wieland
concast

Aircraft and aerospace

Wieland Concast

We are a manufacturer of specialty continuous-cast copper alloys. Wieland Concast has achieved a strong and stable market position through a sharp focus on evolving technologies, quality control, and a high level of customer service.

Rich history

We trace our roots back to 1891, when we began production of brass and bronze ingot in Pittsburgh, Pennsylvania. In 1960, Wieland Concast began producing continuous-cast products. Thirty years later we incorporated the production of copper alloys into our business. Then in 1995, we acquired our Birmingham, Ohio, facility and expanded our product line to include aluminum bronze and manganese bronze.

Today, Wieland Concast is a single-source supplier whose primary focus is the production of copper alloys in bars, rods, tubes, and rectangles as well as custom alloys.

Our facilities

More than 1,100 standard sizes are maintained in our distribution center in Birmingham, Ohio. This facility is a modern, environmentally sound 70,000-sq. ft. distribution warehouse located near the Ohio turnpike and is open six days a week.

While Birmingham is the site for our horizontal continuous casting production operation, our Mars, Pa. plant houses our vertical continuous casting operation. Mars is also the location for our administrative offices.

Our inventory of over 1,100 standard sizes is the largest inventory of standard-stocked, continuous-cast alloys in North America. Wieland Concast is well equipped to serve a large variety of industries, including aircraft and aerospace.

Quality

Wieland Concast is a team of professionals focused on manufacturing the highest quality materials at a fair value that meet and exceed customers' expectations, providing a 99.7% quality acceptance rating. Our goal is to ensure superior products by promoting and demanding adherence to strict requirements.

ISO 9001/AS9100

As an ISO 9001 certified manufacturer, we have been recognized as the premier producer of continuous-cast copper alloys. Wieland Concast is also certified to AS9100 standards and requirements for the aerospace industry. We continually adapt to changing markets and industry demand for greater diversity, higher quality, and more eco-friendly products. Additionally, we invest in state-of-the-art casting equipment and advanced product engineering, as well as comprehensive before-and-after sales service.

Serving the aircraft and aerospace industry

The aircraft and aerospace industry requires alloys to provide corrosion, wear, and impact resistance as well as high-strength characteristics.

At Wieland Concast, our unparalleled experience, service, and quality are at the foundation of our success in meeting the demand for alloys utilized in various aerospace and aircraft-related applications. These include bushings and bearings utilized in landing gear and other industry-specific components.

Alloy offerings

Copper alloys containing variations of aluminum, nickel, and silicon, available in both cast and wrought product forms, are the primary group of alloys serving the aircraft and aerospace industry. Wieland Concast is a North American supplier of Hardiall® C72900, a copper nickel-tin bronze, produced by Lebronze alloys. All C72900 alloys are standard-stocked products.

Adhering to strict SAE Aerospace Material Specifications, Wieland Concast provides the following aerospace-related alloys:

Alloy offerings		
AMS 4640-C63000*	AMS 4634-C64200*	AMS 4598-C72900*
AMS 4590-C63020*	AMS 4596-C72900*	AMS 4880-C95510*
AMS 4633-C64200	AMS 4597-C72900*	AMS 4881-C95520

**standard-stocked alloy*

AMS 4640-C63000

Standard-stocked product	Extruded and drawn	Lebronze alloys

Product description	Nickel-aluminum bronze
Tempers	- HR50 drawn and stress relieved (0.38" to 3.00" O.D.) - TQ50 quenched and temper annealed (over 3.00" O.D.)
Solids	0.38" to 10.00" (9.65 mm to 254.00 mm) O.D.
Tubes	3.00" to 10.00" (76.20 mm to 254.00 mm) O.D.*
Standard lengths	144"

**Consult mill for other sizes.*

Typical uses

Aerospace

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

Chemical composition							
Al (%)	Ni (%)	Fe (%) max	Mn (%) max	Zn (%) max	Sn (%) max	Si (%) max	Cu + Ag (%)
9.00-11.00	4.00-5.50	2.00-4.00	1.50	0.30	0.20	0.25	remain.

Chemical composition according to AMS 4640

Note: copper + silver + sum of named elements, 99.5% min.

Machinability

AMS	Machinability rating	Density (lb/in^3 at 68 $^\circ$F)	Density (gm/cu^3 at 20 $^\circ$C)
AMS 4640-C63000	30	0.274	7.60

Mechanical properties

Mechanical properties according to AMS 4640
Composition similar to UNS C63000
HR50 drawn and stress relieved temper (3/8" to 3" O.D.), TQ50 quenched and temper annealed (over 3" O.D.)

