/8" to 9" O.D.
Rectangles	Up to 15"
Standard lengths	144"
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/ rectangular bar

Typical uses

Electrical

Connectors

Fasteners

Stripped nuts

Industrial

Bearing segment for the steel industry, cams, gears, high-strength clamps, high-temperature applications, large hold-down screws, mining machine parts, pickling baskets, pickling hooks, pressure blocks for the steel industry, valve bodies, welding jaws

Marine

Covers for marine hardware, marine equipment

Note: Also available in a heat-treated condition.

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C95300	B505 B505M	68B J461 J462		QQ-C-390, G7 QQ-B-671, Class 2	MIL-B-16033, Class 2	Aluminum bronze 9B

Chemical composition

Cu (%)	Fe (%)	Al (%)
86.00 min	0.80-1.50	9.00-11.00

Chemical composition according to ASTM B505/B505M-23

Note: Cu + sum of named elements, 99.0% min. Unless otherwise noted, single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 °F)
C95300	55	0.272

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (3000 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
70	483	26	179	25	125	

Mechanical properties according to ASTM B505/B505M-23

Physical properties

	US customary	Metric
Melting point – liquidus	1913 °F	1045 °C
Melting point – solidus	1904 °F	1040 °C
Density	0.272 lb/in ³ at 68 °F	7.53 gm/cm ³ at 20 °C
Specific gravity	7.53	7.53
Electrical conductivity	13% IACS at 68 °F	0.075 MegaSiemens/cm at 20 °C
Thermal conductivity	36.3 Btu/sq ft/ft hr/°F at 68 °F	62.8 W/m at 20 °C
Coefficient of thermal expansion 68-572	9 · 10 ⁻⁶ per °F (68-572 °F)	15.5 · 10 ⁻⁶ per °C (20-300 °C)
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	16000 ksi	110000 MPa
Magnetic permeability*	1.07	1.07

Physical properties provided by CDA

*Field strength 8 kA/m

Fabrication properties

Technique	Suitability
Soldering	Good
Brazing	Good
Oxyacetylene welding	Not recommended
Gas shielded arc welding	Excellent
Coated metal arc welding	Good
Machinability rating	55

Fabrication properties provided by CDA.

Casting characteristics

Casting attribute	Level
Casting yield	Low
Drossing	High
Effect of section size	Low
Fluidity	Medium
Gassing	Medium
Patternmakers shrinkage (inches per foot)	3/16
Shrinkage in solidification	High

Casting characteristics provided by CDA

C95300HT

Continuous cast

Product description	Aluminum bronze
Solids	1/2" to 9" O.D.
Tubes	1 1/8" to 9" O.D.
Rectangles	Up to 15"
Standard lengths	24**
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar *Consult mill for other lengths

Typical uses

Electrical

Connectors

Fasteners

Stripped nuts

Industrial

Bearing segment for the steel industry, cams, gears, high-strength clamps, high-temperature applications, large hold-down screws, mining machine parts, pickling baskets, pickling hooks, pressure blocks for the steel industry, valve bodies, welding jaws

Marine

Covers for marine hardware, marine equipment

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C95300	B505 B505M	68B J461 J462		QQ-C-390, G7 QQ-B-671, Class 2	MIL-B-16033, Class 2	Aluminum bronze 9B

Chemical composition

Cu (%)	Fe (%)	Al (%)
86.00 min	0.80-1.50	9.00-11.00

Chemical composition according to ASTM B505/B505M-23

Note: Cu + sum of named elements, 99.0% min. Unless otherwise noted, single values represent maximums.

C95300HT continued

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 ° F)
C95300HT	55	0.272

Note: HT = heat treated.

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (3000 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
80	552	40	276	12	132	Heat treated

Mechanical properties according to ASTM B505/B505M-23

C95400

Standard-stocked product	Continuous cast	GreenAlloys™
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Product description	Aluminum bronze
Solids	1/2" to 10" O.D.
Tubes	1 1/8" to 12" O.D.*
Rectangles	Up to 15"
Standard lengths	144" *Consult mill for wall thickness
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/ rectangular bar
Compliance	C95400 is compliant with key legislation including (1) Federal Safe Drinking Water Act - SDWA, (2) S. 3874 Federal Reduction of Lead in Drinking Water Act, (3) California AB1953, and (4) Vermont Act 193

Typical uses

Automotive

Weld guns

Fasteners

Large hold-down screws, nuts

Industrial

Bearing segments for the steel industry, bearings, bushings, gears, heavily loaded worm gears, high-strength clamps, landing gear parts, machine parts, pawl, pickling hooks, pressure blocks for the steel industry, pump parts, spur gears, valve bodies, valve guides, valve seats, valves, worm gears

Marine

Covers for marine hardware, ship building

Ordnance

Government fittings

Note: also available in heat-treated condition

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C95400	B505 B505M	J461 J462		QQ-C-390, G5 QQ-B-671, Class 3	MIL-B-16033, Class 3	Aluminum Bronze 9C

Chemical composition

Cu (%)	Fe (%)	Ni (%) ¹	Al (%)	Mn (%)
83.00 min	3.00-5.00	1.50	10.00-11.50	0.50

Chemical composition according to ASTM B505/B505M-23

¹Ni value includes Co.

Note: Cu + sum of named elements, 99.5% min. Unless otherwise noted, single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 °F)
C95400	60	0.269

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
85	586	32	221	12	170	

Mechanical properties according to ASTM B505/B505M-23

Physical properties

	US customary	Metric
Melting point – liquidus	1900 °F	1038 °C
Melting point – solidus	1880 °F	1027 °C
Density	0.269 lb/in ³ at 68 °F	7.45 gm/cm ³ at 20 °C
Specific gravity	7.45	7.45
Electrical conductivity	13% IACS at 68 °F	0.075 MegaSiemens/cm at 20 °C
Thermal conductivity	33.9 Btu/sq ft/ft hr/ °F at 68 °F	58.7 W/m at 20 °C
Coefficient of thermal expansion 68-572	9 · 10 ⁻⁶ per °F (68-572 °F)	15.5 · 10 ⁻⁶ per °C (20-300 °C)
Specific heat capacity	0.1 Btu/lb/°F at 68 °F	419 J/kg at 20 °C
Modulus of elasticity in tension	15500 ksi	107000 MPa
Magnetic permeability*	1.27	1.27
Magnetic permeability**	1.2	1.2

Physical properties provided by CDA

*As cast, field strength 16 kA/m **TQ 50 temper, field strength 16 kA/m

Fabrication properties

Technique	Suitability
Soldering	Good
Brazing	Good
Oxyacetylene welding	Not recommended
Gas shielded arc welding	Good
Coated metal arc welding	Good
Machinability rating	60

Fabrication properties provided by CDA

Casting characteristics

Casting attribute	Level
Casting yield	Low
Drossing	High
Effect of section size	Low
Fluidity	Medium
Gassing	Medium
Patternmakers shrinkage (inches per foot)	3/16
Shrinkage in solidification	High

Casting characteristics provided by CDA

C95400HT

Continuous cast	GreenAlloys™
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Product description	Aluminum bronze
Solids	1/2" to 10" O.D.
Tubes	1 1/8" to 12" O.D.*
Rectangles	Up to 15"
Standard lengths	24"***
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/ rectangular bar
Compliance	C95400 is compliant with key legislation including (1) Federal Safe Drinking Water Act - SDWA, (2) S. 3874 Federal Reduction of Lead in Drinking Water Act, (3) California AB1953, and (4) Vermont Act 193 *Consult mill for wall thickness **Consult mill for other lengths

Typical uses

Automotive

Weld guns

Fasteners

Large hold-down screws, nuts

Industrial

Bearing segments for the steel industry, bearings, bushings, gears, heavily loaded worm gears, high-strength clamps, landing gear parts, machine parts, pawl, pickling hooks, pressure blocks for the steel industry, pump parts, spur gears, valve bodies, valve guides, valve seats, valves, worm gears

Marine

Covers for marine hardware, ship building

Ordnance

Government fittings

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C95400	B505 B505M	J461 J462		QQ-C-390, G5 QQ-B-671, Class 3	MIL-B-16033, Class 3	Aluminum Bronze 9C

Chemical composition

Cu (%)	Fe (%)	Ni (%) ¹	Al (%)	Mn (%)
83.00 min	3.00-5.00	1.50	10.00-11.50	0.50

Chemical composition according to ASTM B505/B505M-23

¹Ni value includes Co.

Note: Cu + sum of named elements, 99.5% min. Unless otherwise noted, single values represent maximums.

C95400HT continued

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 ° F)
C95400HT	60	0.269

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
95	655	45	310	10	177	Heat treated

Mechanical properties according to ASTM B505/B505M-23

C95410

Continuous cast

Product description	Aluminum bronze
Solids	1/2" to 9" O.D.
Tubes	1 1/8" to 9" O.D.
Rectangles	Up to 15"
Standard lengths	144"
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar

Typical uses

Industrial

Bearings, bushings, gears, pickling baskets, pickling hooks, spur gears, valve components, worms

Note: Also available in heat-treated condition.

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C95410	B505 B505M					

Chemical composition

Cu (%)	Fe (%)	Ni (%) ¹	Al (%)	Mn (%)
83.00 min	3.00-5.00	1.50-2.50	10.00-11.50	0.50

Chemical composition according to ASTM B505/B505M-23

¹Ni value includes Co.

Note: Cu + sum of named elements, 99.5% min. Unless otherwise noted, single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68° F)
C95410	60	0.269

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (3000 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
85	586	32	221	12	170	

Mechanical properties according to ASTM B505/B505M-23

Physical properties

	US customary	Metric
Melting point – liquidus	1900 °F	1038 °C
Melting point – solidus	1880 °F	1027 °C
Density	0.269 lb/in ³ at 68 °F	7.45 gm/cm ³ at 20 °C
Specific gravity	7.45	7.45
Electrical conductivity	13% IACS at 68 °F	0.075 MegaSiemens/cm at 20 °C
Thermal conductivity	33.9 Btu/sq ft/ft hr/°F at 68 °F	58.7 W/m at 20 °C
Coefficient of thermal expansion 68-572	9 · 10 ⁻⁶ per °F (68-572 °F)	15.5 · 10 ⁻⁶ per °C (20-300 °C)
Specific heat capacity	0.1 Btu/lb/°F at 68 °F	419 J/kg at 20 °C
Modulus of elasticity in tension	15500 ksi	107000 MPa

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Good
Brazing	Good
Oxyacetylene welding	Not recommended
Gas shielded arc welding	Good
Coated metal arc welding	Good
Machinability rating	60

Fabrication properties provided by CDA

C95410HT

Continuous cast

Product description	Aluminum bronze
Solids	1/2" to 9" O.D.
Tubes	1 1/8" to 9" O.D.
Rectangles	Up to 15"
Standard lengths	24"*
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar *Consult mill for other lengths

Typical uses

Industrial

Bearings, bushings, gears, pickling baskets, pickling hooks, spur gears, valve components, worms

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C95410	B505 B505M					

Chemical composition

Cu (%)	Fe (%)	Ni (%) ¹	Al (%)	Mn (%)
83.00 min	3.00-5.00	1.50-2.50	10.00-11.50	0.50

Chemical composition according to ASTM B505/B505M-23

¹Ni value includes Co.

Note: Cu + sum of named elements, 99.5% min. Unless otherwise noted, single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68° F)
C95410HT	60	0.269

Note: HT = heat treated.

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (3000 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
95	655	45	310	10	177	Heat treated

Mechanical properties according to ASTM B505/B505M-23

C95500

Standard-stocked product*	Continuous cast	GreenAlloys™
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Product description	Nickel-aluminum bronze
Solids	1/2" to 9" O.D.
Tubes	1 1/8" to 9" O.D.**
Rectangles	Up to 15"
Standard lengths	144"
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar
Compliance	C95500 is compliant with key legislation including (1) Federal Safe Drinking Water Act - SDWA, (2) S. 3874 Federal Reduction of Lead in Drinking Water Act, (3) California AB1953, and (4) Vermont Act 193 *Solids is standard stocked **Consult mill for wall thickness

Typical uses

Builders hardware

Window hardware

Consumer

Musical instruments, piano keys

Electrical

Electrical hardware

Fasteners

Stuffing box nuts

Industrial

Aircraft components, bearings, bushings, gears, glands, glass molds, handgun recoil mechanisms, hot mill guides, landing gear parts, machine parts, pickling equipment, piston guides, pump fluid ends, sewage treatment applications, valve bodies, valve components, valve guides, valve seats, wear plates, welding jaws, worm wheels, worms

Marine

Covers for marine hardware, marine applications, marine hardware, ship building

Ordnance

Government fittings

Note: also available in heat-treated condition

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C95500	B505 B505M	J461 J462		QQ-C-390, G3	MIL-B-16033, Class 4	Aluminum Bronze 9D

Chemical composition

Cu (%)	Fe (%)	Ni (%) ¹	Al (%)	Mn (%)
78.00 min	3.00-5.00	3.00-5.50	10.00-11.50	3.50

Chemical composition according to ASTM B505/B505M-23

¹Ni value includes Co.

Note: Cu + sum of named elements, 99.5% min. Unless otherwise noted, single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 °F)
C95500	50	0.272

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
95	655	42	290	10	208	

Mechanical properties according to ASTM B505/B505M-23

Physical properties

	US customary	Metric
Melting point – liquidus	1930 °F	1054 °C
Melting point – solidus	1900 °F	1038 °C
Density	0.272 lb/in ³ at 68 °F	7.53 gm/cm ³ at 20 °C
Specific gravity	7.53	7.53
Electrical conductivity	8% IACS at 68 °F	0.049 MegaSiemens/cm at 20 °C
Thermal conductivity	24.2 Btu/sq ft/ft hr/°F at 68 °F	41.9 W/m at 20 °C
Coefficient of thermal expansion 68-572	9 · 10 ⁻⁶ per °F (68-572 °F)	15.5 · 10 ⁻⁶ per °C (20-300 °C)
Specific heat capacity	0.1 Btu/lb/°F at 68 °F	419 J/kg at 20 °C
Modulus of elasticity in tension	16000 ksi	110000 MPa
Magnetic permeability*	1.32	1.32
Magnetic permeability**	1.2	1.2
Poisson's Ratio	0.32	0.32

Physical properties provided by CDA

*As cast, field strength 16 kA/m **TQ 50 temper, field strength 16 kA/m

Fabrication properties

Technique	Suitability
Soldering	Good
Brazing	Fair
Oxyacetylene welding	Not recommended
Gas shielded arc welding	Good
Coated metal arc welding	Good
Machinability rating	50

Fabrication properties provided by CDA

Casting characteristics

Casting attribute	Level
Casting yield	Low
Drossing	High
Effect of section size	Low
Fluidity	Medium
Gassing	Medium
Patternmakers shrinkage (inches per foot)	3/16
Shrinkage in solidification	High

Casting characteristics provided by CDA

C95500HT

Continuous cast		GreenAlloys™
Product description	Nickel-aluminum bronze	
Solids	1/2" to 9" O.D.	
Tubes	1 1/8" to 9" O.D.*	
Rectangles	Up to 15"	
Standard lengths	24"***	
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar	
Compliance	C95500HT is compliant with key legislation including (1) Federal Safe Drinking Water Act - SDWA, (2) S. 3874 Federal Reduction of Lead in Drinking Water Act, (3) California AB1953, and (4) Vermont Act 193 *Consult mill for wall thickness **Consult mill for other lengths	

Typical uses

Builders hardware

Window hardware

Consumer

Musical instruments, piano keys

Electrical

Electrical hardware

Fasteners

Stuffing box nuts

Industrial

Aircraft components, bearings, bushings, gears, glands, glass molds, handgun recoil mechanisms, hot mill guides, landing gear parts, machine parts, pickling equipment, piston guides, pump fluid ends, sewage treatment applications, valve bodies, valve components, valve guides, valve seats, wear plates, welding jaws, worm wheels, worms

Marine

Covers for marine hardware, marine applications, marine hardware, ship building

Ordnance

Government fittings

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C95500	B505 B505M	J461 J462		QQ-C-390, G3	MIL-B-16033, Class 4	Aluminum bronze 9D

Chemical composition

Cu (%)	Fe (%)	Ni (%) ¹	Al (%)	Mn (%)
78.00 min	3.00-5.00	3.00-5.50	10.00-11.50	3.50

Chemical composition according to ASTM B505/B505M-23

¹Ni value includes Co.

Note: Cu + sum of named elements, 99.5% min. Unless otherwise noted, single values represent maximums.

C95500HT continued

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 ° F)
C95500HT	50	0.272

Note: HT = heat treated.

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (3000 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
110	758	62	427	8	228	Heat treated

Mechanical properties according to ASTM B505/B505M-23

AMS 4880-C95510

	Standard-stocked product*	Continuous cast
Product description	Nickel-aluminum bronze	
Solids	1/2" to 9" O.D.	
Tubes	1 1/8" to 13" O.D.**	
Rectangles	Up to 15"	
Standard lengths	24"***	
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/ rectangular bar *Tubes is standard stocked **Consult mill for wall thickness ***Consult mill for other lengths	

Typical uses

Industrial

Bearings requiring abrasion resistance/good ductility/retention of hardness at moderate temperatures, bushings, hydraulic seal components, landing gear bushings and bearings

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C95510		J461 J462	4880			

Chemical composition

Cu (%)	Sn (%)	Zn (%)	Fe (%)	Ni (%) ¹	Al (%)	Mn (%)
78.00 min	0.20	0.30	2.00-3.50	4.50-5.50	9.70-10.90	1.50

Chemical composition according to AMS 4880

¹Ni value includes Co.

Note: Cu + sum of named elements, 99.8% min. Unless otherwise noted, single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68° F)
C95510	50	0.272

Mechanical properties

Tensile strength, min		Yield strength at 0.2% offset, min		Elongation, in 4D, min	Brinell hardness	Remarks
ksi	MPa	ksi	MPa	%	min to max BHN	
105.0	724	62.5	431	9	192 to 248	Castings <4.0, heat treated
95.0	655	56.0	386	9	192 to 248	Castings 4.0+, heat treated

Mechanical properties according to AMS 4880

C95520HT

Continuous cast

Product description	Nickel-aluminum bronze
Solids	1/2" to 9" O.D.
Tubes	1 1/8" to 13" O.D.
Rectangles	Up to 15"
Standard lengths	24"*
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar *Consult mill for other lengths

Typical uses

Industrial

Aircraft components, bearings, bushings, machine tool parts, piston guides, wear rings, worm wheels

Marine

Hardware, propeller hubs, shafts, sleeves, wear rings, worm gears

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C95520	B505 B505M		4881	QQ-C-390B, Type III		

Chemical composition

Cu (%)	Pb (%)	Sn (%)	Zn (%)	Fe (%)	Ni (%) ¹	Al (%)	Co (%)	Cr (%)	Mn (%)	Si (%)
74.50 min	0.03	0.25	0.30	4.00-5.50	4.20-6.00	10.50-11.50	0.20	0.05	1.50	0.15

Chemical composition according to AMS 4881

¹Ni value includes Co.

Note: Cu + sum of named elements, 99.5% min. Unless otherwise noted, single values represent maximums.

C95520HT continued

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 ° F)
C95520HT	45	0.272

Note: HT = heat treated.

Mechanical properties

Tensile strength, min		Yield strength at 0.2% offset, min		Elongation, in 4D, min	Brinell hardness (3000 kg load)	Remarks
ksi	MPa	ksi	MPa	%	minimum BHN	
125	860	90	621	2	262	Castings <2.00, heat treated

Mechanical properties according to AMS 4881

C95600

Continuous cast

Product description	Nickel-aluminum bronze
Solids	1/2" to 9" O.D.
Tubes	1 1/8" to 9" O.D.
Rectangles	Up to 15"
Standard lengths	144"
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar

Typical uses

Electrical

Cable connectors, terminals

Industrial

Gears, valve stems, worms

Chemical composition

Cu (%)	Ni (%) ¹	Al (%)	Si (%)
88.00 min	0.25	6.00-8.00	1.80-3.20

Chemical composition provided by CDA

¹Ni value includes Co.

Note: Cu + sum of named elements, 99.0% min. Unless otherwise noted, single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 ° F)
C95600	60	0.278

Mechanical properties

Tensile strength, typ		Yield strength at 0.5% extension typ		Elongation	Brinell hardness (3000 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
75	517	34	234	18	140	

Mechanical properties provided by CDA

Physical properties

	US customary	Metric
Melting point – liquidus	1840 °F	1004 °C
Melting point – solidus	1800 °F	982 °C
Density	0.278 lb/in ³ at 68 °F	7.7 gm/cm ³ at 20 °C
Specific gravity	7.7	7.7
Electrical conductivity	8% IACS at 68 °F	0.046 MegaSiemens/cm at 20 °C
Thermal conductivity	22.3 Btu/sq ft/ft hr/°F at 68 °F	38.6 W/m at 20 °C
Coefficient of thermal expansion 68-572	9.2 · 10 ⁻⁶ per °F (68-572 °F)	15.9 · 10 ⁻⁶ per °C (20-300 °C)
Specific heat capacity	0.1 Btu/lb/°F at 68 °F	419 J/kg at 20 °C
Modulus of elasticity in tension	15000 ksi	103422 MPa

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Good
Brazing	Good
Oxyacetylene welding	Not recommended
Gas shielded arc welding	Good
Coated metal arc welding	Fair
Machinability rating	60

Fabrication properties provided by CDA.

Casting characteristics

Casting attribute	Level
Casting yield	Low
Drossing	High
Effect of section size	Low
Fluidity	Medium
Gassing	High
Patternmakers shrinkage (inches per foot)	3/16
Shrinkage in solidification	High

Casting characteristics provided by CDA

C95800

Continuous cast

Product description	Nickel-aluminum bronze
Solids	1/2" to 9" O.D.
Tubes	1 1/8" to 9" O.D.
Rectangles	Up to 15"
Standard lengths	144"
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar

Typical uses

Fasteners

Nuts

Industrial

Bushings, gears, machinery, pickling equipment, propeller blades, propeller hub, shafts, valve bodies, wear plates, worm wheels, worms

Marine

Covers for marine hardware, marine hardware, ship building, valves in contact with sea water

Plumbing

Elbows

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C95800	B505 B505M			QQ-C-390, G8		Alpha nickel-aluminum bronze

Chemical composition

Cu (%)	Pb (%)	Fe (%) ¹	Ni (%) ^{1,2}	Al (%)	Mn (%)	Si (%)
79.00 min	0.03	3.50-4.50	4.00-5.00	8.50-9.50	0.08-1.50	0.10

Chemical composition according to ASTM B505/B505M-23

¹Fe content shall not exceed Ni content.

²Ni value includes Co.

Note: Cu + sum of named elements, 99.5% min. Unless otherwise noted, single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 ° F)
C95800	20	0.276

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm min	Brinell hardness (3000 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
85	586	35	241	18	159	

Mechanical properties according to ASTM B505/B505M-23

Note: C95800 provided as cast or temper annealed.

Physical properties

	US customary	Metric
Melting point – liquidus	1940 °F	1060 °C
Melting point – solidus	1910 °F	1043 °C
Density	0.276 lb/in ³ at 68 °F	7.64 gm/cm ³ at 20 °C
Specific gravity	7.64	7.64
Electrical conductivity	7% IACS at 68 °F	0.041 MegaSiemens/cm at 20 °C
Thermal conductivity	20.8 Btu/sq ft/ft hr/ °F at 68 °F	36 W/m at 20 °C
Coefficient of thermal expansion 68-572	9 · 10 ⁻⁶ per °F (68-572 °F)	15.5 · 10 ⁻⁶ per °C (20-300 °C)
Specific heat capacity	0.105 Btu/lb/ °F at 68 °F	440 J/kg at 20 °C
Modulus of elasticity in tension	16500 ksi	114000 MPa
Magnetic permeability*	1.05	1.05
Poisson's ratio	0.32	0.32

Physical properties provided by CDA

*Field strength is 16 kA/m

Fabrication properties

Technique	Suitability
Soldering	Good
Brazing	Fair
Oxyacetylene welding	Not recommended
Gas shielded arc welding	Good
Coated metal arc welding	Good
Machinability rating	20

Fabrication properties provided by CDA.

Casting characteristics

Casting attribute	Level
Casting yield	Low
Drossing	High
Effect of section size	Low
Fluidity	Medium
Gassing	Medium
Patternmakers shrinkage (inches per foot)	3/16
Shrinkage in solidification	High

Casting characteristics provided by CDA

C95900

Standard-stocked product	Continuous cast	GreenAlloys™
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Product description	Aluminum bronze
Solids	1" to 5" O.D.
Tubes	Consult mill
Rectangles	Up to 7"
Standard lengths	144"
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar
Compliance	C95900 is compliant with key legislation including (1) Federal Safe Drinking Water Act - SDWA, (2) S. 3874 Federal Reduction of Lead in Drinking Water Act, (3) California AB1953, and (4) Vermont Act 193

Typical uses

Industrial

Die components, gears, gibs, worm drives

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C95900	B505 B505M					

Chemical composition

Cu (%)	Fe (%)	Ni (%) ¹	Al (%)	Mn (%)
remain.	3.00-5.00	0.50	12.00-13.50	1.50

Chemical composition according to ASTM B505/B505M-23

¹Ni value includes Co.

Note: Cu + sum of named elements, 99.5% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 ° F)
C95900	10	0.255

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (3000 kg load)	Remarks
ksi	MPa	ksi	MPa	%	minimum BHN	
					241	

Mechanical properties according to ASTM B505/B505M-23

CONCAST380

Standard-stocked product	Continuous cast
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Product description	Aluminum bronze
Solids	1" to 5" O.D.
Rectangles	2" to 3"
Standard lengths	144"
Shape/form	Semi-finished; mill stock or near-net shapes; bar stock; squares; hex; plate; profile or structural shape; flats/rectangular bar

Typical uses

Industrial

Cold rolling metal dies and guides where a hardness minimum is specified

Chemical composition

Cu (%)	Fe (%)	Al (%)	Co (%)	Mn (%)
Remain	4.50-6.50	14.00-16.00	2.50	3.25

Note: Single values represent maximums.

Machinability

Alloy	Machinability rating	Density (lb/in ³ at 68 ° F)
CONCAST380		0.25

Mechanical properties

Tensile strength, min		Yield strength at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm min	Brinell hardness (3000 kg load)	Remarks
ksi	MPa	ksi	MPa	%	minimum BHN	
					340	

C96400

Continuous cast

Product description	Copper-nickel
Solids	1/2" to 9" O.D.
Tubes	1 1/8" to 9" O.D.
Rectangles	Up to 15"
Standard lengths	144"
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar

Typical uses

Industrial

Fittings, pump bodies, pump fixtures, steam fittings

Marine

Boat parts, elbows/flanges/pump bodies/valves used for sea water corrosion resistance

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C96400	B505 B505M					70-30 Copper nickel

Chemical composition

Cu (%)	Pb (%)	Fe (%)	P (%)	Ni (%) ¹	C (%)	Mn (%)	S (%)	Si (%)	Nb (%)
Remain	0.01	0.25-1.50	0.02	28.00-32.00	0.15	1.50	0.02	0.50	0.50-1.50

Chemical composition according to ASTM B505/B505M-23

¹Ni value includes Co.

Note: Cu + sum of named elements, 99.5% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68° F)
C96400	20	0.323

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm min	Brinell hardness	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
65	448	35	241	25		

Mechanical properties according to ASTM B505/B505M-23

Physical properties

	US customary	Metric
Melting point – liquidus	2260 °F	1238 °C
Melting point – solidus	2140 °F	1171 °C
Density	0.323 lb/in ³ at 68 °F	8.94 gm/cm ³ at 20 °C
Specific gravity	8.94	8.94
Electrical conductivity	5% IACS at 68 °F	0.029 MegaSiemens/cm at 20 °C
Thermal conductivity	16.4 Btu/sq ft/ft hr/°F at 68 °F	28.4 W/m at 20 °C
Coefficient of thermal expansion 68-572	9 · 10 ⁻⁶ per °F (68-572 °F)	15.5 · 10 ⁻⁶ per °C (20-300 °C)
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	21000 ksi	144791 MPa

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Excellent
Brazing	Excellent
Oxyacetylene welding	Not recommended
Gas shielded arc welding*	Good
Coated metal arc welding*	Good
Machinability rating	20

Fabrication properties provided by CDA.

*Filler metal R CuNi, or E CuNi.

Casting characteristics

Casting attribute	Level
Casting yield	Low
Drossing	Medium
Effect of section size	Low
Fluidity	High
Gassing	High
Patternmakers shrinkage (inches per foot)	7/32
Shrinkage in solidification	High

Casting characteristics provided by CDA

C96900HT

Continuous cast

Product description	Copper-nickel
Solids	Consult mill
Tubes	2" to 14" O.D.
Rectangles	Consult mill
Standard lengths	24"*
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar *Consult mill for other lengths

Typical uses

Industrial

Bushings, bearings, chemical processing equipment, components for oil refineries, fittings, steam fittings

Marine

Component parts for sea water corrosion resistance, elbows/flanges/propeller sleeves/pump bodies/pump impellers/valves to resist sea water

Plumbing

Plumbing parts

Chemical composition

Cu (%)	Pb (%)	Sn (%)	Zn (%)	Ni (%) ¹	Mg (%)	Mn (%)	Si (%)	Nb (%)
Remain	0.02	7.50-8.50	0.50	14.50-15.50	0.15	0.05-0.30	0.30	0.10

Chemical composition according to ASTM B505/B505M-23

¹Ni value includes Co.

Note: Cu + sum of named elements, 99.5% min. Single values represent maximums.

Mechanical properties

Tensile strength, min		Yield strength, at 0.2% offset, min		Elongation, in 4D or 2 in. or 50 mm min	Brinell hardness	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
110	758	105	724	4		Heat treated Rockwell C32

Mechanical properties according to ASTM B505/B505M-23

C97300

Continuous cast

Product description	Nickel silver bronze
Solids	3/4" to 9" O.D.
Tubes	1 1/8" to 9" O.D.
Rectangles	Up to 14"
Standard lengths	144"
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar

Typical uses

Architecture

Ornamental castings, statuary

Builders

Hardware

Industrial

Valves

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C97300	B505 B505M					15% Nickel silver

Chemical composition

Cu (%)	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%)	Ni (%) ¹	Al (%)	Mn (%)	S (%)	Sb (%)	Si (%)
53.00-58.00	8.00-11.00	1.50-3.00	17.00-25.00	1.50	0.05	11.00-14.00	0.005	0.50	0.08	0.35	0.15

Chemical composition according to ASTM B505/B505M-23

¹Ni value includes Co.

Note: Cu + sum of named elements, 99.0% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68° F)
C97300	70	0.321

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
30	207	15	103	8	55	

Mechanical properties according to ASTM B505/B505M-23

Physical properties

	US customary	Metric
Melting point – liquidus	1904 °F	1040 °C
Melting point – solidus	1850 °F	1010 °C
Density	0.321 lb/in ³ at 68 °F	8.89 gm/cm ³ at 20 °C
Specific gravity	8.89	8.89
Electrical conductivity	6% IACS at 68 °F	0.033 MegaSiemens/cm at 20 °C
Thermal conductivity	16.5 Btu/sq ft/ft hr/°F at 68 °F	28.6 W/m at 20 °C
Coefficient of thermal expansion 68-572	9 · 10 ⁻⁶ per °F (68-572 °F)	15.5 · 10 ⁻⁶ per °C (20-300 °C)
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	16000 ksi	110000 MPa

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Excellent
Brazing	Excellent
Oxyacetylene welding	Not recommended
Gas shielded arc welding	Not recommended
Coated metal arc welding	Not recommended
Machinability rating	70

Fabrication properties provided by CDA.

Casting characteristics

Casting attribute	Level
Casting yield	Medium
Drossing	High
Effect of section size	Medium
Fluidity	High
Gassing	Medium
Patternmakers shrinkage (inches per foot)	3/16
Shrinkage in solidification	Medium

Casting characteristics provided by CDA

C97600

Continuous cast

Product description	Nickel silver bronze
Solids	3/4" to 9" O.D.
Tubes	1 1/8" to 9" O.D.
Rectangles	Up to 14"
Standard lengths	144"
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar

Typical uses

Architecture

Ornamental castings

Builders hardware

Door hardware for prison doors, hardware, window hardware

Consumer

Piano keys

Industrial

Pumps, valves

Marine

Marine furniture

Plumbing

Sanitary fittings

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C97600	B505 B505M					20% Nickel silver

Chemical composition

Cu (%)	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%)	Ni (%) ¹	Al (%)	Mn (%)	S (%)	Sb (%)	Si (%)
63.00-67.00	3.00-5.00	3.50-4.50	3.00-9.00	1.50	0.05	19.00-21.50	0.005	1.00	0.08	0.25	0.15

Chemical composition according to ASTM B505/B505M-23

¹Ni value includes Co.

Note: Cu + sum of named elements, 99.7% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 °F)
C97600	70	0.321

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
40	276	20	138	10	80	

Mechanical properties according to ASTM B505/B505M-23

Physical properties

	US customary	Metric
Melting point – liquidus	2089 °F	1143 °C
Melting point – solidus	2027 °F	1108 °C
Density	0.321 lb/in ³ at 68 °F	8.9 gm/cm ³ at 20 °C
Specific gravity	8.9	8.9
Electrical conductivity	5% IACS at 68 °F	0.029 MegaSiemens/cm at 20 °C
Thermal conductivity	13 Btu/sq ft/ft hr/°F at 68 °F	22.6 W/m at 20 °C
Coefficient of thermal expansion 68-392	9.3 · 10 ⁻⁶ per °F (68-392 °F)	16.1 · 10 ⁻⁶ per °C (20-200 °C)
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	19000 ksi	131000 MPa

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Excellent
Brazing	Excellent
Oxyacetylene welding	Not recommended
Gas shielded arc welding	Not recommended
Coated metal arc welding	Not recommended
Machinability rating	70

Fabrication properties provided by CDA.

Casting characteristics

Casting attribute	Level
Casting yield	Medium
Drossing	Medium-high
Effect of section size	Medium
Fluidity	High
Gassing	Medium-high
Patternmakers shrinkage (inches per foot)	1/8
Shrinkage in solidification	Medium

Casting characteristics provided by CDA

C97800

Continuous cast

Product description	Nickel silver bronze
Solids	3/4" to 9" O.D.
Tubes	1 1/8" to 9" O.D.
Rectangles	Up to 14"
Standard lengths	144"
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar

Typical uses

Architecture

Ornamental castings

Builders Hardware

Hardware

Consumer

Musical instruments components

Industrial

Fittings for dairy and food processing, valves

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C97800	B505 B505M					25% Nickel silver

Chemical composition

Cu (%)	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%)	Ni (%) ¹	Al (%)	Mn (%)	S (%)	Sb (%)	Si (%)
64.00-67.00	1.00-2.50	4.00-5.50	1.00-4.00	1.50	0.05	24.00-27.00	0.005	1.00	0.08	0.20	0.15

Chemical composition according to ASTM B505/B505M-23

¹Ni value includes Co.

Note: Cu + sum of named elements, 99.6% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68° F)
C97800	60	0.32

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm min	Brinell hardness (3000 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
45	310	22	152	8	130	

Mechanical properties according to ASTM B505/B505M-23

Physical properties

	US customary	Metric
Melting point – liquidus	2156 °F	1180 °C
Melting point – solidus	2084 °F	1140 °C
Density	0.32 lb/in ³ at 68 °F	8.86 gm/cm ³ at 20 °C
Specific gravity	8.86	8.86
Electrical conductivity	4% IACS at 68 °F	0.026 MegaSiemens/cm at 20 °C
Thermal conductivity	14.7 Btu/sq ft/ft hr/°F at 68 °F	25.4 W/m at 20 °C
Coefficient of thermal expansion 68-572	9.7 · 10 ⁻⁶ per °F (68-572 °F)	16.8 · 10 ⁻⁶ per °C (20-300 °C)
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	19000 ksi	131000 MPa

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Excellent
Brazing	Excellent
Oxyacetylene welding	Not recommended
Gas shielded arc welding	Not recommended
Coated metal arc welding	Not recommended
Machinability rating	60

Fabrication properties provided by CDA.

Casting characteristics

Casting attribute	Level
Casting yield	Medium
Drossing	Medium-high
Effect of section size	Medium
Fluidity	High
Gassing	Medium-High
Patternmakers shrinkage (inches per foot)	3/16
Shrinkage in solidification	Medium

Casting characteristics provided by CDA

C99500

Continuous cast

Product description	Special alloy
Solids	1/2" to 9" O.D.
Tubes	1 1/8" to 9" O.D.
Rectangles	Up to 14"
Standard lengths	144"
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar

Typical uses

Electrical

Electrical parts

Industrial

Gears for mining equipment, propeller wheels, valve stems

Marine

Outboard marine components

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C99500	B505 B505M B763					

Chemical composition

Cu (%)	Pb (%)	Zn (%)	Fe (%)	Ni (%) ¹	Al (%)	Mn (%)	Si (%)
Remain	0.09	0.50-2.00	3.00-5.00	3.50-5.50	0.50-2.00	0.50	0.50-2.00

Chemical composition according to ASTM B505/B505M-23

¹Not including Co.

Note: Cu + sum of named elements, 99.7% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 ° F)
C99500	50	0.3

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
70	483	40	276	12	145	

Mechanical properties according to ASTM B505/B505M-23

Physical properties

	US customary	Metric
Density	0.3 lb/in ³ at 68 °F	8.3 gm/cm ³ at 20 °C
Specific gravity	8.3	8.3
Electrical conductivity	10% IACS at 68 °F	0.057 MegaSiemens/cm at 20 °C
Coefficient of thermal expansion 68-572	8.3 · 10 ⁻⁶ per °F (68-572 °F)	14.3 · 10 ⁻⁶ per °C (20-300 °C)
Modulus of elasticity in tension	19000 ksi	131000 MPa

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Gas shielded arc welding	Good
Machinability rating	50

Fabrication properties provided by CDA.

Casting characteristics

Casting attribute	Level
Casting yield	Low
Drossing	Medium
Effect of section size	Low
Fluidity	Medium
Gassing	Low
Patternmakers shrinkage (inches per foot)	3/16
Shrinkage in solidification	High

Casting characteristics provided by CDA

Extruded or
cast and drawn
products

Extruded or cast and drawn products

Wieland Concast's line of standard-stocked extruded or cast and drawn products includes C14500, C51000, C54400, AMS 4640-C63000, AMS 4590-C63020, AMS 4634-C64200, C67300, AMS 4596-C72900, AMS 4597-C72900, and AMS 4598-C72900. Our non-standard extruded or cast and drawn products include C23000, C24000, C26000, C31400, C31600, C46400, C52100, C53400, C62400, C64210, C65100, C67400, C67410, C67600, C69300, C69400, and C69430.

The term "extruded and drawn mill products" applies to sheet, rod, bar, tube, plate and wire produced by rolling and extrusion mills, as well as forging. Each of these products start with metal that has been cast into a form or shape that is suitable for further processing into a specific product.

Our extruded or cast and drawn products are cast and cold drawn. Rods are brought to final dimensions by one or more cold drawing operations with suitable intermediate anneals when necessary. After the final draw, the rods are straightened mechanically and cut to the desired length.

Cold drawing improves size consistency, mechanical properties, and machinability.