Size range: up to 1" rounds inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation in 4D	Brinell hardness (3000 kg load)	Remarks
ksi	MPa	ksi	MPa	%	min to max BHN	
110	760	68	469	10	201 to 248	

Size range: over 1" to 2" rounds inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation in 4D	Brinell hardness (3000 kg load)	Remarks
ksi	MPa	ksi	MPa	%	min to max BHN	
110	760	60	414	10	201 to 248	

Size range: over 2" to 3" rounds inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation in 4D	Brinell hardness (3000 kg load)	Remarks
ksi	MPa	ksi	MPa	%	min to max BHN	
105	725	55	379	10	187 to 241	

Size range: over 3" to 5" rounds inclusive

Tensile strength, min		Yield strength, at 0.5% extension under load, min		Elongation in 4D	Brinell hardness (3000 kg load)	Remarks
ksi	MPa	ksi	MPa	%	min to max BHN	
100	690	50	345	10	187 to 241	

Physical properties

	US customary	Metric
Melting point – liquidus	1930 ˚F	1054 ˚C
Melting point – solidus	1895 ˚F	1035 ˚C
Density	0.274 lb/in³ at 68 ˚F	7.58 gm/cm³ 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	9.0 · 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 293 ˚C
Modulas of elasticity in tension	17500 ksi	120650 MPa
Modulus of rigidity	6400 ksi	44130 MPa

Physical properties provided by CDA

Fabrication properties

Joining 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

Physical properties provided by CDA

AMS 4590-63020

Standard-stocked product	Extruded and drawn	Lebronze alloys

Product description	Nickel aluminum bronze
Tempers	TQ50 quenched and temper annealed
Solids	0.75" to 4.00" (19.05 mm to 101.60 mm) O.D.*
Tubes	2.00" to 4.00" (50.80 mm to 101.60 mm) O.D.*
Standard lengths	24"

**Consult mill for other sizes. Tolerances as per AMS2221 do not apply.*

Typical uses

Aerospace

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

Chemical composition										
Al (%)	Ni, incl. Co (%)	Fe (%)	Mn (%) max	Zn (%) max	Sn (%) max	Co (%) max	Si (%) max	Cr (%) max	Pb (%) max	Cu (%)
10.00-11.00	4.20-6.00	4.00-5.50	1.50	0.30	0.25	0.20	0.15	0.05	0.03	remain.

Chemical composition according to AMS 4590

Note: sum of named elements, 99.5% min.

Machinability

AMS	Machinability rating	Density (lb/in^3 at 68 $^\circ$F)	Density (gm/cu^3 at 20 $^\circ$C)
AMS 4590-63020		0.274	7.60

Mechanical properties

Mechanical properties according to AMS 4590
Composition similar to UNS C63020
TQ50 quenched and temper annealed

Size range: up to 1" diameter inclusive (between parallel sides of bars, rods; nom. wall thickness of tubes)

Tensile strength, min		Yield strength, at 0.2% offset, min		Elongation, in 2 in. (50.8 mm) or 4D	Rockwell "C" hardness	Remarks
ksi	MPa	ksi	MPa	%	min HRC	
135	931	100	689	6	26	

Size range: over 1" to 2" diameter inclusive (between parallel sides of bars, rods; nom. wall thickness of tubes)

Tensile strength, min		Yield strength, at 0.2% offset, min		Elongation, in 2 in. (50.8 mm) or 4D	Rockwell "C" hardness	Remarks
ksi	MPa	ksi	MPa	%	min HRC	
130	896	95	655	6	26	

Size range: over 2" to 4" diameter inclusive (between parallel sides of bars, rods; nom. wall thickness of tubes)

Tensile strength, min		Yield strength, at 0.2% offset, min		Elongation, in 2 in. (50.8 mm) or 4D	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/in³ at 68 °F	7.60 gm/cm³ at 20 °C
Specific gravity	7.60	7.60
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 4633-C64200

Extruded and drawn	Lebronze alloys

Product description	Silicon aluminum bronze
Tempers	HR50 drawn and stress relieved
Solids	0.19" to 6.00" (4.82 mm to 152.40 mm) O.D.
Hex	0.50" to 2.00" (12.70 mm to 50.80 mm) O.D.
Rectangles	Consult mill
Standard lengths	144"

**Consult mill for other sizes.*

Typical uses

Aerospace

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

Chemical composition									
Al (%)	Si (%)	Zn (%) max	Fe (%) max	Ni + Co (%) max	Sn (%) max	As (%) max	Mn (%) max	Pb (%) max	Cu (%)
6.30-7.60	1.50-2.20	0.50	0.30	0.25	0.20	0.15	0.10	0.05	remain.