Standard-stocked and non-standard extruded or cast and drawn products

- 14500	- 63020
- 23000	- 64200
- 24000	- 64210
- 26000	- 65100
- 31400	- 67300
- 31600	- 67400
- 46400	- 67410
- 51000	- 67600
- 52100	- 69300
- 53400	- 69400
- 54400	- 69430
- 62400	- 72900
- 63000	

Extruded or cast and drawn product list

Copper alloy UNS no.	ASTM spec	AMS spec	Tempers						Product description	Round size range	Hex/oct size range
C14500*	B301				H02	H04			Tellurium copper	0.375 to 2.75	
C23000	B927			H01	H02	H04			Red brass 85%	0.375 to 2.75	
C24000	B927			H01	H02	H04			Low brass 80%	0.375 to 2.5	0.375 to 2.0
C26000	B927			H01	H02	H04			Cartridge brass 70%	0.375 to 2.5	0.375 to 2.0
C31400*	B140				H02	H04			Leaded commercial bronze	0.375 to 2.0	0.375 to 2.0
C31600	B140				H02	H04			Leaded commercial bronze ²	0.375 to 2.0	0.375 to 2.0
C46400	B21				H02				Naval brass, uninhibited	0.5 to 2.75	0.5 to 2.75
C51000*	B139	4625			H04		H08		Phosphor bronze 5% A	0.375 to 2.5	0.375 to 2.0
C52100	B139				H04				Phosphor bronze 8% C	0.375 to 2.5	0.375 to 2.0
C53400	B139				H04				Phosphor bronze B-1	0.375 to 2.5	0.375 to 2.0
C54400*	B139				H04				Phosphor bronze B-2	0.375 to 2.5	0.375 to 2.0
C62400	B150		HR50						Aluminum bronze 11%	0.5 to 3.0	
C63000*	B150	4640	HR50						Nickel-aluminum bronze	0.375 to 10.0	0.5 to 2.0
C63020*	B150	4590	TQ50						Nickel-aluminum bronze	0.75 to 4.0	
C64200*	B150	4634	HR50						Aluminum bronze	0.1875 to 6.0	0.5 to 2.0
C64210	B150		HR50						Aluminum silicon bronze	0.3125 to 3.0	0.5 to 2.0
C65100	B98				H02	H04	H06		Low-silicon bronze B	0.375 to 2.0	0.375 to 2.0
C67300* ¹					H02				Manganese bronze	0.75 to 3.0	
C67400 ¹									Manganese bronze	0.75 to 3.0	0.375 to 2.0
C67410									Manganese bronze	0.75 to 3.0	0.375 to 2.0
C67600	B138				H02	H04			Manganese bronze	0.75 to 2.0	
C69300	B371				H02				Lead-free brass	0.125 to 3.0	0.375 to 2.5
C69400	B371					H04			Silicon red brass	0.375 to 2.0	0.375 to 2.0
C69430	B371					H04			Silicon red brass	0.375 to 2.0	0.375 to 2.0
C72900*		4596	TX 00						Copper nickel-tin bronze		
C72900*		4597	TX TS						Copper nickel-tin bronze	0.75 to 3.14	
C72900*		4598	TX 00						Copper nickel-tin bronze		

*Standard-stocked alloy. ¹SAE J463 specification. ²(nickel-bearing).

C14500

Standard-stocked product	Extruded and drawn
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Product description	Tellurium copper
Tempers	H02 half hard, H04 hard
Solids	3/8" to 2 3/4" O.D.*
Rectangles	Consult mill
Standard lengths	144" * Consult mill for other sizes

Typical uses

Architecture

Fire protection

Electrical

Electrical connectors, motor parts, soldering copper, switch parts, transistor bases

Industrial

Forgings, furnace-brazed articles, screw machine products, soldering tips, welding torch tips

Plumbing

Fixtures, plumbing fittings, sprinkler heads

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C14500	B124 B124M B301 B301M	J461 J463				Tellurium-bearing (PTE)

Chemical composition

Cu (%) ¹	P (%)	Te (%)
99.90 min	0.004-0.012	0.40-0.70

Chemical composition according to ASTM B301/B301M-13(2020)

¹Includes silver, tellurium, and phosphorus

Note: Includes oxygen-free or deoxidized grades with deoxidizers (such as phosphorus, boron, lithium, or other) in an amount agreed upon. Unless otherwise noted, single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 ° F)
C14500	85	0.323

C14500 continued

Mechanical properties

Mechanical properties according to ASTM B301/B301M-13(2020)
C14500
H02 half hard

Size range 1/16" diameter rod to 1/4" inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or specimen thickness, min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
38	260	30	205	8	76	

Size range over 1/4" diameter rod to 2 5/8" inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or specimen thickness, min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
38	260	30	205	12	76	

C14500
H04 hard

Size range 1/16" diameter rod (round only) to 1/4" inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 4x diameter or specimen thickness, min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
48	330	40	275	4	81	

Size range over 1/4" diameter rod (round only) to 1 1/4" inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or specimen thickness, min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
44	305	38	260	8	81	

Size range over 1 1/4" diameter rod (round only) to 3" inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or specimen thickness, min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
40	275	35	240	8	81	

C14500 continued

Physical properties

	US customary	Metric
Melting point – liquidus	1976 °F	1080 °C
Melting point – solidus	1924 °F	1051 °C
Density	0.323 lb/in ³ at 68 °F	8.94 gm/cm ³ at 20 °C
Specific gravity	8.94	8.94
Electrical conductivity	93% IACS at 68 °F	0.539 MegaSiemens/cm at 20 °C
Thermal conductivity	205 Btu/sq ft/ft hr/°F at 68 °F	355 W/m at 20 °C
Coefficient of thermal expansion 68-212	9.5 · 10 ⁻⁶ per °F (68-212 °F)	16.5 · 10 ⁻⁶ per °C (20-100 °C)
Coefficient of thermal expansion 68-392	9.7 · 10 ⁻⁶ per °F (68-392 °F)	16.8 · 10 ⁻⁶ per °C (20-200 °C)
Coefficient of thermal expansion 68-572	9.9 · 10 ⁻⁶ per °F (68-572 °F)	17.1 · 10 ⁻⁶ per °C (20-300 °C)
Specific heat capacity	0.092 Btu/lb/°F at 68 °F	385.5 J/kg at 20 °C
Modulus of elasticity in tension	17000 ksi	117212 MPa
Modulus of rigidity	6400 ksi	44127 MPa

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Excellent
Brazing	Good
Oxyacetylene welding	Fair
Gas shielded arc welding	Fair
Coated metal arc welding	Not recommended
Spot weld	Not recommended
Seam weld	Not recommended
Butt weld	Fair
Capacity for being cold worked	Good
Capacity for being hot formed	Good
Forgeability rating	65
Machinability rating	85

Fabrication properties provided by CDA

Thermal properties

Treatment	Minimum*	Maximum*
Annealing	800	1200
Hot treatment	1400	1600

Thermal properties provided by CDA

*Temperature is measured in Fahrenheit.

Common fabrication processes

Cold – Drawing, machining, moderate cold heading;
Hot – Extrusion, forging (closed die only)

Common fabrication processes provided by CDA

C23000

Extruded and drawn

Product description	Red brass 85%
Tempers	H01 quarter hard, H02 half hard, H04 hard
Solids	3/8" to 2 1/2" O.D.
Hex	3/8" to 2" O.D.
Standard lengths	144"

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C23000	B927 B927M					

Chemical composition

Cu (%)	Pb (%)	Zn (%)	Fe (%)
84.00-86.00	0.05	Remain	0.05

Chemical composition according to ASTM B927/B927M-23

Note: Cu + sum of named elements, 99.8% min. Single values represent maximums.

Typical uses

Architecture

Etching parts, trim, weather strip

Builders hardware

Kick plates

Consumer

Badges, coinage, compacts, costume jewelry, dials, fire extinguisher cases, lipstick containers, medallions, nameplates, plaques, rouge boxes, tokens, zippers

Electrical

Conduit, rotor bars (AC motors), screw shells, sockets

Fasteners

Eyelets, fasteners

Industrial

Condensor tubes, fire extinguishers, flexible metal hose, heat exchanger shells, heat exchangers, pickling crates, pump cylinder liners, radiator cores, tags, tubing for heat exchangers, tubing for instrumentation

Other

Fire hose couplings

Plumbing

Fittings, j-bends, pipe, pipe nipples, pipe service lines, pump lines, service lines, traps

C23000 continued

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68° F)
C23000	30	0.316

Mechanical properties

Mechanical properties according to ASTM B927/B927M-23

C23000

H01 quarter hard

Size range under 1/2" diameter rod

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or 4x thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical HRB	
44	305	20	140	15		

Size range 1/2" diameter rod to 1" inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or 4x thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical HRB	
42	290	17	115	17		

Size range over 1" diameter rod

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or 4x thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical HRB	
40	275	15	103	19		

C23000 continued

C23000 H02 half hard

Size range under 1/2" diameter rod

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or 4x thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical HRB	
50	345	30	205	7	70	

Size range 1/2" diameter rod to 1" inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or 4x thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical HRB	
45	310	27	185	10	70	

Size range over 1" diameter rod

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or 4x thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical HRB	
40	275	25	170	12	70	

C23000 continued

C23000 H04 hard

Size range under 1/2" diameter rod

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or 4x thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical HRB	
63	435	40	275	5	82	

Size range 1/2" diameter rod to 1" inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or 4x thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical HRB	
60	415	37	255	7	82	

Size range over 1" to 2" diameter rod

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or 4x thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical HRB	
58	400	35	240	9	82	

Physical properties

	US customary	Metric
Melting point – liquidus	1830 °F	999 °C
Melting point – solidus	1770 °F	966 °C
Density	0.313 lb/in ³ at 68 °F	8.67 gm/cm ³ at 20 °C
Specific gravity	8.67	8.67
Electrical conductivity	32% IACS at 68 °F	0.186 MegaSiemens/cm at 20 °C
Thermal conductivity	81 Btu/sq ft/ft hr/°F at 68 °F	140.3 W/m at 20 °C
Coefficient of thermal expansion 68-572	10.6 · 10 ⁻⁶ per °F (68-572 °F)	18.4 · 10 ⁻⁶ per °C (20-300 °C)
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	16000 ksi	110317 MPa
Modulus of rigidity	6000 ksi	41369 MPa

Physical properties provided by CDA

C23000 continued

Fabrication properties

Technique	Suitability
Soldering	Excellent
Brazing	Excellent
Oxyacetylene welding	Good
Gas shielded arc welding	Good
Coated metal arc welding	Not recommended
Spot weld	Fair
Seam weld	Not recommended
Butt weld	Good
Capacity for being cold worked	Excellent
Capacity for being hot formed	Good
Machinability rating	30

Fabrication properties provided by CDA

Thermal properties

Treatment	Minimum*	Maximum*
Annealing	800	1350
Hot treatment	1450	1650

Thermal properties provided by CDA

*Temperature is measured in Fahrenheit.

Common fabrication processes

Blanking, coining, drawing, etching, forming and bending, heading and upsetting, piercing and punching, roll threading and knurling, shearing, spinning, squeezing and swaging, stamping

Common fabrication processes provided by CDA

C24000

Extruded and drawn

Product description	Low brass 80%
Tempers	H01 quarter hard, H02 half hard, H04 hard
Solids	3/8" to 2 1/2" O.D.
Hex	3/8" to 2" O.D.
Standard lengths	144"

Typical uses

Architecture

Medallions, ornamental components, spandrels

Builders Hardware

Decorative panels

Consumer

Clock dials, musical instrument parts, plaques

Electrical

Battery caps, rotor bars (AC motors)

Industrial

Flexible hose, flexible hose bellows, pump lines, welding wire

Other

Tokens

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C24000	B927 B927M					

Chemical composition

Cu (%)	Pb (%)	Zn (%)	Fe (%)
78.50-81.50	0.05	Remain	0.05

Chemical composition according to ASTM B927/B927M-23

Note: Cu + sum of named elements, 99.8% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 °F)
C24000	30	0.313

C24000 continued

Mechanical properties

Mechanical properties according to ASTM B927/B927M-23
C24000
H01 quarter hard

Size range under 1/2" diameter rod

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or 4x thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical HRB	
47	325	25	170	18	55	

Size range 1/2" diameter rod to 1" inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or 4x thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical HRB	
45	310	20	140	20	55	

Size range over 1" diameter rod

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or 4x thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical HRB	
43	295	18	125	22	55	

C24000 continued

C24000 H02 half hard

Size range under 1/2" diameter rod

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or 4x thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical HRB	
53	365	33	230	10	70	

Size range 1/2" diameter rod to 1" inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or 4x thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical HRB	
48	330	30	205	13	70	

Size range over 1" diameter rod

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or 4x thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical HRB	
43	295	28	195	15	70	

C24000 continued

C24000 H04 hard

Size range under ½" diameter rod

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or 4x thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical HRB	
68	470	45	310	8	82	

Size range ½" diameter rod to 1" inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or 4x thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical HRB	
65	450	40	275	10	82	

Size range over 1" to 2" diameter rod

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or 4x thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical HRB	
60	415	35	240	12	82	

Physical properties

	US customary	Metric
Melting point – liquidus	1830 °F	999 °C
Melting point – solidus	1770 °F	966 °C
Density	0.313 lb/in ³ at 68 °F	8.67 gm/cm ³ at 20 °C
Specific gravity	8.67	8.67
Electrical conductivity	32% IACS at 68 °F	0.186 MegaSiemens/cm at 20 °C
Thermal conductivity	81 Btu/sq ft/ft hr/°F at 68 °F	140.3 W/m at 20 °C
Coefficient of thermal expansion 68-572	10.6 · 10 ⁻⁶ per °F (68-572 °F)	18.4 · 10 ⁻⁶ per °C (20-300 °C)
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	16000 ksi	110317 MPa
Modulus of rigidity	6000 ksi	41369 MPa

Physical properties provided by CDA

C24000 continued

Fabrication properties

Technique	Suitability
Soldering	Excellent
Brazing	Excellent
Oxyacetylene welding	Good
Gas shielded arc welding	Good
Coated metal arc welding	Not recommended
Spot weld	Fair
Seam weld	Not recommended
Butt weld	Good
Capacity for being cold worked	Excellent
Capacity for being hot formed	Fair
Machinability rating	30

Fabrication properties provided by CDA

Thermal properties

Treatment	Minimum*	Maximum*
Annealing	800	1300
Hot treatment	1500	1650

Thermal properties provided by CDA

*Temperature is measured in Fahrenheit.

Common fabrication processes

Blanking, drawing, etching, forming and bending, heading and upsetting, piercing and punching, roll threading and knurling, shearing, spinning, squeezing and swaging, stamping

Common fabrication processes provided by CDA

C26000

Extruded and drawn

Product description	Cartridge brass 70%
Tempers	H01 quarter hard, H02 half hard, H04 hard
Solids	3/8" to 2 1/2" O.D.
Hex	3/8" to 2" O.D.
Standard lengths	144"

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C26000	B927 B927M	J461 J463				70/30

Chemical composition

Cu (%)	Pb (%)	Zn (%)	Fe (%)
68.50-71.50	0.07	Remain	0.05

Chemical composition according to ASTM B927/B927M-23

Note: Cu + sum of named elements, 99.7% min. Single values represent maximums.

Typical uses

Architecture

Grillwork

Automotive

Electrical connectors, heater cores, odometer contacts, radiator cores, radiator tanks, radiator tube, tanks, thermostats

Builders Hardware

Decorative hardware, door knobs, finish hardware, hinges, kick plates, locks, push plates

Consumer

Bird cages, buttons, chain links, coinage, costume jewelry, etched articles, fireplace screens, lamps, pen/pencil inserts and clips, planters, shells (electrical sockets), snaps, syringe parts, watch parts

Electrical

Flashlight shells, lamp fixtures, reflectors, screw shells, terminal connectors

Fasteners

Eyelets, fasteners, grommets, pins, rivets, screws

Industrial

Air pressure conveyer systems, bead chain, chain, heat exchangers, liners, power cylinders, pumps, sound-proofing equipment, springs, tubing for instruments and machines, wire screens

Ordnance

Ammunition, ammunition cartridge cases, mechanical housings for lighters, shells (mechanical housings for ammunition)

Other

Stencils, washers

Plumbing

Bathroom fixtures, faucet escutcheons, fittings, plumbing accessories, plumbing brass goods, traps

C26000 continued

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68° F)
C26000	30	0.308

Mechanical properties

Mechanical properties according to ASTM B927/B927M-23

C26000

H01 quarter hard

Size range under ½" diameter rod

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or 4x thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical HRB	
50	345	30	205	20	55	

Size range ½" diameter rod to 1" inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or 4x thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical HRB	
48	330	25	170	24	55	

Size range over 1" diameter rod

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or 4x thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical HRB	
46	315	20	140	28	55	

C26000 continued

C26000 H02 half hard

Size range under 1/2" diameter rod

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or 4x thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical HRB	
57	395	35	241	15	70	

Size range 1/2" diameter rod to 1" inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or 4x thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical HRB	
54	370	32	220	20	70	

Size range over 1" diameter rod

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or 4x thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical HRB	
50	345	30	205	25	70	

C26000 continued

C26000 H04 hard

Size range under 1/2" diameter rod

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or 4x thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical HRB	
70	485	50	345	10	82	

Size range 1/2" diameter rod to 1" inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or 4x thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical HRB	
65	450	45	310	15	82	

Size range over 1" to 2" diameter rod

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or 4x thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical HRB	
60	415	40	275	20	82	

Physical properties

	US customary	Metric
Melting point – liquidus	1750 °F	954 °C
Melting point – solidus	1680 °F	916 °C
Density	0.308 lb/in ³ at 68 °F	8.53 gm/cm ³ at 20 °C
Specific gravity	8.53	8.53
Electrical conductivity	28% IACS at 68 °F	0.162 MegaSiemens/cm at 20 °C
Thermal conductivity	70 Btu/sq ft/ft hr/°F at 68 °F	121.2 W/m at 20 °C
Coefficient of thermal expansion 68-572	11.1 · 10 ⁻⁶ per °F (68-572 °F)	19.2 · 10 ⁻⁶ per °C (20-300 °C)
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	16000 ksi	110317 MPa
Modulus of rigidity	6000 ksi	41369 MPa

Physical properties provided by CDA

C26000 continued

Fabrication properties

Technique	Suitability
Soldering	Excellent
Brazing	Excellent
Oxyacetylene welding	Good
Gas shielded arc welding	Good
Coated metal arc welding	Not recommended
Spot weld	Fair
Seam weld	Not recommended
Butt weld	Good
Capacity for being cold worked	Excellent
Capacity for being hot formed	Fair
Machinability rating	30

Fabrication properties provided by CDA

Thermal properties

Treatment	Minimum*	Maximum*
Annealing	800	1400
Hot treatment	1350	1550

Thermal properties provided by CDA

*Temperature is measured in Fahrenheit.

C31400

Continuous cast and drawn

Product description	Leaded commercial bronze
Tempers	H02 half hard
Solids	3/8" to 2" O.D.
Hex	3/8" to 2" O.D.
Standard lengths	144" *H02 half hard temper is standard stocked

Typical uses

Builders hardware

Door knobs

Electrical

Connectors for wire and cable, electrical plug-type connectors

Fasteners

Nuts, screws

Industrial

Pickling crates, pickling fixtures, pickling racks, screw machine parts

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C31400	B140 B140M				MIL-V-18436	

Chemical composition

Cu (%)	Pb (%)	Zn (%)	Fe (%)	Ni (%)
87.50-90.50	1.30-2.50	Remain	0.10	0.70

Chemical composition according to ASTM B140/B140M-22

Note: Cu + sum of named elements, 99.6% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 ° F)
C31400	80	0.319

C31400 continued

Mechanical properties

Mechanical properties according to ASTM B140/B140M-22
C31400
H02 half hard

Size range ½" diameter and under

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical HRB	
50	345	30	205	7	61	

Size range over ½" diameter to 1" inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical HRB	
45	310	27	185	10	61	

Size range over 1" diameter

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical HRB	
40	275	25	170	12	58	

Physical properties

	US customary	Metric
Melting point – liquidus	1900 °F	1038 °C
Melting point – solidus	1850 °F	1010 °C
Density	0.319 lb/in ³ at 68 °F	8.83 gm/cm ³ at 20 °C
Specific gravity	8.83	8.83
Electrical conductivity	42% IACS at 68 °F	0.246 MegaSiemens/cm at 20 °C
Thermal conductivity	104 Btu/sq ft/ft hr/°F at 68 °F	180 W/m at 20 °C
Coefficient of thermal expansion 68-572	10.2 · 10 ⁻⁶ per °F (68-572 °F)	17.6 · 10 ⁻⁶ per °C (20-300 °C)
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	17000 ksi	117212 MPa
Modulus of rigidity	6400 ksi	44127 MPa

Physical properties provided by CDA

C31400 continued

Fabrication properties

Technique	Suitability
Soldering	Excellent
Brazing	Good
Oxyacetylene welding	Not recommended
Gas shielded arc welding	Not recommended
Coated metal arc welding	Not recommended
Spot weld	Not recommended
Seam weld	Not recommended
Butt weld	Fair
Capacity for being cold worked	Good
Capacity for being hot formed	Poor
Machinability rating	80

Fabrication properties provided by CDA

Thermal properties

Treatment	Minimum*	Maximum*
Annealing	800	1200

Thermal properties provided by CDA

*Temperature is measured in Fahrenheit.

C31600

Continuous cast and drawn

Product description	Leaded commercial bronze (nickel-bearing)
Tempers	H02 half hard
Solids	3/8" to 2" O.D.
Hex	3/8" to 2" O.D.
Standard lengths	144"

Typical uses

Builders hardware

Hardware

Electrical

Connectors

Fasteners

Fasteners, nuts, screws

Industrial

Screw machine parts

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C31600	B140 B140M				MIL-V-18436	

Chemical composition

Cu (%)	Pb (%)	Zn (%)	Fe (%)	P (%)	Ni (%)
87.50-90.50	1.30-2.50	Remain	0.10	0.04-0.10	0.70-1.20

Chemical composition according to ASTM B140/B140M-22

Note: Cu + sum of named elements, 99.6% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 ° F)
C31600	80	0.320

C31600 continued

Mechanical properties

Mechanical properties according to ASTM B140/B140M-22
C31600
H02 half hard

Size range ½" diameter and under

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical HRB	
50	345	30	205	7	61	

Size range over ½" diameter to 1" inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical HRB	
45	310	27	185	10	61	

Size range over 1" diameter

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical HRB	
40	275	25	170	12	58	

Physical properties

	US customary	Metric
Melting point – liquidus	1900 °F	1038 °C
Melting point – solidus	1850 °F	1010 °C
Density	0.32 lb/in ³ at 68 °F	8.86 gm/cm ³ at 20 °C
Specific gravity	8.86	8.86
Electrical conductivity	32% IACS at 68 °F	0.187 MegaSiemens/cm at 20 °C
Thermal conductivity	81 Btu/sq ft/ft hr/°F at 68 °F	140.2 W/m at 20 °C
Coefficient of thermal expansion 68-572	10.2 · 10 ⁻⁶ per °F (68-572 °F)	17.6 · 10 ⁻⁶ per °C (20-300 °C)
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	17000 ksi	117212 MPa

Physical properties provided by CDA

C31600 continued

Fabrication properties

Technique	Suitability
Soldering	Excellent
Brazing	Good
Oxyacetylene welding	Not recommended
Gas shielded arc welding	Not recommended
Coated metal arc welding	Not recommended
Spot weld	Not recommended
Seam weld	Not recommended
Butt weld	Fair
Capacity for being cold worked	Good
Capacity for being hot formed	Poor
Machinability rating	80

Fabrication properties provided by CDA

Thermal properties

Treatment	Minimum*	Maximum*
Annealing	800	1200

Thermal properties provided by CDA

*Temperature is measured in Fahrenheit.

C46400

Continuous cast and drawn

Product description	Naval brass, uninhibited
Tempers	H02 half hard
Solid rounds	1/2" to 2 3/4" O.D.
Hex	1/2" to 2 3/4" O.D.
Rectangles	Consult mill
Standard lengths	144"

Typical uses

Builders Hardware

Lock pins

Electrical

Precision shipboard equipment

Fasteners

Bolts, nuts, rivets

Industrial

Aircraft turnbuckle barrels, balls, bearings, bushings, condenser plates, dies for golf ball production, heat exchanger tubes, hub cones, pressure vessels, structural uses, valve stems, welding rod

Marine

Decorative fittings, hardware, propeller shafts, shafting, turnbuckles

Ordnance

Missile components

Other

Baffle plates and flanges

Plumbing

Fittings

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C46400	B21 B21M	J461 J463		QQ-B-639		

Chemical composition

Cu (%)	Pb (%)	Sn (%)	Zn (%)	Fe (%)
59.00-62.00	0.20	0.50-1.00	Remain	0.10

Chemical composition according to ASTM B21/B21M-20

Note: Cu + sum of named elements, 99.6% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 °F)
C46400	30	0.304

C46400 continued

Mechanical properties

Mechanical properties according to ASTM B21/B21M-20
C46400
H02 half hard

Size range ½" and under

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or specimen thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	min to max HRB	
60	414	27	186	22		

Size range over ½" to 1" inclusive rod

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or specimen thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	min to max HRB	
60	414	27	186	25	60-80	

Size range over 1" to 2" inclusive rod

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or specimen thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	min to max HRB	
58	400	26	179	25	55-80	

Size range over 2" to 3" inclusive rod

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or specimen thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	min to max HRB	
54	372	25	172	25	55-80	

Size range over 3" to 4" inclusive rod

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or specimen thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	min to max HRB	
54	372	22	152	27	55-80	

C46400 continued

Size range over 4"

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or specimen thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	min to max HRB	
54	372	22	152	30	55-80	

Physical properties

	US customary	Metric
Melting point – liquidus	1650 °F	889 °C
Melting point – solidus	1630 °F	888 °C
Density	0.304 lb/in ³ at 68 °F	8.41 gm/cm ³ at 20 °C
Specific gravity	8.41	8.41
Electrical conductivity	26% IACS at 68 °F	0.151 MegaSiemens/cm at 20 °C
Thermal conductivity	67 Btu/sq ft/ft hr/°F at 68 °F	116 W/m at 20 °C
Coefficient of thermal expansion 68-572	11.8 · 10 ⁻⁶ per °F (68-572 °F)	20.4 · 10 ⁻⁶ per °C (20-300 °C)
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	15000 ksi	103420 MPa
Modulus of rigidity	5600 ksi	38611 MPa

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Excellent
Brazing	Excellent
Oxyacetylene welding	Good
Gas shielded arc welding	Fair
Coated metal arc welding	Not recommended
Spot weld	Good
Seam weld	Fair
Butt weld	Good
Capacity for being cold worked	Fair
Capacity for being hot formed	Excellent
Forgeability rating	90
Machinability rating	30

Fabrication properties provided by CDA

Thermal properties

Treatment	Minimum*	Maximum*
Annealing	800	1100
Hot treatment	1200	1500

Thermal properties provided by CDA

*Temperature is measured in Fahrenheit.

Common fabrication processes

Blanking, drawing, forming and bending, heading and upsetting, hot forging and pressing, hot heading and upsetting, shearing

Common fabrication processes provided by CDA

C51000

Standard-stocked product*	Extruded and drawn
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Product description	Phosphor bronze 5% A
Tempers	H04 hard, H08 spring
Solids	3/8" to 2 1/2" O.D.
Hex	3/8" to 2" O.D.
Standard lengths	144" *H04 hard temper solids is standard stocked

Typical uses

Architecture

Bridge bearing plates

Electrical

Electrical connectors, electrical flexing contact blades, electromechanical spring components, electronic and precision instrument parts, electronic connectors, fuse clips, resistance wire, switch parts, wire brushes

Fasteners

Cotter pins, fasteners, lock washers

Industrial

Beater bar, bellows, bourdon tubes, chemical hardware, clutch disks, diaphragms, perforated sheets, pressure-responsive elements, sleeve bushings, springs, textile machinery, truss wire, welding rods

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C51000	B139 B139M	J461 J463	4625			

Chemical composition

Cu (%)	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%)
Remain	0.05	4.20-5.80	0.30	0.10	0.03-0.35

Chemical composition according to ASTM B139/B139M-12(2024)

Note: Cu + sum of named elements, 99.5% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 °F)
C51000	20	0.320

C51000 continued

Mechanical properties

Mechanical properties according to ASTM B139/B139M-12(2024)

C51000

H04 hard

Size range 1/4" to 1/2" round and hexagonal inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or specimen thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical HRB	
70	485			13	87	

Size range over 1/2" to 1" round and hexagonal inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or specimen thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical HRB	
60	415			15	87	

Size range over 1" round and hexagonal

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or specimen thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical HRB	
55	380			18	87	

C51000

H08 spring

Size range 0.026" to 1/2" round inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or specimen thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical HRB	
115	790					

C51000 continued

Size range over 1/16" to 1/8" round inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or specimen thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical HRB	
110	760					

Size range over 1/8" to 1/4" round inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or specimen thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical HRB	
105	725			3.5		

Size range over 1/4" to 3/8" round inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or specimen thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical HRB	
100	690			5		

Size range over 3/8" to 1/2" round inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or specimen thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical HRB	
90	620			9	95	

Physical properties

	US customary	Metric
Melting point – liquidus	1920 °F	1049 °C
Melting point – solidus	1750 °F	954 °C
Density	0.32 lb/in ³ at 68 °F	8.86 gm/cm ³ at 20 °C
Specific gravity	8.86	8.86
Electrical conductivity*	15% IACS at 68 °F	0.088 MegaSiemens/cm at 20 °C
Thermal conductivity	40 Btu/sq ft/ft hr/°F at 68 °F	69.2 W/m at 20 °C
Coefficient of thermal expansion 68-572	9.9 · 10 ⁻⁶ per °F (68-572 °F)	17.1 · 10 ⁻⁶ per °C (20-300 °C)
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	16000 ksi	110310 MPa
Modulus of rigidity	6000 ksi	41370 MPa

Physical properties provided by CDA

*Determined on an alloy containing 5% tin and .2% phosphorus. This value will vary with the composition.

Fabrication properties

Technique	Suitability
Soldering	Excellent
Brazing	Excellent
Oxyacetylene welding	Fair
Gas shielded arc welding	Good
Coated metal arc welding	Fair
Spot weld	Good
Seam weld	Fair
Butt weld	Excellent
Capacity for being cold worked	Excellent
Capacity for being hot formed	Poor
Machinability rating	20

Fabrication properties provided by CDA

Thermal properties

Treatment	Minimum*	Maximum*
Annealing	900	1250

Thermal properties provided by CDA

*Temperature is measured in Fahrenheit.

Common fabrication processes

Blanking, drawing, forming and bending, heading and upsetting, roll threading and knurling, shearing, stamping

Common fabrication processes provided by CDA

C52100

Continuous cast and drawn

Product description	Phosphor bronze 8% C
Tempers	H04 hard
Solids	3/8" to 2 1/2" O.D.
Hex	3/8" to 2" O.D.
Standard lengths	144"

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C52100	B139 B139M					

Chemical composition

Cu (%)	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%)
Remain	0.05	7.00-9.00	0.20	0.10	0.03-0.35

Chemical composition according to ASTM B139/B139M-12(2024)

Note: Cu + sum of named elements, 99.5% min. Single values represent maximums.

Typical uses

Architecture

Bridge bearing plates

Building

Thermostat bellows

Consumer

Coinage, cymbals, power conductor for electro-surgical pencil

Electrical

Cold headed parts, electrical connectors, electrical flexing contact blades, electronic connectors, fuse clips, switch parts, wire brushes

Fasteners

Cotter pins, heavy duty fasteners, lock washers

Industrial

Beater bar, bellows, bourdon tubing, chemical hardware, heavy duty clips, clutch disks, cold headed parts, diaphragms, doctor blades for the paper industry, gears, perforated sheets, pinions, pneumatic hammers, sleeve bushings, heavy duty springs, helical extension springs, helical torsion springs, textile machinery, thrust bearings, truss wire, welding wire, well drill equipment

Marine

Marine parts

C52100 continued

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68° F)
C52100	20	0.318

Mechanical properties

Mechanical properties according to ASTM B139/B139M-12(2024)

C52100

H04 hard

Size range ¼" to ½" round and hexagonal inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or specimen thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical HRB	
85	585			12	93	

Size range over ½" to 1" round and hexagonal inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or specimen thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical HRB	
75	515			15	93	

Size range over 1" round and hexagonal

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or specimen thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical HRB	
60	415			20	93	

Physical properties

	US customary	Metric
Melting point – liquidus	1880 °F	1027 °C
Melting point – solidus	1620 °F	882 °C
Density	0.318 lb/in ³ at 68 °F	8.8 gm/cm ³ at 20 °C
Specific gravity	8.8	8.8
Electrical conductivity	13% IACS at 68 °F	0.076 MegaSiemens/cm at 20 °C
Thermal conductivity	36 Btu/sq ft/ft hr/°F at 68 °F	62.3 W/m at 20 °C
Coefficient of thermal expansion 68-572	10.1 · 10 ⁻⁶ per °F (68-572 °F)	17.4 · 10 ⁻⁶ per °C (20-300 °C)
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	16000 ksi	110310 MPa
Modulus of rigidity	6000 ksi	41370 MPa

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Excellent
Brazing	Excellent
Oxyacetylene welding	Fair
Gas shielded arc welding	Good
Coated metal arc welding	Fair
Spot weld	Good
Seam weld	Fair
Butt weld	Excellent
Capacity for being cold worked	Good
Capacity for being hot formed	Poor
Machinability rating	20

Fabrication properties provided by CDA

Thermal properties

Treatment	Minimum*	Maximum*
Annealing	900	1250

Thermal properties provided by CDA

*Temperature is measured in Fahrenheit.

Common fabrication processes

Blanking, drawing, forming and bending, shearing, stamping

Common fabrication processes provided by CDA

C53400

Continuous cast and drawn

Product description	Phosphor bronze B-1
Tempers	H04 hard
Solids	3/8" to 2 1/2" O.D.
Hex	3/8" to 2" O.D.
Standard lengths	144"

Typical uses

Industrial

Bearings, bushings, fasteners

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C53400	B139 B139M					

Chemical composition

Cu (%)	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%)
Remain	0.80-1.20	3.50-5.80	0.30	0.10	0.03-0.35

Chemical composition according to ASTM B139/B139M-12(2024)

Note: Cu + sum of named elements, 99.5% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 ° F)
C53400	70	0.320

C53400 continued

Mechanical properties

Mechanical properties according to ASTM B139/B139M-12(2024)
C53400
H04 hard

Size range 1/16" to 1/4" round and hexagonal inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or specimen thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical HRB	
65	450			8	86	

Size range 1/4" to 1/2" round and hexagonal inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or specimen thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical HRB	
60	415			10	86	

Size range over 1/2" to 1" round and hexagonal inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or specimen thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical HRB	
55	380			12	86	

Size range over 1" round and hexagonal

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or specimen thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical HRB	
50	345			15	86	

C53400 continued

Physical properties

	US customary	Metric
Melting point – liquidus	1920 °F	1049 °C
Melting point – solidus	1750 °F	954 °C
Density	0.32 lb/in ³ at 68 °F	8.91 gm/cm ³ at 20 °C
Specific gravity	8.91	8.91
Electrical conductivity	15% IACS at 68 °F	0.08 MegaSiemens/cm at 20 °C
Thermal conductivity	40 Btu/sq ft/ft hr/°F at 68 °F	69.28 W/m at 20 °C
Coefficient of thermal expansion 68-572	9.9 · 10 ⁻⁶ per °F (68-572 °F)	17.1 · 10 ⁻⁶ per °C (20-300 °C)
Modulus of elasticity in tension	16000 ksi	110310 MPa
Modulus of rigidity	6000 ksi	41300 MPa

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Excellent
Brazing	Good
Oxyacetylene welding	Poor
Gas shielded arc welding	Fair
Coated metal arc welding	Poor
Spot weld	Fair
Seam weld	Fair
Butt weld	Good
Capacity for being cold worked	Good
Capacity for being hot formed	Poor
Machinability rating	70

Fabrication properties provided by CDA

Thermal properties

Treatment	Minimum*	Maximum*
Annealing	900	1250

Thermal properties provided by CDA

*Temperature is measured in Fahrenheit.

Common fabrication processes

Bending, blanking, forming, knurling, machining, roll threading, shearing, stamping, upsetting

Common fabrication processes provided by CDA

C54400

	Standard-stocked product	Extruded and drawn
Product description	Phosphor bronze B-2	
Tempers	H04 hard	
Solids	3/8" to 2 3/4" O.D.	
Hex	3/8" to 2" O.D.	
Standard lengths	144" *Solids is standard stocked	

Typical uses

Electrical

Electrical connectors

Industrial

Bearings, bushings, gears, pinions, screw machine products, shafts, sleeve bearings, thrust bearings, thrust washers, valve parts

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C54400	B139 B139M	J461 J463				

Chemical composition

Cu (%)	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%)
Remain	3.00-4.00	3.50-4.50	1.50-4.50	0.10	0.01-0.50

Chemical composition according to ASTM B139/B139M-12(2024)

Note: Cu + sum of named elements, 99.5% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 ° F)
C54400	80	0.320

C54400 continued

Mechanical properties

Mechanical properties according to ASTM B139/B139M-12(2024)
C54400
H04 hard

Size range 1/16" to 1/4" round and hexagonal inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or specimen thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical HRB	
65	450			8	86	

Size range 1/4" to 1/2" round and hexagonal inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or specimen thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical HRB	
60	415			10	86	

Size range over 1/2" to 1" round and hexagonal inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or specimen thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical HRB	
55	380			12	86	

Size range over 1" round and hexagonal

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or specimen thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical HRB	
50	345			15	86	

C54400 continued

Physical properties

	US customary	Metric
Melting point – liquidus	1830 °F	999 °C
Melting point – solidus	1700 °F	927 °C
Density	0.320 lb/in ³ at 68 °F	8.89 gm/cm ³ at 20 °C
Specific gravity	8.89	8.89
Electrical conductivity	19% IACS at 68 °F	0.111 MegaSiemens/cm at 20 °C
Thermal conductivity	50 Btu/sq ft/ft hr/°F at 68 °F	86.5 W/m at 20 °C
Coefficient of thermal expansion 68-572	9.6 · 10 ⁻⁶ per °F (68-572 °F)	16.6 · 10 ⁻⁶ per °C (20-300 °C)
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	15000 ksi	103420 MPa
Modulus of rigidity	5600 ksi	38610 MPa

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Excellent
Brazing	Good
Oxyacetylene welding	Not recommended
Gas shielded arc welding	Not recommended
Coated metal arc welding	Not recommended
Spot weld	Not recommended
Seam weld	Not recommended
Butt weld	Fair
Capacity for being cold worked	Good
Machinability rating	80

Fabrication properties provided by CDA

Thermal properties

Treatment	Minimum*	Maximum*
Annealing	900	1250

Thermal properties provided by CDA

*Temperature is measured in Fahrenheit.

Common fabrication processes

Blanking, drawing, forming and bending, machining, shearing, stamping

Common fabrication processes provided by CDA

C62400

Extruded and drawn

Product description	Aluminum bronze 11%
Tempers	HR50 drawn and stress relieved
Solids	1/2" to 3" O.D.*
Standard lengths	144" *Consult mill for other sizes

Typical uses

Fasteners

Nuts

Industrial

Bushings, cams, drift pins, gears, hydraulic bushings, support bushings, tie rods, valve balls, wear plates, welding wire

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C62400	B150 B150M	J461 J463				

Chemical composition

Cu (%) ¹	Sn (%)	Fe (%)	Al (%)	Mn (%)	Si (%)
Remain	0.20	2.00-4.50	10.00-11.50	0.30	0.25

Chemical composition according to ASTM B150/B150M-19

¹Cu value includes Ag.

Note: Cu + sum of named elements, 99.5% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 ° F)
C62400	50	0.269

C62400 continued

Mechanical properties

Mechanical properties according to ASTM B150/B150M-19
C62400
HR50 drawn and stress relieved temper

Size range ½" and under rod

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or specimen thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	min to max HRB	
95	655	45	310	10		

Size range over ½" to 1" rod inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or specimen thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	min to max HRB	
95	655	45	310	12		

Size range over 1" to 2" rod inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or specimen thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	min to max HRB	
90	620	43	295	12		

Size range over 2" to 3" rod inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or specimen thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	min to max HRB	
90	620	40	275	12		

C62400 continued

Physical properties

	US customary	Metric
Melting point – liquidus	1900 °F	1038 °C
Melting point – solidus	1880 °F	1027 °C
Density	0.269 lb/in ³ at 68 °F	7.45 gm/cm ³ at 20 °C
Specific gravity	7.45	7.45
Electrical conductivity	12% IACS at 68 °F	0.07 MegaSiemens/cm at 20 °C
Thermal conductivity	34 Btu/sq ft/ft hr/°F at 68 °F	59 W/m at 20 °C
Coefficient of thermal expansion 68-572	9 · 10 ⁻⁶ per °F (68-572 °F)	15.6 · 10 ⁻⁶ per °C (20-300 °C)
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	17000 ksi	117212 MPa
Modulus of rigidity	6400 ksi	44127 MPa

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Not recommended
Brazing	Fair
Oxyacetylene welding	Not recommended
Gas shielded arc welding	Good
Coated metal arc welding	Good
Spot weld	Good
Seam weld	Good
Butt weld	Good
Capacity for being cold worked	Poor
Capacity for being hot formed	Excellent
Forgeability rating	80
Machinability rating	50

Fabrication properties provided by CDA

Thermal properties

Treatment	Minimum*	Maximum*
Annealing	1100	1200
Hot treatment	1400	1625

Thermal properties provided by CDA

*Temperature is measured in Fahrenheit.

Common fabrication processes

Hot bending, hot forging

Common fabrication processes provided by CDA

AMS 4640-C63000

Standard-stocked product*	Extruded and drawn
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Product description	Nickel-aluminum bronze
Tempers	HR50 drawn and stress relieved, or TQ50 temper annealed
Solids	3/8" to 10" O.D.
Hex	1/2" to 2" O.D.
Standard lengths	144" *Solids is standard stocked

Typical uses

Industrial

Aircraft parts, balls, bearings, bushings, cams, condenser tube for power stations and desalting units, corrosion-resistant articles, gears, heat exchanger flanges, hydraulic bushings for earth-moving equipment, plunger tips, pump parts, pump shafts, shafting, structural members, tanks, valve balls, valve guides, valve seats, welded piping systems

Marine

Bolts, nuts, propellers, pump parts, ship propellers

Plumbing

Faucets

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C63000	B150 B150M	J461 J463	4640		QQ-C-465B AMD1	

Chemical composition

Cu (%) ¹	Sn (%)	Zn (%)	Fe (%)	Ni (%)	Al (%)	Mn (%)	Si (%)
Remain	0.20	0.30	2.00-4.00	4.00-5.50	9.00-11.00	1.50	0.25

Chemical composition according to AMS 4640

¹Cu value includes Ag.

Note: Cu + Ag + sum of named elements, 99.5% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 ° F)
C63000	30	0.274

AMS 4640-C63000 continued

Mechanical properties

Mechanical properties according to AMS 4640
C63000
HR50 drawn and stress relieved temper, or TQ50 temper annealed

Size range up to 1" rounds, hexagons, and octagons inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 4D, min	Hardness	Remarks
ksi	MPa	ksi	MPa	%	min to max HB	
110	760	68	470	10	201-248	

Size range over 1" to 2" rounds, hexagons, and octagons inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 4D, min	Hardness	Remarks
ksi	MPa	ksi	MPa	%	min to max HB	
110	760	60	415	10	201-248	

Size range over 2" to 3" rounds, hexagons, and octagons inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 4D, min	Hardness	Remarks
ksi	MPa	ksi	MPa	%	min to max HB	
105	725	55	380	10	187-241	

Size range over 3" to 5" rounds, hexagons, and octagons inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 4D, min	Hardness	Remarks
ksi	MPa	ksi	MPa	%	min to max HB	
100	690	50	345	10	187-241	

Physical properties

	US customary	Metric
Melting point – liquidus	1930 °F	1054 °C
Melting point – solidus	1895 °F	1035 °C
Density	0.274 lb/in ³ at 68 °F	7.58 gm/cm ³ at 20 °C
Specific gravity	7.58	7.58
Electrical conductivity	7% IACS at 68 °F	0.041 MegaSiemens/cm at 20 °C
Thermal conductivity	22.6 Btu/sq ft/ft hr/°F at 68 °F	39.1 W/m at 20 °C
Coefficient of thermal expansion 68-572	9 · 10 ⁻⁶ per °F (68-572 °F)	15.5 · 10 ⁻⁶ per °C (20-300 °C)
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	17500 ksi	120650 MPa
Modulus of rigidity	6400 ksi	44127 MPa

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Not recommended
Brazing	Fair
Oxyacetylene welding	Not recommended
Gas shielded arc welding	Good
Coated metal arc welding	Good
Spot weld	Good
Seam weld	Good
Butt weld	Good
Capacity for being cold worked	Poor
Capacity for being hot formed	Good
Forgeability rating	75
Machinability rating	30

Fabrication properties provided by CDA

Thermal properties

Treatment	Minimum*	Maximum*
Annealing	1100	1300
Hot treatment	1450	1700

Thermal properties provided by CDA

*Temperature is measured in Fahrenheit.

Common fabrication processes

Forging, hot forming

Common fabrication processes provided by CDA

AMS 4590-C63020

Standard-stocked product	Extruded and drawn
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Product description	Nickel-aluminum bronze
Tempers	TQ50 quenched and tempered
Tubes	2 3/4" to 6" O.D.
Solids	3/4" to 4" O.D.
Hex	Consult mill
Standard lengths	24"

Typical uses

Aerospace

Bearings, bushings

Industrial

Bearings, forming dies for roll bearings, hydraulic bushings for earth-moving equipment, valve balls, valve parts (cryogenic)

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C63020	B150 B150M		4590			

Chemical composition

Cu (%)	Pb (%)	Sn (%)	Zn (%)	Fe (%)	Ni (%) ¹	Al (%)	Co (%)	Cr (%)	Mn (%)	Si (%)
Remain	0.03	0.25	0.30	4.00-5.50	4.20-6.00	10.00-11.00	0.20	0.05	1.50	0.15

Chemical composition according to AMS 4590

¹Ni value includes Co.

Note: Cu + sum of named elements, 99.5% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 °F)	Density (gm/cu ³ at 20 °C)
C63020		0.275	7.6

AMS 4590-C63020 continued

Mechanical properties

Mechanical properties according to AMS 4590
C63020
TQ50 quenched and tempered

Size range up to 1" diameter inclusive

Tensile strength, min		Yield strength, at 0.2% offset, min		Elongation, in 2 in. (50.8 mm) or 4D, min	Rockwell "C" hardness	Remarks
ksi	MPa	ksi	MPa	%	min HRC	
135	931	100	689	6	26	

Size range over 1" to 2" diameter inclusive

Tensile strength, min		Yield strength, at 0.2% offset, min		Elongation, in 2 in. (50.8 mm) or 4D, min	Rockwell "C" hardness	Remarks
ksi	MPa	ksi	MPa	%	min HRC	
130	896	95	655	6	26	

Size range over 2" to 4" diameter inclusive

Tensile strength, min		Yield strength, at 0.2% offset, min		Elongation, in 2 in. (50.8 mm) or 4D, min	Rockwell "C" hardness	Remarks
ksi	MPa	ksi	MPa	%	min HRC	
130	896	90	621	6	26	

Physical properties

	US customary	Metric
Melting point – liquidus	1940 to 1967 °F	1060 to 1075 °C
Density	0.274 lb/in ³ at 68 °F	7.6 gm/cm ³ at 20 °C
Specific gravity	7.6	7.6
Electrical Resistivity	132.33 ohms-cmil/ft at 68 °F	22.0 microhm-cm at 20 °C
Thermal conductivity	31.2 Btu/sq ft/ft hr/°F at 68 °F	54.0 W/m at 20 °C
Coefficient of thermal expansion 68-572	9.4 · 10 ⁻⁶ per °F (68-572 °F)	17.0 · 10 ⁻⁶ per °C (20-300 °C)

Physical properties provided by CDA

AMS 4634-C64200

	Standard-stocked product*	Extruded and drawn
Product description	Aluminum bronze	
Tempers	HR50 drawn and stress relieved	
Solids	3/16" to 6" O.D.	
Hex	1/2" to 2" O.D.	
Standard lengths	144" *Solids is standard stocked	

Typical uses

Automotive

Valve guides (automobile engine)

Electrical

Pole line hardware

Fasteners

Bolts, nuts

Industrial

Cams, gears, valve bodies, valve components, valve stems

Marine

Hardware

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C64200	B150 B150M	J461 J463	4634	QQ-C-465		

Chemical composition

Cu (%) ¹	Pb (%)	Sn (%)	Zn (%)	Fe (%)	Ni (%) ²	Al (%)	Mn (%)	Si (%)
Remain	0.05	0.20	0.50	0.30	0.25	6.30-7.60	0.10	1.50-2.20

Chemical composition according to AMS 4634

¹Cu value includes Ag. ²Ni value includes Co.

Note: Cu + sum of named elements, 99.5% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 ° F)
C64200	60	0.278

AMS 4634-C64200 continued

Mechanical properties

Mechanical properties according to AMS 4634
C64200
HR50 drawn and stress relieved temper

Size range up to ½" bars and rods inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 4D, min	Hardness, internal	Remarks
ksi	MPa	ksi	MPa	%	HRB	
90	621	45	310	9	>80 inclusive	

Size range over ½" to 1" bars and rods inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 4D, min	Hardness, internal	Remarks
ksi	MPa	ksi	MPa	%	HRB	
85	586	45	310	12	>80 inclusive	

Size range over 1" to 2" bars and rods inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 4D, min	Hardness, internal	Remarks
ksi	MPa	ksi	MPa	%	HRB	
80	552	42	290	12	>80 inclusive	

Size range over 2" to 3" bars and rods inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 4D, min	Hardness, internal	Remarks
ksi	MPa	ksi	MPa	%	HRB	
75	517	35	241	15	>80 inclusive	

Physical properties

	US customary	Metric
Melting point – liquidus	1840 °F	1004 °C
Melting point – solidus	1800 °F	982 °C
Density	0.278 lb/in ³ at 68 °F	7.69 gm/cm ³ at 20 °C
Specific gravity	7.69	7.69
Electrical conductivity	8% IACS at 68 °F	0.047 MegaSiemens/cm at 20 °C
Thermal conductivity	26 Btu/sq ft/ft hr/°F at 68 °F	45 W/m at 20 °C
Coefficient of thermal expansion 68-572	10 · 10 ⁻⁶ per °F (68-572 °F)	17.3 · 10 ⁻⁶ per °C (20-300 °C)
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	16000 ksi	110317 MPa
Modulus of rigidity	6000 ksi	41369 MPa

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Not recommended
Brazing	Fair
Oxyacetylene welding	Not recommended
Gas shielded arc welding	Fair
Coated metal arc welding	Fair
Spot weld	Fair
Seam weld	Fair
Butt weld	Fair
Capacity for being cold worked	Poor
Capacity for being hot formed	Excellent
Forgeability rating	80
Machinability rating	60

Fabrication properties provided by CDA

Thermal properties

Treatment	Minimum*	Maximum*
Annealing	1100	1300
Hot treatment	1300	1600

Thermal properties provided by CDA

*Temperature is measured in Fahrenheit.

Common fabrication processes

Forging, hot forming, machining

Common fabrication processes provided by CDA

C64210

Extruded and drawn

Product description	Aluminum silicon bronze
Tempers	HR50 drawn and stress relieved
Solids	5/16" to 3" O.D.
Hex	1/2" to 2" O.D.
Standard lengths	144"

Typical uses

Electrical

Pole line hardware

Industrial

Bearings (high strength/corrosion resistant), bushings (aircraft), chemical-process equipment, pickling equipment, valve bodies, valve stems

Marine

Bolts, lock washers, nuts, screws

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C64210	B150 B150M					

Chemical composition

Cu (%) ¹	Pb (%)	Sn (%)	Zn (%)	Fe (%)	Ni (%) ²	Al (%)	Mn (%)	Si (%)	As (%)
Remain	0.05	0.20	0.50	0.30	0.25	6.30-7.00	0.10	1.50-2.00	0.15

Chemical composition according to ASTM B150/B150M-19

¹Cu value includes Ag. ²Ni value includes Co.

Note: Cu + sum of named elements, 99.5% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 ° F)
C64210	60	0.278

C64210 continued

Mechanical properties

Mechanical properties according to ASTM B150/B150M-19
C64210
HR50 drawn and stress relieved temper (unless noted otherwise)

Size range under 1/2" rod and bar

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or specimen thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	min to max HRB	
90	620	45	310	9	80-100	

Size range 1/2" to 1" rod and bar inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or specimen thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	min to max HRB	
85	585	45	310	12	80-100	

Size range over 1" to 2" rod and bar inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or specimen thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	min to max HRB	
80	550	42	290	12	80-100	

Size range over 2" to 3" rod and bar inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or specimen thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	min to max HRB	
75	515	35	240	15	70-95	

Size range over 3" to 4" rod and bar inclusive (M20 as hot rolled)

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or specimen thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	min to max HRB	
70	485	30	205	15	65-95	

C64210 continued

Size range over 4" rod and bar (M30 as hot extruded)

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, 4x diameter or specimen thickness, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	min to max HRB	
70	485	25	170	15	65-95	

Physical properties

	US customary	Metric
Density	0.278 lb/in ³ at 68 °F	7.7 gm/cm ³ at 20 °C
Specific gravity	7.7	7.7

Physical properties provided by CDA

C65100

Extruded/cast and drawn

Product description	Low-silicon bronze B
Tempers	H02 half hard, H04 hard, H06 extra hard
Solids	3/8" to 2" O.D.
Hex	3/8" to 2" O.D.
Standard lengths	144"

Typical uses

Electrical

Conduit, motor (rotor bars), pole line hardware

Fasteners

Bolts, cable clamps, cap screws, fasteners, machine screws, nuts, rivets, screws, u bolts

Industrial

Heat exchanger tube, hydraulic pressure lines, oil refinery plumbing tube, welding rod

Marine

Hardware

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C65100	B98 B98M					

Chemical composition

Cu (%) ¹	Pb (%)	Zn (%)	Fe (%)	Mn (%)	Si (%)
Remain	0.05	1.50	0.80	0.70	0.80-2.00

Chemical composition according to ASTM B98/B98M-13(2019)

¹Cu value includes Ag.

Note: Cu + sum of named elements, 99.5% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 ° F)
C65100	30	0.316

C65100 continued

Mechanical properties

Mechanical properties according to ASTM B98/B98M-13(2019)

C65100

H02 half hard

Size range up to ½" rod inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	min to max HRB	
55	380	20	140	11	60-85	

Size range over ½" to 2" rod inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	min to max HRB	
55	380	20	140	12	60-85	

C65100

H04 hard

Size range up to ½" rod inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	min to max HRB	
65	450	35	241	8	65-90	

Size range over ½" to 2" rod inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	min to max HRB	
65	450	35	241	10	65-90	

C65100 continued

C65100 H06 extra hard

Size range up to ½" rod inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	min to max HRB	
85	585	55	380	6	75-95	

Size range over ½" to 1" rod inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	min to max HRB	
75	515	45	310	8	75-95	

Size range over 1" to 1½" rod inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	min to max HRB	
75	515	40	275	8	75-95	

Physical properties

	US customary	Metric
Melting point – liquidus	1940 °F	1060 °C
Melting point – solidus	1890 °F	1032 °C
Density	0.316 lb/in ³ at 68 °F	8.75 gm/cm ³ at 20 °C
Specific gravity	8.75	8.75
Electrical conductivity	12% IACS at 68 °F	0.07 MegaSiemens/cm at 20 °C
Thermal conductivity	33 Btu/sq ft/ft hr/°F at 68 °F	57.1 W/m at 20 °C
Coefficient of thermal expansion 68-572	9.9 · 10 ⁻⁶ per °F (68-572 °F)	17.1 · 10 ⁻⁶ per °C (20-300 °C)
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	17000 ksi	117212 MPa
Modulus of rigidity	6400 ksi	44127 MPa

Physical properties provided by CDA

C65100 continued

Fabrication properties

Technique	Suitability
Soldering	Excellent
Brazing	Excellent
Oxyacetylene welding	Good
Gas shielded arc welding	Excellent
Coated metal arc welding	Fair
Spot weld	Excellent
Seam weld	Good
Butt weld	Excellent
Capacity for being cold worked	Excellent
Capacity for being hot formed	Excellent
Machinability rating	30

Fabrication properties provided by CDA

Thermal properties

Treatment	Minimum*	Maximum*
Annealing	900	1250
Hot treatment	1300	1300

Thermal properties provided by CDA

*Temperature is measured in Fahrenheit.

Common fabrication processes

Forming and bending, heading and upsetting, hot forging and pressing, roll threading and knurling, squeezing and swaging

Common fabrication processes provided by CDA

C67300

Standard-stocked product	Extruded and drawn
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Product description	Manganese bronze
Tempers	H02 half hard
Solids	3/4" to 3" O.D.
Hex	Consult mill
Standard lengths	144"

Typical uses

Fasteners

Fasteners, lead screw nuts

Industrial

Bearings, bearings (pins), bushings, clutch bearings, drive shafts, gears and cams, idler pins, piston heads, propeller shafts, pump parts, seal rings, shaft bushings, sleeve bearings, spindles, thrust bearings, wear plates

Marine

Hardware, valve seats

Other

Connecting rods

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C67300		J461 J463				

Chemical composition

Cu (%)	Pb (%)	Sn (%)	Zn (%)	Fe (%)	Ni (%) ¹	Al (%)	Mn (%)	Si (%)
58.00-63.00	0.40-3.00	0.30	Remain	0.50	0.25	0.25	2.00-3.50	0.50-1.50

Chemical composition according to SAE J463

¹Ni value includes Co.

Note: Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 ° F)
C67300	70	0.300

C67300 continued

Mechanical properties

Mechanical properties according to SAE J463
C67300
H02 half hard

Size range up to 1" inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 4x diameter or thickness of specimen, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	min HRB	
65	450	40	275	12	70	

Size range over 1" to 3" inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 4x diameter or thickness of specimen, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	min HRB	
58	400	35	240	15	70	

Size range over 3"

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 4x diameter or thickness of specimen, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	min HRB	
52	360	30	205	18	65	

Physical properties

	US customary	Metric
Melting point – liquidus	1605 °F	874 °C
Density	0.3 lb/in ³ at 68 °F	8.3 gm/cm ³ at 20 °C
Specific gravity	8.3	8.3
Electrical conductivity	22% IACS at 68 °F	0.13 MegaSiemens/cm at 20 °C
Thermal conductivity	55 Btu/sq ft/ft hr/°F at 68 °F	95 W/m at 20 °C
Coefficient of thermal expansion 68-572	11 · 10 ⁻⁶ per °F (68-572 °F)	19 · 10 ⁻⁶ per °C (20-300 °C)
Modulus of elasticity in tension	17000 ksi	117212 MPa

Physical properties provided by CDA

Common fabrication processes

Hot forming, hot pressing, machining

Common fabrication processes provided by CDA

C67400

Extruded and drawn

Product description	Manganese bronze
Tempers	Extruded and drawn
Solids	3/4" to 3" O.D.
Hex	3/8" to 2" O.D.
Standard lengths	144"

Typical uses

Industrial

Bushings, cams, chain guides, food conveyor chain, gears, shafts, wear plates

Other

Connecting rods

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C67400		J461 J463				

Chemical composition

Cu (%)	Pb (%)	Sn (%)	Zn (%)	Fe (%)	Ni (%) ¹	Al (%)	Mn (%)	Si (%)
57.00-60.00	0.50	0.30	Remain	0.35	0.25	0.50-2.00	2.00-3.50	0.50-1.50

Chemical composition according to SAE J463

¹Ni value includes Co.

Note: Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 ° F)
C67400	30	0.292

C67400 continued

Mechanical properties

Mechanical properties according to SAE J463
C67400
Extruded and drawn

Size range up to 1" inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 4x diameter or thickness of specimen, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	min HRB	
78	540	40	275	8	84	

Size range over 1" to 2" inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 4x diameter or thickness of specimen, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	min HRB	
75	515	40	275	10	80	

Size range over 2" to 3" inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 4x diameter or thickness of specimen, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	min HRB	
70	485	36	250	12	78	

Physical properties

	US customary	Metric
Melting point – liquidus	1625 °F	885 °C
Melting point – solidus	1590 °F	866 °C
Density	0.292 lb/in ³ at 68 °F	8.08 gm/cm ³ at 20 °C
Specific gravity	8.08	8.08
Electrical conductivity	23% IACS at 68 °F	0.13 MegaSiemens/cm at 20 °C
Thermal conductivity	58 Btu/sq ft/ft hr/°F at 68 °F	100.5 W/m at 20 °C
Coefficient of thermal expansion 68-572	11 · 10 ⁻⁶ per °F (68-572 °F)	19 · 10 ⁻⁶ per °C (20-300 °C)
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	16000 ksi	110317 MPa
Modulus of rigidity	6000 ksi	41369 MPa

Physical properties provided by CDA

C67400 continued

Fabrication properties

Technique	Suitability
Soldering	Fair
Brazing	Good
Oxyacetylene welding	Not recommended
Gas shielded arc welding	Fair
Coated metal arc welding	Not recommended
Spot weld	Good
Seam weld	Good
Butt weld	Good
Capacity for being cold worked	Poor
Capacity for being hot formed	Excellent
Forgeability rating	100
Machinability rating	30

Fabrication properties provided by CDA

Common fabrication processes

Hot forging and pressing, machining

Common fabrication processes provided by CDA

Thermal properties

Treatment	Minimum*	Maximum*
Annealing	800	1100
Hot treatment	1100	1250

Thermal properties provided by CDA

*Temperature is measured in Fahrenheit.

C67410

Extruded and drawn

Product description	Manganese bronze
Solids	3/4" to 3" O.D.
Hex	3/8" to 2" O.D.
Standard lengths	144"

Typical uses

Industrial

Bushings, cams, chain guides, food conveyor chain, gears, shafts, wear plates

Other

Connecting rods

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C67410						Copper zinc

Chemical composition

Cu (%) ¹	Pb (%)	Sn (%)	Zn (%)	Fe (%)	Ni (%)	Al (%)	Mn (%)	Si (%)
55.00-59.00	0.80	0.50	Remain	1.00	2.00	1.30-2.30	1.00-2.40	0.70-1.30

Chemical composition provided by CDA

¹Cu value includes Ag.

Note: Single values represent maximums.

C67600

Extruded and drawn

Product description	Manganese bronze
Tempers	H02 half hard, H04 hard
Solids	3/4" to 2" O.D.
Hex	Consult mill
Standard lengths	144"

Typical uses

Industrial

Gate valve stems, valve balls, welding rod

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C67600	B138 B138M			QQ-B-728		

Chemical composition

Cu (%) ¹	Pb (%)	Sn (%)	Zn (%)	Fe (%)	Mn (%)
57.00-60.00	0.50-1.00	0.50-1.50	Remain	0.40-1.30	0.05-0.50

Chemical composition according to ASTM B138/B138M-11(2017)

¹Cu value includes Ag.

Note: Cu + sum of named elements, 99.5% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 ° F)
C67600	60	0.302

C67600 continued

Mechanical properties

Mechanical properties according to ASTM B138/B138M-11(2017)

C67600

H02 half hard

Size range up to 1" inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 4x diameter or thickness of specimen, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical HRB	
72	496	36	248	13	90	

Size range over 1" to 2½" inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 4x diameter or thickness of specimen, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical HRB	
70	483	35	241	15	90	

Size range over 2½"

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 4x diameter or thickness of specimen, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical HRB	
65	448	32	221	17	90	

C67600

H04 hard

Size range up to 1" inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 4x diameter or thickness of specimen, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical HRB	
80	552	56	386	8		

C67600 continued

Size range over 1" to 2½" inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 4x diameter or thickness of specimen, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical HRB	
76	524	52	359	10		

Size range over 2½"

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 4x diameter or thickness of specimen, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical HRB	
68	469	45	310	16		

Physical properties

	US customary	Metric
Melting point – liquidus	1630 °F	888 °C
Melting point – solidus	1590 °F	866 °C
Density	0.302 lb/in ³ at 68 °F	8.36 gm/cm ³ at 20 °C
Electrical conductivity	24% IACS at 68 °F	0.14 MegaSiemens/cm at 20 °C
Thermal conductivity	61 Btu/sq ft/ft hr/°F at 68 °F	105.65 W/m at 20 °C
Coefficient of thermal expansion 68-572	11.8 · 10 ⁻⁶ per °F (68-572 °F)	20.4 · 10 ⁻⁶ per °C (20-300 °C)
Modulus of elasticity in tension	15000 ksi	103422 MPa
Modulus of rigidity	5600 ksi	38611 MPa

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Excellent
Brazing	Excellent
Oxyacetylene welding	Good
Gas shielded arc welding	Fair
Spot weld	Good
Capacity for being cold worked	Poor
Capacity for being hot formed	Excellent
Forgeability rating	80
Machinability rating	30

Fabrication properties provided by CDA

C69300

Extruded and drawn	GreenAlloys™
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Product description	Lead-free brass
Tempers	H02 half hard
Solids	1/8" to 2 1/2" O.D.
Tubes	Consult mill
Hex	3/8" to 1" O.D.
Standard lengths	144"
Compliance	C69300 is compliant with key legislation including (1) Federal Safe Drinking Water Act - SDWA, (2) S. 3874 Federal Reduction of Lead in Drinking Water Act, (3) California AB1953, (4) Vermont Act 193, and is NSF/ANSI/CAN 61-2022 compliant

Typical uses

Automotive

Fluid connectors, sensor bodies, thermostat parts

Industrial

Automatic screw machine parts, bolts, condenser tube plates, nuts, pneumatic fittings, pump parts, screw machine parts, valve bodies for water, valve stems

Marine

Marine products, propeller shafts

Plumbing

Faucet stems, faucets, plumbing fittings, water meter cases

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C69300	B371 B371M					

Chemical composition

Cu (%) ¹	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%)	Ni (%) ²	Mn (%)	Si (%)
73.00-77.00	0.02*-0.09	0.20	remain.	0.10	0.04-0.15	0.10	0.10	2.70-3.40

*Pb content is greater than 0.02%.

¹Cu value includes Ag.

²Ni value includes Co.

Note: Cu + sum of named elements, 99.5% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68° F)
C69300	85	0.300

C69300 continued

Mechanical properties

Mechanical properties according to ASTM B371/B371M-19
C69300
H02 half hard

Size range up to ½" inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 4x diameter or thickness of specimen, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	max HRB approve	
85	585	45	310	5	85	

Size range over ½" to 1" inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 4x diameter or thickness of specimen, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	max HRB approx	
75	515	35	240	10	80	

Size range over 1" to 2 ½" inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 4x diameter or thickness of specimen, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	max HRB approx	
70	480	30	205	10	75	

Physical properties

	US customary	Metric
Melting point – liquidus	1616 °F	880 °C
Melting point – solidus	1571 °F	855 °C
Density	0.3 lb/in ³ at 68 °F	8.3 gm/cm ³ at 20 °C
Specific gravity	8.3	8.3
Electrical conductivity	8% IACS at 68 °F	0.046 MegaSiemens/cm at 20 °C
Thermal conductivity	21.8 Btu/sq ft/ft hr/°F at 68 °F	37.76 W/m at 20 °C
Coefficient of thermal expansion 68-212	10.3 · 10 ⁻⁶ per °F (68-212 °F)	17.8 · 10 ⁻⁶ per °C (20-100 °C)
Coefficient of thermal expansion 68-392	10.3 · 10 ⁻⁶ per °F (68-392 °F)	17.8 · 10 ⁻⁶ per °C (20-200 °C)
Coefficient of thermal expansion 68-572	10.4 · 10 ⁻⁶ per °F (68-572 °F)	18 · 10 ⁻⁶ per °C (20-300 °C)
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	15200 ksi	104801 MPa

Physical properties provided by CDA

C69300 continued

Fabrication properties

Technique	Suitability
Soldering	Excellent
Brazing	Good
Oxyacetylene welding	Good
Gas shielded arc welding	Good
Coated metal arc welding	Good
Spot weld	Good
Seam weld	Good
Butt weld	Good
Capacity for being cold worked	Poor
Capacity for being hot formed	Excellent
Forgeability rating	95
Machinability rating	85

Fabrication properties provided by CDA

Common fabrication properties

Forming and bending, machining, shearing

Common fabrication properties provided by CDA

Thermal properties

Treatment	Min*	Max*	Value*	Time*
Stress relief			0	
Solution treatment				0
Annealing	932	1112		
Hot treatment	1202	1517		

Thermal properties provided by CDA

*Temperature is measured in Fahrenheit. **For stress relief, solution treatment and annealing - time is measured in hours/inch of thickness. For precipitation heat treatment - time is measured in hours.

C69400

Extruded and drawn

Product description	Silicon red brass
Tempers	H04 hard
Solids	3/8" to 2" O.D.
Hex	3/8" to 2" O.D.
Standard lengths	144"

Typical uses

Industrial
Valve stems

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C69400	B371 B371M					

Chemical composition

Cu (%) ¹	Pb (%)	Zn (%)	Fe (%)	Si (%)
80.00-83.00	0.30	Remain	0.20	3.50-4.50

Chemical composition according to ASTM B371/B371M-19

¹Cu value includes Ag.

Note: Cu + sum of named elements, 99.5% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 ° F)
C69400	30	0.296

C69400 continued

Mechanical properties

Mechanical properties according to ASTM B371/B371M-19
C69400
H04 hard

Size range up to 1" inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 4x diameter or thickness of specimen, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
80	550	40	250	15	95	

Size range over 1" to 2" inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 4x diameter or thickness of specimen, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
75	515	35	241	15	95	

Size range over 2"

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 4x diameter or thickness of specimen, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
65	450	35	241	15	95	

Physical properties

	US customary	Metric
Melting point – liquidus	1685 °F	918 °C
Melting point – solidus	1510 °F	821 °C
Density	0.296 lb/in ³ at 68 °F	8.19 gm/cm ³ at 20 °C
Specific gravity	8.19	8.19
Electrical conductivity	6.2% IACS at 68 °F	0.04 MegaSiemens/cm at 20 °C
Thermal conductivity	15 Btu/sq ft/ft hr/°F at 68 °F	25.98 W/m at 20 °C
Coefficient of thermal expansion 68-572	11.2 · 10 ⁻⁶ per °F (68-572 °F)	19.3 · 10 ⁻⁶ per °C (20-300 °C)
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	16000 ksi	110310 MPa

Physical properties provided by CDA

C69400 continued

Fabrication properties

Technique	Suitability
Soldering	Excellent
Brazing	Excellent
Oxyacetylene welding	Good
Spot weld	Good
Seam weld	Good
Butt weld	Good
Capacity for being cold worked	Poor
Capacity for being hot formed	Excellent
Forgeability rating	80
Machinability rating	30

Fabrication properties provided by CDA

Thermal properties

Treatment	Minimum*	Maximum*
Annealing	800	1200
Hot treatment	1200	1600

Thermal properties provided by CDA

*Temperature is measured in Fahrenheit.

Common fabrication processes

Forging, screw machining

Common fabrication processes provided by CDA

C69430

Extruded and drawn

Product description	Silicon red brass
Tempers	H04 hard
Solids	3/8" to 2" O.D.
Hex	3/8" to 2" O.D.
Standard lengths	144"

Typical uses

Industrial
Valve stems

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C69430	B371 B371M					

Chemical composition

Cu (%) ¹	Pb (%)	Zn (%)	Fe (%)	Si (%)	As (%)
80.00-83.00	0.30	Remain	0.20	3.50-4.50	0.03-0.06

Chemical composition according to ASTM B371/B371M-19

¹Cu value includes Ag.

Note: Cu + sum of named elements, 99.5% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 ° F)
C69430	30	0.260

C69430 continued

Mechanical properties

Mechanical properties according to ASTM B371/B371M-19
C69430
H04 hard

Size range up to 1" inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 4x diameter or thickness of specimen, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical HRB	
80	550	40	276	15	95	

Size range over 1" to 2" inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 4x diameter or thickness of specimen, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical HRB	
75	515	35	241	15	95	

Size range over 2"

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 4x diameter or thickness of specimen, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	typical HRB	
65	450	35	241	15	95	

Physical properties

	US customary	Metric
Melting point – liquidus	1685 °F	918 °C
Melting point – solidus	1510 °F	821 °C
Density	0.26 lb/in ³ at 68 °F	7.19 gm/cm ³ at 20 °C
Specific gravity	7.19	7.19
Electrical conductivity	6.2% IACS at 68 °F	0.04 MegaSiemens/cm at 20 °C
Thermal conductivity	15 Btu/sq ft/ft hr/°F at 68 °F	25.98 W/m at 20 °C
Coefficient of thermal expansion 68-572	11.2 · 10 ⁻⁶ per °F (68-572 °F)	19.3 · 10 ⁻⁶ per °C (20-300 °C)
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	16000 ksi	110310 MPa

Physical properties provided by CDA

C69430 continued

Fabrication properties

Technique	Suitability
Soldering	Excellent
Brazing	Excellent
Oxyacetylene welding	Good
Spot weld	Good
Seam weld	Good
Butt weld	Good
Capacity for being cold worked	Good
Capacity for being hot formed	Excellent
Forgeability rating	80
Machinability rating	30

Fabrication properties provided by CDA

Common fabrication processes

Forging, screw machining

Common fabrication processes provided by CDA

AMS 4596-C72900 (Hardiall®)

Standard-stocked product	Extruded and drawn
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Product description	Copper nickel-tin bronze
Tempers	TX 00 solution annealed and spinodal hardened
Solids	0.75" to 4.25" (19.05 mm to 107.95 mm) O.D.* *Consult mill for other shapes/sizes

Typical uses

Aerospace

Brakes, compression fit airframe fasteners, control surface and actuator bushings and bearings, door hardware, electronic system connectors, helicopter controls, hydraulic actuators, landing gear bushings and bearings, steering joints, valves, wheel bearings, wing flap bearings

Electrical

Connectors, contacts, controls, miniaturized sockets, relay elements, switches

Industrial

Springs, wire

Marine

Marine components

Oil and gas

Bearings, bushings, drilling components, sucker rod, valve guide bushing couplings

Chemical composition

Ni + Co (%)	Sn (%)	Fe (%)	Zn (%)	Mn (%)	Cb (%)	Mg (%)	Pb (%)	Cu (%)
14.50-15.50	7.50-8.50	0.50	0.50	0.30	0.10	0.15	0.02	Remain

Chemical composition according to AMS 4596

Note: Copper + sum of named elements, 99.5% min. Single values represent maximums.

Machinability

AMS	Machinability rating	Density (lb/in ³)	Density (g/cm ³)
AMS 4596-C72900		0.323	8.94

AMS 4596-C72900 continued

Mechanical properties

Mechanical properties according to AMS 4596
TX 00 solution annealed and spinodal hardened

Size range up to 4.249" (108 mm) inclusive (nominal thickness between parallel sides) bars, rods

Ultimate tensile strength, min		Yield strength, at 0.2% offset, min		Elongation, in 4D, min	Rockwell "C" hardness	Remarks
ksi	MPa	ksi	MPa	%	min HRC	
132	910	107	738	9.5	30	

Size range 4.250" to 8.500" (108 to 216 mm) inclusive (nominal thickness between parallel sides) bars, rods

Ultimate tensile strength, min		Yield strength, at 0.2% offset, min		Elongation, in 4D, min	Rockwell "C" hardness	Remarks
ksi	MPa	ksi	MPa	%	min HRC	
127	876	108	745	3	30	

Physical properties

	US customary	Metric
Melting point – liquidus	2039 °F	1115 °C
Melting point – solidus	1742 °F	950 °C
Density	0.323 lb/in ³ at 68 °F	8.94 gm/cm ³ at 20 °C
Specific gravity	8.94	8.94
Electrical conductivity	7.8% IACS at 68 °F	0.045 MegaSiemens/cm at 20 °C
Thermal conductivity	17 Btu/sq ft/ft hr/ °F at 68 °F	29.4 W/m at 20 °C
Coefficient of thermal expansion 68-572	9.1 · 10 ⁻⁶ per °F (68-572 °F)	15.8 · 10 ⁻⁶ per °C (20-300 °C)
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 293 °C
Modulus of elasticity in tension	18500 ksi	127554 MPa
Modulus of rigidity	7500 ksi	51711 MPa

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Excellent
Brazing	Excellent
Oxyacetylene welding	Good
Gas shielded arc welding	Excellent
Coated metal arc welding	Excellent
Spot weld	Excellent
Seam weld	Excellent
Butt weld	Excellent
Capacity for being cold worked	Excellent
Capacity for being hot formed	Good

Fabrication properties provided by CDA

Thermal properties

Treatment	Minimum*	Maximum*
Annealing	1515	
Hot treatment	1200	1600

Thermal properties provided by CDA

*Temperature is measured in Fahrenheit.

AMS 4597-C72900 (Hardiall®)

Standard-stocked product	Extruded and drawn
--------------------------	--------------------

Product description	Copper nickel-tin bronze
Tempers	TX TS solution annealed, cold finished and spinodal hardened
Solids	0.75" to 3.54" (19.05 mm to 89.92 mm) O.D.* *Consult mill for other shapes/sizes

Typical uses

Aerospace

Brakes, compression fit airframe fasteners, control surface and actuator bushings and bearings, door hardware, electronic system connectors, helicopter controls, hydraulic actuators, landing gear bushings and bearings, steering joints, valves, wheel bearings, wing flap bearings

Electrical

Connectors, contacts, controls, miniaturized sockets, relay elements, switches

Industrial

Springs, wire

Marine

Marine components

Oil and gas

Bearings, bushings, drilling components, sucker rod, valve guide bushing couplings

Chemical composition

Ni + Co (%)	Sn (%)	Fe (%)	Zn (%)	Mn (%)	Cb (%)	Mg (%)	Pb (%)	Cu (%)
14.50-15.50	7.50-8.50	0.50	0.50	0.30	0.10	0.15	0.02	Remain

Chemical composition according to AMS 4597

Note: Copper + sum of named elements, 99.5% min. Single values represent maximums.

Machinability

AMS	Machinability rating	Density (lb/in ³)	Density (g/cm ³)
AMS 4597-C72900		0.323	8.94

Mechanical properties

Mechanical properties according to AMS 4597

TX TS solution annealed, cold finished and spinodal hardened

Size range up to 1.60" (40 mm) exclusive nominal thickness between parallel sides (bars, rods); nominal wall thickness (tubing)

Ultimate tensile strength, min		Yield strength, at 0.2% offset, min		Elongation, in 4D, min	Rockwell "C" hardness	Remarks
ksi	MPa	ksi	MPa	%	min HRC	
165	1137	155	1069	6	34	

Size range 1.60" to 3.25" (40 to 83 mm) inclusive nominal thickness between parallel sides (bars, rods); nominal wall thickness (tubing)

Ultimate tensile strength, min		Yield strength, at 0.2% offset, min		Elongation, in 4D, min	Rockwell "C" hardness	Remarks
ksi	MPa	ksi	MPa	%	min HRC	
156	1075	148	1020	3	34	

Physical properties

	US customary	Metric
Melting point – liquidus	2039 °F	1115 °C
Melting point – solidus	1742 °F	950 °C
Density	0.323 lb/in ³ at 68 °F	8.94 gm/cm ³ at 20 °C
Specific gravity	8.94	8.94
Electrical conductivity	7.8% IACS at 68 °F	0.045 MegaSiemens/cm at 20 °C
Thermal conductivity	17 Btu/sq ft/ft hr/°F at 68 °F	29.4 W/m at 20 °C
Coefficient of thermal expansion 68-572	9.1 · 10 ⁻⁶ per °F (68-572 °F)	15.8 · 10 ⁻⁶ per °C (20-300 °C)
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 293 °C
Modulus of elasticity in tension	18500 ksi	127554 MPa
Modulus of rigidity	7500 ksi	51711 MPa

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Excellent
Brazing	Excellent
Oxyacetylene welding	Good
Gas shielded arc welding	Excellent
Coated metal arc welding	Excellent
Spot weld	Excellent
Seam weld	Excellent
Butt weld	Excellent
Capacity for being cold worked	Excellent
Capacity for being hot formed	Good

Fabrication properties provided by CDA

Thermal properties

Treatment	Minimum*	Maximum*
Annealing	1515	
Hot treatment	1200	1600

Thermal properties provided by CDA

*Temperature is measured in Fahrenheit.

AMS 4598-C72900 (Hardiall®)

Standard-stocked product	Extruded and drawn
--------------------------	--------------------

Product description	Copper nickel-tin bronze
Tempers	TX 00 solution annealed and spinodal hardened
Tubes	2.36" to 7.25" (59.94 mm to 184.15 mm) O.D.* *Consult mill for other shapes/sizes

Typical uses

Aerospace

Brakes, compression fit airframe fasteners, control surface and actuator bushings and bearings, door hardware, electronic system connectors, helicopter controls, hydraulic actuators, landing gear bushings and bearings, steering joints, valves, wheel bearings, wing flap bearings

Electrical

Connectors, contacts, controls, miniaturized sockets, relay elements, switches

Industrial

Springs, wire

Marine

Marine components

Oil and gas

Bearings, bushings, drilling components, sucker rod, valve guide bushing couplings

Chemical composition

Ni + Co (%)	Sn (%)	Fe (%)	Zn (%)	Mn (%)	Cb (%)	Mg (%)	Pb (%)	Cu (%)
14.50-15.50	7.50-8.50	0.50	0.50	0.30	0.10	0.15	0.02	Remain

Chemical composition according to AMS 4598

Note: Copper + sum of named elements, 99.5% min. Single values represent maximums.