Chemical composition according to AMS 4633

Note: sum of named elements, 99.5% min.

Machinability

AMS	Machinability rating	Density (lb/in^3 at 68 $^\circ$F)	Density (gm/cu^3 at 20 $^\circ$C)
AMS 4633-C64200	60	0.278	7.69

Mechanical properties

Mechanical properties according to AMS 4633
Composition similar to UNS C64200
HR50 drawn and stress relieved

Size range: up to ½" inclusive (nominal diameter or distance between parallel sides)

Tensile strength, min		Yield strength, at 0.2% offset, min		Elongation, in 4D, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	min to max HRB	
90	621	45	310	9	80-100	

Size range: over ½" to 1" inclusive (nominal diameter or distance between parallel sides)

Tensile strength, min		Yield strength, at 0.2% offset, min		Elongation, in 4D, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	min to max HRB	
85	586	45	310	12	80-100	

Size range: over 1" to 2" inclusive (nominal diameter or distance between parallel sides)

Tensile strength, min		Yield strength, at 0.2% offset, min		Elongation, in 4D, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	min to max HRB	
80	552	42	290	12	80-100	

Size range: over 2" to 3" inclusive (nominal diameter or distance between parallel sides)

Tensile strength, min		Yield strength, at 0.2% offset, min		Elongation, in 4D, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	min to max HRB	
75	517	35	241	15	70-95	

Physical properties

	US customary	Metric
Melting point – liquidus	1840 °F	1004 °C
Melting point – solidus	1800 °F	982 °C
Density	0.278 lb/in³ at 68 °F	7.69 gm/cm³ 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 293 °C
Modulas of elasticity in tension	16000 ksi	110310 MPa
Modulus of rigidity	6000 ksi	41370 MPa

Physical properties provided by CDA

Fabrication properties

Joining 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

Physical properties provided by CDA

AMS 4634-C64200

Standard-stocked product	Extruded and drawn	Lebronze alloys

Product description	Silicon aluminum bronze
Tempers	Stress relieved
Solids	0.375" to 6.00" (9.53 mm to 152.40 mm) O.D.
Hex	0.50" to 2.00" (12.70 mm to 50.80 mm) O.D.
Rectangles	Consult mill
Standard lengths	144"

**Consult mill for other sizes.*

Typical uses

Aerospace

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

Chemical composition								
Al (%)	Si (%)	Fe (%) max	Ni + Co (%) max	Mn (%) max	Sn (%) max	Zn (%) max	Pb (%) max	Cu + Ag (%)
6.30-7.60	1.50-2.20	0.30	0.25	0.10	0.20	0.50	0.05	remain.

Chemical composition according to AMS 4634

Note: sum of named elements, 99.5% min.

Machinability

AMS	Machinability rating	Density (lb/in^3 at 68 $^\circ$F)	Density (gm/cu^3 at 20 $^\circ$C)
AMS 4634-C64200	60	0.278	7.69

Mechanical properties

Mechanical properties according to AMS 4634
Composition similar to UNS C64200
Stress relieved

Size range: up to ½" inclusive (nominal diameter or distance between parallel sides)

Tensile strength, min		Yield strength, at 0.2% offset, min		Elongation, in 4D, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	min to max HRB	
90	621	45	310	9	80-100	

Size range: over ½" to 1" inclusive (nominal diameter or distance between parallel sides)

Tensile strength, min		Yield strength, at 0.2% offset, min		Elongation, in 4D, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	min to max HRB	
85	586	45	310	12	80-100	

Size range: over 1" to 2" inclusive (nominal diameter or distance between parallel sides)

Tensile strength, min		Yield strength, at 0.2% offset, min		Elongation, in 4D, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	min to max HRB	
80	552	42	290	12	80-100	

Size range: over 2" to 3" inclusive (nominal diameter or distance between parallel sides)

Tensile strength, min		Yield strength, at 0.2% offset, min		Elongation, in 4D, min	Rockwell "B" hardness	Remarks
ksi	MPa	ksi	MPa	%	min to max HRB	
75	517	35	241	15	70-95	

Physical properties

	US customary	Metric
Melting point – liquidus	1840 ˚F	1004 ˚C
Melting point – solidus	1800 ˚F	982 ˚C
Density	0.278 lb/in³ at 68 ˚F	7.69 gm/cm³ 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 293 ˚C
Modulas of elasticity in tension	16000 ksi	110310 MPa
Modulus of rigidity	6000 ksi	41370 MPa