Machinability

AMS	Machinability rating	Density (lb/in ³)	Density (g/cm ³)
AMS 4598-C72900		0.323	8.94

Mechanical properties

Mechanical properties according to AMS 4598
TX 00 solution annealed and spinodal hardened

Size range 1.10" (28 mm) to 7.25" (184 mm) inclusive nominal outside diameter (tube); forward extruded

Ultimate tensile strength, min		Yield strength, at 0.2% offset, min		Elongation, in 4D, min	Rockwell "C" hardness	Remarks
ksi	MPa	ksi	MPa	%	min HRC	
131	903	104	717	8	30	

Size range 7.25" (184 mm) to 13.6" (330 mm) inclusive nominal outside diameter (tube); back extruded

Ultimate tensile strength, min		Yield strength, at 0.2% offset, min		Elongation, in 4D, min	Rockwell "C" hardness	Remarks
ksi	MPa	ksi	MPa	%	min HRC	
130	896	108	745	5	30	

Physical properties

	US customary	Metric
Melting point – liquidus	2039 °F	1115 °C
Melting point – solidus	1742 °F	950 °C
Density	0.323 lb/in ³ at 68 °F	8.94 gm/cm ³ at 20 °C
Specific gravity	8.94	8.94
Electrical conductivity	7.8% IACS at 68 °F	0.045 MegaSiemens/cm at 20 °C
Thermal conductivity	17 Btu/sq ft/ft hr/ °F at 68 °F	29.4 W/m at 20 °C
Coefficient of thermal expansion 68-572	9.1 · 10 ⁻⁶ per °F (68-572 °F)	15.8 · 10 ⁻⁶ per °C (20-300 °C)
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 293 °C
Modulus of elasticity in tension	18500 ksi	127554 MPa
Modulus of rigidity	7500 ksi	51711 MPa

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Excellent
Brazing	Excellent
Oxyacetylene welding	Good
Gas shielded arc welding	Excellent
Coated metal arc welding	Excellent
Spot weld	Excellent
Seam weld	Excellent
Butt weld	Excellent
Capacity for being cold worked	Excellent
Capacity for being hot formed	Good

Fabrication properties provided by CDA

Thermal properties

Treatment	Minimum*	Maximum*
Annealing	1515	
Hot treatment	1200	1600

Thermal properties provided by CDA

*Temperature is measured in Fahrenheit.

Lead-free
replacement
products

Lead-free replacement products

Copper and copper alloys have long been very important materials for pipes, fittings, faucets, and plumbing components.

Within our lead-free replacement alloys, lead is replaced by other elements, but the products still offer exceptional lubricity, tightness, wear, strength, hardness, and machinability.

Bronze metals have always been recyclable, sustainable, and environmentally friendly. At Wieland Concast, we promise to deliver a broad range of alloys that are free of the elements that threaten health and the environment. Our lead-free replacement alloys have extremely low-lead content, some as low as 0.05%. Wieland Concast manufactures a broad selection of lead-free replacement alloys. These products offer the same exceptional value, quality, and performance for which Wieland Concast is known.

Regulatory-compliant alloys

The Safe Drinking Water Act (SDWA) of 1974 governs drinking water quality and was established to minimize chemical and bacterial contamination of drinking water.

The most recent change involves the 2011 Reduction of Lead in Drinking Water Act which amended the SDWA. S. 3874 was effective January of 2014 and redefines SDWA Section 1417(d) to lower the maximum lead content of the wetted surfaces of plumbing products from 8.0% to a weighted average of 0.25%.

Wieland Concast is a leader in the manufacturing of environmentally friendly copper alloys. We are proud to be at the forefront of the lead-free movement by offering regulatory-compliant alloys. Ranging from aluminum bronze to high tin bronze, our lead-free replacement alloys are manufactured to ASTM B standards and specifications and meet the requirements of the "S. 3874-Reduction of Lead in Drinking Water Act" and California legislation "AB1953."

Exceptional quality alloys without the concerns surrounding the use of lead.



Common lead-free replacement alloys

- C69300
- C87850
- C89325
- C89831
- C89833
- C89835
- C89844
- C90300
- C90800
- C90810
- C95400*
- C95500*
- C95900

*Also available in heat-treated condition.

Product descriptions

C89835, a lead-free C932 replacement

Wieland Concast offers C89835 as a standard-stocked inventory item. C89835 is a lead-free replacement for alloys C932, C836, and C844. This standard-stocked alloy supports the market demand for lead-free material and compliance with the S. 3874–Reduction of Lead in Drinking Water Act, effective January 2014.

C89835

Bismuth-based alloys

A group of alloys, which include C89325, C89831, and C89844, are produced using a patented process in which lead is replaced with bismuth to create pressure-tight plumbing fittings and fixtures. It also has excellent machinability. Wieland Concast is one of the few continuous cast foundries in the nation that produces this series of lead-free copper alloys.

C89325

C89833

C89844

C89831

C89835



High tin bronze

High tin bronze alloys are typically found in gear, high-strength bushing and bearing applications where high strength, low speeds, and heavy loads are present. Other high-strength applications for these alloys are pump impellers, piston rings, steam fittings, and valve bodies.

C90300

C90800

C90810

Aluminum bronze

Among standard copper-based alloys, aluminum bronze offers the highest strength. All of the aluminum bronzes can be heat treated, further increasing tensile strength.

C95400

C95500

C95900

Silicon brass

Silicon brass is a copper alloy that removes lead from the product and adds a small amount of silicon (2%-4%) to improve the performance of the alloy during the manufacturing processes.

C69300

C87850

Lead-free product list

Copper Alloy UNS No.	Cu (%)	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%)	Ni (%) ³	Al (%)	Bi (%)	Mn (%)	S (%)	Sb (%)	Si (%)
C69300 ¹	73.00-77.00	0.02 ⁴ -0.09	0.20	Rem.	0.10	0.04-0.15	0.10			0.10		0.10	2.70-3.40
C87850	75.00-78.00	0.02 ⁴ -0.09	0.30	Rem.	0.10	0.05-0.20	0.20			0.10		0.10	2.70-3.40
C89325	84.00-88.00	0.10	9.00-11.00	1.00	0.15	0.10	1.00	0.005	2.70-3.70		0.08	0.50	0.005
C89831	87.00-91.00	0.10	2.70-3.70	2.00-4.00	0.30	0.05	1.00	0.005	2.70-3.70		0.08	0.25	0.005
C89833	86.00-91.00	0.09	4.00-6.00	2.00-6.00	0.30	0.05	1.00	0.005	1.70-2.70		0.08	0.25	0.005
C89835*	85.00-89.00	0.09	6.00-7.50	2.00-4.00	0.20	0.10	1.00	0.005	1.70-2.70		0.08	0.35	0.005
C89844	83.00-86.00	0.20	3.00-5.00	7.00-10.00	0.30	0.05	1.00	0.005	2.00-4.00		0.08	0.25	0.005
C90300*	86.00-89.00 ¹	0.30	7.50-9.00	3.00-5.00	0.20	1.50	1.00	0.005			0.05	0.20	0.005
C90800	85.00-90.00 ¹	0.25	11.00-13.00	0.25	0.15	0.30	0.50	0.005			0.05	0.20	0.005
C90810	Rem. ¹	0.25	11.00-13.00	0.30	0.15	0.15-0.80 ²	0.50	0.005			0.05	0.20	0.005
C95400 ^{5*}	83.00 min					3.00-5.00	1.50	10.00-11.50		0.50			
C95500 ^{5*}	78.00 min					3.00-5.00	3.00-5.50	10.00-11.50		3.50			
C95900	Rem.					3.00-5.00	0.50	12.00-13.50		1.50			

¹Lead-Free Brass *Standard-stocked alloy. ⁴In determining Cu min., Cu may be calculated as Cu + Ni.

²For continuous castings, P shall be 1.5%, max. ³Ni value includes Co. ⁴Pb content is greater than 0.02%.

⁵Also available in heat-treated condition.

Note: Unless otherwise noted, single values represent maximums.

C69300

Extruded and drawn	GreenAlloys™
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Product description	Lead-free brass
Tempers	H02 half hard
Solids	1/8" to 2 1/2" O.D.
Tubes	Consult mill
Hex	3/8" to 1" O.D.
Standard lengths	144"
Compliance	C69300 is compliant with key legislation including (1) Federal Safe Drinking Water Act - SDWA, (2) S. 3874 Federal Reduction of Lead in Drinking Water Act, (3) California AB1953, (4) Vermont Act 193, and is NSF/ANSI/CAN 61-2022 compliant

Typical uses

Automotive

Fluid connectors, sensor bodies, thermostat parts

Industrial

Automatic screw machine parts, bolts, condenser tube plates, nuts, pneumatic fittings, pump parts, screw machine parts, valve bodies for water, valve stems

Marine

Marine products, propeller shafts

Plumbing

Faucet stems, faucets, plumbing fittings, water meter cases

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C69300	B371 B371M					

Chemical composition

Cu (%) ¹	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%)	Ni (%) ²	Mn (%)	Si (%)
73.00-77.00	0.02*-0.09	0.20	remain.	0.10	0.04-0.15	0.10	0.10	2.70-3.40

*Pb content is greater than 0.02%.

¹Cu value includes Ag.

²Ni value includes Co.

Note: Cu + sum of named elements, 99.5% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68° F)
C69300	85	0.300

C69300 continued

Mechanical properties

Mechanical properties according to ASTM B371/B371M-19
C69300
H02 half hard

Size range up to ½" inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 4x diameter or thickness of specimen, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	max HRB approve	
85	585	45	310	5	85	

Size range over ½" to 1" inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 4x diameter or thickness of specimen, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	max HRB approx	
75	515	35	240	10	80	

Size range over 1" to 2 ½" inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 4x diameter or thickness of specimen, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	max HRB approx	
70	480	30	205	10	75	

Physical properties

	US customary	Metric
Melting point – liquidus	1616 °F	880 °C
Melting point – solidus	1571 °F	855 °C
Density	0.3 lb/in ³ at 68 °F	8.3 gm/cm ³ at 20 °C
Specific gravity	8.3	8.3
Electrical conductivity	8% IACS at 68 °F	0.046 MegaSiemens/cm at 20 °C
Thermal conductivity	21.8 Btu/sq ft/ft hr/°F at 68 °F	37.76 W/m at 20 °C
Coefficient of thermal expansion 68-212	10.3 · 10 ⁻⁶ per °F (68-212 °F)	17.8 · 10 ⁻⁶ per °C (20-100 °C)
Coefficient of thermal expansion 68-392	10.3 · 10 ⁻⁶ per °F (68-392 °F)	17.8 · 10 ⁻⁶ per °C (20-200 °C)
Coefficient of thermal expansion 68-572	10.4 · 10 ⁻⁶ per °F (68-572 °F)	18 · 10 ⁻⁶ per °C (20-300 °C)
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	15200 ksi	104801 MPa

Physical properties provided by CDA

C69300 continued

Fabrication properties

Technique	Suitability
Soldering	Excellent
Brazing	Good
Oxyacetylene welding	Good
Gas shielded arc welding	Good
Coated metal arc welding	Good
Spot weld	Good
Seam weld	Good
Butt weld	Good
Capacity for being cold worked	Poor
Capacity for being hot formed	Excellent
Forgeability rating	95
Machinability rating	85

Fabrication properties provided by CDA

Common fabrication properties

Forming and bending, machining, shearing

Common fabrication properties provided by CDA

Thermal properties

Treatment	Min*	Max*	Value*	Time*
Stress relief			0	
Solution treatment				0
Annealing	932	1112		
Hot treatment	1202	1517		

Thermal properties provided by CDA

*Temperature is measured in Fahrenheit. **For stress relief, solution treatment and annealing - time is measured in hours/inch of thickness. For precipitation heat treatment - time is measured in hours.

C87850

	Continuous cast	GreenAlloys™
Product description	Silicon brass	
Solids	Consult mill for sizes	
Tubes	Consult mill for sizes	
Rectangles	Consult mill for sizes	
Standard lengths	144"	
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar	
Compliance	C87850 is compliant with key legislation including (1) Federal Safe Drinking Water Act - SDWA, (2) S. 3874 Federal Reduction of Lead in Drinking Water Act, (3) California AB1953, and (4) Vermont Act 193	

Typical uses

Industrial

Valve bodies for water

Marine

Marine products

Plumbing

Faucets, plumbing fittings, water meter cases

Similar or equivalent specification						
CDA	ASTM	SAE	AMS	Federal	Military	Other
C87850	B505 B505M					

Chemical composition									
Cu (%)	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P	Ni (%) ¹	Mn (%)	Sb (%)	Si (%)
75.00-78.00	0.02*-0.09	0.30	remain.	0.10	0.05-0.20	0.20	0.10	0.10	2.70-3.40

Chemical composition according to ASTM B505/B505M-23

*Pb content is greater than 0.02%.

¹Ni value includes Co.

Note: Cu + sum of named elements, 99.5% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 ° F)
C87850	70	0.3

C87850 continued

Mechanical properties

Mechanical properties according to ASTM B505/B505M-19

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	minimum BHN	
65	448	25	172	8	103	

Physical properties

	US customary	Metric
Melting point – liquidus	1616 °F	880 °C
Melting point – solidus	1571 °F	855 °C
Density	0.3 lb/in ³ at 68 °F	8.3 gm/cm ³ at 20 °C
Electrical conductivity	8% IACS at 68 °F	0.046 MegaSiemens/cm at 20 °C
Thermal conductivity	21.8 Btu/sq ft/ft hr/°F at 68 °F	37.8 W/m at 20 °C
Coefficient of thermal expansion 68-212	10.3 · 10 ⁻⁶ per °F (68-212 °F)	17.8 · 10 ⁻⁶ per °C (20-100 °C)
Coefficient of thermal expansion 68-392	10.3 · 10 ⁻⁶ per °F (68-392 °F)	17.8 · 10 ⁻⁶ per °C (20-200 °C)
Coefficient of thermal expansion 68-572	10.4 · 10 ⁻⁶ per °F (68-572 °F)	18 · 10 ⁻⁶ per °C (20-300 °C)
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	15200 ksi	104801 MPa

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Excellent
Brazing	Excellent
Oxyacetylene welding	Good
Spot weld	Good
Seam weld	Good
Butt weld	Good
Capacity for being cold worked	Poor
Capacity for being hot formed	Excellent
Machinability rating	70

Fabrication properties provided by CDA

Casting characteristics

Casting attribute	Level
Casting yield	Medium
Drossing	Low
Effect of section size	Medium
Fluidity	High
Gassing	Low
Patternmakers shrinkage (inches per foot)	3/16
Shrinkage in solidification	Medium

Casting characteristics provided by CDA

C89325 Lead-free replacement for C937

Continuous cast	GreenAlloys™
Product description	Bismuth tin bronze
Solids	1/2" to 10" O.D.
Tubes	1 1/8" to 9" O.D.
Rectangles	Up to 15"
Standard lengths	144"
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar
Compliance	C89325 is compliant with key legislation including (1) Federal Safe Drinking Water Act - SDWA, (2) S. 3874 Federal Reduction of Lead in Drinking Water Act, (3) California AB1953, and (4) Vermont Act 193

Typical uses

Industrial

Bushings, high-speed/high-pressure bearings

Chemical composition

Cu (%) ¹	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%)	Ni (%) ²	Al (%)	Bi (%)	S (%)	Sb (%)	Si (%)
84.00-88.00	0.10	9.00-11.00	1.00	0.15	0.10	1.00	0.005	2.70-3.70	0.08	0.50	0.005

Chemical composition provided by CDA

¹0.01 - 2.0% as any single or combination of Ce La or other rare earth(x) elements as agreed upon. (x)ASM International definition: one of the group of chemically similar metals with atomic numbers 57 through 71 commonly referred to as lanthanides. ²Ni value includes Co.
Note: Cu + sum of named elements, 99.0% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 ° F)
C89325	80	0.323

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
30	207	12	83	4	73	

Physical properties

	US customary	Metric
Melting point – liquidus	1805 °F	985 °C
Melting point – solidus	1432 °F	777 °C
Density	0.323 lb/in ³ at 68 °F	8.94 gm/cm ³ at 20 °C
Specific gravity	8.94	8.94
Electrical conductivity	10.8% IACS at 68 °F	0.062 MegaSiemens/cm at 20 °C
Thermal conductivity	29 Btu/sq ft/ft hr/°F at 68 °F	50.2 W/m at 20 °C
Coefficient of thermal expansion 68-392	10.3 · 10 ⁻⁶ per °F (68-392 °F)	17.8 · 10 ⁻⁶ per °C (20-200 °C)
Specific heat capacity	0.089 Btu/lb/°F at 68 °F	372.9 J/kg at 20 °C
Modulus of elasticity in tension	16400 ksi	113074 MPa

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Good
Brazing	Good
Oxyacetylene welding	Not recommended
Gas shielded arc welding	Not recommended
Coated metal arc welding	Not recommended
Machinability rating	80

Fabrication properties provided by CDA

Casting characteristics

Casting attribute	Level
Casting yield	High
Drossing	Low
Effect of section size	Low
Fluidity	Medium
Gassing	Medium
Patternmakers shrinkage (inches per foot)	3/32
Shrinkage in solidification	Low

Casting characteristics provided by CDA

C89831 Lead-free replacement for C844

	Continuous cast	GreenAlloys™
Product description	Bismuth tin bronze	
Solids	1/2" to 10" O.D.	
Tubes	1 1/8" to 9" O.D.	
Rectangles	Up to 15"	
Standard lengths	144"	
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar	
Compliance	C89831 is compliant with key legislation including (1) Federal Safe Drinking Water Act - SDWA, (2) S. 3874 Federal Reduction of Lead in Drinking Water Act, (3) California AB1953, and (4) Vermont Act 193	

Typical uses

Industrial

Bushings, high-speed/high-pressure bearings

Chemical composition

Cu (%) ¹	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%)	Ni (%) ²	Al (%)	Bi (%)	S (%)	Sb (%)	Si (%)
87.00-91.00	0.10	2.70-3.70	2.00-4.00	0.30	0.05	1.00	0.005	2.70-3.70	0.08	0.25	0.005

Chemical composition provided by CDA

¹0.01 - 2.0% as any single or combination of Ce La or other rare earth(x) elements as agreed upon. (x)ASM International definition: one of the group of chemically similar metals with atomic numbers 57 through 71 commonly referred to as lanthanides. ²Ni value includes Co.
Note: Cu + sum of named elements, 99.0% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 ° F)
C89831	85	0.318

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
29	200	13	90	5	55	

Physical properties

	US customary	Metric
Melting point – liquidus	1893 °F	1033 °C
Melting point – solidus	1518 °F	825 °C
Density	0.318 lb/in ³ at 68 °F	8.81 gm/cm ³ at 20 °C
Specific gravity	8.81	8.81
Electrical conductivity	20.38% IACS at 68 °F	0.117 MegaSiemens/cm at 20 °C
Thermal conductivity	50 Btu/sq ft/ft hr/°F at 68 °F	86.6 W/m at 20 °C
Coefficient of thermal expansion 68-392	10 · 10 ⁻⁶ per °F (68-392 °F)	17.3 · 10 ⁻⁶ per °C (20-200 °C)
Specific heat capacity	0.092 Btu/lb/°F at 68 °F	385.4 J/kg at 20 °C
Modulus of elasticity in tension	13700 ksi	94458 MPa

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Excellent
Brazing	Good
Oxyacetylene welding	Not recommended
Gas shielded arc welding	Not recommended
Coated metal arc welding	Poor
Machinability rating	85

Fabrication properties provided by CDA

Casting characteristics

Casting attribute	Level
Casting yield	High
Drossing	Low
Effect of section size	Low
Fluidity	Medium
Gassing	Medium
Patternmakers shrinkage (inches per foot)	5/32
Shrinkage in solidification	Low

Casting characteristics provided by CDA

C89833 Lead-free replacement for C836

	Continuous cast	GreenAlloys™
Product description	Bismuth tin bronze	
Solids	1/2" to 10" O.D.	
Tubes	1 1/8" to 9" O.D.	
Rectangles	Up to 15"	
Standard lengths	144"	
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar	
Compliance	C89833 is compliant with key legislation including (1) Federal Safe Drinking Water Act - SDWA, (2) S. 3874 Federal Reduction of Lead in Drinking Water Act, (3) California AB1953, (4) Vermont Act 193, and is NSF/ANSI/CAN 61-2022 compliant	

Typical uses

Industrial

Corrosion-resistant/
pressure-tight castings,
impellers, pumps

Chemical composition

Cu (%)	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%)	Ni (%) ¹	Al (%)	Bi (%)	S (%)	Sb (%)	Si (%)
86.00-91.00	0.09	4.00-6.00	2.00-6.00	0.30	0.05	1.00	0.005	1.70-2.70	0.08	0.25	0.005

Chemical composition provided by CDA

¹Ni value includes Co.

Note: Cu + sum of named elements, 99.3% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68° F)
C89833	81	0.317

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
30	207	14	97	6	60	

Physical properties

	US customary	Metric
Melting point – liquidus	1877 °F	1025 °C
Melting point – solidus	1454 °F	790 °C
Density	0.317 lb/in ³ at 68 °F	8.78 gm/cm ³ at 20 °C
Specific gravity	8.78	8.78
Electrical conductivity	17.8% IACS at 68 °F	0.103 MegaSiemens/cm at 20 °C
Thermal conductivity	41 Btu/sq ft/ft hr/°F at 68 °F	71 W/m at 20 °C
Coefficient of thermal expansion 68-392	13 · 10 ⁻⁶ per °F (68-392 °F)	22.5 · 10 ⁻⁶ per °C (20-200 °C)
Specific heat capacity	0.085 Btu/lb/°F at 68 °F	356.1 J/kg at 20 °C
Modulus of elasticity in tension	15500 ksi	106869 MPa

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Excellent
Brazing	Good
Oxyacetylene welding	Not recommended
Gas shielded arc welding	Not recommended
Coated metal arc welding	Poor
Machinability rating	81

Fabrication properties provided by CDA

Casting characteristics

Casting attribute	Level
Casting yield	High
Drossing	Low
Effect of section size	Low
Fluidity	Medium
Gassing	Medium
Patternmakers shrinkage (inches per foot)	11/64
Shrinkage in solidification	Low

Casting characteristics provided by CDA

C89835 Lead-free replacement for C932, C836, C844

Standard-stocked product*	Continuous cast	GreenAlloys™
Product description	Bismuth tin bronze	
Solids	1/2" to 8" O.D.	
Tubes	1 1/8" to 14" O.D.**	
Rectangles	Up to 15"	
Standard lengths	105" *Solids and tubes are standard stocked **Consult mill for wall thickness	
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/ rectangular bar	
Compliance	C89835 is compliant with key legislation including (1) Federal Safe Drinking Water Act - SDWA, (2) S. 3874 Federal Reduction of Lead in Drinking Water Act, (3) California AB1953, (4) Vermont Act 193, and is NSF/ANSI/CAN 61-2022 compliant	

Typical uses

Industrial

Housing, small gears

Industrial

Faucets, pipe fittings, plumbing goods, pump components, water pump impellers

Chemical composition											
Cu (%)	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%)	Ni (%) ¹	Al (%)	Bi (%)	S (%)	Sb (%)	Si (%)
85.00-89.00	0.09	6.00-7.50	2.00-4.00	0.20	0.10	1.00	0.005	1.70-2.70	0.08	0.35	0.005

Chemical composition provided by CDA

¹Ni value includes Co.
Note: Cu + sum of named elements, 99.3% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68° F)
C89835	70	0.321

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
30	207	14	97	6	65	

Physical properties

	US customary	Metric
Melting point – liquidus	1855 °F	1012 °C
Melting point – solidus	1445 °F	785 °C
Density	0.321 lb/in ³ at 68 °F	8.89 gm/cm ³ at 20 °C
Specific gravity	8.89	8.89
Electrical conductivity	14.5% IACS at 68 °F	0.084 MegaSiemens/cm at 20 °C
Thermal conductivity	38 Btu/sq ft/ft hr/°F at 68 °F	65.8 W/m at 20 °C
Coefficient of thermal expansion 68-392	10 · 10 ⁻⁶ per °F (68-392 °F)	17.3 · 10 ⁻⁶ per °C (20-200 °C)
Specific heat capacity	0.093 Btu/lb/°F at 68 °F	389.6 J/kg at 20 °C
Modulus of elasticity in tension	16900 ksi	116522 MPa

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Excellent
Brazing	Good
Oxyacetylene welding	Not recommended
Gas shielded arc welding	Not recommended
Coated metal arc welding	Not recommended
Machinability rating	70

Fabrication properties provided by CDA

Casting characteristics

Casting attribute	Level
Casting yield	High
Drossing	Low
Effect of section size	Low
Fluidity	Medium
Gassing	Medium
Patternmakers shrinkage (inches per foot)	1/8
Shrinkage in solidification	Low

Casting characteristics provided by CDA

C89844 Lead-free replacement for C844

	Continuous cast	GreenAlloys™
Product description	Bismuth tin bronze	
Solids	1/2" to 10" O.D.	
Tubes	1 1/8" to 9" O.D.	
Rectangles	Up to 15"	
Standard lengths	144"	
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar	
Compliance	C89844 is compliant with key legislation including (1) Federal Safe Drinking Water Act - SDWA, (2) S. 3874 Federal Reduction of Lead in Drinking Water Act, (3) California AB1953, and (4) Vermont Act 193	

Typical uses
Plumbing
 Fittings/valves for potable water

Chemical composition											
Cu (%)	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%)	Ni (%) ¹	Al (%)	Bi (%)	S (%)	Sb (%)	Si (%)
83.00-86.00	0.20	3.00-5.00	7.00-10.00	0.30	0.05	1.00	0.005	2.00-4.00	0.08	0.25	0.005

Chemical composition provided by CDA

¹Ni value includes Co.
 Note: Cu + sum of named elements, 99.3% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 ° F)
C89844	70	0.31

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
28	193	13	90	5	55	

Physical properties

	US customary	Metric
Melting point – liquidus	1850 °F	1010 °C
Melting point – solidus	1550 °F	853 °C
Density	0.31 lb/in ³ at 68 °F	8.58 gm/cm ³ at 20 °C
Specific gravity	8.58	8.58
Electrical conductivity	16.8% IACS at 68 °F	0.095 MegaSiemens/cm at 20 °C
Thermal conductivity	46.7 Btu/sq ft/ft hr/°F at 68 °F	80.9 W/m at 20 °C
Coefficient of thermal expansion 68-392	10 · 10 ⁻⁶ per °F (68-392 °F)	17.3 · 10 ⁻⁶ per °C (20-200 °C)
Specific heat capacity	0.08 Btu/lb/°F at 68 °F	335.2 J/kg at 20 °C
Modulus of elasticity in tension	13000 ksi	89622 MPa

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Excellent
Brazing*	Good
Oxyacetylene welding	Not recommended
Gas shielded arc welding	Not recommended
Coated metal arc welding	Not recommended
Machinability rating	70

Fabrication properties provided by CDA

*Since brazing is performed within the hot-short range, strain must be avoided during brazing and cooling.

Casting characteristics

Casting attribute	Level
Casting yield	High
Drossing	Medium
Effect of section size	High
Fluidity	Medium
Gassing	Medium
Patternmakers shrinkage (inches per foot)	3/16
Shrinkage in solidification	Medium

Casting characteristics provided by CDA

C90300

Standard-stocked product*	Continuous cast	GreenAlloys™
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Product description	Tin bronze
Solids	1/2" to 10" O.D.
Tubes	1" to 16" O.D.
Rectangles	Up to 20"
Standard lengths	144" *Solids is standard stocked
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/ rectangular bar

Typical uses

Building

Heavy construction equipment

Fasteners

Swivel

Industrial

Bearings, bushings, gear blanks, gears, piston rings, pump bodies, pump impellers, valve bodies, valves

Plumbing

Steam fittings

Chemical composition

Cu (%) ¹	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%)	Ni (%) ^{1,2}	Al (%)	S (%)	Sb (%)	Si (%)
86.00-89.00	0.30	7.50-9.00	3.00-5.00	0.20	1.50	1.00	0.005	0.05	0.20	0.005

Chemical composition according to ASTM B505/B505M-23

¹In determining Cu min., Cu may be calculated as Cu + Ni. ²Ni value includes Co.
Note: Cu + sum of named elements, 99.4% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 ° F)
C90300	30	0.318

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
44	303	22	152	18	70	

Physical properties

	US customary	Metric
Melting point – liquidus	1832 °F	1000 °C
Melting point – solidus	1570 °F	854 °C
Density	0.318 lb/in ³ at 68 °F	8.8 gm/cm ³ at 20 °C
Specific gravity	8.8	8.8
Electrical conductivity	12% IACS at 68 °F	0.069 MegaSiemens/cm at 20 °C
Thermal conductivity	43.2 Btu/sq ft/ft hr/°F at 68 °F	74.8 W/m at 20 °C
Coefficient of thermal expansion 68-392	10 · 10 ⁻⁶ per °F (68-392 °F)	17.3 · 10 ⁻⁶ per °C (20-200 °C)
Specific heat capacity	0.09 Btu/lb/°F at 68 °F	377.1 J/kg at 20 °C
Modulus of elasticity in tension	14000 ksi	96527 MPa
Magnetic permeability	1	1

Physical properties provided by CDA

Fabrication properties

Technique	Suitability
Soldering	Excellent
Brazing*	Good
Oxyacetylene welding	Fair
Gas shielded arc welding	Fair
Coated metal arc welding	Fair
Machinability rating	30

Fabrication properties provided by CDA

*Since brazing is performed within the hot-short range, strain must be avoided during brazing and cooling.

Casting characteristics

Casting attribute	Level
Casting yield	Medium
Drossing	Low
Effect of section size	High
Fluidity	Medium
Gassing	Medium
Patternmakers shrinkage (inches per foot)	3/16
Shrinkage in solidification	Medium

Casting characteristics provided by CDA

C90800

	Continuous cast	GreenAlloys™
Product description	Tin bronze	
Solids	1" to 6" O.D.	
Tubes	1" to 6" O.D.	
Rectangles	Up to 10"	
Standard lengths	144"	
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar	
Compliance	C90800 is compliant with key legislation including (1) Federal Safe Drinking Water Act - SDWA, (2) S. 3874 Federal Reduction of Lead in Drinking Water Act, (3) California AB1953, and (4) Vermont Act 193	

Typical uses

Industrial

Speed reducers, worm gears

Chemical composition

Cu (%) ¹	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%) ²	Ni (%) ³	Al (%)	S (%)	Sb (%)	Si (%)
85.00-89.00	0.25	11.00-13.00	0.25	0.15	0.30	0.50	0.005	0.05	0.20	0.005

Chemical composition according to ASTM B505/B505M-23

¹In determining Cu min., Cu may be calculated as Cu + Ni.

²For continuous castings, P shall be 1.5% max.

³Ni value includes Co.

Note: Cu + sum of named elements, 99.4% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 °F)
C90800		0.317

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
35	241	17	117	10	65	

C90810

	Continuous cast	GreenAlloys™
Product description	High tin bronze	
Solids	1" to 6" O.D.	
Tubes	1" to 6" O.D.	
Rectangles	Up to 10"	
Standard lengths	144"	
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar	
Compliance	C90810 is compliant with key legislation including (1) Federal Safe Drinking Water Act - SDWA, (2) S. 3874 Federal Reduction of Lead in Drinking Water Act, (3) California AB1953, and (4) Vermont Act 193	

Typical uses

Industrial

Bearings, gears, shafts, worm gears

Chemical composition

Cu (%) ¹	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%) ²	Ni (%) ³	Al (%)	S (%)	Sb (%)	Si (%)
remain.	0.25	11.00-13.00	0.30	0.15	0.15-0.80	0.50	0.005	0.05	0.20	0.005

Chemical composition provided by CDA

¹In determining Cu min., Cu may be calculated as Cu + Ni.

²For continuous castings, P shall be 1.5% max.

³Ni value includes Co.

Note: Cu + sum of named elements, 99.4% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68° F)
C90810	20	0.323

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
					95	

C95400

Standard-stocked product	Continuous cast	GreenAlloys™
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Product description	Aluminum bronze
Solids	1/2" to 10" O.D.
Tubes	1 1/8" to 12" O.D.*
Rectangles	Up to 15"
Standard lengths	144" *Consult mill for wall thickness
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/ rectangular bar
Compliance	C95400 is compliant with key legislation including (1) Federal Safe Drinking Water Act - SDWA, (2) S. 3874 Federal Reduction of Lead in Drinking Water Act, (3) California AB1953, and (4) Vermont Act 193

Typical uses

Automotive

Weld guns

Fasteners

Large hold-down screws, nuts

Industrial

Bearing segments for the steel industry, bearings, bushings, gears, heavily loaded worm gears, high-strength clamps, landing gear parts, machine parts, pawl, pickling hooks, pressure blocks for the steel industry, pump parts, spur gears, valve bodies, valve guides, valve seats, valves, worm gears

Marine

Covers for marine hardware, ship building

Ordnance

Government fittings

Note: also available in heat-treated condition

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C95400	B505 B505M	J461 J462		QQ-C-390, G5 QQ-B-671, Class 3	MIL-B-16033, Class 3	Aluminum Bronze 9C

Chemical composition

Cu (%)	Fe (%)	Ni (%) ¹	Al (%)	Mn (%)
83.00 min	3.00-5.00	1.50	10.00-11.50	0.50

Chemical composition according to ASTM B505/B505M-23

¹Ni value includes Co.

Note: Cu + sum of named elements, 99.5% min. Unless otherwise noted, single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 °F)
C95400	60	0.269

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
85	586	32	221	12	170	

Mechanical properties according to ASTM B505/B505M-23

Physical properties

	US customary	Metric
Melting point – liquidus	1900 °F	1038 °C
Melting point – solidus	1880 °F	1027 °C
Density	0.269 lb/in ³ at 68 °F	7.45 gm/cm ³ at 20 °C
Specific gravity	7.45	7.45
Electrical conductivity	13% IACS at 68 °F	0.075 MegaSiemens/cm at 20 °C
Thermal conductivity	33.9 Btu/sq ft/ft hr/ °F at 68 °F	58.7 W/m at 20 °C
Coefficient of thermal expansion 68-572	9 · 10 ⁻⁶ per °F (68-572 °F)	15.5 · 10 ⁻⁶ per °C (20-300 °C)
Specific heat capacity	0.1 Btu/lb/°F at 68 °F	419 J/kg at 20 °C
Modulus of elasticity in tension	15500 ksi	107000 MPa
Magnetic permeability*	1.27	1.27
Magnetic permeability**	1.2	1.2

Physical properties provided by CDA

*As cast, field strength 16 kA/m **TQ 50 temper, field strength 16 kA/m

Fabrication properties

Technique	Suitability
Soldering	Good
Brazing	Good
Oxyacetylene welding	Not recommended
Gas shielded arc welding	Good
Coated metal arc welding	Good
Machinability rating	60

Fabrication properties provided by CDA

Casting characteristics

Casting attribute	Level
Casting yield	Low
Drossing	High
Effect of section size	Low
Fluidity	Medium
Gassing	Medium
Patternmakers shrinkage (inches per foot)	3/16
Shrinkage in solidification	High

Casting characteristics provided by CDA

C95400HT

	Continuous cast	GreenAlloys™
Product description	Aluminum bronze	
Solids	1/2" to 10" O.D.	
Tubes	1 1/8" to 12" O.D.*	
Rectangles	Up to 15"	
Standard lengths	24"***	
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/ rectangular bar	
Compliance	C95400 is compliant with key legislation including (1) Federal Safe Drinking Water Act - SDWA, (2) S. 3874 Federal Reduction of Lead in Drinking Water Act, (3) California AB1953, and (4) Vermont Act 193 *Consult mill for wall thickness **Consult mill for other lengths	

Typical uses

Automotive

Weld guns

Fasteners

Large hold-down screws, nuts

Industrial

Bearing segments for the steel industry, bearings, bushings, gears, heavily loaded worm gears, high-strength clamps, landing gear parts, machine parts, pawl, pickling hooks, pressure blocks for the steel industry, pump parts, spur gears, valve bodies, valve guides, valve seats, valves, worm gears

Marine

Covers for marine hardware, ship building

Ordnance

Government fittings

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C95400	B505 B505M	J461 J462		QQ-C-390, G5 QQ-B-671, Class 3	MIL-B-16033, Class 3	Aluminum Bronze 9C

Chemical composition

Cu (%)	Fe (%)	Ni (%) ¹	Al (%)	Mn (%)
83.00 min	3.00-5.00	1.50	10.00-11.50	0.50

Chemical composition according to ASTM B505/B505M-23

¹Ni value includes Co.

Note: Cu + sum of named elements, 99.5% min. Unless otherwise noted, single values represent maximums.

C95400HT continued

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 ° F)
C95400HT	60	0.269

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
95	655	45	310	10	177	Heat treated

Mechanical properties according to ASTM B505/B505M-23

C95500

Standard-stocked product*	Continuous cast	GreenAlloys™
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Product description	Nickel-aluminum bronze
Solids	1/2" to 9" O.D.
Tubes	1 1/8" to 9" O.D.**
Rectangles	Up to 15"
Standard lengths	144"
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar
Compliance	C95500 is compliant with key legislation including (1) Federal Safe Drinking Water Act - SDWA, (2) S. 3874 Federal Reduction of Lead in Drinking Water Act, (3) California AB1953, and (4) Vermont Act 193 *Solids is standard stocked **Consult mill for wall thickness

Typical uses

Builders hardware

Window hardware

Consumer

Musical instruments, piano keys

Electrical

Electrical hardware

Fasteners

Stuffing box nuts

Industrial

Aircraft components, bearings, bushings, gears, glands, glass molds, handgun recoil mechanisms, hot mill guides, landing gear parts, machine parts, pickling equipment, piston guides, pump fluid ends, sewage treatment applications, valve bodies, valve components, valve guides, valve seats, wear plates, welding jaws, worm wheels, worms

Marine

Covers for marine hardware, marine applications, marine hardware, ship building

Ordnance

Government fittings

Note: also available in heat-treated condition

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C95500	B505 B505M	J461 J462		QQ-C-390, G3	MIL-B-16033, Class 4	Aluminum Bronze 9D

Chemical composition

Cu (%)	Fe (%)	Ni (%) ¹	Al (%)	Mn (%)
78.00 min	3.00-5.00	3.00-5.50	10.00-11.50	3.50

Chemical composition according to ASTM B505/B505M-23

¹Ni value includes Co.

Note: Cu + sum of named elements, 99.5% min. Unless otherwise noted, single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 °F)
C95500	50	0.272

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (500 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
95	655	42	290	10	208	

Mechanical properties according to ASTM B505/B505M-23

Physical properties

	US customary	Metric
Melting point – liquidus	1930 °F	1054 °C
Melting point – solidus	1900 °F	1038 °C
Density	0.272 lb/in ³ at 68 °F	7.53 gm/cm ³ at 20 °C
Specific gravity	7.53	7.53
Electrical conductivity	8% IACS at 68 °F	0.049 MegaSiemens/cm at 20 °C
Thermal conductivity	24.2 Btu/sq ft/ft hr/°F at 68 °F	41.9 W/m at 20 °C
Coefficient of thermal expansion 68-572	9 · 10 ⁻⁶ per °F (68-572 °F)	15.5 · 10 ⁻⁶ per °C (20-300 °C)
Specific heat capacity	0.1 Btu/lb/°F at 68 °F	419 J/kg at 20 °C
Modulus of elasticity in tension	16000 ksi	110000 MPa
Magnetic permeability*	1.32	1.32
Magnetic permeability**	1.2	1.2
Poisson's Ratio	0.32	0.32

Physical properties provided by CDA

*As cast, field strength 16 kA/m **TQ 50 temper, field strength 16 kA/m

Fabrication properties

Technique	Suitability
Soldering	Good
Brazing	Fair
Oxyacetylene welding	Not recommended
Gas shielded arc welding	Good
Coated metal arc welding	Good
Machinability rating	50

Fabrication properties provided by CDA

Casting characteristics

Casting attribute	Level
Casting yield	Low
Drossing	High
Effect of section size	Low
Fluidity	Medium
Gassing	Medium
Patternmakers shrinkage (inches per foot)	3/16
Shrinkage in solidification	High

Casting characteristics provided by CDA

C95500HT

Continuous cast	GreenAlloys™
Product description	Nickel-aluminum bronze
Solids	1/2" to 9" O.D.
Tubes	1 1/8" to 9" O.D.*
Rectangles	Up to 15"
Standard lengths	24"***
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar
Compliance	C95500HT is compliant with key legislation including (1) Federal Safe Drinking Water Act - SDWA, (2) S. 3874 Federal Reduction of Lead in Drinking Water Act, (3) California AB1953, and (4) Vermont Act 193 *Consult mill for wall thickness **Consult mill for other lengths

Typical uses

Builders hardware

Window hardware

Consumer

Musical instruments, piano keys

Electrical

Electrical hardware

Fasteners

Stuffing box nuts

Industrial

Aircraft components, bearings, bushings, gears, glands, glass molds, handgun recoil mechanisms, hot mill guides, landing gear parts, machine parts, pickling equipment, piston guides, pump fluid ends, sewage treatment applications, valve bodies, valve components, valve guides, valve seats, wear plates, welding jaws, worm wheels, worms

Marine

Covers for marine hardware, marine applications, marine hardware, ship building

Ordnance

Government fittings

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C95500	B505 B505M	J461 J462		QQ-C-390, G3	MIL-B-16033, Class 4	Aluminum bronze 9D

Chemical composition

Cu (%)	Fe (%)	Ni (%) ¹	Al (%)	Mn (%)
78.00 min	3.00-5.00	3.00-5.50	10.00-11.50	3.50

Chemical composition according to ASTM B505/B505M-23

¹Ni value includes Co.

Note: Cu + sum of named elements, 99.5% min. Unless otherwise noted, single values represent maximums.

C95500HT continued

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 ° F)
C95500HT	50	0.272

Note: HT = heat treated.

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (3000 kg load)	Remarks
ksi	MPa	ksi	MPa	%	typical BHN	
110	758	62	427	8	228	Heat treated

Mechanical properties according to ASTM B505/B505M-23

C95900

Standard-stocked product	Continuous cast	GreenAlloys™
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Product description	Aluminum bronze
Solids	1" to 5" O.D.
Tubes	Consult mill
Rectangles	Up to 7"
Standard lengths	144"
Shape/form	Semi-finished, mill stock or near-net shapes, anode, bar stock, billet/bloom, squares, hex, plate, profile or structural shape, flats/rectangular bar
Compliance	C95900 is compliant with key legislation including (1) Federal Safe Drinking Water Act - SDWA, (2) S. 3874 Federal Reduction of Lead in Drinking Water Act, (3) California AB1953, and (4) Vermont Act 193

Typical uses

Industrial

Die components, gears, gibs, worm drives

Similar or equivalent specification

CDA	ASTM	SAE	AMS	Federal	Military	Other
C95900	B505 B505M					

Chemical composition

Cu (%)	Fe (%)	Ni (%) ¹	Al (%)	Mn (%)
remain.	3.00-5.00	0.50	12.00-13.50	1.50

Chemical composition according to ASTM B505/B505M-23

¹Ni value includes Co.

Note: Cu + sum of named elements, 99.5% min. Single values represent maximums.

Machinability

Copper alloy UNS no.	Machinability rating	Density (lb/in ³ at 68 ° F)
C95900	10	0.255

Mechanical properties

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation, in 2 in. or 50 mm, min	Brinell hardness (3000 kg load)	Remarks
ksi	MPa	ksi	MPa	%	minimum BHN	
					241	

Mechanical properties according to ASTM B505/B505M-23

Special applications

Special applications

Overview

Concast offers a wide variety of special application products, including proprietary alloys, copper anodes, near-net shapes, and custom shapes. Concast Metal Products also offers secondary processes to enhance material properties and performance such as heat treating, stress relieving, temper annealing, and centerless grinding. Research and development in the area of proprietary alloys is also a facet of what Concast can provide.

Proprietary alloys

Concast will work with engineers to develop proprietary alloys that require unique properties such as tensile, yield, elongation, lubrication, high temperature, or aesthetics.



Developing
unique
copper alloy
products
for our
customer's
specific
needs.



Special applications continued

Near-net shapes

Near-net shapes, also called custom shapes, from Wieland Concast offer the industry's best value in copper alloy bar stock. Utilizing near-net shapes allows for decreased raw material purchases and reduced scrap. The amount of machining is lessened due to faster throughput. As an end result, tooling costs are lowered and equipment life is extended. Near-net shapes can be developed to the customer's exacting specifications based on the end-use parts being produced.



Anodes

Wieland Concast produces brass anodes and phos-copper anodes for a variety of plating applications.

Brass anodes are used extensively in decorative applications, from light fixture plating to manufactured cabinet hardware. Plastic parts finished with decorative chrome plating also utilize phos-copper anodes in the plating process.

Brass anodes are available in either C24000 (80/20) or C26000 (70/30) alloys. Other brass alloys may be available upon request.

Phos-copper anodes are used to electroplate rotogravure rolls for the printing industry. Phos-copper anodes are key components in printed circuitry, specialized electrical ground rods, and many other plating applications.

Phos-copper anodes are produced in either low-phos (0.02%-0.04% phos) or high-phos (0.04%-0.06% phos).

We ship our anodes in both bar and nugget forms. Special sizes and grades are available on a made-to-order basis.



Tolerances

Tolerances

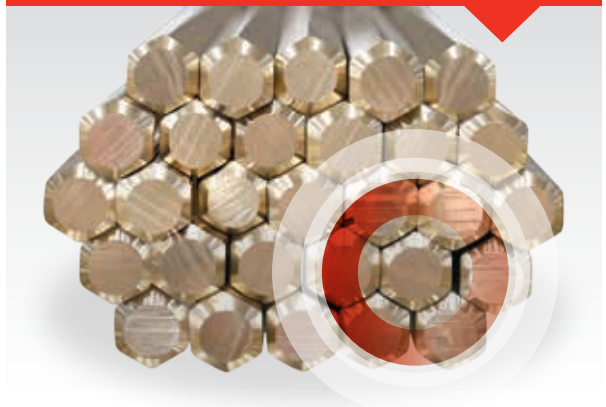
Our capabilities

Our ability to hold consistent tolerances with minimum variation makes our products ideal for CNC equipment. We are able to perform to this high standard by utilizing precision-machined in-house dies. Additional finishing allowance for tubes and rounds over 13 inches in length is .007 inches per linear inch due to curvature (TIR) inherent in longer lengths of material. This standard applies to both I.D. and O.D. Additional finishing allowance for rectangles over 13 inches in length is .0035 inches per linear inch due to curvature (TIR) in longer lengths of material. This standard applies to both thickness and width. These tolerances found in Wieland Concast products are significantly better than sand, centrifugal, and other types of casting methods.

Straightness tolerances are also critical due to the increased speed capabilities of new generation CNC equipment. All of our bars and tubes are Medart® straightened enabling them to exceed ASTM B505 straightness requirements. As a result, our customers are able to utilize the optimum performance of their equipment with the result of increasing their competitive advantage.

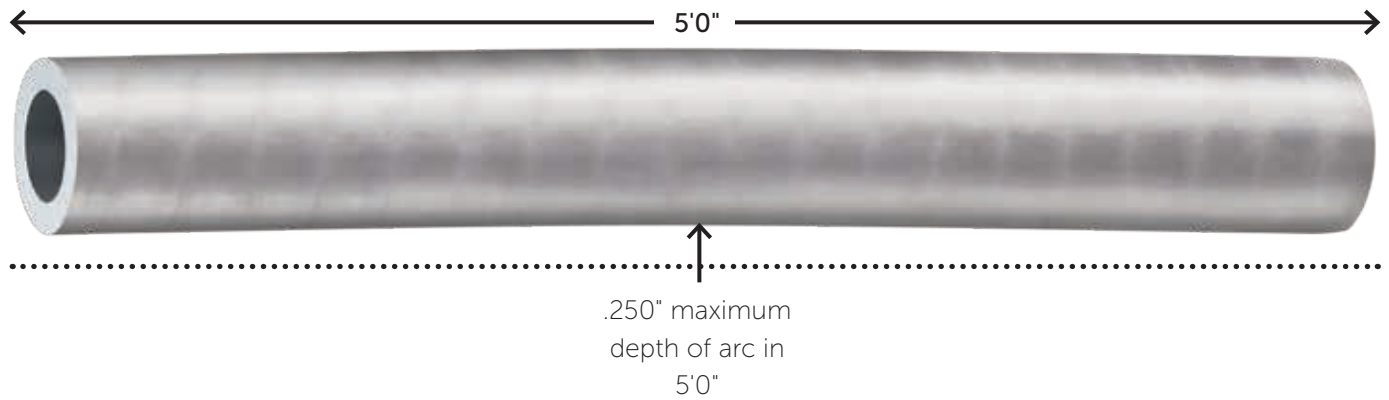
Wieland Concast products can be ordered to the cast size or "to finish to" condition. Our standard stock is produced oversized in the "to finish to" condition so the customer will be assured the size ordered will finish machine to that size with as little as .031 inches of material to be removed.

Our material tolerances allow for the optimum performance of modern machining equipment.

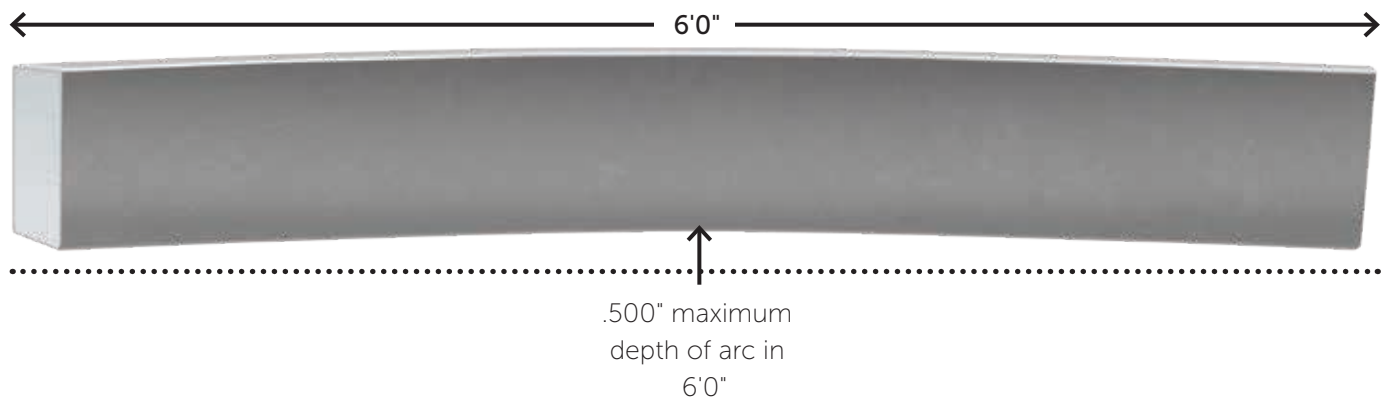


Straightness specifications

Round Rod or Tube



Bar and Shape



Produced to meet or exceed ASTM B505

Straightness tolerances cast products

Product	Length* ft (m)	Maximum curvature [†] (depth of arc), in. (mm)
Round rod or tube	up to 10 (3.05)	1/4 (6.4) in any 5-ft (1.52-m) portion
Round rod or tube	10 (3.05) and over	1/2 (13) in any 10-ft (3.05-m) portion*
Bar and shape	any length	1/2 (13) in any 6-ft (1.83-m) portion* [†]

*Total length.

[†]Applicable to any longitudinal surface or edge.

Straightness tolerances are critical due to the increased speed capabilities of the new generation CNC equipment. All of our bars and tubes are Medart® straightened enabling them to exceed ASTM B505 straightness requirements. This allows our customers to utilize the optimum performance of their equipment with the result of increasing their competitive advantage.

Cast to size tolerances

Leaded bronze tubes and solids

Diameter tolerances for AS CAST leaded bronze tubes and solids

Diameter tolerances of the casting, inches.

Finished outside diameter	Inside diameter	Outside diameter
Up to 3.999" inclusive	-0.033" to +0.012"	-0.005" to +0.005"
4.000" to 5.000" inclusive	-0.046" to +0.016"	-0.008" to +0.008"
5.001" to 9.000" inclusive	-0.064" to +0.032"	-0.016" to +0.016"
9.001" to 16.000" inclusive	-0.064" to +0.032"	-0.016" to +0.032"

Cast to size tolerances

Leaded bronze rectangles

Diameter tolerances for AS CAST leaded bronze rectangles

Diameter tolerances of the casting, inches.

Distance between parallel surfaces	Thickness	Width
Up to 3.999" inclusive	-0.016" to +0.016"	-0.016" to +0.016"
4.000" to 5.000" inclusive	-0.016" to +0.016"	-0.016" to +0.016"
Over 5.000"	-0.016" to +0.016"	-0.016" to +0.016"

Cast to size tolerances

Aluminum bronze tubes and solids

Diameter tolerances for AS CAST aluminum bronze tubes and solids

Diameter tolerances of the casting, inches.

Finished outside diameter	Inside diameter	Outside diameter
Up to 3.000" inclusive	-0.033" to +0.012"	-0.010" to +0.010"
3.001" to 4.000" inclusive	-0.050" to +0.015"	-0.015" to +0.015"
4.001" to 5.500" inclusive	-0.070" to +0.025"	-0.020" to +0.020"
Over 5.50"	-0.090" to +0.035"	-0.025" to +0.025"

Cast to size tolerances

Aluminum bronze rectangles

Diameter tolerances for AS CAST aluminum bronze rectangles

Diameter tolerances of the casting, inches.

Distance between parallel surfaces	Thickness	Width
Up to 3.000" inclusive	-0.020" to +0.020"	-0.020" to +0.020"
3.001" to 4.000" inclusive	-0.020" to +0.020"	-0.020" to +0.020"
4.001" to 5.500" inclusive	-0.020" to +0.020"	-0.020" to +0.020"
Over 5.500"	-0.025" to +0.025"	-0.025" to +0.025"

To finish to tolerances

Leaded bronze tubes and solids

Concast standard inventory of bars and shapes are produced oversized to finish machine to the print of part size.

Concast can cast to a near-net shape with as little as 0.015" variation to the shape.

Finishing allowances added for TO FINISH TO leaded bronze tubes and solids

Finish allowances added to finished or print dimensions of the part, inches.

Finished outside diameter	Inside diameter	Outside diameter
Up to 2" inclusive	-0.0190" to -0.0640"	+0.0300" to +0.0400"
Over 2" to 4" inclusive	-0.0190" to -0.0640"	+0.0340" to +0.0440"
Over 4" to 5" inclusive	-0.0470" to -0.1090"	+0.0550" to +0.0710"
Over 5" to 9" inclusive	-0.0620" to -0.1580"	+0.0780" to +0.1100"
Over 9" to 12" inclusive	-0.0780" to -0.1820"	+0.0940" to +0.1340"
Over 12" to 16" inclusive	-0.1020" to -0.2140"	+0.1180" to +0.1660"

To finish to tolerances

Leaded bronze rectangles

Finishing allowances added for TO FINISH TO leaded rectangles

Finish allowances added to finished or print dimensions of the part, inches.

Finished width	Thickness	Width
Up to 3.999" inclusive	+0.047" to +0.079"	+0.047" to +0.079"
Over 4" to 5" inclusive	+0.078" to +0.110"	+0.078" to +0.110"
Over 5.001"	+0.109" to +0.141"	+0.109" to +0.141"

To finish to tolerances

Aluminum bronze tubes and solids

Finishing allowances added for TO FINISH TO aluminum bronze tubes and solids

Finish allowances added to finished or print dimensions of the part, inches.

Finished outside diameter	Inside diameter	Outside diameter
Up to 3" inclusive	-0.0505" to -0.0955"	+0.0525" to +0.0725"
Over 3" to 4 1/2" inclusive	-0.0900" to -0.1450"	+0.0790" to +0.1090"
Over 4 1/2" to 5 1/2" inclusive	-0.1000" to -0.1650"	+0.1050" to +0.1450"
Over 5 1/2"	-0.1350" to -0.2100"	+0.1630" to +0.2130"

To finish to tolerances

Aluminum bronze rectangles

Concast standard inventory of bars and shapes are produced oversized to finish machine to the print of part size.

Concast can cast to a near-net shape with as little as 0.015" variation to the shape.

Finishing allowances added for TO FINISH TO 959 aluminum bronze rectangles

Finish allowances added to finished or print dimensions of the part, inches.

Finished width, inches	Thickness	Width
Up to 9 1/2" inclusive	+0.163" to +0.263"	+0.113" to +0.163"
Over 9 1/2"	+0.163" to +0.263"	+0.163" to +0.263"

Finishing allowances added for TO FINISH TO aluminum bronze rectangles

Finish allowances added to finished or print dimensions of the part, inches.

Finished width, inches	Thickness	Width
Up to 3" inclusive	+0.067" to +0.107"	+0.043" to +0.083"
Over 3" to 5 1/2" inclusive	+0.067" to +0.107"	+0.043" to +0.083"
Over 5 1/2" to 12" inclusive	+0.087" to +0.127"	+0.063" to +0.113"
Over 12"	+0.163" to +0.263"	+0.125" to +0.225"

Note: Thickness of rectangles 3" and greater will use the over 12" wide tolerances.

Dimensional tolerances for cold drawn leaded commercial bronze

Alloys C31400, C31600

Manufactured to:



Designation: B140/B140M-12(2017)

Standard Specification for
Copper-Zinc-Lead (Red Brass or
Hardware Bronze) Rod, Bar, and
Shapes

Tolerances to:



Designation: B249/B249M-23

Standard Specification for
General Requirements for Extruded
and Drawn Copper and Copper-
Alloy Rod, Bar, Shapes and Forgings

Diameter tolerance

	Round	Hexagon & octagon
Up to 0.500" inclusive	+/- 0.0015"	+/- 0.003"
Over 0.500" to 1.00" inclusive	+/- 0.002"	+/- 0.004"
Over 1.00" to 2.00" inclusive	+/- 0.0025"	+/- 0.005"
Over 2.00"	0.15% of the diameter	0.30% of the flat to flat

Example of the over 2" diameter tolerance:

2.5" diameter x 0.0015 (0.15%) = 0.00375" round to 0.004". Therefore, the tolerance would be +/- 0.004"

2.5" hexagon x 0.003 (0.30%) = 0.0075" round to 0.008". Therefore, the tolerance would be +/- 0.008"

Dimensional tolerances for cold drawn phosphor bronze

Alloys C51000, C52100, C53400, C54400

Manufactured to:



Designation: B139/B139M-12(2024)

Standard Specification for Phosphor Bronze Rod, Bar and Shapes

Tolerances to:



Designation: B249/B249M-23

Standard Specification for General Requirements for Extruded and Drawn Copper and Copper-Alloy Rod, Bar, Shapes and Forgings

Diameter tolerance

	Round	Hexagon & octagon
Up to 0.500" inclusive	+/- 0.002"	+/- 0.004"
Over 0.500" to 1.00" inclusive	+/- 0.003"	+/- 0.005"
Over 1.00" to 2.00" inclusive	+/- 0.004"	+/- 0.006"
Over 2.00"	0.20% of the diameter	0.40% of the flat to flat

Example of the over 2" diameter tolerance:

2.5" diameter x 0.002 (0.20%) = 0.005". Therefore, the tolerance would be +/- 0.005"

2.5" hexagon x 0.004 (0.40%) = 0.010". Therefore, the tolerance would be +/- 0.010"

Dimensional tolerances for cold drawn nickel-aluminum bronze

Alloy C63000

Manufactured to:



Designation: B150/B150M-19

Standard Specification for Aluminum Bronze Rod, Bar and Shapes

Tolerances to:



Designation: B249/B249M-23

Standard Specification for General Requirements for Extruded and Drawn Copper and Copper-Alloy Rod, Bar, Shapes and Forgings

Diameter tolerance

	Round	Hexagon & octagon
Up to 0.500" inclusive	+/- 0.002"	+/- 0.004"
Over 0.500" to 1.00" inclusive	+/- 0.003"	+/- 0.005"
Over 1.00" to 2.00" inclusive	+/- 0.004"	+/- 0.006"
Over 2.00"	0.20% of the diameter	0.40% of the flat to flat

Example of the over 2" diameter tolerance:

2.5" diameter x 0.002 (0.20%) = 0.005". Therefore, the tolerance would be +/- 0.005"

2.5" hexagon x 0.004 (0.40%) = 0.010". Therefore, the tolerance would be +/- 0.010"

Dimensional tolerances for cold drawn aluminum bronze

Alloy C64200

Manufactured to:



Designation: B150/B150M-19
Standard Specification for Aluminum Bronze Rod, Bar and Shapes

Tolerances to:



Designation: B249/B249M-23
Standard Specification for General Requirements for Extruded and Drawn Copper and Copper-Alloy Rod, Bar, Shapes and Forgings

Diameter tolerance

	Round	Hexagon & octagon
Up to 0.500" inclusive	+/- 0.002"	+/- 0.004"
Over 0.500" to 1.00" inclusive	+/- 0.003"	+/- 0.005"
Over 1.00" to 2.00" inclusive	+/- 0.004"	+/- 0.006"
Over 2.00"	0.20% of the diameter	0.40% of the flat to flat

Example of the over 2" diameter tolerance:

2.5" diameter x 0.002 (0.20%) = 0.005". Therefore, the tolerance would be +/- 0.005"

2.5" hexagon x 0.004 (0.40%) = 0.010". Therefore, the tolerance would be +/- 0.010"

Dimensional tolerances for cold drawn low-silicon bronze

Alloy C65100

Manufactured to:



Designation: B98/B98M-13(2019)

Standard Specification for
Copper-Silicon Alloy Rod, Bar and
Shapes

Tolerances to:



Designation: B249/B249M-23

Standard Specification for
General Requirements for Extruded
and Drawn Copper and Copper-
Alloy Rod, Bar, Shapes and Forgings

Diameter tolerance

	Round	Hexagon & octagon
Up to 0.500" inclusive	+/- 0.0015"	+/- 0.003"
Over 0.500" to 1.00" inclusive	+/- 0.002"	+/- 0.004"
Over 1.00" to 2.00" inclusive	+/- 0.0025"	+/- 0.005"
Over 2.00"	0.15% of the diameter	0.30% of the flat to flat

Example of the over 2" diameter tolerance:

2.5" diameter x 0.0015 (0.15%) = 0.00375" round to 0.004". Therefore, the tolerance would be +/- 0.004"

2.5" hexagon x 0.003 (0.30%) = 0.0075" round to 0.008". Therefore, the tolerance would be +/- 0.008"

Stocked size
schedules

Stocked size schedules

Included in this section:

C14500
C51000 Lead-Free Replacement
C54400
AMS 4640-C63000
AMS 4590-C63020
AMS 4634-C64200
C67300
AMS 4596-C72900 (Hardiall®)
AMS 4597-C72900 (Hardiall®)
AMS 4598-C72900 (Hardiall®)
C86300
C89835 Lead-Free Replacement for C932, C836, C844
C90300
C93200
C95400
C95500
AMS 4880-C95510
C95900

Over 1,100
standard-
stocked
options
available for
immediate
shipment.



C14500 Size schedule

Standard-stocked product

Extruded and drawn

ASTM B301 solids

Size O.D.	Weight per inch	Weight per foot	Size O.D.	Weight per inch	Weight per foot	Size O.D.	Weight per inch	Weight per foot
0.375	0.037	0.438	1.125	0.321	3.851	2.000	1.014	12.170
0.500	0.063	0.760	1.250	0.396	4.753	2.250	1.284	15.403
0.625	0.099	1.188	1.375	0.479	5.752	2.500	1.585	19.016
0.750	0.143	1.711	1.500	0.570	6.845	2.750	1.918	23.010
0.875	0.194	2.392	1.625	0.670	8.034			
1.000	0.254	3.042	1.750	0.777	9.318			

C51000 Size schedule

Standard-stocked product

Extruded and drawn

ASTM B139 solids

Size O.D.	Weight per inch	Weight per foot	Size O.D.	Weight per inch	Weight per foot	Size O.D.	Weight per inch	Weight per foot
3/8	0.035	0.417	13/16	0.167	2.000	1 1/2	0.569	6.833
7/16	0.049	0.583	7/8	0.188	2.250	1 5/8	0.660	7.917
1/2	0.063	0.750	15/16	0.222	2.267	1 3/4	0.771	9.250
9/16	0.083	1.000	1	0.250	3.000	1 7/8	0.882	10.583
5/8	0.097	1.167	1 1/8	0.319	3.833	2	1.007	12.083
11/16	0.118	1.417	1 1/4	0.396	4.750	2 1/4	1.271	15.250
3/4	0.139	1.667	1 3/8	0.472	5.667	2 1/2	1.569	18.833

*H04 hard temper is standard stocked
Hexes available upon request.

C54400 Size schedule

Standard-stocked product

Extruded and drawn

ASTM B139 solids

Size O.D.	Weight per inch	Weight per foot	Size O.D.	Weight per inch	Weight per foot	Size O.D.	Weight per inch	Weight per foot
3/8	0.035	0.417	7/8	0.188	2.250	1 3/4	0.771	9.250
7/16	0.049	0.583	15/16	0.222	2.667	1 7/8	0.882	10.583
1/2	0.063	0.750	1	0.250	3.000	2	1.007	12.083
9/16	0.083	1.000	1 1/8	0.319	3.833	2 1/4	1.271	15.250
5/8	0.097	1.167	1 1/4	0.396	4.750	2 1/2	1.569	18.833
11/16	0.118	1.417	1 3/8	0.472	5.667	2 3/4	1.917	23.000
3/4	0.139	1.667	1 1/2	0.569	6.833			
13/16	0.167	2.000	1 5/8	0.660	7.917			

Hexes available upon request.

AMS 4640-C63000 Size schedule

Standard-stocked product

Extruded and drawn

Solids

Size O.D.	Weight per inch	Weight per foot	Size O.D.	Weight per inch	Weight per foot	Size O.D.	Weight per inch	Weight per foot
0.3750	0.030	0.362	1.7500	0.656	7.867	4.5000	4.391	52.689
0.5000	0.054	0.652	1.8750	0.756	9.073	4.7500	4.872	58.468
0.6250	0.082	0.989	2.0000	0.846	10.152	5.0000	5.350	64.196
0.6875	0.102	1.222	2.0625	0.898	10.770	5.2500	5.930	71.158
0.7500	0.119	1.431	2.1250	0.949	11.388	5.5000	6.479	77.739
0.8125	0.141	1.702	2.2500	1.077	12.923	5.7500	7.059	84.700
0.8750	0.165	1.978	2.3750	1.189	14.262	6.0000	7.800	93.600
0.9375	0.189	2.240	2.5000	1.319	15.824	6.5000	9.091	109.091
1.0000	0.213	2.561	2.6250	1.454	17.443	6.7500	9.800	117.600
1.0625	0.240	2.875	2.7500	1.592	19.108	7.0000	10.491	125.895
1.1250	0.267	3.205	2.8750	1.778	21.336	7.5000	12.099	145.186
1.1875	0.297	3.561	3.0000	1.977	23.727	8.0000	13.557	162.679
1.2500	0.334	4.008	3.2500	2.393	28.717	8.5000	15.410	184.920
1.3750	0.399	4.791	3.5000	2.658	31.895	9.0000	17.422	209.075
1.4375	0.444	5.334	3.7500	3.052	36.632	9.5000	19.028	228.336
1.5000	0.480	5.760	4.0000	3.485	41.820	10.0000	21.267	255.200
1.6250	0.559	6.708	4.2500	3.879	46.542			

AMS 4590-C63020 Size schedule

Standard-stocked product

Extruded and drawn

Tubes

Nominal size		Weight	Weight	Nominal size		Weight	Weight	Nominal size		Weight	Weight
I.D.	x O.D.	per inch	per foot	I.D.	x O.D.	per inch	per foot	I.D.	x O.D.	per inch	per foot
1.500	x 2.750	1.151	13.812	2.500	x 4.250	2.570	30.845	3.000	x 5.000	3.468	41.620
	x 3.000	1.462	17.542						5.500	4.604	55.248
				2.750	x 4.500	2.761	33.137		6.000	5.850	70.198
1.750	x 3.250	1.625	19.500		5.500	4.917	59.005				
								4.000	x 6.000	4.304	51.648
2.000	x 3.500	1.787	21.449								
	4.000	2.600	31.195								

Solids

Size	Weight	Weight	Size	Weight	Weight	Size	Weight	Weight
O.D.	per inch	per foot	O.D.	per inch	per foot	O.D.	per inch	per foot
0.750	0.121	1.452	1.750	0.660	7.920	2.750	1.630	19.560
1.000	0.216	2.592	2.000	0.862	10.344	3.000	1.940	23.280
1.250	0.337	4.044	2.250	1.091	13.092	4.000	3.449	41.388
1.500	0.485	5.820	2.500	1.347	16.164			

AMS 4634-C64200 Size schedule

Standard-stocked product

Extruded and drawn

Solids

Size O.D.	Weight per inch	Weight per foot	Size O.D.	Weight per inch	Weight per foot	Size O.D.	Weight per inch	Weight per foot
0.1875	0.008	0.092	0.8750	0.170	2.036	2.0000	0.876	10.507
0.2500	0.014	0.170	0.9375	0.194	2.326	2.1250	1.005	12.063
0.3125	0.022	0.268	1.0000	0.222	2.664	2.2500	1.122	13.464
0.3750	0.031	0.369	1.0625	0.249	2.984	2.3750	1.339	16.067
0.4375	0.042	0.509	1.1250	0.279	3.351	2.5000	1.389	16.672
0.5000	0.055	0.665	1.2500	0.343	4.113	2.7500	1.664	19.972
0.5625	0.070	0.838	1.3750	0.415	4.977	3.0000	1.988	23.854
0.6250	0.086	1.026	1.5000	0.504	6.053	4.0000	3.557	42.686
0.6875	0.104	1.252	1.6250	0.582	6.978	5.0000	5.456	65.468
0.7500	0.125	1.504	1.7500	0.674	8.090	6.0000	8.027	96.319
0.8125	0.145	1.736	1.8750	0.771	9.250			

C67300 Size schedule

Standard-stocked product

Extruded and drawn

SAE J463 solids

Size O.D.	Weight per inch	Weight per foot	Size O.D.	Weight per inch	Weight per foot	Size O.D.	Weight per inch	Weight per foot
0.3750	0.033	0.397	1.1875	0.334	4.008	2.0000	0.951	11.409
0.5000	0.066	0.787	1.2500	0.358	4.297	2.1250	1.035	12.421
0.5620	0.073	0.870	1.3750	0.452	5.427	2.2500	1.160	13.925
0.7500	0.134	1.603	1.4375	0.487	5.840	2.5000	1.433	17.192
0.8750	0.175	2.105	1.5000	0.535	6.425	2.7500	1.733	20.801
1.0000	0.237	2.848	1.5625	0.578	6.936	3.0000	2.063	24.755
1.0625	0.266	3.190	1.7500	0.731	8.775			
1.1250	0.301	3.611	1.8750	0.835	10.025			

AMS 4596-C72900 (Hardiall®) Size schedule

Standard-stocked product

Extruded and drawn

AMS 4596 solids

Size O.D.	Weight per inch	Weight per foot	Size O.D.	Weight per inch	Weight per foot	Size O.D.	Weight per inch	Weight per foot
0.750	0.143	1.714	2.250	1.286	15.427	3.750	3.571	42.853
1.000	0.254	3.047	2.500	1.587	19.046	4.000	4.063	48.758
1.250	0.397	4.761	2.625	1.750	20.998	4.500	5.142	61.709
1.500	0.571	6.857	2.750	1.921	23.046	5.000	6.349	76.184
1.750	0.778	9.333	3.000	2.286	27.426	5.500	7.682	92.182
1.875	0.893	10.713	3.250	2.682	32.188	6.000	9.142	109.705
2.000	1.016	12.189	3.500	3.111	37.330	6.750	11.570	138.845

AMS 4597-C72900 (Hardiall®) Size schedule

Standard-stocked product

Extruded and drawn

AMS 4597 solids

Size O.D.	Weight per inch	Weight per foot	Size O.D.	Weight per inch	Weight per foot	Size O.D.	Weight per inch	Weight per foot
0.750	0.143	1.714	1.250	0.397	4.761	1.750	0.778	9.333
1.000	0.254	3.047	1.500	0.571	6.857	2.000	1.016	12.189

AMS 4598-C72900 (Hardiall®) Size schedule

Standard-stocked product

Extruded and drawn

AMS 4598 tubes

Nom size		Weight	Weight	Nom size		Weight	Weight	Nom size		Weight	Weight
I.D	x O.D.	per inch	per foot	I.D	x O.D.	per inch	per foot	I.D	x O.D.	per inch	per foot
2.750	x 4.500	3.458	41.500	3.653	x 6.374	6.896	82.760	6.440	x 8.560	8.210	98.520
3.500	x 5.000	3.374	40.492	3.750	x 5.000	2.765	33.180	7.000	x 8.000	3.7916	45.500
	5.500	4.549	54.590	5.000	x 7.000	6.200	74.400				
	5.875	5.628	67.540								

*Consult mill for other shapes/sizes.

C86300 Size schedule

Standard-stocked product

Continuous cast

ASTM B505 tubes

Nominal size I.D. x O.D.	Weight per inch	Weight per foot	Nominal size I.D. x O.D.	Weight per inch	Weight per foot	Nominal size I.D. x O.D.	Weight per inch	Weight per foot
1 x 1 1/2	0.368	4.417	2 1/2 x 3	0.833	10.000	4 x 4 1/2	1.569	18.833
2	0.764	9.167	3 1/2	1.667	20.000	5	2.639	31.667
2 1/2	1.292	15.500				6	5.326	63.917
3	1.903	22.833	3 x 3 1/2	1.076	12.917			
4	3.556	42.667	4	1.951	23.417	5 x 6	3.528	42.333
			5	4.104	49.250	7	6.396	76.750
1 1/2 x 2	0.514	6.167						
			3 1/2	4 1/4	1.875	22.500		
1 3/4 x 2 1/4	0.588	7.055				4 3/4	2.868	34.417
						5 1/2	4.514	54.167
2 x 2 1/4	0.368	4.417						

ASTM B505 solids

Size O.D.	Weight per inch	Weight per foot	Size O.D.	Weight per inch	Weight per foot	Size O.D.	Weight per inch	Weight per foot
1	0.257	3.083	3	2.069	24.833	5	5.806	69.667
1 1/2	0.542	6.500	3 1/2	2.861	34.333	6	8.569	102.833
2	0.944	11.333	4	3.688	44.250			
2 1/2	1.438	17.250	4 1/2	4.792	57.500			

C89835 Size schedule

Standard-stocked product	Continuous cast	GreenAlloys™
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Tubes

Standard-stocked product				Continuous cast				GreenAlloys™			
Nominal size I.D. x O.D.	Weight per inch	Weight per foot		Nominal size I.D. x O.D.	Weight per inch	Weight per foot		Nominal size I.D. x O.D.	Weight per inch	Weight per foot	
0.500 x 1.250	0.363	4.356		1.750 x 2.000	0.312	3.744		3.000 x 3.500	0.981	11.771	
1.500	0.541	6.492		2.250	0.585	7.020		3.750	1.448	17.371	
1.750	0.750	9.000		2.500	0.889	10.668		4.000	2.057	24.686	
2.000	1.000	12.000		2.750	1.225	14.700		4.500	3.095	37.141	
				3.000	1.592	19.104		5.000	4.308	51.695	
0.750 x 1.250	0.290	3.480		3.250	2.038	24.457					
1.500	0.470	5.640		3.500	2.486	29.829		3.250 x 3.750	1.048	12.571	
1.750	0.677	8.124		3.750	2.952	35.429		4.000	1.666	20.000	
2.000	0.921	11.052		4.000	3.543	42.514		4.500	2.711	32.534	
2.250	1.194	14.328						5.000	3.924	47.088	
2.500	1.500	18.000		2.000 x 2.250	0.354	4.248					
				2.500	0.658	7.896		3.500 x 4.000	1.238	14.857	
1.000 x 1.250	0.185	2.220		2.750	0.994	11.928		4.500	2.296	27.550	
1.500	0.362	4.344		3.000	1.361	16.332		5.000	3.509	42.103	
1.750	0.572	6.862		3.250	1.810	21.714					
2.000	0.816	9.792		3.500	2.248	26.971		3.750 x 4.500	1.849	22.187	
2.250	1.089	13.068		3.750	2.714	32.571		5.000	3.062	36.740	
2.500	1.393	16.716		4.000	3.314	39.771					
2.750	1.729	20.748		4.500	4.316	51.788		4.000 x 4.500	1.371	16.447	
3.000	2.100	25.200		5.000	5.523	66.342		5.000	2.583	31.000	
3.250	2.562	30.743									
3.500	3.000	36.000		2.250 x 2.750	0.731	8.772		4.250 x 5.000	2.073	24.881	
4.000	4.076	48.571		3.000	1.100	13.200					
				3.250	1.533	18.400		4.500 x 5.000	1.532	18.384	
1.250 x 1.500	0.226	2.712		3.500	1.981	23.772					
1.750	0.435	5.220		3.750	2.448	29.371					
2.000	0.680	8.160		4.000	3.048	36.571					
2.250	0.952	11.424									
2.500	1.257	15.084		2.500 x 3.000	0.804	9.648					
2.750	1.592	19.104		3.250	1.238	14.857					
3.000	1.960	23.520		3.500	1.676	20.114					
3.250	2.419	29.029		3.750	2.152	25.829		1.000	0.276	3.314	
3.500	2.857	34.289		4.000	2.752	33.029		1.250	0.429	5.143	
4.000	3.905	46.857		4.500	3.768	45.221		1.500	0.610	7.314	
				5.000	4.981	59.774		1.750	0.829	9.943	
1.500 x 1.750	0.267	3.204						2.000	1.076	12.914	
2.000	0.512	6.144		2.750 x 3.250	0.905	10.857		2.250	1.352	16.229	
2.250	0.784	9.408		3.500	1.349	16.114		2.500	1.667	20.000	
2.500	1.089	13.068		3.750	1.819	21.829		2.750	2.010	24.114	
2.750	1.424	17.088		4.000	2.419	29.029		3.000	2.390	28.686	
3.000	1.791	21.492		4.500	3.448	41.370		3.500	3.156	37.871	
3.250	2.248	26.971						4.000	4.160	49.916	
3.500	2.686	32.229						4.500	5.247	62.958	
3.750	3.162	37.943						5.000	6.459	77.512	
4.000	3.743	44.914									
4.500	4.737	56.844									

Solids

Size O.D.	Weight per inch	Weight per foot
1.000	0.276	3.314
1.250	0.429	5.143
1.500	0.610	7.314
1.750	0.829	9.943
2.000	1.076	12.914
2.250	1.352	16.229
2.500	1.667	20.000
2.750	2.010	24.114
3.000	2.390	28.686
3.500	3.156	37.871
4.000	4.160	49.916
4.500	5.247	62.958
5.000	6.459	77.512

C90300 Size schedule

Standard-stocked product	Continuous cast	GreenAlloys™
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ASTM B505 solids

Size O.D.	Weight per inch	Weight per foot	Size O.D.	Weight per inch	Weight per foot	Size O.D.	Weight per inch	Weight per foot
1	0.278	3.333	3	2.361	28.333	5	6.549	78.583
1 1/2	0.597	7.167	3 1/2	3.201	38.417	5 1/2	7.813	93.750
2	1.049	12.583	4	4.215	50.583	6	9.493	113.917
2 1/2	1.646	19.750	4 1/2	5.319	63.833			