Physical properties provided by CDA

Fabrication properties

Joining 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

Physical properties provided by CDA

AMS 4596-C72900 (Hardiall®)

Standard-stocked product	Extruded and drawn	Lebronze alloys

Product description	Copper nickel-tin bronze
Tempers	TX 00 solution annealed and spinodal hardened
Solids	0.75" to 6.75" (19.05 mm to 171.45 mm) O.D.*

**Consult mill for other shapes and sizes.*

Typical uses

Aerospace

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

Chemical composition								
NI + Co (%)	Sn (%)	Fe (%) max	Zn (%) max	Mn (%) max	Cb (%) max	Mg (%) max	Pb (%) max	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.

Machinability

AMS	Machinability rating	Density (lb/in^3 at 68˚F)	Density (gm/cu^3 at 20˚C)
AMS 4596-C72900		0.323	8.95

Mechanical properties

Mechanical properties according to AMS 4596
Composition similar to UNS C72900
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 2 in. (50.8 mm) or 4D	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/in³ at 68 °F	8.94 gm/cm³ 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
Modulas of elasticity in tension	18500 ksi	127554 MPa
Modulus of rigidity	7500 ksi	51711 MPa

Physical properties provided by CDA

Fabrication properties

Joining 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

Physical properties provided by CDA

AMS 4597-C72900 (Hardiall®)

Standard-stocked product	Extruded and drawn	Lebronze alloys

Product description	Copper nickel-tin bronze
Tempers	TX TS solution annealed, cold finished and spinodal hardened
Solids	0.75" to 2.00" (19.05 mm to 50.80 mm) O.D.*

**Consult mill for other shapes and sizes.*

Typical uses

Aerospace

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

Chemical composition

Ni + Co (%)	Sn (%)	Fe (%) max	Zn (%) max	Mn (%) max	Cb (%) max	Mg (%) max	Pb (%) max	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.

Machinability

AMS	Machinability rating	Density (lb/in^3 at 68˚F)	Density (gm/cu^3 at 20˚C)
AMS 4597-C72900		0.323	8.95

Mechanical properties

Mechanical properties according to AMS 4597
Composition similar to UNS C72900
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 2 in. (50.8 mm) or 4D	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/in³ at 68 °F	8.94 gm/cm³ 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
Modulas of elasticity in tension	18500 ksi	127554 MPa
Modulus of rigidity	7500 ksi	51711 MPa

Physical properties provided by CDA

Fabrication properties

Joining 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

Physical properties provided by CDA

AMS 4598-C72900 (Hardiall®)

Standard-stocked product	Extruded and drawn	Lebronze alloys

Product description	Copper nickel-tin bronze
Tempers	TX 00 solution annealed and spinodal hardened
Tubes	4.50" to 8.56" (114.30 mm to 217.42 mm) O.D.*

**Consult mill for other shapes and sizes.*

Typical uses

Aerospace

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

Chemical composition

Ni + Co (%)	Sn (%)	Fe (%) max	Zn (%) max	Mn (%) max	Cb (%) max	Mg (%) max	Pb (%) max	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.

Machinability

AMS	Machinability rating	Density (lb/in^3 at 68 $^\circ$F)	Density (gm/cu^3 at 20 $^\circ$C)
AMS 4598-C72900		0.323	8.95

Mechanical properties

Mechanical properties according to AMS 4598
Composition similar to UNS C72900
TX 00 solution annealed, cold finished 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 2 in. (50.8 mm) or 4D	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/in³ at 68 °F	8.94 gm/cm³ 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
Modulas of elasticity in tension	18500 ksi	127554 MPa
Modulus of rigidity	7500 ksi	51711 MPa

Physical properties provided by CDA

Fabrication properties

Joining 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

Physical properties provided by CDA

AMS 4880-C95510

Standard-stocked product	Continuous cast	Wieland Concast U.S.

Product description	Nickel-aluminum bronze
Tempers	TQ50 quench hardened and temper annealed
Solids	0.50" to 9.00" (12.70 mm to 228.60 mm) O.D.*
Tubes	1.13" to 9.50" (28.70 mm to 241.30 mm) O.D.*
Rectangles	Up to 15" (381 mm)
Standard lengths	24"**

**Consult mill for other sizes. **Consult mill for other lengths.*

Typical uses

Aerospace

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

Chemical composition						
Cu (%) min	Al (%)	Ni + Co (%)	Fe (%)	Mn (%) max	Zn (%) max	Sn (%) max
78.00	9.70-10.90	4.50-5.50	2.00-3.50	1.50	0.30	0.20

Chemical composition according to AMS 4880

Note: sum of named elements, 99.8% min.