C93200 Size schedule

Standard-stocked product

Continuous cast

ASTM B505 tubes

Nominal size		Weight per inch	Weight per foot	Nominal size		Weight per inch	Weight per foot	Nominal size		Weight per inch	Weight per foot
I.D.	x O.D.			I.D.	x O.D.			I.D.	x O.D.		
1/2	x 1	0.224	2.692	1 1/8	x 1 3/8	0.206	2.467	1 3/4	x 2	0.327	3.925
	1 1/8	0.291	3.589		1 1/2	0.308	3.701		2 1/8	0.477	5.720
	1 1/4	0.383	4.598		1 5/8	0.411	4.935		2 1/4	0.626	7.514
	1 3/8	0.458	5.495		1 3/4	0.533	6.393		2 3/8	0.776	9.308
	1 1/2	0.561	6.729		2	0.785	9.421		2 1/2	0.935	11.215
	1 3/4	0.766	9.196		2 1/8	0.907	10.879		2 5/8	1.084	13.009
	2	1.019	12.224		2 1/4	1.056	12.673		2 3/4	1.262	15.140
5/8	x 1	0.187	2.243	1 1/4	x 1 1/2	0.234	2.804	3	1.645	19.738	
	1 1/8	0.262	3.140		1 1/4	0.234	2.804	3 1/4	2.056	24.673	
	1 1/4	0.346	4.150		1 5/8	0.336	4.037	3 1/2	2.486	29.832	
	1 3/8	0.439	5.271		1 3/4	0.467	5.607	3 3/4	2.879	34.542	
	1 1/2	0.533	6.393		1 7/8	0.589	7.065	4	3.533	42.393	
	1 3/4	0.738	8.860		2	0.710	8.523	4 1/4	4.019	48.224	
	2	0.981	11.776		2 1/8	0.841	10.093	1 7/8	x 2 1/4	0.514	6.168
3/4	x 1	0.140	1.682	2 1/4	0.981	11.776	2 3/8	0.673	8.075		
	1 1/8	0.215	2.579	2 1/2	1.290	15.477	2 1/2	0.822	9.869		
	1 1/4	0.308	3.701	2 3/4	1.626	19.514	2 5/8	0.972	11.664		
	1 3/8	0.393	4.710	3	2.000	24.000	2 3/4	1.159	13.907		
	1 1/2	0.495	5.944	3 1/4	2.411	28.935	3	1.495	17.944		
	1 5/8	0.579	6.953	3 1/2	2.832	33.981	2	x 2 1/4	0.355	4.262	
	1 3/4	0.701	8.411	4	3.869	46.430		2 3/8	0.551	6.617	
2	0.944	11.327	1 3/8	x 1 5/8	0.271	3.252		2 1/2	0.710	8.523	
2 1/4	1.215	14.579		1 3/4	0.364	4.374		2 5/8	0.869	10.430	
2 1/2	1.523	18.280		1 7/8	0.486	5.832		2 3/4	1.037	12.449	
7/8	x 1 1/8	0.168		2.019	2	0.636		7.626	2 7/8	1.215	14.579
	1 1/4	0.262		3.140	2 1/8	0.766		9.196	3	1.430	17.159
	1 3/8	0.336		4.037	2 1/4	0.907	10.879	3 1/4	1.832	21.981	
	1 1/2	0.449		5.383	2 3/8	1.065	12.785	3 1/2	2.252	27.028	
	1 5/8	0.551	6.617	2 1/2	1.206	14.467	3 3/4	2.738	24.42		
	1 3/4	0.645	7.738	2 5/8	1.383	16.598	4	3.308	39.701		
	1 7/8	0.776	9.308	3	1.879	22.542	4 1/2	4.364	52.374		
2	0.897	10.766	1 1/2	x 1 3/4	0.280	3.364	5	5.533	66.393		
2 1/4	1.168	14.019		1 7/8	0.393	4.710	5 1/2	7.009	84.112		
1	x 1 1/4	0.187		2.243	2	0.551	6.617	6	8.467	101.607	
	1 3/8	0.290		3.477	2 1/8	0.673	8.075	2 1/8	x 2 5/8	0.738	8.860
	1 1/2	0.393		4.710	2 1/4	0.822	9.869		2 3/4	0.879	10.542
	1 5/8	0.495		5.944	2 3/8	0.981	11.776		2 7/8	1.093	13.121
	1 3/4	0.607		7.290	2 1/2	1.131	13.570		3	1.299	15.589
	1 7/8	0.720	8.636	2 3/4	1.458	17.495	3 1/2		2.121	25.458	
	2	0.850	10.206	3	1.841	22.093	2 1/4		x 2 3/4	0.785	9.421
2 1/4	1.112	13.346	3 1/4	2.252	27.028	2 7/8			0.953	11.439	
2 3/8	1.262	15.140	3 1/2	2.664	31.963	3		1.150	13.794		
2 1/2	1.421	17.047	3 3/4	3.150	37.794	3 1/8		1.327	15.925		
2 3/4	1.757	21.084	4	3.710	44.523	3 1/4		1.570	18.841		
3	2.131	25.570	4 1/2	4.776	57.308	3 1/2		2.000	24.000		
3 1/4	2.523	30.280	1 5/8	x 2	0.430	5.159		3 3/4	2.467	29.607	
3 1/2	2.963	35.551		2 1/8	0.579	6.953	4	3.056	36.673		
4	4.000	48.000		2 1/4	0.729	8.748	4 1/4	3.533	42.393		
				2 3/8	0.879	10.542					
				2 1/2	1.028	12.336					
				2 5/8	1.196	14.355					
				2 3/4	1.355	16.262					
			3	1.748	20.972						

C93200 Size schedule continued

ASTM B505 tubes

Nominal size I.D.	x	O.D.	Weight per inch	Weight per foot	Nominal size I.D.	x	O.D.	Weight per inch	Weight per foot	Nominal size I.D.	x	O.D.	Weight per inch	Weight per foot
2 3/8	x	2 3/4	0.589	7.065	3 1/2	x	4	1.234	14.804	5 1/4	x	7	6.084	73.009
		2 7/8	0.813	9.757			4 1/4	1.804	21.645					
		3	1.009	12.112			4 1/2	2.346	28.150	5 1/2	x	6	2.103	25.234
		3 1/4	1.355	16.262			4 3/4	2.897	34.766			6 1/2	3.692	44.299
		3 1/2	1.785	21.421			5	3.523	42.280			7	5.421	65.047
		4	2.841	34.093			5 1/4	4.336	52.037			7 1/2	7.262	87.140
							5 1/2	5.065	60.785			8	9.224	110.692
2 1/2	x	2 3/4	0.439	5.271			6	6.495	77.944					
		3	0.869	10.430			6 1/2	8.093	97.121	5 3/4	x	6 3/4	3.832	45.981
		3 1/8	1.065	12.785								7 1/4	5.636	67.626
		3 1/4	1.280	15.364	3 3/4	x	4 1/2	1.916	22.991			7 1/2	6.561	78.729
		3 1/2	1.720	20.636			4 3/4	2.449	29.383			8 1/2	10.654	127.850
		3 3/4	2.187	26.243			5	3.065	36.785					
		4	2.776	33.308			5 1/2	4.636	55.626	6	x	6 1/2	2.252	27.028
		4 1/4	3.318	39.813			6	6.056	72.673			6 3/4	3.121	37.458
		4 1/2	3.804	45.645								7	3.991	47.888
		4 3/4	4.355	52.262	4	x	4 1/2	1.393	16.710			7 1/4	4.907	58.879
		5	5.019	60.224			4 3/4	1.972	23.664			7 1/2	5.832	69.981
		5 1/2	6.467	77.607			5	2.598	31.178			8	7.804	93.645
		6	7.953	95.439			5 1/4	3.430	41.159			8 1/2	9.916	118.991
							5 1/2	4.121	49.458			9	12.112	145.346
2 5/8	x	3 1/2	1.542	18.505			6	5.589	67.065			10	17.103	205.234
							6 1/2	7.178	86.131			11	22.421	269.047
							7	8.907	106.879			12	28.271	339.252
2 3/4	x	3 1/4	0.944	11.327			7 1/2	10.748	128.972					
		3 1/2	1.364	16.374			8	12.710	152.523	6 1/2	x	7 1/4	3.374	40.486
		3 3/4	1.850	22.206			9	17.000	204.000			7 1/2	4.299	51.589
		4	2.449	29.383								8	6.262	75.140
		4 1/4	3.000	36.000								8 1/2	8.374	100.486
		4 1/2	3.495	41.944	4 1/4	x	4 3/4	1.467	17.607			9	10.589	127.065
		4 3/4	4.056	48.673			5	2.084	25.009			9 1/2	13.093	157.121
		5 3/4	6.981	83.776			5 1/4	2.935	35.215					
							5 1/2	3.617	43.402					
2 7/8	x	4	2.299	27.589			6	5.093	61.121	7	x	7 3/4	3.589	43.065
							6 1/2	6.673	80.075			8	4.598	55.178
3	x	3 1/2	0.963	11.551								8 1/2	6.692	80.299
		3 3/4	1.495	17.944	4 1/2	x	5	1.650	19.800			9	8.916	106.991
		4	2.112	25.346			5 1/4	2.346	28.150			9 1/2	11.421	137.047
		4 1/4	2.664	31.963			5 1/2	3.103	37.234			10	13.897	166.766
		4 1/2	3.140	38.000			6	4.551	54.617			11	19.271	231.252
		4 3/4	3.738	44.860			6 1/2	6.159	73.907			12	25.168	302.019
		5	4.346	52.150			7	7.860	94.318					
		5 1/2	5.869	70.430						7 1/2	x	8 1/2	4.916	58.991
		6	7.280	87.364	4 3/4	x	5 1/4	1.822	21.869			9	7.112	85.346
		6 1/2	8.888	106.654			5 1/2	2.523	30.280			9 1/2	9.617	115.402
		7	10.607	127.290			5 3/4	3.234	38.804			10	12.019	144.224
		8	14.402	172.822			6	3.972	47.664			10 1/2	14.757	177.084
							6 1/2	5.579	66.953					
3 1/4	x	3 3/4	1.037	12.449						8	x	9	5.308	63.701
		4	1.710	20.523	5	x	5 1/2	1.925	23.103			9 1/4	6.505	78.056
		4 1/4	2.271	27.252			5 3/4	2.636	31.626			9 1/2	7.729	92.748
		4 1/2	2.720	32.636			6	3.393	40.710			10	10.196	122.355
		4 3/4	3.318	39.813			6 1/2	5.000	60.000			10 1/2	12.841	154.093
		5	3.925	47.103			7	6.710	80.523			11	15.561	186.729
		5 1/2	5.439	65.271			7 1/2	8.561	102.729			12	21.421	257.047
							8	10.505	126.056			13	28.383	340.598
							9	14.813	177.757					
							10	20.056	240.673					
							11	26.067	312.800					

C93200 Size schedule continued

ASTM B505 tubes

Nominal size			Weight	Weight	Nominal size			Weight	Weight	Nominal size			Weight	Weight
I.D.	x	O.D.	per inch	per foot	I.D.	x	O.D.	per inch	per foot	I.D.	x	O.D.	per inch	per foot
8 1/2	x	9 1/2	5.869	70.430	10	x	11	6.794	81.533	11 1/2	x	13	11.140	133.682
		10	8.159	97.907			11 1/2	9.533	114.393			13 1/2	14.542	174.505
		10 1/2	10.738	128.860			12	12.551	150.617			14 1/2	21.570	258.841
		11 1/2	16.748	200.972			13	19.159	229.907					
							14	26.019	312.224	12	x	13 1/2	11.813	141.757
9	x	10	6.159	73.907			16	42.848	514.171			14	15.131	181.570
		10 1/4	8.589	103.065								15	22.477	269.720
		10 1/2	8.673	104.075	10 1/2	x	11 1/2	7.065	84.785			16	31.686	380.229
		11	11.327	135.925			12	9.925	119.103					
		11 1/2	14.224	170.692			12 1/2	13.364	160.374	12 1/2	x	14	12.320	147.840
		12	17.290	207.477			13	16.701	200.411					
		14	31.952	383.429						13	x	14 1/2	12.727	152.726
					11	x	12	7.486	89.832			15	16.858	202.296
9 1/2	x	10 1/2	6.477	77.720			12 1/2	10.879	130.542					
		11	9.075	108.897			13	13.953	167.439	13 1/2	x	15 1/2	16.907	202.879
		11 1/2	11.850	142.206			14	20.841	250.093					
		12 1/2	18.355	220.262						14	x	15 1/2	13.430	161.159
												16	17.692	212.299

ASTM B505 solids

Size	Weight	Weight	Size	Weight	Weight	Size	Weight	Weight
O.D.	per inch	per foot	O.D.	per inch	per foot	O.D.	per inch	per foot
3/8	0.043	0.516	2 1/8	1.187	14.243	4 3/4	5.841	70.093
1/2	0.075	0.897	2 1/4	1.327	15.925	5	6.439	77.271
5/8	0.112	1.346	2 3/8	1.477	17.720	5 1/4	7.206	86.467
3/4	0.159	1.907	2 1/2	1.636	19.626	5 1/2	7.916	94.991
7/8	0.215	2.579	2 5/8	1.794	21.533	6	9.336	112.037
1	0.271	3.252	2 3/4	1.972	23.664	6 1/2	10.907	130.879
1 1/8	0.346	4.150	2 7/8	2.150	25.794	7	12.636	151.626
1 1/4	0.421	5.047	3	2.346	28.150	7 1/2	14.486	173.832
1 3/8	0.579	6.953	3 1/4	2.738	32.860	8	16.411	196.935
1 1/2	0.607	7.290	3 1/2	3.168	38.019	9	20.673	248.075
1 5/8	0.701	8.411	3 3/4	3.636	43.626	10	25.607	307.290
1 3/4	0.813	9.757	4	4.178	50.131	11	30.822	369.869
1 7/8	0.925	11.103	4 1/4	4.710	56.523	12	35.701	428.411
2	1.056	12.673	4 1/2	5.271	63.252	13	43.215	518.579

C93200 Size schedule continued

ASTM B505 rectangles

Nominal size		Weight	Weight	Nominal size		Weight	Weight	Nominal size		Weight	Weight				
thickness	x width	per inch	per foot	thickness	x width	per inch	per foot	thickness	x width	per inch	per foot				
1/4	x 4	0.466	5.589	3/4	x 1	0.322	3.863	1 1/2	x 2	1.021	12.247				
		0.986	11.836			0.610	7.315			1.514	18.164				
		1.445	17.342			0.897	10.767			2.123	25.479				
3/8	x 4	0.630	7.562	3/4	x 1	1.123	13.479	1 1/2	x 2	2.575	30.904				
		1.308	15.669			1.466	17.589			3.158	37.890				
		1.932	23.178			1.726	20.712			3.671	44.055				
						2.034	24.411			4.240	50.877				
						2.281	27.370			4.705	56.466				
						2.610	31.315			5.219	62.630				
1/2	x 1	0.226	2.712	3/4	x 1	2.849	34.192	1 1/2	x 2	5.740	68.877				
		0.432	5.178			3.377	40.521			6.411	76.932				
		0.637	7.644			4.034	48.411								
		0.788	9.452			4.562	54.740			1 3/4	x 4	2.445	29.342		
		1.048	12.575			4.979	59.753					4.918	59.014		
		1.274	15.288									7.253	87.041		
		1.452	17.425			1	x 1			0.418	5.014	2	x 4	2.781	33.370
		1.623	19.479							0.712	8.548			5.562	66.740
		1.863	22.356							1.048	12.575			7.562	90.740
		2.048	24.575			1	x 1			1.466	17.589	2	x 4	8.322	99.863
		2.507	30.082							1.884	22.603				
		2.856	34.274							2.253	27.041			3	x 11
		2.993	35.918			2.616	31.397			19.836	238.027				
						2.932	35.178			6 1/4	x 6 1/4	13.062	156.740		
		5/8	x 1			0.281	3.370					3/4	x 1	3.349	40.192
0.521	6.247			3.658	43.890										
0.767	9.205			4.089	49.068										
0.966	11.589			4.267	51.205										
1.260	15.123			4.822	57.863										
1.507	18.082			5.185	62.219										
1.753	21.041			5.555	66.658										
1.932	23.178			5.918	71.014										
2.247	26.959			6.658	79.890										
2.493	29.918			7.185	86.219										
2.986	35.836			1 1/4	x 1	0.507	6.082								
3.479	41.753					0.959	11.507								
3.603	43.233					1.411	16.932								
						1.788	21.452								
						2.315	27.781								
		2.767	33.205												
		3.219	38.630												
		3.596	43.151												
		4.123	49.479												
		4.575	54.904												
		5.027	60.329												
		5.390	64.685												
		5.925	71.096												
		6.377	76.521												
		6.671	80.055												

C95400 Size schedule

Standard-stocked product

Continuous cast

GreenAlloys™

ASTM B505 tubes

Nominal Size		Weight		Nominal Size		Weight		Nominal Size		Weight	
I.D.	x O.D.	per inch	per foot	I.D.	x O.D.	per inch	per foot	I.D.	x O.D.	per inch	per foot
3/4	x 1 1/4	0.278	3.333	2 1/4	x 2 5/8	0.549	6.583	4	x 4 1/2	1.361	16.333
	1 1/2	0.431	5.167		2 3/4	0.694	8.333		4 3/4	1.972	23.667
	1 3/4	0.611	7.333		3	1.007	12.083		5	2.528	30.333
	2	0.819	9.833		3 1/4	1.458	17.500		5 1/2	3.667	44.000
					3 1/2	1.826	21.917		6	5.139	61.667
7/8	x 1 1/4	0.243	2.917		3 3/4	2.243	26.917		7	7.993	95.917
					4	2.674	32.083		8	11.222	134.667
1	x 1 3/8	0.271	3.250								
	1 1/2	0.347	4.167	2 1/2	x 3	0.771	9.250	4 1/4	x 5	2.104	25.250
	1 3/4	0.528	6.333		3 1/4	1.208	14.500				
	2	0.736	8.833		3 1/2	1.590	19.083	4 1/2	x 5	1.708	20.500
	2 1/4	0.972	11.667		3 3/4	1.986	23.833		5 1/4	2.181	26.167
	2 1/2	1.236	14.833		4	2.417	29.000		5 1/2	2.819	33.833
	3	1.840	22.083		4 1/2	3.333	40.000		6	4.301	51.667
	3 1/2	2.618	31.417		5	4.472	53.667		6 1/2	5.639	67.667
	4	3.438	41.250		6	7.076	84.917		7 1/2	8.729	104.750
1 1/4	x 1 3/4	0.417	5.000	2 3/4	x 3 1/4	0.951	11.417	5	x 5 1/2	1.840	22.083
	2	0.625	7.500		3 1/2	1.306	15.667		5 3/4	2.660	31.917
	2 1/4	0.861	10.333		3 3/4	1.729	20.750		6	3.361	40.333
	2 1/2	1.118	13.417		4	2.146	25.750		6 1/2	4.722	56.667
	2 3/4	1.396	16.750		4 1/4	2.590	31.083		7	6.201	74.417
	3	1.729	20.750		4 1/2	3.042	36.500		8	9.431	113.167
	3 1/2	2.514	30.167								
				3	x 3 1/2	1.021	12.250	5 1/2	x 6 1/2	3.639	43.667
1 1/2	x 1 7/8	0.382	4.583		3 3/4	1.431	17.167				
	2	0.486	5.833		4	1.854	22.250	6	x 7	3.9861	47.833
	2 1/4	0.722	8.667		4 1/4	2.299	27.583		x 8	7.236	86.833
	2 1/2	0.986	11.833		4 1/2	2.785	33.417		9	10.868	130.417
	2 3/4	1.278	15.333		5	3.924	47.083				
	3	1.590	19.083		5 1/2	5.090	61.083	6 1/2	x 7 1/2	4.271	51.250
	3 1/2	2.389	28.667		6	6.549	78.583				
	4	3.201	38.417		7	9.396	112.750	7	x 8	4.556	54.667
	4 1/2	4.132	49.583						x 9	8.257	99.083
									x 10*	12.070	144.840
1 3/4	x 2 1/8	0.438	5.250	3 1/4	x 3 3/4	1.111	13.333				
	2 1/4	0.556	6.667		4	1.535	18.417				
	2 1/2	0.806	9.667		4 1/2	2.451	29.417	8	x 10*	8.980	107.760
	2 3/4	1.111	13.333		5	3.611	43.333		x 11*	13.490	161.880
	3	1.431	17.167						x 12*	18.430	221.160
	3 1/4	1.854	22.250	3 1/2	x 4	1.208	14.500				
	3 1/2	2.257	27.08		4 1/4	1.653	19.833	8 1/2	x 10 1/2*	9.196	110.352
	3 3/4	2.611	31.333		4 1/2	2.125	25.500				
	4	2.965	35.583		5	3.264	39.167	9	x 11*	9.980	119.760
					5 1/2	4.417	53.000	9	x 12*	14.910	178.920
					6	5.882	70.583				
2	x 2 3/8	0.493	5.917					10	x 12*	10.970	131.640
	2 1/2	0.625	7.500	3 3/4	x 4 3/4	2.313	27.750				
	2 3/4	0.910	10.917								
	3	1.243	14.917								
	3 1/4	1.681	20.167								
	3 1/2	2.042	24.500								
	3 3/4	2.438	29.250								
	4	2.861	34.333								
	4 1/2	3.799	45.583								
	5	4.917	59.000								
	6	7.507	90.083								

*Available in 13" minimum lengths and 1" increments above 13".

C95400 Size schedule continued

ASTM B505 solids

Size O.D.	Weight per inch	Weight per foot	Size O.D.	Weight per inch	Weight per foot	Size O.D.	Weight per inch	Weight per foot
1/2	0.069	0.833	2 1/4	1.146	13.750	4 3/4	5.083	61.000
5/8	0.097	1.167	2 1/2	1.396	16.750	5	5.625	67.500
3/4	0.139	1.667	2 3/4	1.688	20.250	5 1/2	6.764	81.167
7/8	0.188	2.250	3	2.000	24.000	6	8.194	98.333
1	0.243	2.917	3 1/4	2.389	28.667	6 1/2	9.556	114.667
1 1/4	0.368	4.417	3 1/2	2.771	33.250	7	11.049	132.583
1 1/2	0.521	6.250	3 3/4	3.153	37.833	8	14.333	172.000
1 5/8	0.611	7.333	4	3.576	42.917	9	18.007	216.083
1 3/4	0.701	8.417	4 1/4	4.035	48.417			
2	0.910	10.917	4 1/2	4.500	54.000			

C95400 Size schedule continued

ASTM B505 rectangles

Nominal size		Weight	Weight	Nominal size		Weight	Weight	Nominal size		Weight	Weight	
thickness	x width	per inch	per foot	thickness	x width	per inch	per foot	thickness	x width	per inch	per foot	
1/4	x 1	0.103	1.233	3/4	x 3/4	0.192	2.301	1 3/4	x 2	1.027	12.329	
	1 1/2	0.144	1.726		1	0.247	2.959		2 1/2	1.274	15.288	
	2	0.192	2.301		1 1/2	0.356	4.274		3	1.514	18.164	
	2 1/2	0.240	2.877		2	0.466	5.589		4	2.014	24.164	
	3	0.281	3.370		2 1/2	0.582	6.986		5	2.507	30.082	
	4	0.377	4.521		3	0.692	8.301		10	5.007	60.082	
	5	0.459	5.507		3 1/2	0.801	9.616					
6	0.596	7.151	4	0.918	11.014	2	x 2	1.171	14.055			
12	1.130	13.562	5	1.144	13.726		2 1/2	1.445	17.342			
			6	1.404	16.849		3	1.726	20.712			
3/8	x 1	0.137	1.644		8	1.836	22.027	3 1/2	2.000	24.000		
	1 1/2	0.199	2.384		12	2.678	32.137	4	2.295	27.534		
	2	0.260	3.123	1	x 1	0.315	3.781	6	3.459	41.507		
	2 1/2	0.322	3.863		1 1/4	0.390	4.685	12	6.870	82.438		
	3	0.384	4.603		1 1/2	0.459	5.507	15	8.918	107.014		
	3 1/2	0.452	5.425		1 3/4	0.534	6.411	2 1/2	x 2 1/2	1.795	21.534	
	4	0.507	6.082		2	0.610	7.315		3	2.137	25.644	
	5	0.630	7.562		2 1/2	0.753	9.041		4	2.836	34.027	
	6	0.795	9.534		3	0.897	10.767		5	3.527	42.329	
	8	1.041	12.493		3 1/2	1.041	12.493		6	4.240	50.877	
12	1.521	18.247	4		1.192	14.301	12		8.445	101.342		
			5		1.479	17.753	15		11.075	132.904		
1/2	x 1/2	0.089	1.068		6	1.801	21.616		3	x 3	2.541	30.493
	1	0.171	2.055		7	2.068	24.822			4	3.384	40.603
	1 1/4	0.212	2.548		8	2.370	28.438			6	5.089	61.068
	1 1/2	0.253	3.041		12	3.493	41.918	15	13.123	157.479		
	2	0.329	3.945	1 1/4	x 1 1/4	0.473	5.671	3 1/2	x 15	15.151	181.808	
	2 1/2	0.411	4.932		1 1/2	0.568	6.822	4	x 4	4.466	53.589	
	3	0.486	5.836		1 3/4	0.658	7.890		15	17.226	206.712	
	3 1/2	0.568	6.822		2	0.747	8.959		6	x 6	9.986	119.836
	4	0.644	7.726		2 1/2	0.925	11.096					
	5	0.801	9.616		3	1.103	13.233					
	6	0.993	11.918		3 1/2	1.281	15.370					
	8	1.315	15.781		4	1.466	17.589					
	10	1.630	19.562		5	1.808	21.699					
12	1.938	23.260	10		3.637	43.644						
5/8	x 1	0.205	2.466		1 1/2	x 1 1/2	0.671	8.055				
	1 1/2	0.301	3.616			1 3/4	0.774	9.288				
	2	0.397	4.767			2	0.890	10.685				
	2 1/2	0.493	5.918	2 1/2		1.103	13.233					
	3	0.589	7.068	3		1.308	15.699					
	4	0.781	9.370	3 1/2		1.527	18.329					
	5	0.973	11.671	4		1.740	20.877					
	6	1.199	14.384	5		2.144	25.726					
	8	1.562	18.740	6		2.651	31.808					
				12		5.130	61.562					
				15		6.911	82.932					

C95500 Size schedule

Standard-stocked product*

Continuous cast

GreenAlloys™

ASTM B505 solids

Size O.D.	Weight per inch	Weight per foot	Size O.D.	Weight per inch	Weight per foot	Size O.D.	Weight per inch	Weight per foot
1.000	0.243	2.917	2.500	1.424	17.083	4.000	3.646	43.750
1.500	0.535	6.417	3.000	2.035	24.417			
2.000	0.924	11.083	3.500	2.806	33.667			

AMS 4880-C95510 Size schedule

Standard-stocked product

Continuous cast

Tubes

Nom. Size		Weight		Nom. Size		Weight		Nom. Size		Weight	
O.D.	x I.D.	Per Inch	Per Foot	O.D.	x I.D.	Per Inch	Per Foot	O.D.	x I.D.	Per Inch	Per Foot
2.000	x 1.000	0.739	8.868	3.500	x 1.500	2.476	29.712	5.750	x 4.250	3.979	47.748
2.250	x 1.250	0.867	10.404		2.500	1.639	19.668	6.000	x 3.000	6.469	77.628
	1.500	0.707	8.484	3.750	x 2.000	2.437	29.244		3.750	5.556	66.672
2.500	x 1.000	1.242	14.904		2.500	1.943	23.316		4.500	4.433	53.196
	1.500	1.002	12.024		2.750	1.764	21.168		5.375	2.397	28.764
	1.750	0.821	9.852	4.000	x 2.000	2.860	34.320	6.500	x 4.000	6.608	79.296
2.750	x 1.500	1.254	15.048		2.500	2.505	30.060		5.000	4.704	56.448
	1.750	1.008	12.096	4.125	x 3.125	1.923	23.076	7.000	x 4.000	8.000	96.000
2.875	x 1.875	1.149	13.788	4.250	x 3.000	2.311	27.732	8.000	x 6.000	7.347	88.164
3.000	x 1.500	1.515	18.180	4.500	x 2.500	3.327	39.924	8.500	x 6.000	8.866	106.392
	2.000	1.210	14.520		3.000	2.792	33.504		6.500	7.568	90.816
3.125	x 2.125	1.378	16.536	5.000	x 3.000	4.207	50.484	11.000	x 9.000	9.867	118.404
3.250	x 2.000	1.657	19.884		3.750	3.012	36.144	12.000	x 10.250	9.794	117.528
	2.250	1.512	18.144	5.500	x 3.500	4.396	52.752	13.000	x 10.000	16.564	198.768

C95900 Size schedule

Standard-stocked product

Continuous cast

GreenAlloys™

ASTM B505 rectangles

Nominal size		Weight	Weight	Nominal size		Weight	Weight	Nominal size		Weight	Weight
thickness	x width	per inch	per foot	thickness	x width	per inch	per foot	thickness	x width	per inch	per foot
1/4	x 1	0.160	1.917	1/2	x 1	0.236	2.833	1	x 1	0.396	4.750
	2	0.285	3.417		2	0.431	5.167		2	0.715	8.583
	3	0.313	3.750		3	0.521	6.250		2 1/2	0.785	9.417
	4	0.542	6.500		4	0.813	9.750		3	0.931	11.167
	5	0.667	8.000		5	1.007	12.083		4	1.229	14.750
	6	0.799	9.583		6	1.194	14.333		5	1.514	18.167
	7	0.924	11.083		7	1.389	16.667		6	1.813	21.750
	8	1.049	12.583		8	1.576	18.917		7	2.313	27.750
	9	1.181	14.167		9	1.771	21.250		8	2.632	31.583
	10	1.306	15.667		10	1.958	23.500		9	2.951	35.417
	12	1.563	18.750		12	2.319	27.833		10	3.264	39.167
									12	3.951	47.417
3/8	x 1	0.201	2.417	5/8	x 1 1/2	0.326	3.917	1 1/2	x 4	1.792	21.500
	2	0.361	4.333								
	3	0.424	5.083	3/4	x 1	0.319	3.833	1 3/4	x 2 1/2	1.257	15.083
	4	0.681	8.167		2	0.576	6.917				
	5	0.833	10.000		3	0.729	8.750				
	6	0.993	11.917		4	1.083	13.000	2	x 5	2.771	33.250
	7	1.153	13.833		5	1.340	16.083				
	8	1.313	15.750		6	1.597	19.167	2 1/2	x 4	2.868	34.417
	9	1.472	17.667		7	1.847	22.167		7	4.757	57.083
	10	1.632	19.583		8	2.104	25.250				
	12	1.958	23.500		9	2.361	28.333				
					10	2.611	31.333				
					12	3.118	37.417				

ASTM B505 rectangles (metric sizes)

Nominal size		Weight	Weight	Nominal size		Weight	Weight	Nominal size		Weight	Weight
thickness	x width	per inch	per foot	thickness	x width	per inch	per foot	thickness	x width	per inch	per foot
20 mm	x 50 mm	0.486	5.833	20 mm	x 100 mm	0.944	11.333	20 mm	x 160 mm	1.507	18.083
20 mm	x 75 mm	0.711	8.532	20 mm	x 125 mm	1.174	14.083				
20 mm	x 80 mm	0.764	9.167	20 mm	x 150 mm	1.390	16.680				

ASTM B505 solids

Size	Weight	Weight	Size	Weight	Weight	Size	Weight	Weight
O.D.	per inch	per foot	O.D.	per inch	per foot	O.D.	per inch	per foot
1	0.236	2.833	2	0.875	10.500	3 1/2	2.694	32.333
1 1/4	0.354	4.250	2 1/4	1.104	13.250	4	3.431	41.167
1 1/2	0.507	6.083	2 1/2	1.347	16.167	4 1/2	4.549	54.583
1 3/4	0.701	8.417	3	1.938	23.250	5	5.368	64.417

Technical
information

Technical information

Included in this section:

- Casting is key
- Continuous-cast product list
- Extruded or cast and drawn product list
- Lead-free product list (chemical composition)
- Continuous-cast products chemical composition
- Continuous-cast specification cross reference
- Continuous-cast application cross reference
- Continuous-cast hardness ratings
- Continuous-cast machinability ratings
- Corrosion ratings of continuous-cast copper alloys in various media
- Extruded or cast and drawn product chemical composition
- Extruded or cast and drawn product typical uses
- Extruded or cast and drawn hardness ratings
- Extruded or cast and drawn machinability ratings
- Lead-free hardness ratings
- Lead-free machinability ratings
- Chemical symbols for elements

We are
a trusted
resource for
informed
industry
decisions.



Casting is key

Through decades of experience, Concast has proven that superior products are created through vertical or horizontal continuous casting methods. The preferred casting technique is determined by the alloy and by the size range being produced.

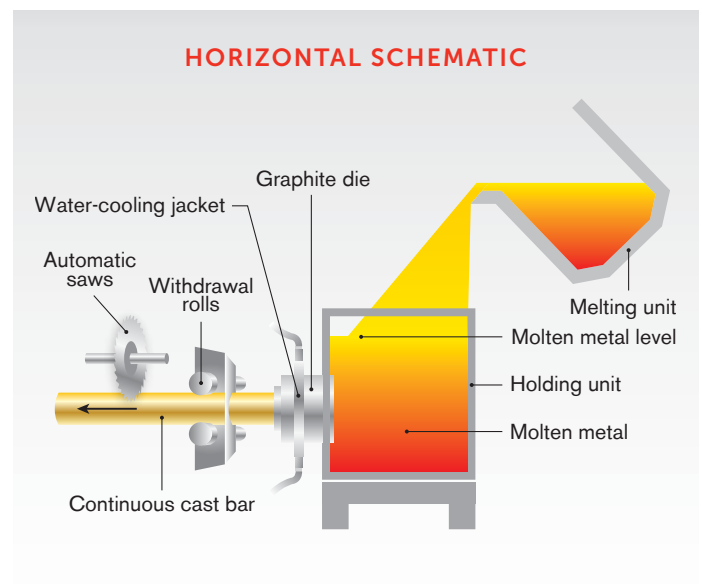
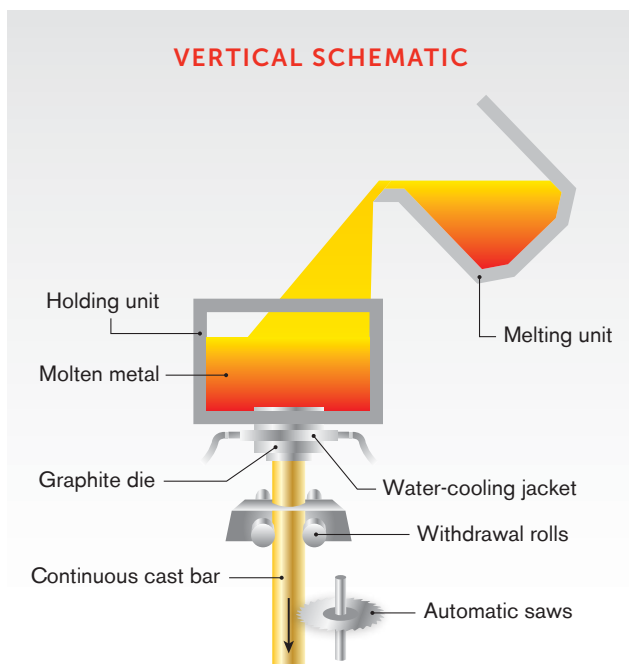


Vertical continuous casting

Vertical continuous casting has been the strength of Wieland Concast's production for over a third of a century. As the metal flows down into a water-cooled die at the bottom of the crucible during vertical continuous casting, solidification of the alloy occurs. The cast product continues smoothly downward through rollers beneath the die. With precise temperature control, the rollers carefully withdraw the cast metal to determine its grain structure and metallurgical properties.

Horizontal continuous casting

Horizontal continuous casting is best suited for aluminum bronzes due to the material's metallurgy. As a result, our Birmingham plant has been dedicated almost exclusively to the production of aluminum bronze. During horizontal continuous casting, metal flows out the front of the crucible and into a water-cooled die where solidification takes place. Drive rollers pull the bar along roller tables that support the weight of the bar while it casts. With precise control of temperature, the desired grain structure and metallurgical properties are created.



Continuous-cast product list

Common continuous-cast products, product forms, and size ranges

Copper alloy UNS no.	Product description	Solid bar stock		Tubes		Rectangles	
		Avail.	Size range	Avail.	Size range	Avail.	Size range
C83600	Leaded red brass	X	1/2" to 13" O.D.	X	1" to 16" O.D.	X	Up to 20"
C83800	Leaded red brass	X	1/2" to 13" O.D.	X	1" to 16" O.D.	X	Up to 20"
C84200	Leaded semi-red brass	X	1/2" to 13" O.D.	X	1" to 16" O.D.	X	Up to 20"
C84400	Leaded semi-red brass	X	1/2" to 13" O.D.	X	1" to 16" O.D.	X	Up to 20"
C84800	Leaded semi-red brass	X	1/2" to 13" O.D.	X	1" to 16" O.D.	X	Up to 20"
C85700	Leaded yellow brass	X	1/2" to 13" O.D.	X	1-1/8" to 9" O.D.	X	Up to 15"
C86200	Manganese bronze	X	1/2" to 9" O.D.	X	1-1/8" to 9" O.D.	X	Up to 15"
C86300*	Manganese bronze	X	1/2" to 9" O.D.	X	1-1/8" to 9" O.D.	X	Up to 15"
C86400	Manganese bronze	X	1/2" to 9" O.D.	X	1-1/8" to 9" O.D.	X	Up to 15"
C86500	Manganese bronze	X	1/2" to 9" O.D.	X	1-1/8" to 9" O.D.	X	Up to 15"
C86700	Manganese bronze	X	1/2" to 9" O.D.	X	1-1/8" to 9" O.D.	X	Up to 15"
C87850	Silicon brass	X	Consult mill	X	Consult mill	X	Consult mill
C89320	Bismuth tin bronze	X	1/2" to 10" O.D.	X	1-1/8" to 9" O.D.	X	Up to 15"
C89325	Bismuth tin bronze	X	1/2" to 10" O.D.	X	1-1/8" to 9" O.D.	X	Up to 15"
C89520	Bismuth tin bronze	X	1/2" to 10" O.D.	X	1-1/8" to 9" O.D.	X	Up to 15"
C89831	Bismuth tin bronze	X	1/2" to 10" O.D.	X	1-1/8" to 9" O.D.	X	Up to 15"
C89833	Bismuth tin bronze	X	1/2" to 10" O.D.	X	1-1/8" to 9" O.D.	X	Up to 15"
C89835*	Bismuth tin bronze	X	1/2" to 10" O.D.	X	1-1/8" to 9" O.D.	X	Up to 15"
C89844	Bismuth tin bronze	X	1/2" to 10" O.D.	X	1-1/8" to 9" O.D.	X	Up to 15"
C90300*	Tin bronze	X	1/2" to 10" O.D.	X	1" to 16" O.D.	X	Up to 20"
C90500	Tin bronze	X	1/2" to 10" O.D.	X	1" to 16" O.D.	X	Up to 20"
C90700	Tin bronze	X	1/2" to 10" O.D.	X	1" to 16" O.D.	X	Up to 20"
C90800	Tin bronze	X	1" to 6" O.D.	X	1" to 6" O.D.	X	Up to 10"
C90810	High tin bronze	X	1" to 6" O.D.	X	1" to 6" O.D.	X	Up to 10"
C91000	Tin bronze	X	1" to 6" O.D.	X	1" to 6" O.D.	X	Up to 10"
C91100	High tin bronze	X	1" to 6" O.D.	X	1" to 6" O.D.	X	Up to 10"
C91300	Tin bronze	X	1" to 6" O.D.	X	1" to 6" O.D.	X	Up to 10"
C91600	High tin bronze	X	1" to 6" O.D.	X	1" to 6" O.D.	X	Up to 10"
C91700	High tin bronze	X	1" to 6" O.D.	X	1" to 6" O.D.	X	Up to 10"
C92200	Leaded tin bronze	X	1/2" to 13" O.D.	X	1" to 16" O.D.	X	Up to 20"
C92300	Leaded tin bronze	X	1/2" to 13" O.D.	X	1" to 16" O.D.	X	Up to 20"
C92500	Nickel-phosphor bronze	X	1/2" to 13" O.D.	X	1" to 16" O.D.	X	Up to 20"
C92700	Leaded tin bronze	X	1/2" to 13" O.D.	X	1" to 16" O.D.	X	Up to 20"
C92800	Leaded tin bronze	X	1/2" to 13" O.D.	X	1" to 16" O.D.	X	Up to 20"
C92900	Leaded nickel-tin bronze	X	1/2" to 13" O.D.	X	1" to 16" O.D.	X	Up to 20"
C93200*	Leaded tin bronze	X	1/2" to 13" O.D.	X	1" to 16" O.D.	X	Up to 20"
C93400	High-leaded tin bronze	X	1/2" to 13" O.D.	X	1" to 16" O.D.	X	Up to 20"

*Standard-stocked alloy.

Please consult mill for minimum I.D., minimum thickness, and minimum wall thickness.

Continuous-cast product list continued

Copper alloy UNS no.	Product description	Solid bar stock		Tubes		Rectangles	
		Avail.	Size range	Avail.	Size range	Avail.	Size range
C93500	High-leaded tin bronze	X	1/2" to 13" O.D.	X	1" to 16" O.D.	X	Up to 20"
C93600	High-leaded tin bronze	X	1/2" to 13" O.D.	X	1" to 16" O.D.	X	Up to 20"
C93700	High-leaded tin bronze	X	1/2" to 10" O.D.	X	1" to 16" O.D.	X	Up to 20"
C93800	High-leaded tin bronze	X	1/2" to 10" O.D.	X	1" to 16" O.D.	X	Up to 20"
C93900	High-leaded tin bronze	X	1/2" to 10" O.D.	X	1" to 16" O.D.	X	Up to 20"
C94000	High-leaded tin bronze	X	1/2" to 10" O.D.	X	1" to 16" O.D.	X	Up to 10"
C94100	High-leaded tin bronze	X	1/2" to 10" O.D.	X	1" to 16" O.D.	X	Up to 10"
C94300	High-leaded tin bronze	X	1/2" to 10" O.D.	X	1" to 16" O.D.	X	Up to 10"
C94700	Nickel-tin bronze	X	1/2" to 10" O.D.	X	1" to 16" O.D.	X	Up to 20"
C94700HT	Nickel-tin bronze	X	1/2" to 10" O.D.	X	1" to 16" O.D.	X	Up to 20"
C94800	Leaded nickel-tin bronze	X	1/2" to 10" O.D.	X	1" to 16" O.D.	X	Up to 20"
C95200	Aluminum bronze	X	1/2" to 9" O.D.	X	1-1/8" to 9" O.D.	X	Up to 15"
C95300	Aluminum bronze	X	1/2" to 9" O.D.	X	1-1/8" to 9" O.D.	X	Up to 15"
C95300HT	Aluminum bronze	X	1/2" to 9" O.D.	X	1-1/8" to 9" O.D.	X	Up to 15"
C95400*	Aluminum bronze	X	1/2" to 9" O.D.	X	1-1/8" to 9" O.D.	X	Up to 15"
C95400HT	Aluminum bronze	X	1/2" to 9" O.D.	X	1-1/8" to 9" O.D.	X	Up to 15"
C95410	Aluminum bronze	X	1/2" to 9" O.D.	X	1-1/8" to 9" O.D.	X	Up to 15"
C95410HT	Aluminum bronze	X	1/2" to 9" O.D.	X	1-1/8" to 9" O.D.	X	Up to 15"
C95500*	Nickel-aluminum bronze	X	1/2" to 9" O.D.	X	1-1/8" to 9" O.D.	X	Up to 15"
C95500HT	Nickel-aluminum bronze	X	1/2" to 9" O.D.	X	1-1/8" to 9" O.D.	X	Up to 15"
C95510*	Nickel-aluminum bronze	X	1/2" to 9" O.D.	X	1-1/8" to 13" O.D.	X	Up to 15"
C95520HT	Nickel-aluminum bronze	X	1/2" to 9" O.D.	X	1-1/8" to 9" O.D.	X	Up to 15"
C95600	Nickel-aluminum bronze	X	1/2" to 9" O.D.	X	1-1/8" to 9" O.D.	X	Up to 15"
C95800	Nickel-aluminum bronze	X	1/2" to 9" O.D.	X	1-1/8" to 9" O.D.	X	Up to 15"
C95900*	Aluminum bronze	X	1" to 5" O.D.		Consult mill	X	Up to 7"
CONCAST380	Aluminum bronze	X	1" to 5" O.D.			X	Up to 10"
C96400	Copper-nickel	X	1/2" to 9" O.D.	X	1-1/8" to 9" O.D.	X	Up to 15"
C96900HT	Copper-nickel	X	1/2" to 9" O.D.	X	1-1/8" to 9" O.D.	X	Up to 15"
C97300	Nickel silver bronze	X	3/4" to 9" O.D.	X	1-1/8" to 9" O.D.	X	Up to 14"
C97600	Nickel silver bronze	X	3/4" to 9" O.D.	X	1-1/8" to 9" O.D.	X	Up to 14"
C97800	Nickel silver bronze	X	3/4" to 9" O.D.	X	1-1/8" to 9" O.D.	X	Up to 14"
C99500	Special alloy	X	1/2" to 9" O.D.	X	1-1/8" to 9" O.D.	X	Up to 14"

*Standard-stocked alloy.

Please consult mill for minimum I.D., minimum thickness, and minimum wall thickness.

All alloys also available as near-net shape, solid hex bar, and hex tube except Concast380 which is not available as hex tube.

Extruded or cast and drawn product list

Copper alloy UNS no.	ASTM spec	AMS spec	Tempers						Product description	Round size range	Hex/oct size range
C14500*	B301				H02	H04			Tellurium copper	0.375 to 2.75	
C23000	B927			H01	H02	H04			Red brass 85%	0.375 to 2.75	
C24000	B927			H01	H02	H04			Low brass 80%	0.375 to 2.5	0.375 to 2.0
C26000	B927			H01	H02	H04			Cartridge brass 70%	0.375 to 2.5	0.375 to 2.0
C31400*	B140				H02	H04			Leaded commercial bronze	0.375 to 2.0	0.375 to 2.0
C31600	B140				H02	H04			Leaded commercial bronze ²	0.375 to 2.0	0.375 to 2.0
C46400	B21				H02				Naval brass, uninhibited	0.5 to 2.75	0.5 to 2.75
C51000*	B139	4625				H04		H08	Phosphor bronze 5% A	0.375 to 2.5	0.375 to 2.0
C52100	B139					H04			Phosphor bronze 8% C	0.375 to 2.5	0.375 to 2.0
C53400	B139					H04			Phosphor bronze B-1	0.375 to 2.5	0.375 to 2.0
C54400*	B139					H04			Phosphor bronze B-2	0.375 to 2.5	0.375 to 2.0
C62400	B150		HR50						Aluminum bronze 11%	0.5 to 3.0	
C63000*	B150	4640	HR50						Nickel-aluminum bronze	0.375 to 10.0	0.5 to 2.0
C63020*	B150	4590	TQ50						Nickel-aluminum bronze	0.75 to 4.0	
C64200*	B150	4634	HR50						Aluminum bronze	0.1875 to 6.0	0.5 to 2.0
C64210	B150		HR50						Aluminum silicon bronze	0.3125 to 3.0	0.5 to 2.0
C65100	B98				H02	H04	H06		Low-silicon bronze B	0.375 to 2.0	0.375 to 2.0
C67300* ¹					H02				Manganese bronze	0.75 to 3.0	
C67400 ¹									Manganese bronze	0.75 to 3.0	0.375 to 2.0
C67410									Manganese bronze	0.75 to 3.0	0.375 to 2.0
C67600	B138				H02	H04			Manganese bronze	0.75 to 2.0	
C69300	B371				H02				Lead-free brass	0.125 to 3.0	0.375 to 2.5
C69400	B371					H04			Silicon red brass	0.375 to 2.0	0.375 to 2.0
C69430	B371					H04			Silicon red brass	0.375 to 2.0	0.375 to 2.0
C72900*		4596	TX 00						Copper nickel-tin bronze		
C72900*		4597	TX TS						Copper nickel-tin bronze	0.75 to 3.14	
C72900*		4598	TX 00						Copper nickel-tin bronze		

*Standard-stocked alloy. ¹SAE J463 specification. ²(nickel-bearing).

Lead-free product list

Copper Alloy UNS No.	Cu (%)	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%)	Ni (%) ³	Al (%)	Bi (%)	Mn (%)	S (%)	Sb (%)	Si (%)
C69300 ¹	73.00-77.00	0.02 ⁴ -0.09	0.20	Rem.	0.10	0.04-0.15	0.10			0.10		0.10	2.70-3.40
C87850	75.00-78.00	0.02 ⁴ -0.09	0.30	Rem.	0.10	0.05-0.20	0.20			0.10		0.10	2.70-3.40
C89325	84.00-88.00	0.10	9.00-11.00	1.00	0.15	0.10	1.00	0.005	2.70-3.70		0.08	0.50	0.005
C89831	87.00-91.00	0.10	2.70-3.70	2.00-4.00	0.30	0.05	1.00	0.005	2.70-3.70		0.08	0.25	0.005
C89833	86.00-91.00	0.09	4.00-6.00	2.00-6.00	0.30	0.05	1.00	0.005	1.70-2.70		0.08	0.25	0.005
C89835*	85.00-89.00	0.09	6.00-7.50	2.00-4.00	0.20	0.10	1.00	0.005	1.70-2.70		0.08	0.35	0.005
C89844	83.00-86.00	0.20	3.00-5.00	7.00-10.00	0.30	0.05	1.00	0.005	2.00-4.00		0.08	0.25	0.005
C90300*	86.00-89.00 ¹	0.30	7.50-9.00	3.00-5.00	0.20	1.50	1.00	0.005			0.05	0.20	0.005
C90800	85.00-90.00 ¹	0.25	11.00-13.00	0.25	0.15	0.30	0.50	0.005			0.05	0.20	0.005
C90810	Rem. ¹	0.25	11.00-13.00	0.30	0.15	0.15-0.80 ²	0.50	0.005			0.05	0.20	0.005
C95400 ^{5*}	83.00 min					3.00-5.00	1.50	10.00-11.50		0.50			
C95500 ^{5*}	78.00 min					3.00-5.00	3.00-5.50	10.00-11.50		3.50			
C95900	Rem.					3.00-5.00	0.50	12.00-13.50		1.50			

¹Lead-Free Brass *Standard-stocked alloy. ⁴In determining Cu min., Cu may be calculated as Cu + Ni.

²For continuous castings, P shall be 1.5%, max. ³Ni value includes Co. ⁴Pb content is greater than 0.02%.

⁵Also available in heat-treated condition.

Note: Unless otherwise noted, single values represent maximums.

Continuous-cast products chemical composition

Copper alloy UNS no.	Product description	Cu (%)	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%)	Ni (%) ³	Al (%)	Co (%)	Bi (%)	Mn (%)	S (%)	Sb (%)	Si (%)	Se (%)
C83600	Leaded red brass	84.00-86.00 ¹	4.00-6.00	4.00-6.00	4.00-6.00	0.30	1.50	1.00 ¹	0.005				0.08	0.25	0.005	
C83800	Leaded red brass	82.00-83.80 ¹	5.00-7.00	3.30-4.20	5.00-8.00	0.30	1.50	1.00 ¹	0.005				0.08	0.25	0.005	
C84200	Leaded semi-red brass	78.00-82.00 ¹	2.00-3.00	4.00-6.00	10.00-16.00	0.40	1.50	0.80 ¹	0.005				0.08	0.25	0.005	
C84400	Leaded semi-red brass	78.00-82.00 ¹	6.00-8.00	2.30-3.50	7.00-10.00	0.40	1.50	1.00 ¹	0.005				0.08	0.25	0.005	
C84800	Leaded semi-red brass	75.00-77.00 ¹	5.50-7.00	2.00-3.00	13.00-17.00	0.40	1.50	1.00 ¹	0.005				0.08	0.25	0.005	
C85700	Leaded yellow brass	58.00-64.00 ¹	0.80-1.50	0.50-1.50	32.00-40.00	0.70		1.00 ¹	0.80						0.05	
C86200	Manganese bronze	60.00-66.00 ¹	0.20	0.20	22.00-28.00	2.00-4.00		1.00 ¹	3.00-4.90			2.50-5.00				
C86300*	Manganese bronze	60.00-66.00 ¹	0.20	0.20	22.00-28.00	2.00-4.00		1.00 ¹	5.00-7.50			2.50-5.00				
C86400	Manganese bronze	56.00-62.00 ¹	0.50-1.50	0.50-1.50	34.00-42.00	0.40-2.00		1.00	0.50-1.50			0.10-1.50				
C86500	Manganese bronze	55.00-60.00 ¹	0.40	1.00	36.00-42.00	0.40-2.00		1.00	0.50-1.50			0.10-1.50				
C86700	Manganese bronze	55.00-60.00 ¹	0.50-1.50	1.50	30.00-38.00	1.00-3.00		1.00	1.00-3.00			0.10-3.50				
C87850	Silicon brass	75.00-78.00	0.02-0.09	1.50	30.00-38.00	1.00-3.00		1.00	1.00-3.00			0.10-3.50				
C89320	Bismuth tin bronze	87.00-91.00	0.09	5.00-7.00	1.00	0.20	0.30	1.00	0.005		4.00-6.00		0.08	0.35	0.005	
C89325	Bismuth tin bronze	84.00-88.00	0.10	9.00-11.00	1.00	0.15	0.10	1.00	0.005		2.70-3.70		0.08	0.50	0.005	
C89520	Bismuth tin bronze	85.00-87.00	0.09	5.00-6.00	4.00-6.00	0.20		1.00	0.005		1.60-2.20 ⁴		0.08	0.25		0.80-1.10 ⁴
C89831	Bismuth tin bronze	87.00-91.00	0.10	2.70-3.70	2.00-4.00	0.30	0.05	1.00	0.005		2.70-3.70		0.08	0.25	0.005	
C89833	Bismuth tin bronze	86.00-91.00	0.09	4.00-6.00	2.00-6.00	0.30	0.05	1.00	0.005		1.70-2.70		0.08	0.25	0.005	

*Standard-stocked alloy. ¹In determining Cu min., Cu may be calculated as Cu + Ni.
 Note: Single values represent maximums.

²Pb content is greater than 0.02%.

³Ni value includes Co.

⁴Bi:Se >= 2:1

Continuous-cast products chemical composition continued

Copper alloy UNS no.	Product description	Cu (%)	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%)	Ni (%) ³	Al (%)	Co (%)	Bi (%)	Mn (%)	S (%)	Sb (%)	Si (%)	Se (%)
C89835*	Bismuth tin bronze	85.00-89.00	0.09	6.00-7.50	2.00-4.00	0.20	0.10	1.00	0.005		1.70-2.70		0.08	0.35	0.005	
C89844	Tin bronze	83.00-86.00	0.20	3.00-5.00	7.00-10.00	0.30	0.05	1.00	0.005		2.00-4.00		0.08	0.25	0.005	
C90300*	Tin bronze	86.00-89.00 ¹	0.30	7.50-9.00	3.00-5.00	0.20	1.50	1.00 ¹	0.005				0.05	0.20	0.005	
C90500	Tin bronze	86.00-89.00 ¹	0.30	9.00-11.00	1.00-3.00	0.20	1.50	1.00 ¹	0.005				0.05	0.20	0.005	
C90700	Tin bronze	88.00-90.00 ¹	0.50	10.00-12.00	0.50	0.15	1.50	0.50 ¹	0.005				0.05	0.20	0.005	
C90800	Tin bronze	85.00-89.00 ¹	0.25	11.00-13.00	0.25	0.15	0.30	0.50	0.005				0.05	0.20	0.005	
C90810	High tin bronze	Rem. ¹	0.25	11.00-13.00	0.30	0.15	0.15-0.80 ²	0.50	0.005				0.05	0.20	0.005	
C91000	Tin bronze	84.00-86.00 ¹	0.20	14.00-16.00	1.50	0.10	1.50	0.80	0.005				0.05	0.20	0.005	
C91100	High tin bronze	82.00-85.00 ¹	0.25	15.00-17.00	0.25	0.25	1.00 ²	0.50	0.005				0.05	0.20	0.005	
C91300	Tin bronze	79.00-82.00 ¹	0.25	18.00-20.00	0.25	0.25	1.50	0.50 ¹	0.005				0.05	0.20	0.005	
C91600	High tin bronze	86.00-89.00 ¹	0.25	9.70-10.80	0.25	0.20	0.30	1.20-2.00	0.005				0.05	0.20	0.005	
C91700	High tin bronze	84.00-87.00 ¹	0.25	11.30-12.50	0.25	0.20	0.30	1.20-2.00	0.005				0.05	0.20	0.005	
C92200	Leaded tin bronze	86.00-90.00 ¹	1.00-2.00	5.50-6.50	3.00-5.00	0.25	1.50	1.00 ¹	0.005				0.05	0.25	0.005	
C92300	Leaded tin bronze	85.00-89.00 ¹	0.30-1.00	7.50-9.00	2.50-5.00	0.25	1.50	1.00 ¹	0.005				0.05	0.25	0.005	
C92500	Nickel-phosphor bronze	85.00-88.00 ¹	1.00-1.50	10.00-12.00	0.50	0.30	1.50	0.80-1.50 ¹	0.005				0.05	0.25	0.005	
C92700	Leaded tin bronze	86.00-89.00 ¹	1.00-2.50	9.00-11.00	0.70	0.20	1.50	1.00 ¹	0.005				0.05	0.25	0.005	
C92800	Leaded tin bronze	78.00-82.00 ¹	4.00-6.00	15.00-17.00	0.80	0.20	1.50	0.80 ¹	0.005				0.05	0.25	0.005	

*Standard-stocked alloy. ¹In determining Cu min., Cu may be calculated as Cu + Ni. ²For continuous castings, P shall be 1.50% max. ³Ni value includes Co.
 Note: Single values represent maximums.

Continuous-cast products chemical composition continued

Copper alloy UNS no.	Product description	Cu (%)	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%)	Ni (%) ⁵	Al (%)	Co (%)	Bi (%)	Mn (%)	S (%)	Sb (%)	Si (%)	Se (%)
C9290	Leaded nickel-tin bronze	82.00-86.00 ¹	2.00-3.20	9.00-11.00	0.25	0.20	1.50	2.80-4.00 ¹	0.005				0.05	0.25	0.005	
C93200*	Leaded tin bronze	81.00-85.00 ¹	6.00-8.00	6.30-7.50	2.00-4.00	0.20	1.50	1.00 ¹	0.005				0.08	0.35	0.005	
C93400	High-leaded tin bronze	82.00-85.00 ¹	7.00-9.00	7.00-9.00	0.80	0.20	1.50	1.00 ¹	0.005				0.08	0.50	0.005	
C93500	High-leaded tin bronze	83.00-86.00 ¹	8.00-10.00	4.30-6.00	2.00	0.20	1.50	1.00 ¹	0.005				0.08	0.30	0.005	
C93600	High-leaded tin bronze	79.00-83.00	11.00-13.00	6.00-8.00	1.00	0.20	1.50	1.00	0.005				0.08	0.55	0.005	
C93700	High-leaded tin bronze	78.00-82.00	8.00-11.00	9.00-11.00	0.80	0.70 ²	1.50	0.50	0.005				0.08	0.50	0.005	
C93800	High-leaded tin bronze	75.00-79.00	13.00-16.00	6.30-7.50	0.80	0.15	1.50	1.00	0.005				0.08	0.80	0.005	
C93900	High-leaded tin bronze	76.50-79.50	14.00-18.00	5.00-7.00	1.50	0.40	1.50	0.80	0.005				0.08	0.50	0.005	
C94000	High-leaded tin bronze	69.00-72.00	14.00-16.00	12.00-14.00	0.50	0.25	1.50	0.50-1.00	0.005				0.25 ⁶	0.50	0.005	
C94100	High-leaded tin bronze	72.00-79.00	18.00-22.00	4.50-6.50	1.00	0.25	1.50	1.00	0.005				0.25 ⁶	0.80	0.005	
C94300	High-leaded tin bronze	67.00-72.00	23.00-27.00	4.50-6.00	0.80	0.15	1.50	1.00	0.005				0.25 ⁶	0.80	0.005	
C94700	Nickel-tin bronze	85.00-90.00	0.09 ²	4.50-6.00	1.00-2.50	0.25	0.05	4.50-6.00	0.005			0.20	0.05	0.15	0.005	
C94700HT	Nickel-tin bronze	85.00-90.00	0.09 ²	4.50-6.00	1.00-2.50	0.25	0.05	4.50-6.00	0.005			0.20	0.05	0.15	0.005	
C94800	Leaded nickel-tin bronze	84.00-89.00	0.30-1.00	4.50-6.00	1.00-2.50	0.25	0.05	4.50-6.00	0.005			0.20	0.05	0.15	0.005	
C95200	Aluminum bronze	86.00 min				2.50-4.00			8.50-9.50							
C95300	Aluminum bronze	86.00 min				0.80-1.50			9.00-11.00							
C95300HT	Aluminum bronze	86.00 min				0.80-1.50			9.00-11.00							

*Standard-stocked alloy. ¹In determining Cu min., Cu may be calculated as Cu + Ni. ²It is possible that the mechanical requirements of Copper Alloy UNS No. C94700 in the heat-treated condition will not be attained if the lead content exceeds 0.01%. ³Fe shall be 0.25% max. ⁴For continuous castings, S shall be 0.25% max. ⁵Ni value includes Co. ⁶For

Note: Unless otherwise noted, single values represent maximums. HT = heat treated.

Continuous-cast products chemical composition continued

Copper alloy UNS no.	Product description	Cu (%)	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%)	Ni (%) ³	Al (%)	Co (%)	Bi (%)	Mn (%)	S (%)	Sb (%)	Si (%)	Se (%)
C95400*	Aluminum bronze	83.00 min				3.00-5.00		1.50	10.00-11.50			0.50				
C95400HT	Aluminum bronze	83.00 min				3.00-5.00		1.50	10.00-11.50			0.50				
C95410	Aluminum bronze	83.00 min				3.00-5.00		1.50-2.50	10.00-11.50			0.50				
C95410HT	Aluminum bronze	83.00 min				3.00-5.00		1.50-2.50	10.00-11.50			0.50				
C95500*	Nickel-aluminum bronze	78.00 min				3.00-5.00		3.00-5.50	10.00-11.50			3.50				
C95500HT	Nickel-aluminum bronze	78.00 min				3.00-5.00		3.00-5.50	10.00-11.50			3.50				
C95510* (AMS 4880)	Nickel-aluminum bronze	78.00 min		0.20	0.30	2.00-3.50		4.50-5.50	9.70-10.90			1.50				
C95520HTA	Nickel-aluminum bronze	74.50 min	0.03	0.25	0.30	4.00-5.50		4.20-6.00	10.50-11.50	0.20		1.50			0.15	
C95600	Nickel-aluminum bronze	88.00 min						0.25	6.00-8.00						1.80-3.20	
C95800	Nickel-aluminum bronze	79.00 min	0.03			3.50-4.50 ²		4.00-5.00 ²	8.50-9.50			0.80-1.50			0.10	
C95900*	Aluminum bronze	Rem.				3.00-5.00		0.50	12.00-13.50			1.50				
CONCAST380	Aluminum bronze	Rem.				4.50-6.50			14.00-16.00	2.50		3.25				
C96400B	Copper-nickel	Rem.	0.01			0.25-1.50	0.02	28.00-32.00				1.50	0.02		0.50	
C96900HT ^c	Copper-nickel	Rem.	0.02	7.50-8.50	0.50			14.50-15.50				0.05-0.30			0.30	
C97300	Nickel silver bronze	53.00-58.00	8.00-11.00	1.50-3.00	17.00-25.00	1.50	0.05	11.00-14.00	0.005			0.50	0.08	0.35	0.15	
C97600	Nickel silver bronze	63.00-67.00	3.00-5.00	3.50-4.50	3.00-9.00	1.50	0.05	19.00-21.50	0.005			1.00	0.08	0.25	0.15	
C97800	Nickel silver bronze	64.00-67.00	1.00-2.50	4.00-5.50	1.00-4.00	1.50	0.05	24.00-27.00	0.005			1.00	0.08	0.20	0.15	
C99500	Special alloy	Rem.	0.09		0.50-2.00	3.00-5.00		3.50-5.50	0.50-2.00			0.50			0.50-2.00	

*Standard-stocked alloy. ¹In determining Cu min, Cu may be calculated as Cu + Ni. ²Fe content shall not exceed Ni content. ³Ni value includes Co (excluding C99500).

^AChemical requirements for other elements: Cr 0.05%, max. ^BChemical requirements for other elements: C 0.15%, max and Nb 0.50-1.50%. ^CChemical requirements for other elements: Mg 0.15%, max and Nb 0.10%, max.

Note: Unless otherwise noted, single values represent maximums. HT = heat treated.

Continuous-cast specification cross reference

Product description	CDA	ASTM	Asarcon	SAE	AMS	Federal	Military	Other designation
Leaded red brass	C83600	B505	B145, 4A	40	J461	J462	4855	QQ-C-390, B5
	C83800	B505	B145, 4B	46			4855	QQ-C-390, B4
Leaded semi-red brass	C84200	B505						QQ-B-1005, Comp 3
	C84400	B505	B145, 5A					QQ-B-1005, Comp 11
	C84800	B505						QQ-B-1005, Comp 11
Leaded yellow brass	C85700							QQ-C-390, A1
High-strength yellow brass	C86200	B505						QQ-B-621, Class A
	C86300	B505						QQ-B-726, Class B
	C86400	B505		430A	J461	J462		MIL-C-22229, Comp 9
	C86500	B505		430B	J461	J462		MIL-C-22229, Comp 8
Manganese bronze	C86700	B271	B584	43	J461	J462	4860	QQ-C-390, C3
		B763	B763					MIL-C-22229, Comp 7
Silicon brass	C87850	B505						
Bismuth tin bronze	C89320	B505						
	C89325	B584						
	C89520	B584						
	C89831							
	C89833							
	C89835							
C89844	B585	B763						

Continuous-cast specification cross reference continued

Product description	CDA	ASTM	Asarcon	SAE	AMS	Federal	Military	Other designation
Tin bronze	C90300	B505	B143, 1B	J461	J462	QQ-C-390, D5	MIL-B-11553, Comp 5	Gun metal Tin bronze, 65
	C90500	B505	B143, A	620	J462	QQ-B-1005, Comp 3	MIL-B-11553, Comp 5	
	C90700	B505	B22	62	J461	QQ-C-390, D6	MIL-B-11553, Comp 16	
	C90800	B427		65	J461	QQ-B-1005, Comp 16		
	C91000	B505				QQ-C-390, D2	MIL-B-16262, Grade III	
	C91300	B505	B22, A	190	7322A	QQ-C-390, D1		
High tin bronze	C90800							
	C91100	B22						
	C91600	B427				QQ-C-390, F1		
Leaded tin bronze	C92200	B505	B61	J461	J462	QQ-C-390, D4	MIL-B-11553, Comp 1	Navy M bronze
	C92300	B505	B143, 2B	622	J461	QQ-B-1005, Comp 1	MIL-B-11553, Comp 6	
	C92700	B505		621	J462	QQ-C-390, D3		
	C92800	B505		63	J461			
Nickel phosphor bronze	C92500	B505		J461	J462			Ring metal
	C92900	B505	B427, D					
Leaded tin bronze	C93200	B505	B144, 3B	J461	J462	QQ-C-390, E7	MIL-B-11553, Comp 12	Bearing bronze
	C93400	B505		660	J462			
High-leaded tin bronze	C93500	B505	B144, 3C	J461	J462	QQ-C-390, E8	MIL-B-11553, Comp 8	Bearing bronze: 80-10-10 bronze Anti-acid metal: SAE 67
	C93600	B505		66	J461	QQ-B-1005, Comp 8	MIL-B-11553, Comp 14	
	C93700	B505	B22, C	64	J461	QQ-C-390, E10	MIL-B-11553, Comp 23	
	C93800	B505	B66	715		QQ-C-390, E6	MIL-B-11553, Comp 19	

Continuous-cast specification cross reference continued

Product description	CDA	ASTM	Asarcon	SAE	AMS	Federal	Military	Other designation
High-headed tin bronze continued	C93900	B505	616	J461	J462	QQ-C-390, E4	MIL-B-11553, Comp 13	79-6-15
	C94000	B505	520	67	J462	QQ-C-390, E2	MIL-B-16261, Grade X	
	C94100	B505		J461	J462	QQ-C-390, E5	QQ-C-390, E1	
	C94300	B505		J461	J462	QQ-B-1005, Comp 13	QQ-B-1005, Comp 18	MIL-B-16261, Grade V
Nickel-tin bronze	C94700	B505	50N	J461	J462	QQ-C-390, F2		Cast nickel-tin bronze
	C94700HT	B505	50N	J461	J462	QQ-C-390, F2		Cast nickel-tin bronze
Leaded nickel-tin bronze	C94800	B505	51N			QQ-C-390, F3		
Aluminum bronze	C95200	B505		J461	J462	QQ-C-390, G6	MIL-B-16033, Class 1	Aluminum bronze 9A
	C95300	B505		J461	J462	QQ-C-390, G7	MIL-B-16033, Class 2	Aluminum bronze 9B
	C95300HT	B505		J461	J462	QQ-C-390, G7	MIL-B-16033, Class 2	Aluminum bronze 9B
	C95400	B505		J461	J462	QQ-C-390, G5	MIL-B-16033, Class 3	Aluminum bronze 9C
	C95400HT	B505		J461	J462	QQ-C-390, G5	MIL-B-16033, Class 3	Aluminum bronze 9C
	C95410	B505		J461	J462	QQ-C-390, G5	MIL-B-16033, Class 3	Aluminum bronze 9C
	C95410HT	B505		J461	J462	QQ-C-390, G5	MIL-B-16033, Class 3	Aluminum bronze 9C
	C95900	B505		J461	J462	QQ-C-390, G3	MIL-B-16033, Class 4	Aluminum bronze 9D
	CONCAST380	B505		J461	J462	QQ-C-390, G3	MIL-B-16033, Class 4	Aluminum bronze 9D
	C95500	B505		J461	J462	QQ-C-390, G3	MIL-B-16033, Class 4	Aluminum bronze 9D
Nickel aluminum bronze	C95500HT	B505		J461	J462	QQ-C-390, G3		
	C95510	B505		J461	J462	4880		
	C95520HT	B148		J461	J462	4881		
	C95600	B505		J461	J462	QQ-C-390B, Type III		
Copper-nickel	C96400	B505				QQ-C-390, G8		Alpha nickel-aluminum bronze
	C96900HT	B505				QQ-C-390, X9		70-30 copper nickel
Nickel silver bronze	C93700	B505						15% nickel silver
	C97800	B505						20% nickel silver dairy metal 25% nickel silver
Special alloy	C99500	B505						

Note: HT = heat treated.

Continuous-cast application cross reference

Application	Recommended alloys (copper alloy UNS no.)						
acid resisting applications	C93800						
acid-resistant pumps	C95200						
air actuators	C83600						
air line fittings	C84800						
air/gas/water fittings	C83800						
aircraft components	C95500						
applications requiring acid resistance to sulfite fluids	C93700						
automotive fittings	C93200						
automotive synchronizer rings	C92500						
backing for babbitt-lined bearings	C93500						
backs for lined bearings	C89320	C93600					
backs for lined journal bearings for locomotives	C93800						
backs for lined journal bearings for passenger cars	C93800						
bearing cage blanks	C86400						
bearing liners	C95200						
bearing segments for steel industry	C83600	C95300	C95400				
bearings	C86400	C86700	C90300	C90500	C90700	C90810	C91000
	C91100	C91300	C91600	C92200	C92300	C92700	C93200
	C93400	C93500	C93700	C93800	C93900	C94700	C94800
	C95200	C95400	C95410				
bearings for cranes	C93200						
bearings for heavy loads and relatively slow speeds	C90700						
bearings plates	C93700						
bearings requiring abrasion resistance /good ductility/retention of hardness at moderate temperatures	C95510						
bells	C91300						
boat parts	C84400	C86200	C86300	C86400	C86500		
brackets	C86200	C86300	C86500	C86700	C93700		
bridge pins	C86300						
bushings	C83600	C83800	C84200	C86200	C86300	C86400	C89325
	C90300	C90500	C91100	C91300	C91600	C92200	C92300
	C92700	C92800	C93200	C93400	C93700	C95200	C95400
	C95410	C95500	C95510	C95800			
bushings for corrosion/lubrication/pressure	C93600						
bushings for high speed and heavy pressure	C93700						
cable connectors	C95600						
cam bushings for diesel engines	C89320	C93600					
cams	C86200	C86300	C86400	C86700	C92900		
cases for dead bolt locks	C84400						
circuit breaker parts	C94700						
clamps	C86200	C86300	C86500	C90500			
cocks	C84800						
cold rolling metal dies and guides where a hardness minimum is specified	C380						
compressors	C86500						
connectors	C90500	C95300					
cooling equipment	C83600	C84400	C92200				
corrosion-resistant castings	C92800	C93400	C93500	C93700			
corrosion-resistant/pressure-tight castings	C89831	C89833					
couplings	C83600	C84200					
covers for marine hardware	C86300	C86400	C86500	C95200	C95300	C95400	C95500
	C95800						
crank shafts	C93700						
crankshaft main bearings	C89320	C93600					
cryogenic valves	C92200						
dead bolt locks	C84400						
deep well pump bowl bushings	C89320						
deep well pump line shaft bearings	C89320	C93600					
die components	C95900						

Continuous-cast application cross reference continued

Application	Recommended alloys (copper alloy UNS no.)						
diesel engine wrist pin bushings	C93200						
door hardware for prisons	C84400	C85700	C86500				
elbows	C84200	C95800					
elbows/flanges/pump bodies/valves used for sea water corrosion resistance	C96400						
electric motor bearings	C89320	C93600					
electrical components	C86300	C86400					
electrical equipment	C86400						
electrical hardware	C86500	C95200	C95500				
electrical parts	C99500						
expansion bearings	C90500						
faucets	C83600	C84800	C87850	C89835			
feeding mechanisms	C94700						
finishing dies for wood pulp industry	C90500						
fittings	C84800	C86400	C86700	C91600	C93200	C96400	
fittings for dairy and food processing	C97800						
fittings for oil lines	C84200						
fittings used to 550 °f	C92200						
fittings/valves for potable water	C89844						
fixtures	C83600	C84400	C86400				
flanges	C85700						
flow monitor valves	C93600						
forging press toggle lever bearings	C93200						
forming dies for wood pulp industry	C86300	C86500					
frames	C86200	C86300	C86500				
freight car bearings	C93800						
fuel pump bushings	C93200						
furnaces	C83600						
gas line fittings	C84800						
gear blanks	C90300	C90500					
gear boxes	C90700						
gear components	C94800						
gears	C86200 C91700 C95200 C95900	C86300 C92200 C95300	C86500 C92300 C95400	C90500 C92500 C95410	C90700 C92700 C95500	C90810 C92900 C95600	C91600 C94700 C95800
gears for mining equipment	C99500						
general hardware	C84200	C84800					
general purpose bushings	C93200						
general service bearings for moderate pressure	C93800						
general utility bearings	C89320						
general-service bearings	C92900						
gibs	C86300	C95900					
glands	C95500						
glass molds	C95500						
government fittings	C95400	C95500					
guide bushings for piston rods	C89320	C93600					
guide bushings for valves	C89320	C93600					
gun mounts	C86200	C95200					
gun slides	C95200						
handgun recoil mechanisms	C95500						
handles for dental equipment	C83600						
hardware	C83600	C83800	C84400	C84800	C97600	C97800	
heating equipment	C83600	C84400	C92200				
heavily loaded worm gears	C95400						
heavy construction equipment	C90300	C90500					

Continuous-cast application cross reference continued

Application	Recommended alloys (copper alloy UNS no.)					
heavy load/relatively slow-speed bearings	C91700					
heavy-duty bearings	C92700					
high pressure hydraulic equipment	C92300					
high speed/heavy load bearings	C93700					
high-pressure steam equipment	C92300					
high-speed bearings for light loads	C94000	C94300				
high-speed/high-pressure bearings	C89325	C89831				
high-speed/light-load bushings	C93500					
high-speed/light-to-medium-pressure bushings	C94000	C94300				
high-strength clamps	C95200	C95300	C95400			
high-strength machine parts	C86200	C86300				
high-temperature applications	C95300					
hollow conductors	C91100					
hooks	C86200	C86300	C86500			
hot mill guides	C95200	C95500				
housings	C89835					
hydrant parts	C95200					
hydraulic cylinder parts	C86300					
hydraulic gland seals	C89320	C93600				
hydraulic press main lining	C93200					
hydraulic press stuffing box	C93200					
hydraulic seal components	C95510					
impellers	C83600	C89831	C89833	C93700		
impellers for mine water	C92900					
industrial centrifuges	C93800					
insert bearings	C93200					
landing gear bushings and bearings	C95510					
landing gear parts	C95400	C95500				
large bearings for ships	C93700	C93800				
large gear parts	C95200					
large hold-down screws	C83600	C95300	C95400			
large valve stems	C86300					
lead screw nuts	C92700					
lever arms	C86400	C86500	C86700			
light-duty gears	C86400					
lightning protection	C83600					
linkage bushings for presses	C93200					
locomotive bearing parts	C93600					
low pressure fittings	C84400					
low pressure valves	C83600	C84200	C84800			
low-friction/moderate pressure bushings	C93800					
machine parts	C93800	C95400	C95500			
machine tool bearings	C93200					
machinery	C86500	C95800				
machinery parts	C86400	C86700	C93200	C93700	C94800	
machinery parts (substituted for steel and malleable iron)	C86500					
machinery parts requiring high strength	C86500					
main bearings for presses	C89320	C93600				
main spindle bearings	C93200					
marine applications	C95500					
marine castings	C86200	C92200				
marine engines	C95200					
marine equipment	C95300					
marine fittings	C86400					
marine furniture	C97600					

Continuous-cast application cross reference continued

Application	Recommended alloys (copper alloy UNS no.)						
marine hardware	C84400 C95800	C85700	C86300	C86400	C86700	C95200	C95500
marine products	C83600	C87850					
marine racing propellers	C86200						
mechanical components where aesthetics are important	C85700						
medium-pressure hydraulic equipment	C92200						
medium-pressure steam equipment to 550 °F	C92200						
mild acidic applications	C93500						
mild alkali applications	C95200						
mining machine parts	C95300						
moderate-duty gears	C86700						
motion translation devices	C94800						
musical instrument components	C97800						
musical instruments	C84400	C87500	C86400	C95500			
nozzles	C94700						
nuts	C92200 C93700	C95200	C95400	C95800	C90500	C91600	C92300
nuts for transducers	C84400						
ornamental castings	C97300	C97600	C97800	C92200			
ornamental fixtures	C83600	C84400					
ornamental hardware	C85700						
outboard marine components	C99500						
parts for boats	C83600						
parts for steel maintenance	C93700						
pawl	C95400						
piano keys	C86400	C95500	C97600				
pickling baskets	C95300	C95410					
pickling equipment	C95200	C95500	C95800				
pickling hooks	C95300	C95400	C95410				
pickling tanks	C95200						
pipe fittings	C83600	C84200	C84400	C89835			
piston cylinders	C94700						
piston guides	C95500						
piston pin bearings	C89320	C93600					
piston rings	C90300	C90500	C91000	C91000	C91300	C91600	
plugs	C84200						
piston rings	C90300	C90500	C91000	C91000	C91300	C91600	
plugs	C84200						
piston rings	C90300	C90500	C91000	C91000	C91300	C91600	
plugs	C84200						
piston rings	C90300 C92300	C90500 C92800	C91000	C91000	C91300	C91600	C92200
plugs	C84200						
plumbing	C84200						
plumbing castings	C89520						
plumbing fittings	C84800	C87850					
plumbing fixtures	C84800	C83800					
plumbing goods	C89835						
plungers	C95200						
press dies	C86200						
pressing dies for wood pulp	C86500						
pressure blocks for steel industry	C83600	C95300	C95400				
pressure-tight castings	C93700						
printing presses	C83600						
propeller blades	C95800						
propeller hub	C95800						

Continuous-cast application cross reference continued

Application	Recommended alloys (copper alloy UNS no.)						
propeller wheels	C99500						
propellers	C86300	C86400	C86700	C95200			
propellers for salt and fresh water	C86500						
pump bodies	C90300	C90500	C92900	C93900	C96400		
pump bodies for acid mine water	C93800						
pump components	C89835						
pump fixtures	C83600	C83800	C84400	C86400	C93200	C96400	
pump fluid ends	C95500						
pump impellers	C90300 C93400	C90500	C91600	C92200	C92300	C92700	C93200
pump impellers for acid mine water	C93800						
pump impellers for mine water	C93900						
pump parts	C83600	C92300	C95200	C95400			
pump pistons	C92700						
pump rods	C95200						
pump sleeves	C89320	C93600					
pumps	C83600	C89831	C89833	C93200	C93700	C93800	C97600
pumps used to 550 °f	C92200						
railroad applications	C93800	C94000	C94300				
railroad catenary fittings	C83800						
railroad engine casings	C93800						
restaurant equipment	C90700						
rings	C83600						
rod bushings	C89320	C93600					
roll neck bearings	C93200						
roller bearings	C86400						
rolling mill bearings	C89320	C93200	C93600				
rudders	C86200	C86300	C86500				
sanitary fittings	C97600						
screw down nuts	C86300	C86200	C86400	C86700			
seal rings	C90500						
seals	C89320	C93600					
sewage treatment applications	C95500						
shafts	C86200	C90810	C95800				
shift forks	C94700						
ship building	C95400	C95500	C95800				
ship trim	C85700						
sleeve bushings	C89320						
sleeve bushings (for cranes, etc.)	C93600						
slide bars	C93400						
slide guides for steel mills	C93700						
slow-speed/heavy-load bearings	C86300						
small gears	C83600	C84200	C89835				
small pump castings	C84200						
soft bushings	C94000	C94300					
soft metal applications	C94000	C94300					
spacer bushings	C89320						
spacer bushings (for pumps, etc.)	C93600						
speed reducers	C90700	C90800					
spur gears	C95400	C95410					
statuary	C97300						
steam castings	C91600						
steam fittings	C90300	C90500	C92700	C96400			
steel mill bushings	C93600						
stops	C84800						