Machinability

AMS	Machinability rating	Density (lb/in^3 at 68 $^\circ$F)	Density (gm/cu^3 at 20 $^\circ$C)
AMS 4880-C95510	50	0.272	7.53

Mechanical properties

Mechanical properties according to AMS 4880
Composition similar to UNS C95510
TQ50 quench hardened and temper annealed

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	192-248	castings <4.0 (102 mm), nominal cross-section, heat treated
95.0	655	56.0	386	9	192-248	castings 4.0 (102 mm)+, nominal cross-section, heat treated

AMS 4881-C95520

Continuous cast	Wieland Concast U.S.

Product description	Nickel-aluminum bronze
Tempers	TQ50 quench hardened and temper annealed
Solids	0.50" to 4.00" (12.70 mm to 101.60 mm) O.D.*
Tubes	1.13" to 9.50" (28.70 mm to 241.30 mm) O.D.*
Rectangles	Up to 15" (381 mm)
Standard lengths	24"**

**Consult mill for other sizes. **Consult mill for other lengths.*

Typical uses

Aerospace

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

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

Chemical composition according to AMS 4881

Note: sum of named elements, 99.8% min.

Machinability

AMS	Machinability rating	Density (lb/in^3 at 68 $^\circ$F)	Density (gm/cu^3 at 20 $^\circ$C)
AMS 4881-C95520	45	0.272	7.53

Mechanical properties

Mechanical properties according to AMS 4881
Composition similar to UNS C95520
TQ50 quench hardened and temper annealed

Tensile strength, min		Yield strength, at 0.2% offset, min		Elongation, in 4D, min	Brinell hardness	Remarks
ksi	MPa	ksi	MPa	%	min BHN	
125	860	90	621	2	262 (3000 kg)	castings <2.0 (50.8 mm) nominal section thickness, heat treated

Aerospace-related alloy properties

General information

AMS	Material description	Tempers
4640-C63000*	Aluminum bronze	HR50 drawn and stress relieved (3/8" to 3" O.D.). TQ50 temper annealed (> 3" O.D.)
4590-C63020*	Nickel aluminum bronze	TQ50 quenched and tempered
4633-C64200	Silicon aluminum bronze	HR50 drawn and stress relieved
4634-C64200*	Silicon aluminum bronze	Stress relieved
4596-C72900*†	Copper nickel-tin bronze	TX00 solution annealed and spinodal hardened
4597-C72900*†	Copper nickel-tin bronze	TX TS solution annealed, cold finished and spinodal hardened
4598-C72900*†	Copper nickel-tin bronze	TX00 solution annealed and spinodal hardened
4880-C95510*	Nickel aluminum bronze	TQ50 quench hardened and temper annealed
4881-C95520	Nickel aluminum bronze	Quench hardened and temper annealed

**standard-stocked alloy.* *†Wieland Concast is a North American supplier of Hardiall® C72900 produced by Lebronze alloys.*

Chemical composition														
AMS	Cu (%)	Pb (%)	Sn (%)	Zn (%)	Fe (%)	Ni (%)	Al (%)	Co (%)	Cr (%)	Mn (%)	Si (%)	Mg (%)	As (%)	Cb (%)
4640-C63000	remain.		0.20	0.30	2.00-4.00	4.00-5.50	9.00-11.00			1.50	0.25			
4590-C63020	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			
4633-C64200	remain.	0.05	0.20	0.50	0.30	0.25	6.30-7.60			0.10	1.50-2.20		0.15	
4634-C64200	remain.	0.05	0.20	0.50	0.30	0.25	6.30-7.60			0.10	1.50-2.20			
4596-C72900	remain.	0.02	7.50-8.50	0.50	0.50	14.50-15.50				0.30		0.15		0.10
4597-C72900	remain.	0.02	7.50-8.50	0.50	0.50	14.50-15.50				0.30		0.15		0.10
4598-C72900	remain.	0.02	7.50-8.50	0.50	0.50	14.50-15.50				0.30		0.15		0.10
4880-C95510	78.00 min		0.20	0.30	2.00-3.50	4.50-5.50	9.70-10.90			1.50				
4881-C95520	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			

Note: Unless otherwise noted, single values represent maximums.

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