Continuous-cast application cross reference continued

Application	Recommended alloys (copper alloy UNS no.)						
stripped nuts	C95300						
structural castings	C92300	C94800					
structural parts	C86200						
struts	C86200	C86300	C86500				
stuffing box nuts	C95500						
switches	C86300	C86400					
swivel	C90300						
tees	C84200						
terminals	C95600						
thrust bearings	C93400						
thrust block	C94100						
thrust pads	C95200						
thrust washers	C93200						
transducer housings	C83600						
trowels for cement working	C83600						
trunnion bearings	C93200						
unions	C84200						
valve bodies	C83600 C95300	C90300 C95400	C90500 C95500	C90700 C95800	C91300	C92300	C95200
valve bodies for the water industry	C84400						
valve bodies for the water meter industry	C83600						
valve bodies for water	C87850						
valve components	C92200	C94700	C95410	C95500			
valve guides	C95400	C95500					
valve seat	C84400	C95200	C95400	C95500			
valve stems	C86200	C86400	C86700	C95600	C99500		
valves	C83600 C97300	C83800 C97600	C84400 C97800	C90300	C90500	C95200	C95400
valves for the water meter industry	C83600						
valves for water meters	C84400	C92200					
valves in contact with sea water	C95800						
washers	C84800	C89320	C93200	C93400			
washers for engines	C93700						
water conditioners	C90500						
water meter cases	C87850						
water pump bushings	C93200						
water pump impellers	C89835						
wear guides	C94700						
wear plates	C92900	C95200	C95500	C95800			
wear rings for forming dies for wood pulp industry	C86300						
wear rings for pressing dies for wood pulp industry	C86200	C86500					
wearing material for rod bushings	C93800						
wearing material for shoes	C93800						
wearing material for wedges	C93800						
weld guns	C86500	C95400					
welding jaws	C95200	C95300	C95500				
window hardware	C85700	C86400	C95500	C97600			
worm drives	C95900						
worm gears	C86200 C95400	C90500	C90700	C90800	C90810	C91700	C92900
worm wheels	C90700	C91700	C95200	C95500	C95800		
worms	C95200	C95410	C95500	C95600	C95800		
wrist pin bushings	C89320	C93600					

Continuous-cast hardness ratings

Copper alloy UNS no.	Product description	Hardness type	Typical or minimum	Hardness
C94300	High-leaded tin bronze	Brinell 500 kg load	Typical	45
C94100	High-leaded tin bronze	Brinell 500 kg load	Typical	50
C89520	Bismuth tin bronze	Brinell 500 kg load	Minimum	54
C84400	Leaded semi-red brass	Brinell 500 kg load	Typical	55
C84800	Leaded semi-red brass	Brinell 500 kg load	Typical	55
C89831	Bismuth tin bronze	Brinell 500 kg load	Typical	55
C89844	Bismuth tin bronze	Brinell 500 kg load	Typical	55
C93800	High-leaded tin bronze	Brinell 500 kg load	Typical	55
C97300	Nickel silver bronze	Brinell 500 kg load	Typical	55
C83600	Leaded red brass	Brinell 500 kg load	Typical	60
C83800	Leaded red brass	Brinell 500 kg load	Typical	60
C84200	Leaded semi-red brass	Brinell 500 kg load	Typical	60
C89833	Bismuth tin bronze	Brinell 500 kg load	Typical	60
C93400	High-leaded tin bronze	Brinell 500 kg load	Typical	60
C93500	High-leaded tin bronze	Brinell 500 kg load	Typical	60
C93700	High-leaded tin bronze	Brinell 500 kg load	Typical	60
C93900	High-leaded tin bronze	Brinell 500 kg load	Typical	63
C89835	Bismuth tin bronze	Brinell 500 kg load	Typical	65
C92200	Leaded tin bronze	Brinell 500 kg load	Typical	65
C93200	Leaded tin bronze	Brinell 500 kg load	Typical	65
C93600	High-leaded tin bronze	Brinell 500 kg load	Typical	65
C89320	Bismuth tin bronze	Brinell 500 kg load	Typical	70
C90300	Tin bronze	Brinell 500 kg load	Typical	70
C92300	Leaded tin bronze	Brinell 500 kg load	Typical	70
C89325	Bismuth tin bronze	Brinell 500 kg load	Typical	73
C85700	Leaded yellow brass	Brinell 500 kg load	Typical	75
C90500	Tin bronze	Brinell 500 kg load	Typical	75
C92900	Leaded nickel-tin bronze	Brinell 500 kg load	Typical	75
C92700	Leaded tin bronze	Brinell 500 kg load	Typical	77
C92500	Nickel-phosphor bronze	Brinell 500 kg load	Typical	80
C94000	High-leaded tin bronze	Brinell 500 kg load	Typical	80
C94800	Leaded nickel-tin bronze	Brinell 500 kg load	Typical	80
C97600	Nickel silver bronze	Brinell 500 kg load	Typical	80
C91600	High tin bronze	Brinell 500 kg load	Typical	85
C94700	Nickel-tin bronze	Brinell 500 kg load	Typical	85
C86400	Manganese bronze	Brinell 500 kg load	Typical	90
C90800	Tin bronze	Brinell 500 kg load	Typical	95
C90810	Tin bronze	Brinell 500 kg load	Typical	95
C91700	High tin bronze	Brinell 500 kg load	Typical	95
C90700	Tin bronze	Brinell 500 kg load	Typical	102
C87850	Silicon brass	Brinell 500 kg load	Minimum	103
C91000	Tin bronze	Brinell 500 kg load	Typical	105
C92800	Leaded tin bronze	Rockwell "B"	Minimum	72*
C95300	Aluminum bronze	Brinell 3000 kg load	Typical	125
C95200	Aluminum bronze	Brinell 3000 kg load	Typical	125
C86500	Manganese bronze	Brinell 3000 kg load	Typical	130
C97800	Nickel silver bronze	Brinell 3000 kg load	Typical	130
C95300HT	Aluminum bronze	Brinell 3000 kg load	Typical	132
C91100	High tin bronze	Brinell 3000 kg load	Typical	135
C95600	Nickel-aluminum bronze	Brinell 3000 kg load	Typical	140

*Brinell equivalent 114 (500 kg load). Note: HT = heat treated.

Continuous-cast hardness ratings continued

Copper alloy UNS no.	Product description	Hardness type	Typical or minimum	Hardness
C96400	Copper-nickel	Brinell 3000 kg load	Typical	140
C99500	Special alloy	Brinell 500 kg load	Typical	145
C86700	Manganese bronze	Brinell 3000 kg load	Typical	155
C95800	Nickel-aluminum bronze	Brinell 3000 kg load	Typical	159
C91300	Tin bronze	Brinell 3000 kg load	Typical	160
C95400	Aluminum bronze	Brinell 3000 kg load	Typical	170
C95410	Aluminum bronze	Brinell 3000 kg load	Typical	170
C95400HT	Aluminum bronze	Brinell 3000 kg load	Typical	177
C95410HT	Aluminum bronze	Brinell 3000 kg load	Typical	177
C86200	Manganese bronze	Brinell 3000 kg load	Typical	180
C94700HT	Nickel-tin bronze	Brinell 3000 kg load	Typical	180
C95510 (AMS 4880)	Nickel-aluminum bronze	Brinell 3000 kg load	Minimum	192
C95500	Nickel-aluminum bronze	Brinell 3000 kg load	Typical	208
C86300	Manganese bronze	Brinell 3000 kg load	Typical	223
C95500HT	Nickel-aluminum bronze	Brinell 3000 kg load	Typical	228
C95900	Aluminum bronze	Brinell 3000 kg load	Minimum	241
C95520HT	Nickel-aluminum bronze	Brinell 3000 kg load	Minimum	262
C96900HT	Nickel-tin bronze	Rockwell "C"	Minimum	32*
CONCAST380	Aluminum bronze	Brinell 3000 kg load	Minimum	340

*Brinell equivalent 301 (3000 kg load). Note: HT = heat treated.

Continuous-cast machinability ratings

Copper alloy UNS no.	Product description	Machinability
C83800	Leaded red brass	90
C84400	Leaded semi-red brass	90
C84800	Leaded semi-red brass	90
C89520	Bismuth tin bronze	85
C89831	Bismuth tin bronze	85
C83600	Leaded red brass	84
C89833	Bismuth tin bronze	81
C84200	Leaded semi-red brass	80
C85700	Leaded yellow brass	80
C89320	Bismuth tin bronze	80
C89325	Bismuth tin bronze	80
C93600	High-leaded tin bronze	80
C93700	High-leaded tin bronze	80
C93800	High-leaded tin bronze	80
C93900	High-leaded tin bronze	80
C94000	High-leaded tin bronze	80
C94100	High-leaded tin bronze	80
C94300	High-leaded tin bronze	80
C87850	Silicon brass	70
C89835	Bismuth tin bronze	70
C89844	Bismuth tin bronze	70
C92800	Leaded tin bronze	70
C93200	Leaded tin bronze	70
C93400	High-leaded tin bronze	70
C93500	High-leaded tin bronze	70
C97300	Nickel silver bronze	70
C97600	Nickel silver bronze	70
C86400	Manganese bronze	65
C95400	Aluminum bronze	60
C95400HT	Aluminum bronze	60
C95410	Aluminum bronze	60
C95410HT	Aluminum bronze	60
C95600	Nickel-aluminum bronze	60

Copper alloy UNS no.	Product description	Machinability
C97800	Nickel silver bronze	60
C86700	Manganese bronze	55
C95300	Aluminum bronze	55
C95300HT	Aluminum bronze	55
C94800	Leaded nickel-tin bronze	50
C95500	Nickel-aluminum bronze	50
C95500HT	Nickel-aluminum bronze	50
C95510 (AMS 4880)	Nickel-aluminum bronze	50
C99500	Special alloy	50
C92700	Leaded tin bronze	45
C95520HT	Nickel-aluminum bronze	45
C92200	Leaded tin bronze	42
C92300	Leaded tin bronze	42
C92900	Leaded nickel-tin bronze	40
C86200	Manganese bronze	30
C90300	Tin bronze	30
C90500	Tin bronze	30
C92500	Nickel phosphor bronze	30
C86500	Manganese bronze	26
C90700	Tin bronze	20
C90810	High tin bronze	20
C91000	Tin bronze	20
C91600	High tin bronze	20
C91700	High tin bronze	20
C94700	Nickel-tin bronze	30
C94700HT	Nickel-tin bronze	30
C95200	Aluminum bronze	20
C95800	Nickel-aluminum bronze	20
C96400	Copper-nickel	20
C91100	High tin bronze	10
C91300	Tin bronze	10
C95900	Aluminum bronze	10
C86300	Manganese bronze	8

Note: HT = heat treated.

Corrosion ratings of continuous-cast copper alloys in various media

Ratings: A = Recommended B = Acceptable C = Not recommended

Corrosive medium	Copper	Tin bronze	Leaded tin bronze	High-leaded tin bronze	Leaded red brass	Leaded semi-red brass	Leaded yellow brass	Leaded high-strength yellow brass	High-strength yellow brass	Aluminum bronze	Leaded nickel brass	Leaded nickel bronze	Silicon bronze	Silicon brass
Acetate solvents	B	A	A	A	A	A	B	A	A	A	A	A	A	B
Acetic acid														
20%	A	C	B	C	B	C	C	C	C	A	C	A	A	B
50%	A	C	B	C	B	C	C	C	C	A	C	B	A	B
Glacial	A	A	A	C	A	C	C	C	C	A	B	B	A	A
Acetone	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Acetylene ¹	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Alcohols ²	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Aluminum chloride	C	C	C	C	C	C	C	C	C	B	C	C	C	C
Aluminum sulfate	B	B	B	B	B	C	C	C	C	A	C	C	A	A
Ammonia, moist gas	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Ammonia, moisture-free	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Ammonium chloride	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Ammonium hydroxide	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Ammonium nitrate	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Ammonium sulfate	B	B	B	B	B	C	C	C	C	A	C	C	A	A
Aniline and aniline dyes	C	C	C	C	C	C	C	C	C	B	C	C	C	C
Asphalt	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Barium chloride	A	A	A	A	A	C	C	C	C	A	A	A	A	C
Barium sulfide	C	C	C	C	C	C	C	C	B	C	C	C	C	C
Beer ²	A	A	B	B	B	C	C	C	A	A	C	A	A	B
Beet sugar syrup	A	A	B	B	B	A	A	A	B	A	A	A	B	B
Benzene	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Benzol	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Boric acid	A	A	A	A	A	A	B	A	A	A	A	A	A	A
Butane	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Calcium bisulfite	A	A	B	B	B	C	C	C	C	A	B	A	A	B
Calcium chloride, acid	B	B	B	B	B	B	C	C	C	A	C	C	A	C
Calcium chloride, alkaline	C	C	C	C	C	C	C	C	C	A	C	A	C	B
Calcium hydroxide	C	C	C	C	C	C	C	C	C	B	C	C	C	C
Calcium hypochlorite	C	C	B	B	B	C	C	C	C	B	C	C	C	C
Cane sugar syrups	A	A	B	A	B	A	A	A	A	A	A	A	A	B
Carbonated beverages	A	C	C	C	C	C	C	C	C	A	C	C	A	C
Carbon dioxide, dry	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Carbon dioxide, moist ²	B	B	B	C	B	C	C	C	C	A	C	A	A	B
Carbon tetrachloride, dry	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Carbon tetrachloride, moist	B	B	B	B	B	B	B	B	B	B	B	A	A	A
Chlorine, dry	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Chlorine, moist	C	C	B	B	B	C	C	C	C	C	C	C	C	C
Chromic, acid	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Citric, acid	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Copper sulfate	B	A	A	A	A	C	C	C	C	B	B	B	A	A

¹Acetylene forms an explosive compound with copper when moist or when certain impurities are present and the gas is under pressure. Alloys containing less than 65% Cu are satisfactory under this use. When gas is not under pressure other copper alloys are satisfactory.

²Copper and copper alloys resist corrosion by most food products. Traces may be dissolved and affect taste or color. In such cases, copper metals are often tin coated.

Corrosion ratings of continuous-cast copper alloys in various media continued

Ratings: A = Recommended B = Acceptable C = Not recommended

Corrosive medium	Copper	Tin bronze	Leaded tin bronze	High-leaded tin bronze	Leaded red brass	Leaded semi-red brass	Leaded yellow brass	Leaded high-strength yellow brass	High-strength yellow brass	Aluminum bronze	Leaded nickel brass	Leaded nickel bronze	Silicon bronze	Silicon brass
Cottonseed oil ²	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Creosole	B	B	B	B	B	C	C	C	C	A	B	B	B	B
Ethers	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Ethylene glycol	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Ferric chloride, sulfate	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Ferrous chloride, sulfate	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Formaldehyde	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Formic acid	A	A	A	A	A	B	B	B	B	A	B	B	B	C
Freon	A	A	A	A	A	A	A	A	A	A	A	A	A	B
Fuel oil	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Furfural	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Gasoline	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Gelatin ²	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Glucose	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Glue	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Glycerin	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Hydrochloric or muriatic acid	C	C	C	C	C	C	C	C	C	B	C	C	C	C
Hydrofluoric acid	B	B	B	B	B	B	B	B	B	B	B	B	B	B
Hydrofluosilicic acid	B	B	B	B	B	C	C	C	C	B	C	C	B	C
Hydrogen	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Hydrogen peroxide	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Hydrogen sulfide, dry	C	C	C	C	C	C	C	C	C	B	C	C	B	C
Hydrogen sulfide, moist	C	C	C	C	C	C	C	C	C	B	C	C	C	C
Lacquers	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Lacquer thinners	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Lactic acid	A	A	A	A	A	C	C	C	C	A	C	C	A	C
Linseed oil	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Liquors														
Black	B	B	B	B	B	C	C	C	C	B	C	C	B	B
Green	C	C	C	C	C	C	C	C	C	B	C	C	C	B
White	C	C	C	C	C	C	C	C	C	A	C	C	C	B
Magnesium chloride	A	A	A	A	A	C	C	C	C	A	C	C	A	B
Magnesium hydroxide	B	B	B	B	B	B	B	B	B	A	B	B	B	B
Magnesium sulfate	A	A	A	A	B	C	C	C	C	A	C	B	A	B
Mercury and mercury salts	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Milk ²	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Mosasses ²	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Natural gas	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Nickel chloride	A	A	A	A	A	C	C	C	C	B	C	C	A	C
Nickel sulfate	A	A	A	A	A	C	C	C	C	A	C	C	A	C
Nitric acid	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Oleic acid	A	A	B	B	B	C	C	C	C	A	C	A	A	B
Oxalic acid	A	A	B	B	B	C	C	C	C	A	C	A	A	B
Phosphoric acid	A	A	A	A	A	C	C	C	C	A	C	A	A	A
Picric acid	C	C	C	C	C	C	C	C	C	C	C	C	C	C

²Copper and copper alloys resist corrosion by most food products. Traces may be dissolved and affect taste or color. In such cases, copper metals are often tin coated.

Corrosion ratings of continuous-cast copper alloys in various media continued

Ratings: A = Recommended B = Acceptable C = Not recommended

Corrosive medium	Copper	Tin bronze	Leaded tin bronze	High-leaded tin bronze	Leaded red brass	Leaded semi-red brass	Leaded yellow brass	Leaded high-strength yellow brass	High-strength yellow brass	Aluminum bronze	Leaded nickel brass	Leaded nickel bronze	Silicon bronze	Silicon brass
Potassium chloride	A	A	A	A	A	C	C	C	C	A	C	C	A	C
Potassium cyanide	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Potassium hydroxide	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Potassium sulfate	A	A	A	A	A	C	C	C	C	A	C	C	A	C
Propane gas	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Sea water	A	A	A	A	A	C	C	C	C	A	C	C	B	B
Soap solutions	A	A	A	A	B	C	C	C	C	A	C	C	A	C
Sodium bicarbonate	A	A	A	A	A	A	A	A	A	A	A	A	A	B
Sodium bisulfate	C	C	C	C	C	C	C	C	C	A	C	C	C	C
Sodium carbonate	C	A	A	A	A	C	C	C	C	A	C	C	C	A
Sodium chloride	A	A	A	A	A	B	C	C	C	A	C	C	A	C
Sodium cyanide	C	C	C	C	C	C	C	C	C	B	C	C	C	C
Sodium hydroxide	C	C	C	C	C	C	C	C	C	A	C	C	C	C
Sodium hypochlorite	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Sodium nitrate	B	B	B	B	B	B	B	B	B	A	B	B	A	A
Sodium peroxide	B	B	B	B	B	B	B	B	B	B	B	B	B	B
Sodium phosphate	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Sodium sulfate, silicate	A	A	B	B	B	B	C	C	C	A	C	C	A	B
Sodium sulfide, thiosulfate	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Stearic acid	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Sulfur, solid	C	C	C	C	C	C	C	C	C	A	C	C	C	C
Sulfur chloride	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Sulfur dioxide, dry	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Sulfur dioxide, moist	A	A	A	B	B	C	C	C	C	A	C	C	A	B
Sulfur trioxide, dry	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Sulfuric acid														
78% or less	B	B	B	B	B	C	C	C	C	A	C	C	B	B
78% to 90%	C	C	C	C	C	C	C	C	C	B	C	C	C	C
90% to 95%	C	C	C	C	C	C	C	C	C	B	C	C	C	C
Fuming	C	C	C	C	C	C	C	C	C	A	C	C	C	C
Tannic acid	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Tartaric acid	B	A	A	A	A	A	A	A	A	A	A	A	A	A
Toluene	B	B	A	A	A	B	B	B	B	B	B	B	B	A
Trichlorethylene, dry	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Trichlorethylene, moist	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Turpentine	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Varnish	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Vinegar	A	A	B	B	B	C	C	C	C	B	C	C	A	B
Water, acid mine	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Water, condensate	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Water, potable	A	A	A	A	A	A	B	B	B	A	A	A	A	A
Whiskey ²	A	A	C	C	C	C	C	C	C	A	C	C	A	C
Zinc chloride	C	C	C	C	C	C	C	C	C	B	C	C	B	C
Zinc sulfate	A	A	A	A	A	C	C	C	C	B	C	A	A	C

²Copper and copper alloys resist corrosion by most food products. Traces may be dissolved and affect taste or color. In such cases, copper metals are often tin coated.

Extruded or cast and drawn product chemical composition

Copper alloy UNS no.	ASTM spec	AMS spec	Product description	Cu (%)	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%)	Ni (%)	Al (%)	Co (%)	Cr (%)	Mn (%)	Si (%)	As (%)	Te (%)
C14500*	B301		Tellurium copper	99.90 min ³					0.004-0.012								0.40-0.70
C23000	B927		Red brass 85%	84.00-86.00	0.05		Rem.	0.05									
C24000	B927		Low brass 80%	78.50-81.50	0.05		Rem.	0.05									
C26000	B927		Cartridge brass 70%	68.50-71.50	0.07		Rem.	0.05									
C31400*	B140		Leaded commercial bronze	87.50-90.50	1.30-2.50		Rem.	0.10		0.70							
C31600	B140		Leaded commercial bronze (nickel-bearing)	87.50-90.50	1.30-2.50		Rem.	0.10	0.04-0.10	0.70-1.20							
C46400	B21		Naval brass, uninhibited	59.00-62.00	0.20	0.50-1.00	Rem.	0.10									
C51000*	B139	4625	Phosphor bronze 5% A	Rem.	0.05	4.20-5.80	0.30	0.10	0.03-0.35								
C52100	B139		Phosphor bronze 8% A	Rem.	0.05	7.00-9.00	0.20	0.10	0.03-0.35								
C53400	B139		Phosphor bronze B-1	Rem.	0.08-1.20	3.50-5.80	0.30	0.10	0.03-0.35								
C54400*	B139		Phosphor bronze B-2	Rem.	3.00-4.00	3.50-4.50	1.50-4.50	0.10	0.01-0.50								
C62400	B150		Aluminum bronze 11%	Rem.		0.20		2.00-4.50			10.00-11.50			0.30	0.25		
C63000*	B150	4640	Nickel-aluminum bronze	Rem.		0.20	0.30	2.00-4.00		4.00-5.50 ²	9.00-11.00			1.50	0.25		
C63020*	B150	4590	Nickel-aluminum bronze	Rem.	0.03	0.25	0.30	4.00-5.50		4.20-6.00	10.00-11.00	0.20	0.05	1.50	0.15		
C64200*	B150	4634	Aluminum bronze	Rem.	0.05	0.20	0.50	0.30		0.25 ²	6.30-7.60			0.10	1.50-2.20	0.09	

*Standard-stocked alloy. ¹Cu value includes Ag. ²Ni value includes Co. ³Includes tellurium and phosphorus
 Note: Unless otherwise noted, single values represent maximums.

Extruded or cast and drawn chemical composition continued

Copper alloy UNS no.	ASTM spec	AMS spec	Product description	Cu (%)	Pb (%)	Sn (%)	Zn (%)	Fe (%)	P (%)	Ni (%) ²	Al (%)	Co (%)	Cr (%)	Mn (%)	Si (%)	As (%)	Te (%)
C64210	B150		Aluminum silicon bronze	Rem. ¹	0.05	0.20	0.50	0.30		0.25 ²	6.30-7.60			0.10	1.50-2.00	0.09	
C65100	B98		Low-silicon bronze B	Rem. ¹	0.05		1.50	0.80						0.70	0.80-2.00		
C67300*†			Manganese bronze	58.00-63.00 ¹	0.40-3.00	0.30	Rem.	0.50		0.25 ²	0.25			2.00-3.50	0.50-1.50		
C67400 ¹			Manganese bronze	57.00-60.00	0.50	0.30	Rem.	0.35		0.25 ²	0.50-2.00			2.00-3.50	0.50-1.50		
C67410			Manganese bronze	55.00-59.00 ¹	0.80	0.50	Rem.	1.00		2.00	1.30-2.30			1.00-2.40	0.70-1.30		
C67600	B138		Manganese bronze	57.00-60.00 ¹	0.50-1.00	0.50-1.50	Rem.	0.40-1.30						0.05-0.50			
C69300	B371		Lead-free brass	73.00-77.00 ¹	0.02 ² -0.09	0.20	Rem.	0.10	0.04-0.15	0.10			0.10	2.70-3.40			
C69400	B371		Silicon red bronze	80.00-83.00 ¹	0.30		Rem.	0.20							3.50-4.50		
C69430	B371		Silicon red bronze	80.00-83.00 ¹	0.30		Rem.	0.20							3.50-4.50	0.03-0.06	
C72900* ^B		4596	Copper nickel-tin bronze	Rem.	0.02	7.50-8.50	0.50	0.50		14.50-15.50 ²				0.30			
C72900* ^B		4597	Copper nickel-tin bronze	Rem.	0.02	7.50-8.50	0.50	0.50		14.50-15.50 ²				0.30			
C72900* ^B		4598	Copper nickel-tin bronze	Rem.	0.02	7.50-8.50	0.50	0.50		14.50-15.50 ²				0.30			

*Standard-stocked alloy. ¹SAE J4633 specification. ²Cu value includes Ag. ³Ni value includes Co. ⁴Pb content is greater than 0.02%. ⁵Chemical requirements for other elements: Cb 0.10%, max and Mg 0.15%, max.
 Note: Single values represent maximums.

Extruded or cast and drawn typical uses

Copper alloy UNS no.	Product description	Architecture	Automotive	Builders hardware	Consumer	Electrical	Fasteners	Industrial	Marine	Ordnance	Other	Plumbing
C14500	Tellurium copper	fire protection			badges, coinage, compacts, costume jewelry, dials, fire extinguisher cases, lipstick containers, nameplates, plaques, rouge boxes, tokens, zippers	electrical connectors, motor parts, soldering copper, switch parts, transistor bases	eyelets, fasteners	forgings, furnace brazed products, screw machine products, soldering tips, welding torch tips				fixtures, plumbing fittings, sprinkler heads
C23000	Red brass 85%	etching parts, trim, weather strip		kick plates	badges, coinage, jewelry, dials, fire extinguisher cases, lipsticker containers, nameplates, plaques, rouge boxes, tokens, zippers	conduit, rotor bars (AC motors), screw shells, sockets		condensor tubes, fire extinguishers, flexible metal hose, heat exchanger shells, heat exchanger pickling crates, pump cylinder liners, radiator cores, tags, tubing for heat exchangers, tubing for instrumentation			fire hose couplings	fittings, j-bends, pipe, pipe nipples, pipe service lines, pump lines, service lines, traps
C24000	Low brass 80%	medallions, ornamental components, spandrels		decorative panels	clock dials, musical instrument parts, plaques	battery caps, rotor bars for AC motors		flexible hose, flexible hose bellows, pump lines, welding wire			tokens	
C26000	Cartridge brass 70%	grillwork	odometer contacts, heater cores, thermostats, electrical connectors, radiator cores, radiator tube, radiator tanks	locks, push plates, finish hardware, kick plates, decorative hardware, door knobs, hinges	snaps, planters, fireplace screens, etched articles, bird cages, coinage, chain links, pen/pencil inserts and clips, syringe parts, watch parts, costume jewelry, buttons, shells, electrical sockets, lamps	terminal connectors, flashlight shells, lamp fixtures, reflectors, screw shells	pins, rivets, fasteners, grommets, eyelets, screws	air pressure conveyor systems, sound proofing equipment, springs, chain, bead chain, tubing for instruments and machines, heat exchangers, pump cylinders, wire screens, pumps, liners, power cylinders		ammunition cartridge cases, mechanical housings for lighters, mechanical housings for ammunition, ammunition	stencils, washers	fittings, bathroom fixtures, plumbing accessories, faucets, escutchions, traps, plumbing, brass goods
C31400	Leaded commercial bronze			door knobs		electrical plug type connectors, connectors for wire and cable	nuts, screws	pickling crates, pickling fixtures, pickling racks, screw machine parts				
C31600	Leaded commercial bronze (nickel-bearing)			hardware		connectors	fasteners, nuts, screws	screw machine parts				
C46400	Naval brass, uninhibited			lock pins		precision shipboard equipment	bolts, nuts, rivets	aircraft turbuckle barrels, balls, bearings, bushings, condenser plates, dies for golf ball production, heat exchanger tubes, hub cones, pressure vessels, structural uses, valve stems, welding rod	decorative fittings, hardware, propeller shafts, shafting, turbuckles	missile components	baffle plates and flanges	fittings
C51000	Phosphor bronze 5% A	bridge bearing plates			resistance wire, fuse clips, electromechanical spring components, electrical flexing contact blades, electronic connectors, wire brushes, switch parts, electronic and precision instrument parts		fasteners, cotter pins, lock washers	bourdon tubes, bellows, perforated sheets, chemical hardware, truss wire, springs, sleeve bushings, diaphragms, clutch disks, pressure responsive elements, beater bar, textile machinery, welding rods				

Extruded or cast and drawn typical uses continued

Copper alloy UNS no.	Product description	Aerospace	Architecture	Automotive	Builders hardware	Consumer	Electrical	Fasteners	Industrial	Marine	Other	Plumbing
C52100	Phosphor bronze 8% C		bridge bearing plates		thermostat bellows	power conductor for electro-surgical pencil, coinage, cymbals	electronic connectors, electrical connectors, cold headed parts, electrical flexing contact blades, electrical flexing contact blades, wire brushes, switch parts, fuse clips	coiler pins, fasteners, heavy duty, lock washers	cold headed parts, thrust bearings, truss wire, pneumatic hammers, doctor blades, paper industry, bournon tubing, well drill equipment, clutch disks, welding wire, diaphragms, beater bar, bellows, springs, helical extension springs, helical torsion, clips, heavy duty, gears, pinions, textile machinery, perforated sheets, chemical hardware, springs, heavy duty, sleeve bushings	marine parts		
C53400	Phosphor bronze B-1								bushings, bearings, fasteners			
C54400	Phosphor bronze B-2						electrical connectors		bushings, gears, pinions, screw machine products, thrust washers, valve parts, sleeve bearings, thrust bearings, bearings, shafts			
C62400	Aluminum bronze 11%							nuts	bushings, cams, drift pins, gears, hydraulic bushings, support bushings, tie rods, valve balls, wear plates, welding wire			
C63000 (AMS 4640)	Nickel-aluminum bronze								balls, bearings, bushings, cams, condenser tube for power stations and desalting units, corrosion resistant articles, gears, heat exchanger flanges, hydraulic bushings for earth moving equipment, plunger tips, pump parts, pump shafts, shafting, structural members, tanks, valve balls, valve guides, valve seats, welded piping systems	nuts, propeilers, pump parts, ship bolts, propellers		faucets
C63020 (AMS 4590)	Nickel-aluminum bronze								bearings, forming dies for roll bearings, hydraulic bushings for earth moving equipment, valve balls, valve parts- cryogenic, dies			
C64200 (AMS 4634)	Aluminum bronze			valve guides, automobile engine			pole line hardware	bolts, nuts	cams, gears, valve bodies, valve components, valve stems	hardware		
C64210	Aluminum silicon bronze						pole line hardware		bushings, aircraft, valve bodies, valve stems, pickling equipment, bearings, high-strength/corrosion-resistant chemical process equipment	nuts, bolts, lock washers, screws		
C65100	Low-silicon bronze B						conduit, pole line hardware, motor, rotor bars	bolts, cable clamps, cap screws, machine screws, nuts, rivets, u bolts, fasteners, screws	oil refinery plumbing tube, heat exchanger tube, welding rod, hydraulic pressure lines	hardware		
C67300	Manganese bronze							fasteners, lead screw nuts	bearings, bushings, drive shafts, gears/cams, idler pins, piston heads, propeller shafts, pump parts, seal rings, shaft bushings, sleeve bearings, spindles, thrust bearings, wear plates, clutch bearings	hardware, valve seats	connecting rods	
C67400	Manganese bronze								bushings, cams, chain guides, food conveyor chain, gears, shafts, wear plates		connecting rods	

Extruded or cast and drawn typical uses continued

Copper alloy UNS no.	Product description	Aerospace	Automotive	Electrical	Industrial	Marine	Oil and gas	Other
C67410	Manganese bronze				bushings, cams, chain guides, food conveyor chain, gears, shafts, wear plates			connecting rods
C67600	Manganese bronze				gate valve stems, valve balls, welding rod			
C69300	Lead-free brass		fluid connectors, sensor bodies, thermostat parts					
C69400	Silicon red brass				valve stems			
C69430	Silicon red brass				valve stems			
C72900 (AMS 4596)	Copper nickel-tin bronze	landing gear bushings and bearings, control surface and actuator bushings and bearings, wing flap bearings, wheel bearings, brakes, door hardware, hydraulic actuators, valves, steering joints, helicopter controls, compression fit airframe fasteners, electronic system connectors		connectors, contacts, controls, miniaturized sockets, relay elements, switches	springs, wire	marine components	bushings, bearings, drilling components, sucker rod, valve guide bushing couplings	
C72900 (AMS 4597)	Copper nickel-tin bronze	landing gear bushings and bearings, control surface and actuator bushings and bearings, wing flap bearings, wheel bearings, brakes, door hardware, hydraulic actuators, valves, steering joints, helicopter controls, compression fit airframe fasteners, electronic system connectors		connectors, contacts, controls, miniaturized sockets, relay elements, switches	springs, wire	marine components	bushings, bearings, drilling components, sucker rod, valve guide bushing couplings	
C72900 (AMS 4598)	Copper nickel-tin bronze	landing gear bushings and bearings, control surface and actuator bushings and bearings, wing flap bearings, wheel bearings, brakes, door hardware, hydraulic actuators, valves, steering joints, helicopter controls, compression fit airframe fasteners, electronic system connectors		connectors, contacts, controls, miniaturized sockets, relay elements, switches	springs, wire	marine components	bushings, bearings, drilling components, sucker rod, valve guide bushing couplings	

Extruded or cast and drawn hardness ratings

Copper alloy UNS no.	Product description	Temper	Hardness type	Typical or min. or max.	Hardness
C14500	Tellurium copper	H02, H04	Brinell 500 kg load	Typical	H02-76, H04-81
C23000	Red brass 85%				
C24000	Low brass 80%	H01, H02, H04	Rockwell "B"	Typical	H01-55, H02-70, H04-82
C26000	Cartridge brass 70%	H01, H02, H04	Rockwell "B"	Typical	H01-55, H02-70, H04-82
C31400	Leaded commercial bronze	H02	Rockwell "B"	Typical	61
C31600	Leaded commercial bronze*	H04	Rockwell "B"	Typical	61
C46400	Naval brass, uninhibited	H02	Rockwell "B"	Min. to max.	55-80
C51000	Phosphor bronze 5% A	H04, H08	Rockwell "B"	Typical	87
C52100	Phosphor bronze 8% C	H04	Rockwell "B"	Typical	93
C53400	Phosphor bronze B-1	H04	Rockwell "B"	Typical	86
C54400	Phosphor bronze B-2	H04	Rockwell "B"	Typical	80
C62400	Aluminum bronze 11%				
C63000 (AMS 4640)	Nickel-aluminum bronze	HR50, TQ50	Brinell 3000 kg load	Min. to max.	187-248
C63020 (AMS 4590)	Nickel-aluminum bronze	TQ50	Rockwell "C"	Min.	26
C64200 (AMS 4634)	Aluminum bronze	HR50	Rockwell "B"	Min.	80
C64210	Aluminum silicon bronze	HR50	Rockwell "B"	Min. to max.	65-100
C65100	Low-silicon bronze B	H02, H04, H06	Rockwell "B"	Min. to max.	60-95
C67300	Manganese bronze	H02	Rockwell "B"	Min.	65
C67400	Manganese bronze		Rockwell "B"	Min.	78
C67410	Manganese bronze				
C67600	Manganese bronze	H02, H04	Rockwell "B"	Typical	90
C69300	Lead-free brass	H02	Rockwell "B"	Max.	85
C69400	Silicon red brass	H02, H04	Rockwell "B"	Typical	95
C69430	Silicon red brass	H02, H04	Rockwell "B"	Typical	95
C72900 (AMS 4596)	Copper nickel-tin bronze	TX 00	Rockwell "C"	Min.	30
C72900 (AMS 4597)	Copper nickel-tin bronze	TX TS	Rockwell "C"	Min.	34
C72900 (AMS 4598)	Copper nickel-tin bronze	TX 00	Rockwell "C"	Min.	30

*(nickel-bearing).

Extruded or cast and drawn machinability ratings

Copper alloy UNS no.	Product description	Machinability
C14500	Tellurium copper	85
C69300	Lead-free brass	85
C31400	Leaded commercial bronze	80
C31600	Leaded commercial bronze (nickel-bearing)	80
C54400	Phosphor bronze B-2	80
C67410	Manganese bronze	80
C53400	Phosphor bronze B-1	70
C67300	Manganese bronze	70
C64200 (AMS 4634)	Aluminum bronze	60
C64210	Aluminum silicon bronze	60
C67600	Manganese bronze	60
C62400	Aluminum bronze 11%	50
C23000	Red brass 85%	30
C24000	Low brass 80%	30
C26000	Cartridge brass 70%	30
C46400	Naval brass, uninhibited	30
C63000 (AMS 4640)	Nickel aluminum bronze	30
C65100	Low-silicon bronze B	30
C67400	Manganese bronze	30
C69400	Silicon red brass	30
C69430	Silicon red brass	30
C51000	Phosphor bronze 5% A	20
C52100	Phosphor bronze 8% C	20
C63020 (AMS 4590)	Nickel aluminum bronze	
C72900 (AMS 4596)	Copper nickel-tin bronze	
C72900 (AMS 4597)	Copper nickel-tin bronze	
C72900 (AMS 4598)	Copper nickel-tin bronze	

Lead-free hardness ratings

Copper alloy UNS no.	Product description	Temper	Hardness type	Typical or min. or max.	Hardness
C89831	Bismuth tin bronze	M07	Brinell 500 kg load	Typical	55
C89844	Bismuth tin bronze	M07	Brinell 500 kg load	Typical	55
C89833	Bismuth tin bronze	M07	Brinell 500 kg load	Typical	60
C89835	Bismuth tin bronze	M07	Brinell 500 kg load	Typical	65
C90300	Tin bronze	M07	Brinell 500 kg load	Typical	70
C89325	Bismuth tin bronze	M07	Brinell 500 kg load	Typical	73
C69300	Lead-free brass	H02	Rockwell "B" hardness	Max.	80
C90800	Tin bronze	M07	Brinell 500 kg load	Typical	95
C90810	High tin bronze	M07	Brinell 500 kg load	Typical	95
C87850	Silicon brass	M07	Brinell 500 kg load	Min.	103
C95400	Aluminum bronze	M07	Brinell 3000 kg load	Typical	170
C95400HT	Aluminum bronze	TQ50	Brinell 3000 kg load	Typical	177
C95500	Nickel-aluminum bronze	M07	Brinell 3000 kg load	Typical	208
C95500HT	Nickel-aluminum bronze	TQ50	Brinell 3000 kg load	Typical	228
C95900	Aluminum bronze	M07	Brinell 3000 kg load	Min.	241

Note: HT = heat treated.

Lead-free machinability ratings

Copper alloy UNS no.	Product description	Machinability
C69300	Lead-free brass	85
C89831	Bismuth tin bronze	85
C89833	Bismuth tin bronze	81
C89325	Bismuth tin bronze	80
C87850	Silicon brass	70
C89835	Bismuth tin bronze	70
C89844	Bismuth tin bronze	70
C90300	Tin bronze	60
C95400	Aluminum bronze	60
C95400HT	Aluminum bronze	50
C95500	Nickel-aluminum bronze	50
C95500HT	Nickel-aluminum bronze	30
C90800	Tin bronze	20
C90810	High tin bronze	20
C95900	Aluminum bronze	10

Note: HT = heat treated.

Chemical symbols for elements

Chemical element	Symbol	Chemical element	Symbol
Aluminum	Al	Magnesium	Mg
Antimony	Sb	Manganese	Mn
Arsenic	As	Mercury	Hg
Beryllium	Be	Nickel	Ni
Bismuth	Bi	Niobium/Columbium	Nb/Cb
Boron	B	Phosphorous	P
Cadmium	Cd	Selenium	Se
Calcium	Ca	Silicon	Si
Carbon	C	Silver	Ag
Chromium	Cr	Sulfur	S
Cobalt	Co	Tellurium	Te
Copper	Cu	Titanium	Ti
Iron	Fe	Tin	Sn
Lead	Pb	Zinc	Zn
Lithium	Li	Zirconium	Zr

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